



SCHOOL OF DESIGN
MASTER DEGREE THESIS:
Product Service System Design

Shanghai OrganiX

A Sustainable Product-Service System to accelerate a sustainable production of food and foster its consumption in Chinese restaurants.

SUPERVISORS:

Carlo Arnaldo Vezzoli
Zhu Xiaocun

AUTHOR:

Giacomo Guaragna
873840

A.Y.

2018/2019

*To all the special ones who
have always been there, no
matter the distance.*

ABSTRACT / ENGLISH

More than ever before, food today has become a heated debate topic. As a matter of facts, food is not anymore only conceived for its material nature but also its connections with many different aspects of today's society.

Food is part of a complex system which is shaped and influenced by human activities. These activities have consequence along the entire supply chain. In particular, the production of food, its most impactful step, sorts ripple effects on human health, economics, and environment, in a sort of vicious circle which now affects the whole world.

In Chinese culture, food has always played an important role. However, today, food safety is threatened by the huge quantities of fertilizers and pesticides that are used in agriculture, the main cause of water pollution and soil degradation. Considering its increasing population and urbanization trend, compared to the fewer available natural resources, China cannot rely on its current food production as a long term sustainable solution to feeding the country.

Through a preliminary field and desk research, Sustainable Product-Service Systems (S.PSS) have been pointed out as promising models for the development of a sustainable alternative to the existing food production. This thesis project aims to tackle the issue of the unsustainable food production in Shanghai, analyzing the strategic role of the restaurants within the system. Indeed, in this particular context, restaurants have been recognized as key places for the diffusion of sustainably produced food and awareness over its consumption.

Through the analysis of the current Shanghai restaurants' food supply chain, its steps, actors and relationships, and the identification of sustainability priorities, the project will identify sustainable food production opportunities, and it will offer a design solution of implementation.

KEYWORDS:

Shanghai Food Supply Chain, Shanghai Restaurants, Sustainable Food Production, Product Service System Design, System Design for Sustainability.

ABSTRACT / ITALIANO

Oggi più che mai, il concetto di "cibo" è oggetto di accese discussioni. Infatti, non si può più solo osservare il cibo per la sua natura fisica ma lo si deve osservare anche per la profonda connessione con diverse attività della società odierna.

Il cibo fa parte di un sistema complesso creato e influenzato dalle attività umane. Queste producono delle conseguenze lungo tutta la filiera agroalimentare. In particolare, la produzione di cibo, ovvero la fase più impattante della filiera, genera effetti a catena sulla salute umana, quella economica e quella ambientale, creando un circolo vizioso che ormai interessa l'intero pianeta.

Nella cultura cinese, il cibo ha sempre rivestito un ruolo importante. Oggi, però, la sicurezza alimentare è messa a rischio dalle grandi quantità di fertilizzanti e pesticidi chimici usati dal settore agricolo, la principale causa dell'inquinamento delle fonti di acqua e del suolo. Considerando l'aumento della popolazione e dell'urbanizzazione, rispetto alle scarse risorse naturali, la Cina non potrà più contare sull'attuale sistema di produzione del cibo come soluzione a lungo termine per sfamare il paese.

A seguito della ricerca preliminare svolta, i Sistemi di Prodotto-Servizio Sostenibili (S.PSS) sono stati individuati come modello promettente per lo sviluppo di un'alternativa sostenibile all'attuale sistema di produzione del cibo. L'obiettivo del progetto di tesi è di affrontare la non-sostenibilità del sistema attuale, attraverso un'analisi del ruolo strategico dei ristoranti, identificati come luoghi chiave per la diffusione di cibo prodotto in maniera sostenibile e la consapevolezza sul suo consumo.

Partendo dall'analisi della filiera agroalimentare media dei ristoranti a Shanghai, le sue fasi, gli attori e le loro relazioni, e dall'identificazione delle priorità di sostenibilità, il progetto mostrerà alcune opportunità per lo sviluppo di sistemi di produzione sostenibile di cibo e offrirà una soluzione progettuale per l'implemento di uno di essi.

PAROLE CHIAVE:

Filiera Alimentare Shanghai, Ristoranti Shanghai, Produzione Sostenibile di Cibo, Product Service System Design, System Design for Sustainability.

TABLE OF CONTENTS

1

INTRODUCTION 13

- 1.1 PROJECT OVERVIEW 14
- 1.2 RESEARCH CONTEXT 15
- 1.3 RESEARCH METHOD 20
- 1.4 OUTLINE OF THE DOCUMENT 24

PART 1: CONTEXTUAL FRAMEWORK

2

RESEARCH BACKGROUND 27

- 2.1 FOOD 28
 - 2.1.1 hunger and global nutrition trends 31
 - 2.1.2 Food security 35
 - 2.1.3 Sustainable development 37
 - 2.1.4 Sustainable Development Goals (SDGs) 40
 - 2.1.5 Sustainable food 42
- 2.2 FOOD IN CHINA 44
 - 2.2.1 china overview 44
 - 2.2.2 changing consumption habits 46
 - 2.2.3 Health-related diseases 49
 - 2.2.4 Food market call for better food 51
 - 2.2.5 Chinese cuisine 53
 - 2.2.6 Health concept 55
 - 2.2.7 Chinese food culture 56
 - 2.2.9 Food safety 66
 - 2.2.10 Food scandals 68

2.3 FOOD LIFE CYCLE 72

- 2.3.1 Food system 73
- 2.3.2 Food consumption stage and food waste (world and China) 78
- 2.3.3 Food Life Cycle Assessment 84
- 2.3.4 Production: the real impact in the food life cycle 89
- 2.3.5 Food production 97

2.4 SUSTAINABLE FOOD PRODUCTION 108

- 2.4.1 Sustainable production models 108
- 2.4.2 Sustainable agriculture 113
- 2.4.3 Soil health and beyond organic agriculture 122
- 2.4.4 Sustainable food production in China 127

2.5 SUSTAINABLE PRODUCT-SERVICE SYSTEMS (S.PSS) 130

- 2.5.1 Product-service systems 130
- 2.5.2 Sustainable Product Service Systems 132
- 2.5.3 S.PSS typologies 133
- 2.5.4 Design criteria for system eco-efficiency: S.PSS sustainable priorities 137

PART 2: THE DESIGN PROCESS

3

STRATEGIC ANALYSIS

3.1 PRELIMINARY FIELD RESEARCH 150

- 3.1.1 Observations in restaurants 151
- 3.1.2 On-line questionnaire to consumers 158
- 3.1.3 End user and its satisfaction 161

3.2 SHANGHAI FOOD SYSTEM 170

- 3.2.1 Research process and briefing 170

3.2.2 Shanghai food supply chain	171
3.2.3 Observations along the food supply chain	179
3.2.5 System visualization	198

3.3 INFLUENCING TRENDS 204

3.3.1 current trends	204
3.3.2 Future trends	207

3.4 EXPLORING OPPORTUNITIES 212

3.4.1 Organic food as design opportunity	212
3.4.2 Different organic systems	214
3.3.2 Future trends	207

3.5 BEYOND ORGANIC MARKET ANALYSIS 220

3.5.1 Organic restaurant chains analysis	220
--	-----

3.6 SUSTAINABLE FOOD SYSTEM DEFINITION 226

3.7 ANALYSIS OF BEST PRACTICES 227

3.8 DEFINING THE SUSTAINABLE PRIORITIES 232

4 SYSTEM CONCEPT DESIGN 235

4.1 IDEAS GENERATION AND CONCEPT DRAFTS 236

4.1.1 Farmers validation	240
4.1.2 Second concept	242

4.2 CONCEPT CO-DESIGN: ACTORS' FEEDBACKS 246

4.2.1 Round table with CSA members and farmers	246
4.2.2 Consumers activities	249
4.2.3 Restaurant manager interview	253

4.2.4 Insights elaboration 255

4.3 KEY ACTORS AND PROBLEMS DEFINITION 258

4.4 FINAL CONCEPT 260

PART 3: FINAL RESULTS

5 "SHANGHAI ORGANIX" SYSTEM 265

5.1 SYSTEM DEFINITION 266

5.2 OFFERING 267

5.3 SERVICE MODELS 270

5.4 PARTNERSHIPS & STAKEHOLDERS 274

5.5 SHANGHAI ORGANIX SYSTEM 280

5.6 TOUCHPOINTS 284

5.7 MARKET OPPORTUNITIES 288

5.7.1 Competitors 291

5.8 ABOUT BUSINESS 298

5.9 PROTOTYPING 306

5.10 SUSTAINABLE ASSESSMENT 310

6 CONCLUSIONS 313

6.1 RESEARCH CONCLUSIONS 314

6.2 PROJECT'S REFLECTIONS AND IMPLEMENTATIONS 315

6.3 PERSONAL CONCLUSIONS 316

7

REFERENCES 319

7.1 BIBLIOGRAPHY 320

7.2 LIST OF FIGURES 332

8

APPENDIX 335

ACKNOWLEDGMENTS 344

1

INTRODUCTION

1.1

PROJECT OVERVIEW

This thesis project has been conceived during the double master degree program in Product Service System Design, between Politecnico di Milano and Tongji University in Shanghai, and it has been developed with the support of two academic tutors, professor Carlo Vezzoli and Zhu Xiaocun. The starting point of the project dates back to September 2018, and it was officially proposed in November of the same year. The reason behind the choice of developing a sustainability-related project was the interest in going deeper into the topic, previously only superficially faced. Besides, it was in the author's curiosity to understand why sustainability is such a trendy topic which, unfortunately, has not been considered yet as a real development driver together with economy, rather an obstacle to it. Finally, the reason behind the choice was also driven by the interest in getting to know which role designers can have within the sustainability field.

In the wide field of sustainability, then, it was decided to focus on food because of its multiple connections with many aspects of human activities and society. Also, it was found out that food, and in particular, its production, has profound impacts on the environment, at a global scale. Differently from other sustainability-related issues, food is a very tangible phenomenon, which is part of humans' everyday life. It is physical and it satisfies one of the basic human needs: even if we do not like some of the aspects related to it (shopping, washing, cleaning, cooking, etc...), it is something that we need to care about or encounter at least two or three times per day. Considering the importance food is given in China as integral part of their culture, and the author's passion in the topic, food was chosen as a topic through which tackle today's sustainability problems.

As for the process, the project has gone through different steps, which have influenced its development and the activities that were carried out. Indeed, initially, the investigation focus was on food waste. As a matter of facts, this issue is today on everyone's lips, probably due to the responsibility of consumers, and the consequent possibility of doing something about it.

During the analysis of the current food system in Shanghai, different activities were conducted, also with the involvement of its main actors, in order to assess the level of sustainability, the critical points, and the opportunities for improvement.

The opportunities were recognized in the organic food productions of the city, in particular in the small, not industrial organic farms. That was the moment when it was needed to re-iterate the research process to better map and understand the organic context, with its actors, relationships and problems, in Shanghai, as well as to conduct an additional literature research about it.

In the end, a concept aimed to foster a sustainable food production and its consumption in Shanghai restaurants was conceived. The concept was afterward improved and validated with some of the main actors of the system and finally developed in details.

1.2 RESEARCH CONTEXT

When we talk about food, we usually refer to its final consumption. Undoubtedly, the act of eating is dressed with multiple meanings and it is creator of meanings. Eventually, food is, most of the time, a pleasure.

However, what we do not generally conceive, being in a context of abundance, is the chain of activities that makes the food available. Food consumption (the act of eating) is only the last part of a complex system, which is known as food supply chain or food system. The food supply chain of the industrialized countries is surely effective since it evolved and improved over time, succeeding in feeding us yesterday as well as today.

However, it is far from being efficient as, in order to generate the huge amount of food we are used to, it requires huge quantities of energies and different materials and it wastes many resources (food included). This is particularly evident in the first step of the food chain: the production.

Considering the overall system, crops and livestock are the two productions which impact the most, as they are the main contributor to the overall greenhouse gas emissions, a common reference unit to measure the environmental impact. According to these emissions, agriculture, indeed, is the second largest human sector contributing the most to the overall global emissions. In China, the agricultural sector is not different. In the last thirty years, due to the economic growth, the country was able to triple its agricultural output, therefore satisfying the needs of a growing population and silencing the doubts about its productivity and feeding capacity.

However, the astonishing increase in the productivity it is most likely due to technological improvements and to the huge quantities of fertilizers and pesticides that have been sprayed on the fields, making China ranking among the world's largest users of chemicals.

As it is possible to imagine, the massive use of these substances has led to enormous pollution of the country's few natural resources available for agriculture, resulting in land degradation and water scarcity. Agriculture, indeed, is reported to be the main cause of water pollution, greater than manufacturing (McMillan, 2018). This is especially worrying, considering that China needs to feed 20% of the global population with only 7% of the total arable land and 6% of the total freshwater (FAOSTAT, 2013).

The impact of the different steps of the food system accumulates along the chain, finally represented together by the most visible and closest to consumers phenomenon: the food waste.

Food waste is not the most impactful step of the chain but is its final and most explicit concretization. Food waste is due to overproduction (and consumption habits) and, thus, it means that the current system fails at sustainably performing its function (i.e. feeding a number of people). In other words, wasting food means wasting also all the energies and resources that were used to produce that food. The phenomenon has gained much attention also because it happens at the most accessible step of the chain by consumers, i.e. the step that consumers can influence.

The big impact due to food production is therefore worsened by the huge quantities of food that gets wasted. This is particularly evident in the restaurants. Indeed, in China, the food services level is the stage of the food chain where the majority of food waste is generated (FAO, 2011), accounting for almost 10% of the country's annual food production (WBCSD, 2015).

In Shanghai, averagely the food supply chain of restaurants is highly fragmented and characterized by a high number of intermediate steps or intermediaries so that there is usually no direct connection between the restaurants and the producers. Producers are traditionally placed in the peri-urban areas of Shanghai, accounting for a big portion of the food consumed in the city. Also, the vast majority of them is composed of very small farms or production units, less than 1 hectares big. However, recently, a slow trend towards centralization has started, incorporating together different small farms, together with a major reliability on further-away production sites (away from Shanghai).

On the other hand, a small developing movement of alternative food production models has also started to spread, embodied by the organic farms.

Due to their chemical-free production and their different economic model, organic farms are surely offering a concrete sustainable alternative. Indeed, they do not rely on the existing distribution channels either and, differently, they are based on a much more direct relationship with the consumers.

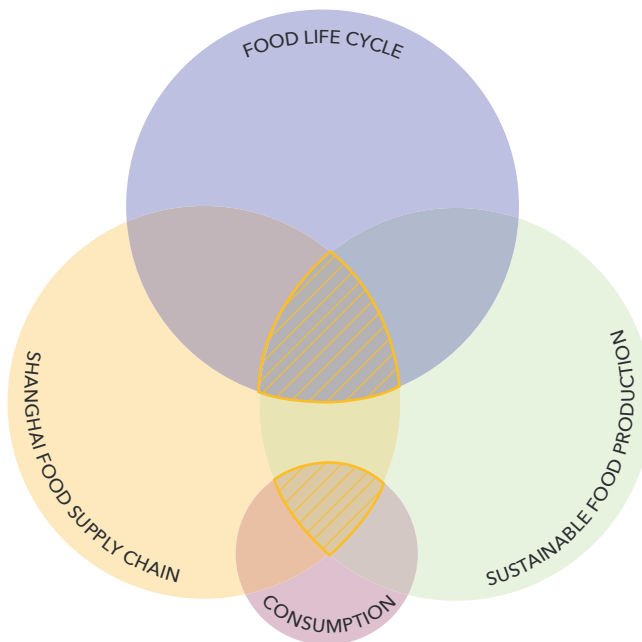
Indeed, because of the powerful way it is usually communicated, organic food can also spread the awareness about a more conscious food consumption, hence answering together to the issues of food production and food consumption.

Organic food has therefore identified as a possible solution to the un-sustainability of the current food system, which, more than ever before, is acknowledged not to represent a long term solution for the country and the world in general.

In this framework, the initial question which moves the overall investigation was “how to foster a sustainable production of food and its consumption in China, starting from restaurants?”.

In order to answer this initial question, the research was conducted in different areas, shown in the image below.

Fig.1 Literature research areas.



The research began with the analysis of the food consumption habits and eating patterns of Chinese people, especially in restaurants. Only afterward, the study of the life cycle of the food was conducted, revealing that the current food system presents multiple downsides in sustainability terms. Therefore, a second round of research was conducted in Shanghai, focused on the average food supply chain of the restaurants in the city. As it was expected, many of its aspects, presented and discussed in this thesis (see "strategic analysis"), were found to be the source of problems both in environmental, but also in economic terms.

At the same time, the main issue started to be clear. Any solution had to target the food production step. Hence, In order to understand which opportunities could potentially improve the current system, deeper research on sustainable food production was conducted. Thanks to that, it was possible to recognize that organic producers could represent the right opportunity for a more sustainable supply chain of the restaurants in Shanghai.

However, since no particular investigation had been conducted on the specific organic context in Shanghai, a third round of research was conducted. Thus, the intersection of the research areas brought to the exploration of what had then degenerated the final concept: organic food.

RESEARCH PURPOSE AND SIGNIFICANCE OF THE STUDY

This thesis project would contribute to the current discussion about the role of the food, analyzed through the lens of sustainability. Food is analyzed according to its general implications in human society, and then, according to the Chinese culture so that to compare it with the global data and trends. After, the investigation goes deeper into the life cycle steps so that to answer the question related to the most impactful step of the food supply chain. Here, indeed, the food production and the food consumption stages are analyzed, showing their relationships and reporting the current and recent academic contributions.

Therefore, the investigation deepens the topic of sustainable alternatives to the current un-sustainable food productions, reporting the acknowledged requirements for such a practice and the latest, modern techniques. Hence, the research sheds the light on the discussion about which farming practice is better or more sustainable and promising for the future development of humankind and the planet.

All the information collected during the research has been a combination of literature and field activities conducted in Shanghai. There, the aforementioned topics are deepened based on the particular context of the Chinese city, in particular

taking restaurants as the reference point for the overall investigation. Therefore, this thesis project, on one side, aims at exploring and giving an answer to those who claim the importance of finding alternative food production models to the current ones and of reducing the tendency of food waste in restaurants, and, on the other, at offering a design-oriented, context-based and culture-specific solution to intervene in this complicated framework, especially by targeting policy-makers and administrators, and entrepreneurs.

RESEARCH CONDITIONS

Conducting a design project in China, based on the local context, has its barriers and limitations. The context-specific research, indeed, is influenced by the availability of English resources. One of the main issues in the literature analysis is that many contributions related to China or Shanghai are secondary resources since the first ones are written in the Chinese language.

In some cases, these secondary sources are considered trustworthy; in some other, fewer occasions not as much. Therefore, in the latter case, a field investigation has been conducted in loco in order to verify them.

For the field activities as well, the research has been conditioned by the English-speaking actors met along the process. In all the other cases, when English nor Chinese was the common language, the help of Chinese colleagues and friends has been of fundamental importance.

Also, the field research has been influenced by the reachable places of investigation. Shanghai is a very extended city with a good transportation system, which however cannot cover the entire surface. Therefore, again, it has not been possible to physically visit some under-analysis places. When this happened, a literature review was conducted in turn.

The activities that have been carried out did not require the need for any particular equipment (different from the usual design tools, i.e. camera, microphone, notebooks...). As already stated, rather, there was the need of trying the experience/ offering of different restaurants in Shanghai city, and of traveling to some of the key, reachable places of the food supply chain in order to observe them and meet some of the actors or professionals working there. Finally, it was decided to join a community supported agriculture of one of the farms in Shanghai so that to bond with the farmers and the community members, and to try their distribution/ consumption model (and to eat good food).

1.3

RESEARCH METHOD

In the setup of this thesis work, different research activities were planned, both desk and field ones. These activities are all based on two design methodologies, which were analyzed and, then, combined together: on the one hand, the service design approach and tools and, on the other, the Methodology for System Design for Sustainability (MSDS).

Service design is both the design of services and a way of working (mindset) which sees the application of different methodologies and tools. Because the concepts and keywords usually associated to service design, as human centered design, user experience, interaction design, business, and communication, are diverse, it is hard to define a singular and comprehensive definition. Indeed, being composed of many different methodologies and approaches, service design is more and more a hot and debated discipline. Its diverse intrinsic nature is what makes the service design discipline gaining more success and popularity every day.

“Service design adopts the mindset and workflow of the design process, combining an active, iterative approach with a flexible and relatively light-weight set of tools borrowed from marketing, branding, user experience, and elsewhere. It is its patchwork background that makes service design powerful. As a design discipline, it is focused on solving the right problem – by framing the problem or opportunity in the right way. So service design usually starts by investigating the needs of the user or customer. It is inquiring and inquisitive, using a range of mostly qualitative research methods to explore the “how and why” of the opportunity space. Understanding needs, instead of jumping straight to a “solution,” makes true innovation possible” (Stickdorn, Hormess, Lawrence, Schneider, 2018, p. 13).

For the development of this thesis project, the service design approach was useful to understand the users’ needs, to envision new solutions and to involve people in the process.

Indeed, “It [service design] is a human-centered, collaborative, interdisciplinary, iterative approach which uses research, prototyping, and a set of easily understood activities and visualization tools to create and orchestrate experiences that meet the needs of the business, the user, and other stakeholders (Stickdorn, et al., 2018).

This approach is therefore inherently holistic and based on a systemic thinking. This ultimately makes the service design the perfect discipline through which face complexity.

According to the Service Design Network (SDN), indeed, service design “uses a holistic and highly collaborative approach to generate value for both the service user and the service provider throughout the service’s lifecycle. In practice, service design helps to choreograph the processes, technologies, and interactions driving the delivery of services, using a human-centred perspective” (Service Design Network, 2019).

Instead, the Methodology for System Design for Sustainability (MSDS) is the strategic methodology elaborated by System Design and Innovation for Sustainability (DIS) and Design Department of Politecnico di Milano within the EU funded “Learning Network for Sustainability” (LeNS project) during 2007-2010 and within the MEPSS EU project.

It is defined as “a method [that] aims to support and orient the entire process of system innovation development towards sustainability [and where] special attention has been paid to facilitating co-designing processes both within the organisation itself (between people from different disciplinary backgrounds) and outside, bringing different socio-economic actors and end-users into play. The method is organised in stages, processes and sub-processes. It is characterised by a flexible modular structure so that it can easily be adapted to the specific needs of designers /companies and to diverse design contexts and conditions” (Vezzoli, Kohtala, Srinivasan, 2014, p. 90).

According to the MSDS, “strategic analysis” is the first stage of the process, aimed to collect and elaborate that useful information for the generation of potentially sustainable ideas. Through different research activities, based on the demand that needs to be satisfied (what the user is trying to accomplish), a detailed picture of the current system with its actors and relationships is drawn, and it gets assessed according to the environmental and socio-ethic priorities. This assessment and definition of the most important sustainable priorities to focus on is what guides and informs the next steps of the process.

The second stage is called “exploring opportunities” and aims to identify potential guidelines for the development of promising new systems, based on the information previously collected. The activities of this part entail studying the trends possibly able to influence the system in the future, analyzing case studies of existing good practices, and, more broadly, identifying promising directions (often with the participation of the various actors of the system).

The third stage is “designing system concepts”, aimed to conceive and explore different ideas, representing system concepts, which are assessed according to the sustainability proprieties (defined before) and their potential. The best or most promising one is then chosen and developed in greater detail.

“Designing the system” is the fourth and last step of the MSDS process. During this stage, indeed, the necessary details to enable the concept to implement are outlined. They include the relationships between the actors and their motivations in joining the new system, the different elements of the system, the activities, requirements, and resources needed to possibly actuate the concept.

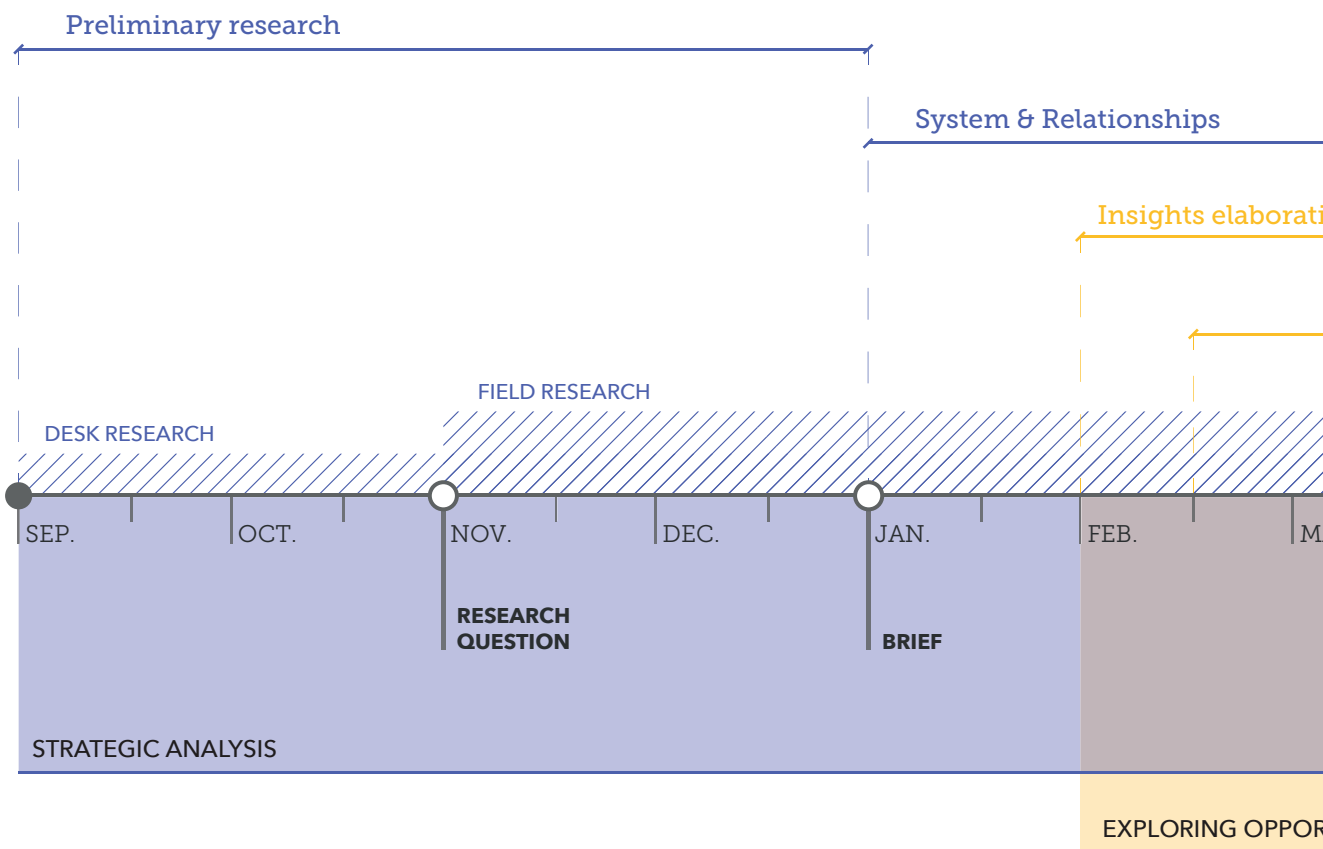
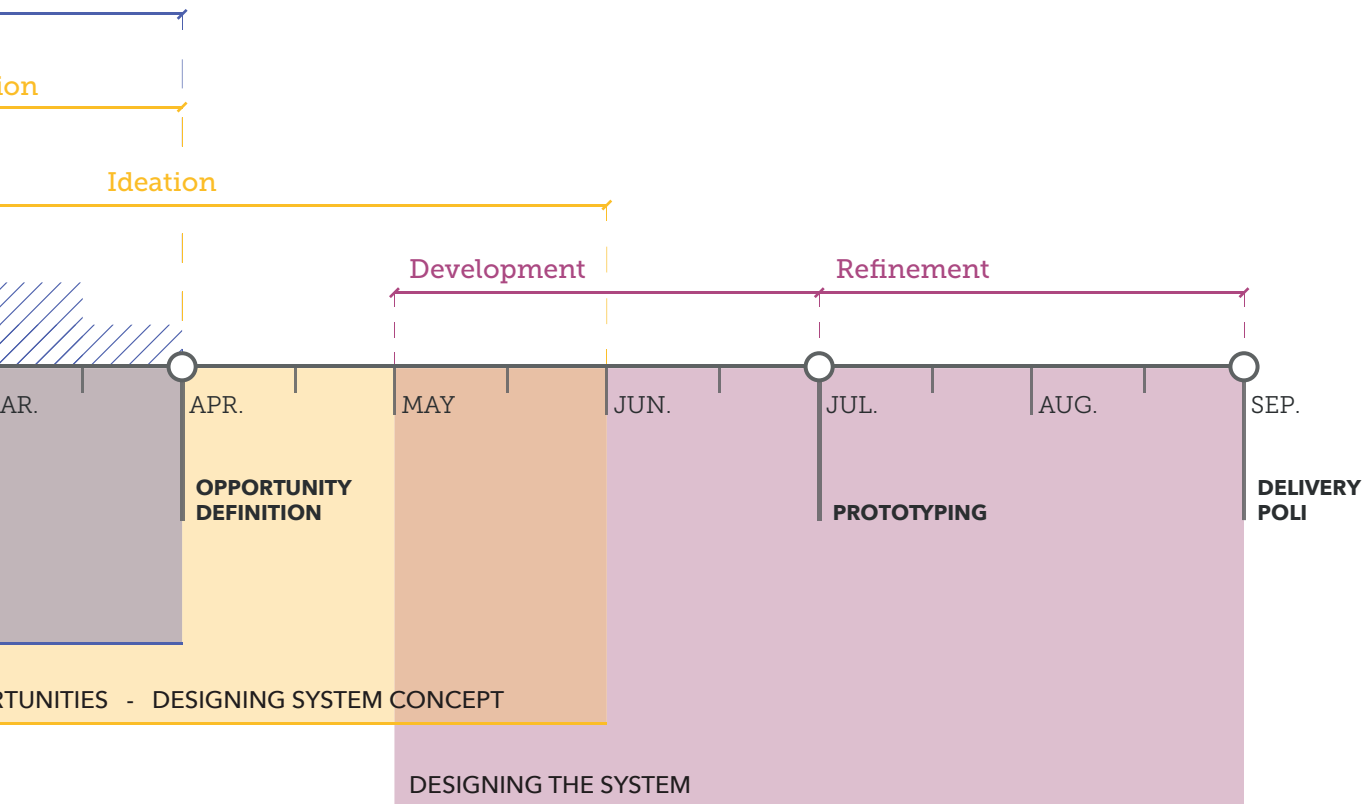


Fig.2 The process.

Finally, the MSDS process draws a comparison between the assessment of the current system (done during the strategic analysis) and the new one, allowing not only the designer(s) but also the addressees of the project to be informed about its impacts and to draw reflections.

The MSDS, hence, was developed to support professionals (in particular designers) to tackle and develop sustainability projects. The reason why a specific methodology was created is due to the complexity of dealing with sustainability. Indeed, it is not possible to look at this topic as a singular unit. Rather, because of its multiple, interrelated aspects and consequences, it needs to be faced through a holistic approach and systemic thinking.

Here it is where the foundation for the integration with the methodologies and practices of service design lays. In addition, the same MSDS has the character of flexibility which makes it open to be shaped according to each projects' needs. Therefore, the process of this thesis work has been set up by following the MSDS stages, and many of its activities have been conducted by using the service design approach and tools.



1.4

OUTLINE OF THE DOCUMENT

The structure of this document follows the thesis process, with a few little changes. Indeed, for a more organized and clearer report of the project activities, the document has been divided into three parts. The first one will present the background information useful to understand the knowledge base that informed and supported the development of the project. Starting with an introduction related to food, the chapter will report the state of the art and the ongoing discussions related to it and its implications with sustainability, in the academic research context. Then, an exhaustive description of the topic, analyzed according to the Chinese context, will be offered with the aim to grasp its values and importance in Chinese society.

The research focus will subsequently move to the analysis of the food life cycle, where the major impactful steps of the food supply chain will be discussed. Hence, the investigation will deepen the analysis about food production, the most impactful step of the supply chain, and about sustainable alternatives to it. Finally, the research will shed light on product service systems, identified as promising design solutions to tackle sustainability-related project.

The chapter "Research background", indeed, will be preparatory for the second part, which more accurately follows the thesis process.

The first chapter, called "strategic analysis", will report the information collected (especially) during the field research, aimed at defining the current system, the status quo. This part will present the results of the activities conducted in the key places of the food supply chain of Shanghai restaurants and conducted together with the actors of the system.

After the analysis, but within the same chapter, the exploration of opportunities will be presented, showing the trends and the elaboration of the information and insights that have then generated the basis for the conceptual phase (called here "system concepts design").

In that phase, not only the concept(s) and the process that brought to the final concept will be discussed, but also a second round of research conducted on the more specific context of the organic food will be presented. Finally, a detailed presentation and description of the selected final concept will be offered, followed by the conclusions and reflections of the entire work.

**PART 1:
CONTEXTUAL
FRAMEWORK**

2 RESEARCH BACKGROUND

This chapter will present the background information useful to understand the knowledge base that informed and supported the development of the project. Starting with an introduction related to food, the chapter will report the ongoing discussions related to it and its implications with sustainability, in the academic research context. Then, an exhaustive description of the topic, analyzed according to the Chinese context, will be offered with the aim to grasp its values and

importance in Chinese society. The research focus will subsequently move to the analysis of the food life cycle, where the major impactful steps of the food supply chain will be discussed. Hence, the investigation will deepen the analysis about the food production, the most impactful step of the supply chain, and about sustainable alternatives to it. Finally, the research will shed light on product service systems, identified as promising design solutions to tackle sustainability related project.

2.1 FOOD

“Food is power”

JOSH TICKELL, 2017, P. 12

We live in the era of food. Surely, humankind and animal genre have been sustained on food since their beginning but, nowadays, more than every other period of the past, food has attracted interest from many different fields and public opinion altogether because of its constantly more evident, interrelated connections with almost all the other aspects of human life.

Food has become one of the keys to understand and to face today's challenges, concerning the development of the humankind.

Although food is defined as “material consisting essentially of protein, carbohydrate, and fat used in the body of an organism to sustain growth, repair, and vital processes and to furnish energy” (Merriam Webster, 2019), it is obvious that it is much more than its material nature: it does not only satisfies the basic need of hunger anymore.

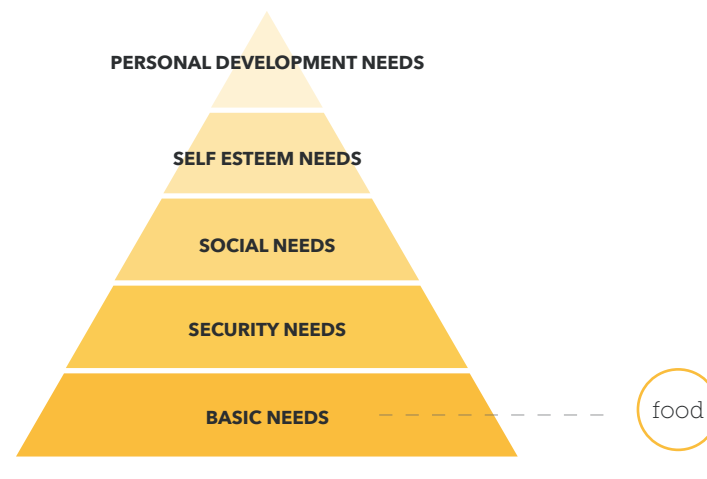
Yet, in order to understand why it is so powerful, the analysis needs to start exactly from there. When Tickell states that “food is power” (2017), he elevates the food as the basis of civilization. In facts, by recalling the history of early civilizations, living in different parts of the world as the Romans and Greeks, and the Mesoamerican Inca, Aztec, and Maya, he acknowledges that, despite the different factors that may have brought them to collapse, like war, famine, flooding, drought, and disease, the food has always been a constant.

“Each society that failed to outsmart nature by producing enough food to keep up with their growing populations faced the same fate [i.e. collapse]” (Tickell, 2017, p. 71).

The famous hierarchy of human needs by Abraham Maslow is probably the most relevant evidence of the importance of food. His theory, exquisitely expressed in the form of a pyramid (fig. 3), constitutes the basis for many sociological and psychological pieces of research, investigating the needs that humans have.

Food is considered a basic need and it is counted in the first layer of the pyramid, together with water, air, sexual instinct, sleep, clothing, and shelter: all the things that make people survive. The higher in the pyramid the least the urgency of the need.

Fig.3 Maslow's pyramid of needs (Maslow, 1943).



Although the physical importance of food cannot be denied, it is evident that nowadays, in the industrialized countries, food, rather than being a survival need, is considered a commodity, something taken for granted, which is hence invested of other significances. Indeed, food has become so present in our daily life that it is now part of our habits and cultures. People talk about food, think about food, dream about food. Food is part of how we communicate and interact with others, which does not only happen in public, through the traditional media, Social Network, cooking TV shows, books, but also in the private sphere.

Yet again, its connection with our private lives also concerns public choices: the body and physical appearances, health and wellness, economics and ethics.

Fieldhouse describes food as “a vehicle for expressing friendship, for smoothing social intercourse, for showing concern. It is also ridden with status symbolism and is manipulated, subtly or blatantly, to demonstrate differences in social standing. Rituals and celebrations are usually centred around food; sometimes the type of food served can define the event, as with the Thanksgiving turkey or the Christmas pudding. The major transitional crises of life, the rites of passage, are marked in almost all societies by ritual or ceremonial distribution and consumption of food” (1995, p. 78).

The cultural connotations of food, however, only depicts one aspect of human life and society.

Indeed, food is part of a complex system, consisting of production, post-harvesting, processing, distribution, and its final consumption. Even if we do not clearly see it, what we consume does have consequences, and it sorts effects upstream in the previous steps of the system, especially in the production. The production, in particular, has multiple ripple effects (described in detail in the dedicated chapter below) on human health, economics, and environment, in a sort of vicious circle which is not anymore local but global. This is surely what ultimately gives to the overall picture concerning food the status of complexity.

Continuing in his analysis, Tickell claims that “civilizations grow until they either collapse or find yet another finite resource with which to temporarily prop up their soils. For the first time in history, we are now playing this game at a global scale” (2017).

Even though considering today's world disparities, differences and contrasts, food actually connects us all, visibly or not (“Food is much more,” FAO). What is extraordinary of food is that, even if it is a global issue and a capital, it assumes different connotations, values, and beliefs in each part of the world.

In order to well understand this complex topic, the research will start from the analysis of the current global facts about food. The arguments, when possible, will be considered from a sustainability point of view.

2.1.1 HUNGER AND GLOBAL NUTRITION TRENDS

Albeit at a slower pace than at any time since 1950, the global population is growing. From an estimated 7.7 billion people registered in 2019, the future estimate indicates that the global population will grow until 2100, reaching around 8.5 billion in 2030 (United Nations Department for economic and social affairs, 2019).

With such a growing number of people and the already evident environmental problems that the humankind is facing, producing enough food for everyone has become an issue of great interest. Farmers, indeed, are expected to produce more and more food per unit of land but it is clear that the land is a finite resource which humans are depleting at a very fast rate.

Agriculture is therefore at the threshold of a necessary paradigm shift. "For the first time at a global level, food production faces multiple limiting factors for key resources such as land, water, energy and inputs" (UN, 2012).

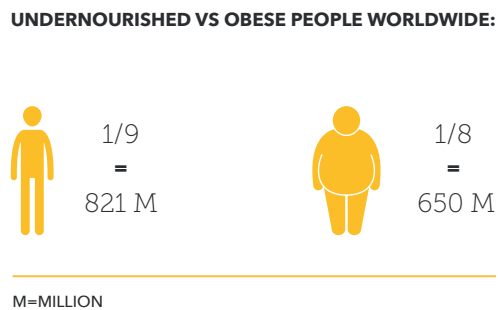
Despite all, global agricultural production increased at an average rate of 2% a year between 1961 and 2007 (UN, 2012), increasing the yields out of the same (or slightly increased) land. Moreover, other studies and scholars, like Kearney, reported that, globally, significant improvements have been made in raising food consumption per person with a rise of almost 400kcal per person per day, going from 2411 to 2789 kcal per person per day between 1969/ 1971 and 1999/2001 (2010).

However, even if in the past dramatic improvements to reduce the number of people suffering from hunger have taken place, in 2017 the United Nation Development Program reported that there are still 821 million people undernourished, often as a direct consequence of environmental degradation, drought, and biodiversity loss. Most of them live in the developing countries, especially in Asia, that accounts for around the 63% of the world's hungry, where 12.9% of the population is undernourished (UNDP, 2019). Undernourishment hits nearly one out of nine people in the world (WFP, 2019), whereas obesity one out of eight people (UNDP, 2019).

What is astonishing behind these data is that while the world currently produces enough food to feed everyone (UN, 2012), the world is increasingly dominated by degenerative nutrition-related diseases. Indeed, there are more overweight and obese people than underweight or malnourished in the world (Popkin, 2006).

Hence, as Martinengo noticed, it is evident that “the field of food and nutrition is marked by numerous contradictions, which set rich countries against poor countries, but they are also present within the wealthy countries and affect all segments of the population. Globally speaking, the clearest antinomy involving food is the disparity between abundance and scarcity (2015, p. 10).

Fig.4 The disparity between abundance and scarcity, adapted from FAO, 2019.



Many of the reasons at the base of the numbers and data presented above are directly related to the nutrition transition, which is defined as a series of adverse changes in diet, physical activity and health (Kearney, 2010).

The development of technologies and agriculture, especially in the most developed countries, brought to a decrease in the price of food, especially for fat and animal products. Together with the increasing imports of usually cheap, not healthy foods from industrialized countries, the poor had gained easier access to nutrition. As a result, traditional diets featuring grains and vegetables are giving way to meals high in fat and sugar (Kearney, 2010), which are responsible for the degenerative nutrition-related diseases, mentioned above.

The same author claims that “a difficulty in arresting the effects of the nutrition transition is due in part to the paradox that while the diet associated with the nutrition transition (high fat, sugar and salt) is unhealthy, it is also more diverse and pleasurable” (Kearney, 2010, p. 9).

Therefore, the challenge is to find a diet which is varied and healthy, and, also tasteful so that to reduce the nutrition-related diseases, as obesity and diabetes. In his analysis of the global food consumption trends, Kearney identifies a group of drivers that directly influence the nutrition transition, which are income, urbanization, trade liberalization, transnational food corporations, retailing and food industry marketing. In particular, the first two drivers are of particular interest in this thesis research.

INCOME

Over the next three to four decades, global per capita income is projected to rise at a rate of over 2% per annum, with developing countries that are starting from a low base expected to rise at even higher rates (Du, Mroz, Zhai, & Popkin, 2004). However, because higher incomes do not necessarily equal to higher education, rising incomes will potentially bring higher fat diets and unhealthy nutrition, at least in a first moment in those developing countries which are witnessing a steep growth. In most industrial countries, in facts, the effects of increased income have generally been considered beneficial, resulting in better quality diets, better healthcare, lower mortality and lower risk of obesity (Kearney, 2010).

URBANIZATION

As reported by the Department of Economic and Social Affairs of the United Nations in 2018, today the 55% of the world's population lives in urban areas, a proportion that is expected to increase to 68% by 2050. In addition, the projections show that urbanization, the gradual shift in residence of the human population from rural to urban areas, combined with the overall growth of the world's population could add another 2.5 billion people to urban areas by 2050, with close to 90% of this increase taking place in Asia and Africa (World Urbanization Prospects 2018 Highlights).

More and more people, hence, will find themselves living in a big city. There, they will most likely have access to a multitude of different kinds of food (generally with higher calories intake) and, at the same time, they will conduct a lifestyle which offers less and fewer opportunities of being on a healthy diet, and of doing physical activities. This is evidence of the fact that obesity and diabetes in developing countries are advancing more rapidly in cities than in rural areas (Kearney, 2010).

Finally, the same author recognizes that the driver of urbanization is an issue at a global scale. Indeed with more advanced (and cheaper) transportation systems able to more easily reach the big cities, suppliers all over the world will get easier access to new markets, ultimately facilitating the globalization of food consumption patterns (Kearney, 2010).

Fig.5 Increasing urban demographic concentration (500px.com/Denys Nevozhai).



2.1.2 FOOD SECURITY

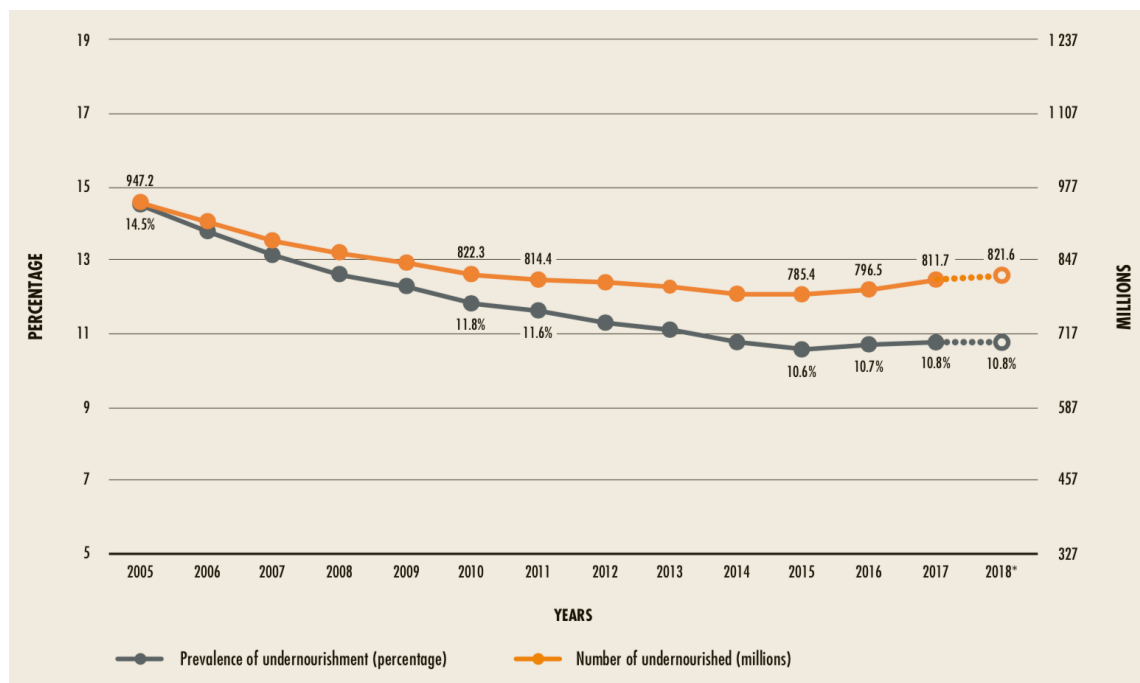
Why food is so important today?

Martinengo claims that food is so relevant because there is not enough of it (2015). Actually, rather than being a matter of scarcity, it would be more accurate to say that, nowadays, food is badly distributed and consumed. The result, anyway, is people in hunger or affected by undernourishment.

The academic discussion towards this issue is moderately active. Probably, the most relevant contribution is given by the annual reports published by FAO, together with the United Nations.

Their last publication reports that the global number of undernourished people, as well as the number of people who suffer from hunger, has slowly increased, albeit slowly, especially in almost all subregions of Africa and, to a lesser extent, in Latin America and Western Asia (FAO, 2019).

Fig.6 Undernourished people's trend (FAO, 2019).



Given the complexity of today's society, the imperative of making sure that no one suffers from hunger does not correctly and exhaustively depict the current situation anymore. Indeed, the report also states that there are many people who, while not "hungry" may still be food insecure. These people have access to food to meet their energy requirements, but they are uncertain that it will last, and may be forced to reduce the quality and/or quantity of the food they eat in order to survive. This moderate level of severity of food insecurity can contribute to various forms of malnutrition and has serious consequences for their health and well-being.

"Food security exists when all people, at all times, have physical, social and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (World Health Organization, 1996).

Another contribution to this topic is given by a prior study, conducted by FAO, about food waste and food losses, and their potential role in influencing the number of hungry or undernourished people. The study exactly highlights that food insecurity is often more a question of access (purchasing power and prices of food) than a supply problem, and that improving the efficiency of the food supply chain could help to bring down the cost of food to the consumer and, thus, to increase access (Gustavsson et al., 2011). The authors firmly believe that the issues of food waste and losses are crucial in fighting hunger, raising income and improving food security, especially in the world's poorest countries.

As a matter of facts, about 2 billion people in the world experience moderate or severe food insecurity. The lack of regular access to nutritious and sufficient food of these people puts them at greater risk of malnutrition and poor health, with a prevalence slightly higher for women than for men (FAO, 2019).

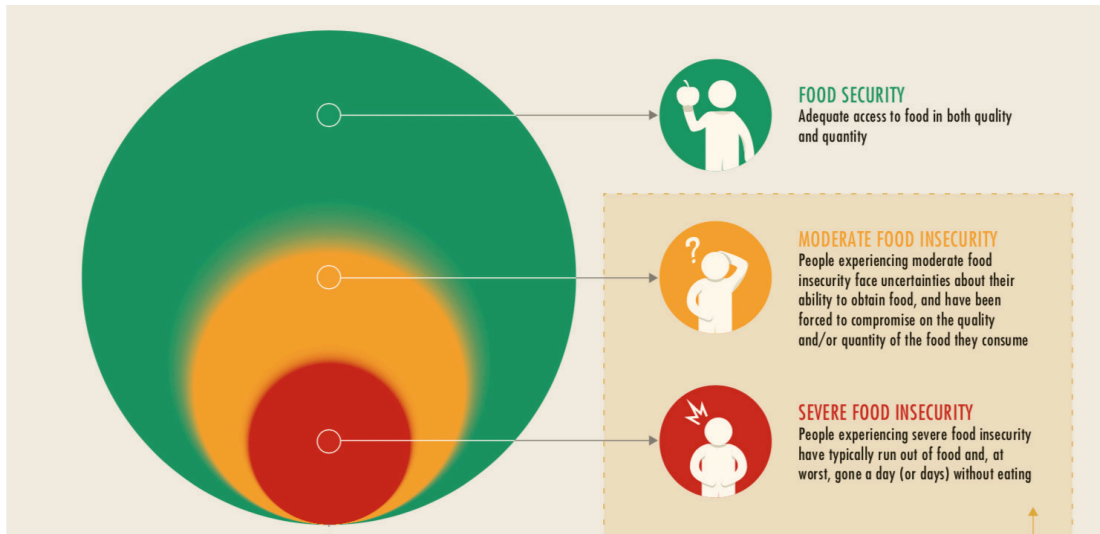
Two kinds of food insecurity conditions, in particular, can be observed:

Moderate food insecurity: consisting of people who face uncertainties about their ability to obtain food and have been forced to reduce, at times during the year, the quality and/or quantity of food they consume due to lack of money or other resources.

Severe food insecurity: consisting of people who have likely run out of food, experienced hunger and, at the most extreme, gone for days without eating, putting their health and well-being at grave risk.

In order to better understand the issue of food security, it is useful to analyze its main causes. The previous editions of the report on "the state of food security and nutrition in the world", cited before, identified that conflict, climate variability and extremes, and economic slowdowns were behind the recent rise in hunger. Indeed, the report explains that the economic events generally affect food security

Fig.7 Moderate and severe insecurity (FAO, 2019).



and nutrition, depending, not only on the extreme poverty level but also on the existence of inequalities in income distribution, as well as in access to basic services and assets. And in low-income countries, the effects on security and nutrition are evidently heavier (FAO, 2019).

It is therefore clear how the economy, unequal rights (and inequalities in general), level of poverty, food waste and losses, and unstable political government are all decisive factors that lead to food insecurity.

2.1.3 SUSTAINABLE DEVELOPMENT

Some of the phenomena treated in the previous chapters are arguments of discussion within the wide topic of “sustainable development”.

The term was first conceived and introduced only in late 1987 from the World Commission for Environment and Development (WCED), that defined it as “[the] development that meets the needs of the present without compromising the ability of future generations to meet their own needs (1987).

It was already late because the changes and damages to the environment were already taking places and because, in retrospect, the term has continuously lost its powerful meaning. Indeed, even if the concept of sustainable development was re-used in all the most important following sustainability-related global conference, as the ones that took place in Rio first and Johannesburg later, the great success on a communicative level did not bring any paradigm changes.

Surely, the introduction of the term itself has been a watershed in the sustainability discussions worldwide, making the idea of a different kind of development official.

In the recent literature, an important contribution is given by Manzini and Vezzoli, who claims that sustainable development could only happen if humans would change their way of living, rethinking drastically the same concept of well-being (2008). According to the authors, the idea of well-being is a social construct, created in a particular economical and cultural context, when the understanding of the "limitations" was scarce and natural resources were taken for granted.

What they believe in is that "transition towards sustainability will be a social learning process that will teach us, progressively, through mistakes and contradictions – like every other learning process – how to live better, consuming (a lot) less and how to recreate the physical and social ambient we live in" (Vezzoli & Manzini, 2008).

In this framework, the active agents of this social learning change will have the responsibility (but also the possibility) to guide and facilitate the transition. In particular, the two authors identify four principal participants: consumers, producers, the public institutions and designers.

Of particular interest in this research is the analysis of the role of the producers, the companies. While the consumers would potentially play an important role possibly able to influence the direction of the market (through the power of their spending decisions), and the designers would guide the transition by putting together all the different actors and facilitating their dialogue and ideas exchange, the producers may become the most active agents of sustainability, with the public sector promoting the social learning process. Indeed, if is true that companies and their industrial activities are the biggest cause of the environmental problems confronted today, it is also true that, within this production–consumption system, they have the most advanced knowledge base, organizational resources, and initiative (Vezzoli & Manzini, 2008).

Even if sustainable development has lost part of its significance and lowered its impact, the term successfully made sustainability become even a trend of nowadays. Some people, in facts, have already chosen to live according to less consumeristic and material principles, driven by ideological, functional and economic reasons. This is particularly evident when these more sustainable lifestyles well match with these people's living conditions, i.e. when these kinds of choices are just more right.

Therefore, a win-win solution would be one that could be spontaneously identified as better by people and that, at the same time, respect the limits of nature's resilience. As a matter of facts, it is clear that life on Earth depends on the functioning system of nature, on its quality and productive capacity of all the things we benefit from and generate, as food to mention one.

The nature resilience is an important issue because is the capacity of an ecosystem to overcome certain disturbances without losing irrevocably the equilibrium conditions and without compromising the ability of future generations to meet their needs.

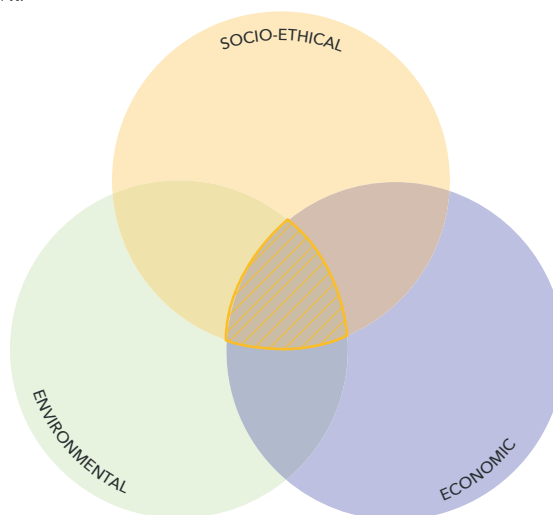
It is both a global and local issue, which can be viewed as composed of three intertwined dimensions:

Environmental sustainability: It is the ability to not exceeding the biosphere and geosphere resilience capacity, not exceeding the capacity of absorption of human effects such as global warming, acidification, ozone layer depletion, acidification, eutrophication, etc.

Socio-ethical sustainability: It is the ability to provide the same resource satisfaction level for present and future generations as equity of distribution of environmental space and resources, following the principle that everyone has the same right to access global natural resources.

Economic sustainability: It is the ability to actuate monetary practicable and prosperous solutions (Vezzoli, Kohtala, & Srinivasan, 2014).

Fig.8 The dimensions of sustainability for a sustainable development.



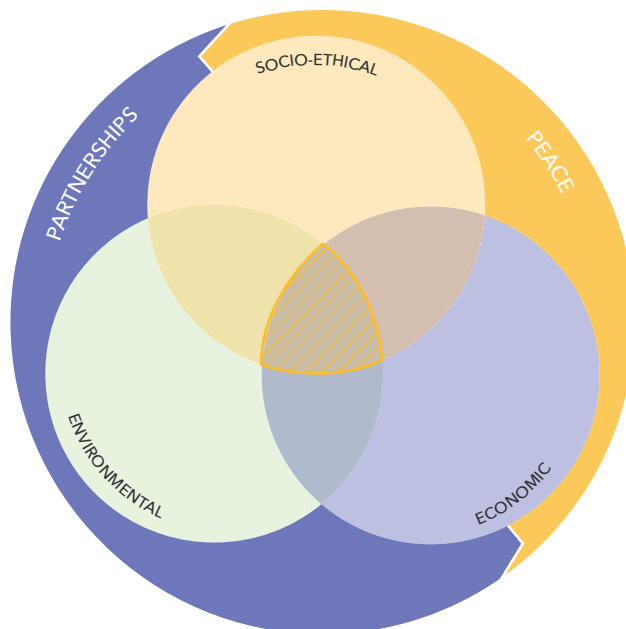
2.1.4 SUSTAINABLE DEVELOPMENT GOALS (SDGS)

In order to achieve a sustainable development, in 2015 the United Nations presented the Sustainable Development Goals (SDGs), as part of the 2030 Agenda for Sustainable Development.

The Agenda, signed by 193 worldwide countries' leaders, establish a set of goals and objectives to be achieved by 2030, through a new global partnership. The aim is to ensure, in all contexts worldwide, economic growth, social inclusion and environmental protection, fostering peaceful, just, and inclusive societies ("The Sustainable Development Agenda," 2019).

The 2030 Agenda ultimately inspires to rethink the way we approach the development challenges of today, by adding two dimensions to the concept of sustainable development: partnership and peace (added to the previously cited environmental, socio-ethical and economic ones).

Fig.9 The sustainable development model of The Sustainable Development Agenda, adapted from un.org, 2019.



In order to achieve a sustainable development, the Agenda has set a group of 17 goals (SDGs), based on the previously established Millennium Development Goals, which are divided into three main categories, aiming to end poverty, protect the planet and ensure prosperity for all. Each goal has specific targets to be achieved (within eleven years from now), with many tools, data, and objectives that should be followed by all the interested stakeholders, involved in this challenge.

The SDGs cover a broad range of social and economic development issues but they do not represent the Agenda in its entirety. Indeed, they are considered to be focus areas, necessary to achieve the sustainable development

Fig.10 The 17 Sustainable Development Goals, adapted from un.org, 2019.



2.1.5 SUSTAINABLE FOOD

Why do we mention food when considering sustainability? What is the role of food in the sustainable development? The answers to these two questions should be now clearer.

Food is at the base of everything we are and we do, directly or indirectly. From the choice of what to eat in our daily routine, to the necessary activities to get it, no matter the context.

What we buy influences what we produce and how we do it. This has consequences in the substances used for the production of the food and in the environmental side effects, which, in turn, result in what we introduce in our body and how it gets sustained, and in the (worse) conditions we found ourselves in to produce food again. Sustainable food, therefore, means sustainable system, in all of its aspects.

In the academic context, considering its double complexity (due to the words "sustainability" and "food"), there has not been found any official definition of "sustainable food". However, one interesting contribution to the issue is offered by Meyer-Höfer, Tijerino, and Spiller, who, in their analysis on the sustainable consumption of food in China and India, propose a definition which is surely wide, yet useful to better understand what certainly sustainable food is. They state that:

"sustainable food should at least comply with the following criteria: respect biophysical and environmental limits in their production and processing, respect high standards of animal health and welfare, be compatible with the production of affordable food for all sectors of society, support rural economies and the diversity of rural culture, provide a viable livelihood for farmers, processors and retailers, whose employees enjoy a safe and hygienic working environment whether nationally or abroad, be available, be affordable, safe, healthy and nutritious" (2015, p. 3).

Again, from this analysis, it is clear how food is a complex topic which has multiple implications in many different aspects of today's society, with particular stress on its production. Considering the fast development of China and its foreseeable impacts at a global scale, the next chapter will analyze the current situation of China, and, in particular, of its food.

2.2 FOOD IN CHINA

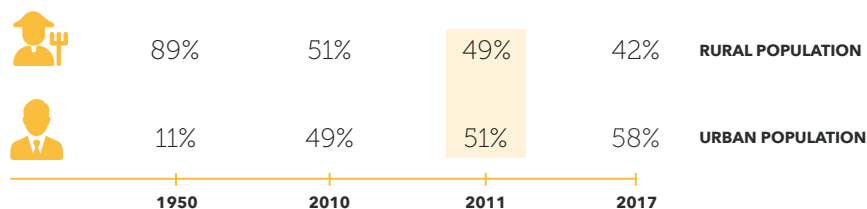
In order to better understand the following data and aspects related to food in China, a brief introduction to the current and most recent framework of the country will be offered. The next chapter, indeed, aims to give contextual information related to China as it is today and to shed the light on the role of food, so that to have the tools to understand the next, analyzed topics.

2.2.1 CHINA OVERVIEW

China is one of the largest and the most populous country in the world, with a population reaching circa 1.4 billion people. Also, the country is still in the middle of the largest urbanization in the history of humankind. As a matter of facts, in the last 30 years, due to the famous opening to the foreign markets (consequent to the fall of the strict communism of the previous years), the country witnessed unprecedented growth. This phenomenon is one of the factors that helped China lift an astonishing 600 million people out of poverty between 1981 and 2004 (WBCSD, 2015), while today the amount of people who lived below the poverty line accounts for 1.9% of the entire population (UNDP, 2019).

Moreover, from being mostly a rural country, China quickly changed its demographics. In 2012, for the first time, more people were registered to live in China's urban areas than in its rural regions (World Bank China Statistic, 2014). The projections expect the transformation to endure throughout all the 22nd century, with a first estimate suggesting that, by 2030, there will be 1 billion Chinese people living in cities (WBCSD, 2015).

Fig.11 Urban/rural China population over time, adapted from China Statistical Yearbook, 2018.

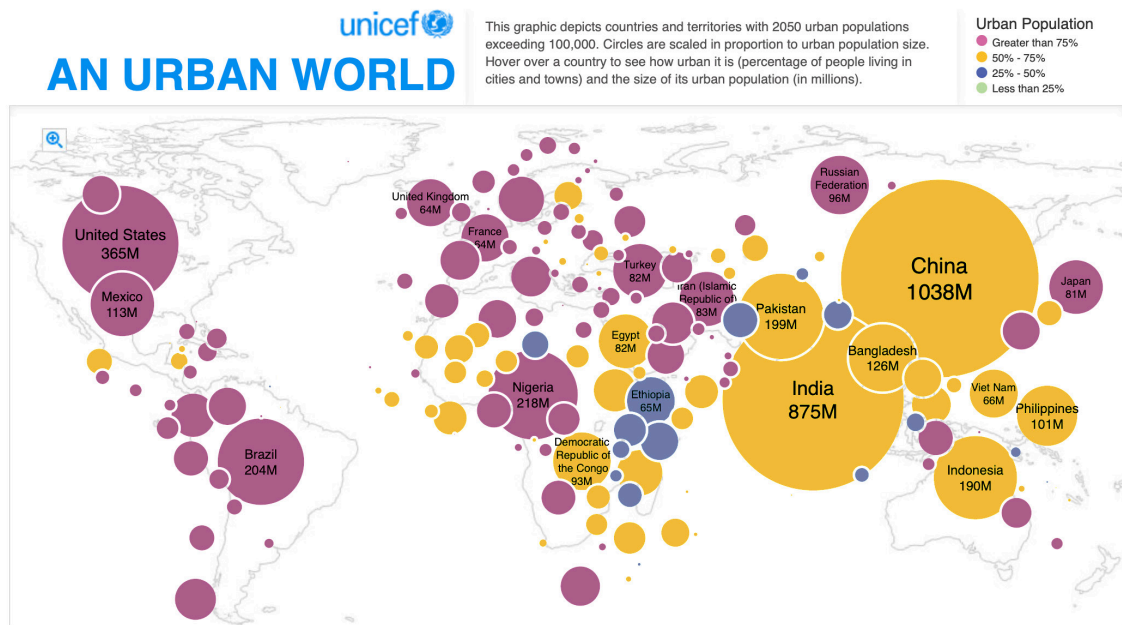


This is a totally foreseeable happening even today. Indeed, the proportion of people living in urban areas is already 58%, compared to 42% of people still living in the countryside (China Statistical Yearbook, 2018). Also, another source states that the trend is expected to continue to rise in the future, adding 255 million people by 2050 to the current Chinese population (UNDP, 2019).

Because of its sheer size and role in today's global dynamics, China's food security is of particular concern for the world, with roughly 20% of the world's population but only 7% of its arable land (FAOSTAT 2013). Also for the country itself, food security has historically played a crucial role in public health, considering that the country went through 3 years of famine in the middle of the last century, with consequent high rates of mortality. This cursed event particularly hit the life of people, with repercussions still evident today, and, as a legacy of this public health tragedy, food supply, price, and availability are today high priorities on China's national agenda (Lam, Remais, Fung, Xu, & Sun, 2013).

However, in the recent years, China managed to increase the yields from its land and, today, even if still the 8% of the population suffer from undernourishment, the country is on the right path to achieve the Sustainable Development Goal number 2, i.e. zero hunger (China Sustainable Development Report 2019).

Fig.12 Countries and territories with 2050 urban population exceeding 100'000, adapted from unicef.org, 2012.



2.2.2 CHANGING CONSUMPTION HABITS

Another interesting aspect is that, together with the changes in the demographic composition of the ever more populated cities, also new lifestyles have come into being. In particular, those living in the urban areas witnessed a substantial change in their lifestyle, from a subsistence level and agrarian focus to a consumption-focused lifestyle, definitely inspired by Westerners trends.

Indeed, another key consequence of the astonishing growth of the country has been a substantial growth in the incomes of urban residents, that has naturally brought to a rapid change of the standard national diet to include more meat, as well as to increase the consumption of processed fats and sugars (WBCSD, 2015).

The already reported analysis, conducted by Kearney, on the global consumption trends and drivers, supports the evident nutrition transition of China towards unhealthy (for the body and the environment) new diets.

Indeed, while in the recent years significant improvements were made in raising food consumption per person, "between 1963 and 2003, China, as a prime example of a populous developing country, showed even more dramatic changes, especially in vegetable oils (680%), meat (349%) and sugar (305%)" (Kearney, 2010, p. 3).

Thus, it is clear that at the same time that poverty sharply declined, the rise in income level has affected diets adversely from a health perspective (Du et al., 2004).

In his analysis, Kearney continues by reporting a very important contribution made by Popkin, affirming that China is experiencing a nutrition transition considerably sooner and at a much lower level of the gross national product when compared with the USA and Western European countries (Popkin, 1999, as cited in Kearney, 2010). In addition, he reports the evidence that because the nutrition transition appears to take place at a faster rate among those on lower incomes, traditional diets featuring grains and vegetables are giving way to meals high in fat and sugar (Kearney, 2010). This is confirmed by Zhai et al. who also found that the increase in the consumption of animal products was higher for urban residents compared with those living in the countryside (2009), underlining the previously mentioned consumption-focused lifestyle and its negative impacts in the diets.

Another research, conducted by Shimokawa, investigating the meat consumption in China, strengthens and highlights the aforementioned increase in meat as raising trend in the dietary habits of Chinese.

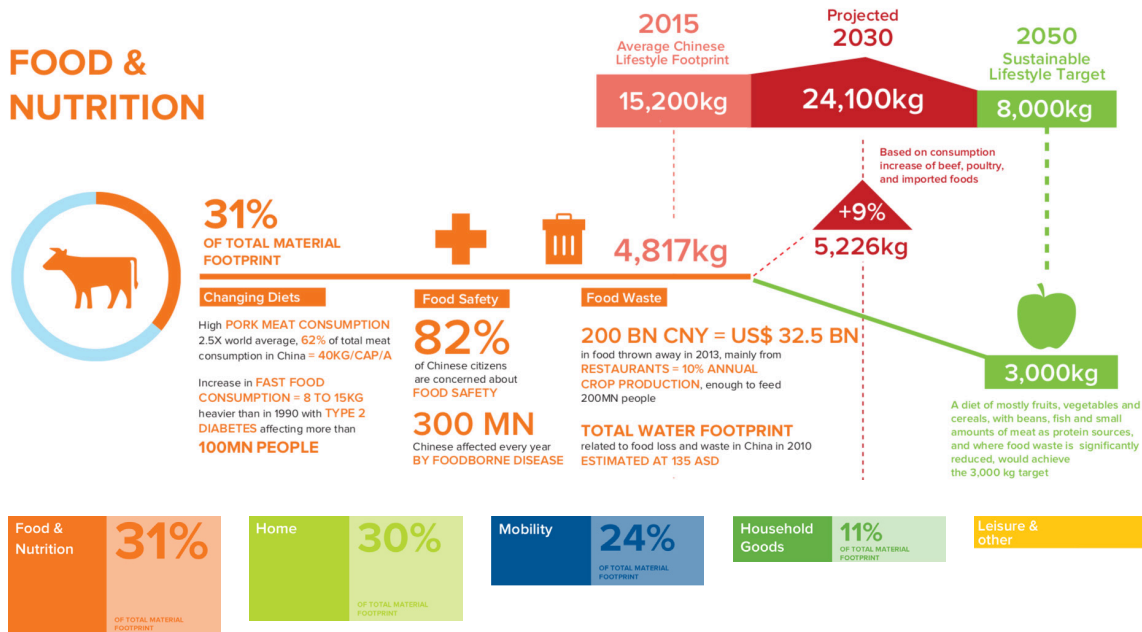
In fact, the research reported that “the demand for meat products and animal feeds in China is expected to increase steadily in the following decade, i.e., the OECD-FAO (2014) projects that China’s annual total meat consumption would increase and reach 98.5 million metric tons in 2023 (16.6% increase from the level in 2013), which would be more than the double of that in the US in 2023 (40.6 million metric tons). Previous studies indicate that China’s increasing demand for meat products and animal feeds can cause substantial damages on food security, environment and public health in China and possibly in other developing countries (FAO, 2006; Sun & Wu, 2013; Wang et al., 2014, as cited in Shimokawa, 2015).

The “Sustainable lifestyle report”, conducted by the World Business Council for Sustainable Development in China in 2015, analyzes the Chinese consumption hotspots and offers another great insight into the consumption trend of Chinese people concerning food (one of the consumption hotspot). The study helps to understand the current importance (expressed through the material footprint) of food for the average Chinese urban citizen, the impact of its consumption, and a suggestion for improvements.

First of all, the terms material footprint and consumption hotspots need to be explicated. The term “material footprint” (MF) was firstly introduced in 2013 as an indicator defined as “a global allocation of used raw material extraction to the final demand of an economy” (Wiedmann et al., 2015). In other words, it is a consumption-based indicator of resource use.

Instead, the term “consumption hotspot” refers to a “lifestyle or consumption trend that’s on the rise, and that poses the biggest risk to the environment and social wellbeing” (WBCSD, 2015). Because of this risk, the efforts focusing on these hotspots, aimed to reduce their impacts, could potentially reach significant results.

Fig.13 Current average lifestyle material footprint of food and nutrition as a % of the total individual lifestyle footprint (average Chinese) including the hotspots driving the footprint today and projected to 2020-30. A future sustainable lifestyle target level of material intensity for food consumption is also suggested. WBCSD, 2015.



As it is possible to observe from the image, the food and nutrition is the hotspot contributing the most to the material footprint of the average Chinese urban citizen, followed by energy consumption at home, mobility, and goods. The causes for its high percentage are due to the changing diets (already discussed above), food safety (that will be discussed in its dedicated chapter), and food waste.

Also, it is possible to notice that the skyrocketing of the consumption of meat, also due to the increasing fast food consumption, not only weights considerably in the material footprint but it also causing health related diseases. As regards the food safety, what can be said here is that it weighs so much in the material footprint because Chinese, due to different motivations, are obsessed with what they eat, and they are willing to spend more for products they can trust (usually this kind of food requires more resources to be produced, compared to a less safe one. This is definitely an issue hardly understandable or perceivable in Europe, considering the wide number of regulations addressing food production. The chapter about food safety will tackle the issue).

Finally, food waste is reported as a cause for the high percentage of food and nutrition because is an issue across the all supply chain, including a tendency towards the over-packaging of food items, and particularly in the consumption stage. Indeed, the study reports that the most serious area of food waste is in the restaurant industry that thrown away an amount of edible food corresponding to 10% of China's annual food production (WBCSD, 2015), probably able to feed that 1.9% of the poor population or the 8% of the undernourished.

As we said, the developing countries are witnessing a nutrition transition that is taking place at a very fast speed, changing the traditional dietary habits, and mostly bringing severe consequences to the body. Indeed, the trend towards the increased prevalence of overweight is now occurring most rapidly in conjunction with accelerated economic growth (Kearney, 2010). Considering the number of people still in hunger, the result is a double burden of under-nutrition and over-nutrition. The consequences of such burdens are outstanding. In facts, previous analysis conducted in other developing countries demonstrated that the increasing consumption of highly calorific and more energy-dense food, combined with a less active lifestyle, leads to an increased incidence of obesity and diet-related diseases like diabetes, heart disease and even certain types of cancer (Shetty, 2002)

2.2.3 HEALTH-RELATED DISEASES

The shreds of evidence of health-related diseases associated with dietary changing habits, due to urbanization and economic growth, have been already largely reported. In particular, the "Sustainable lifestyle report", conducted by the World Business Council for Sustainable Development in China in 2015, eventually states that the changes in the dietary habits result in significant health issues, like obesity, hypertension, and Type 2 diabetes, affecting not only adults but also children (WBCSD, 2015).

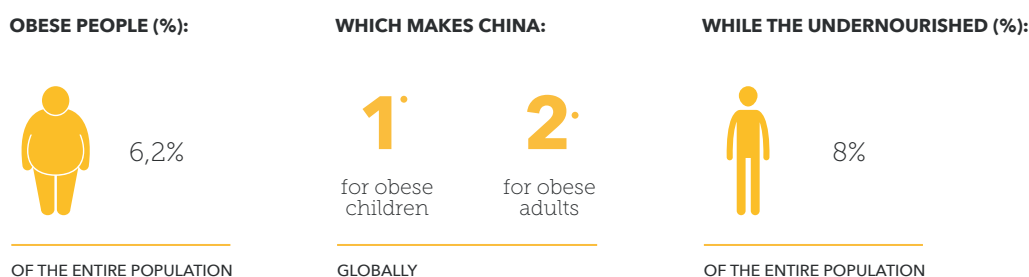
Of particular relevance, and highly discussed in the academic context, is the issue of obesity because it poses health problems throughout the entire life of an individual. As a matter of facts, among adults, obese people have higher rates of mortality due to an increased risk of cardiovascular disease, cancer, and diabetes.

Also, obesity, among the health-related diseases related to nutrition, is definitely a huge phenomenon. It is, in fact, on the rise in almost all countries, contributing to 4 million deaths globally (FAO, 2019).

In 2016, more than 1.9 billion adults aged 18 years and older were overweight. Of these over 650 million adults were obese, a number that tripled since 1975 ("Obesity and overweight," WHO). In addition, over the same period of time, the prevalence of obesity more than doubled among children and adolescents (FAO, 2019).

Worldwide acknowledged factors fostering the risk of obesity include higher cost (and lower appeal) of nutritious foods and their substitution with cheaper foods that are high in fats and sugar, increase consumption of fast food and carbonated soft drinks, low physical activities, and the stress of living with uncertain access to food (FAO, 2019).

Fig.14 Health-related issues in today's China (China Sustainable Development Report 2019).



In China the framework is controversial. Indeed, today, the proportion of obese people is 6.2% of the entire Chinese population, considerably lower than that of the US (around a stunning 35%). Yet, China has the highest number of obese children and the second-highest number of obese adults (the US hold the record) (China Sustainable Development Report 2019). This is also evidence of why what happens in China may generate consequences on a global scale.

Also, that percentage needs additional clarification. In facts, while the overall country level of obesity is that 6.2%, there is a disparity between what has been registered in rural areas and in cities, where it reached even the 20% ("Obesity and overweight," WHO).

There are two interesting studies on the presence of obesity among Chinese people, both focusing on the relationships between the illness and the growth of the fast-food industry.

The first study mainly focuses on the adult obesity rate at a national level and highlights that in the past two decades, the fast-food industry has rapidly augmented in China together with overweight and obesity rates, increased from 20% in 1992

to 30% in 2002 and 42% in 2012 (Wang, Wang, Xue, & Qu, 2016). Definitely, a similar growth to the fast-food industry's one.

Indeed, over two million fast-food facilities operated throughout China as of 2014, making up about the 20% of China's total catering sub-sector revenue, and particularly successful in urban areas thanks to the increased family income, busier lifestyle, the industry's vigorous and effective marketing and changing social norms and values. This fast expansion has made it easier for consumers to consume fast food due to lower costs and price, time saved, and travel convenience, therefore causing a higher probability of becoming obese or overweight (Wang et al., 2016).

The second study, on the other hand, mainly focuses on children and eventually states that, even if overweight and obesity prevalence has rapidly increased in children, from less than 3% overall in 1985 to approximately 10% in girls and 20% in boys in 2010, and that fast food consumption generally increased, the consumption of western fast food did not appear to be a large contributor of childhood obesity in China (Xue, Wu, Wang, & Wang, 2016).

The study, however, acknowledges that "nevertheless, FFC may affect overweight/obesity indirectly. For example, FFC may have promoted western food culture among Chinese children, which may influence their other food intake and cause a shift to high energy density food and drinks at home or away from home" (Xue et al., 2016).

2.2.4 FOOD MARKET CALL FOR BETTER FOOD

The market is another lens through which it is possible to examine the current Chinese changing consumption patterns and their future developments.

A deep analysis into the consumption patterns of the current Chinese society reveals two opposite drivers dominating the food market.

If on the one hand, as described above, there has been reported an increase in meat, high fat and sugar-based foods, with an increase in the fast-food industry clearly derived from the West, on the other, it has also been registered an increase in the interest towards fresh and organic food. Indeed, Meyer-Höfer et al. revealed a growing interest in food safety, quality and nutrition issues, especially among young and educated high-income consumers (2015). Besides, data from the consulting firm iResearch shows China's fresh food e-commerce industry grew by 59.7% in 2017 to 139.1 billion yuan (\$22.1 billion) (2018).

Part 1: Contextual framework

In particular, China's middle class seems to be shifting toward diets that focus more on quality, style, and health. It is not a case that China was the world's leading market for fresh food in 2016, with total volume sales of 705 million tons and 35% of the global market in 2016 (Euromonitor, 2017).

As reported by Zhou, Weiming, Wang, Liu, & Cao the increase in per-capita income, consequent to the great Chinese economic growth, has indeed resulted in the augmented demand for high value and quality foods, a wider food variety choice

Fig.15 Market signals for better food, like fresh and organic (500px.com, Luis Vasconcelos).



and more out of home consumption, especially among young and educated high-income consumers (2012).

Another author reports that, regularly, every time that there is public concern about food poisonings and dangerous chemical residues in the food, the public opinion asks for "green" and organic products. This is the reason why, considering the recent food scandals in China, consumers are demanding greater quality, convenience, and safety in the food they consume (Gale & Huang, 2007). In addition, in his analysis of the demand for food quantity and quality in China, Gale and Huang affirm that "as increasingly affluent consumers increase their spending on food, they may buy not only more but better food. While most Chinese consumers are believed to be very price sensitive in food-buying decisions, an increasing number are willing to pay premium prices for food [and that] food quality rises with income at all income levels" (2007).

Finally, the author acknowledges how the concentration of income growth in the richest tier of urban households suggests that their spending has been disproportionately influential in driving the food demand and market developments, explaining in this way the extremely rapid growth in supermarkets, convenience stores, and restaurants, for instance.

Hence, from the analysis of the current market research and the most recent literature contribution, it is possible to perceive the increasing, yet slow, interests and demand for better or more sustainable kinds of food. Interestingly, the two very important reasons behind consumers choice towards sustainable food consumption are redundantly reported to be health and price, the former especially relevant for people with young children. However, it is considered necessary to guarantee safety and credibility of sustainable food, in particular to Chinese consumers (Meyer-Höfer et al., 2015), for sustainable food to expand.

2.2.5 CHINESE CUISINE

China is one of the world's four ancient civilizations, and the written history of China dates back to the Shang Dynasty over 3,000 years ago ("The History of China," 2019). It is not surprising that this culture has developed along with its food tradition, which is hence considered one of the most ancient as well.

China has a vast territory and abundant resources, and each region has a different climate, natural products, and folk customs. Throughout history, different regions have formed their own food flavors and styles of cooking.

As for the flavor, the whole country can be generally divided into four parts: sweet south, salt north, sour east, and spicy west ("Chinese Food/Cuisine", n.d.):

Fig.16 China flavors divided per region (ChinaHighlights.com).



Northern China: salty, simple, fewer vegetables with wheat as the staple food. Food using wheat as its main ingredients, such as noodles and dumplings is prevalent there.

Western China: hearty halal food.

Central China: spicy with a lot of seasonings.

Eastern China: sweet and light.

Southern minority: sour, and many minorities eat chilies every day.

A common characteristic of all the four Chinese food flavors is the use of vegetables as high nutritional ingredients. A legend said that a person, named Shen Nong, tasted many plants and classified them into edible vegetables, inedible weeds, and herbs, around 7,000 years ago. Confucius as well (552–479 B.C.) emphasized the necessity of vegetables in the food menu, by saying that eating vegetable was useful not only to eliminate people's hunger but also to have positive effects on health preservation (Li, Yin, & Saito, 2004).

There are also many old sayings about the importance of eating vegetables in China, that stress the point out and recall the long Chinese history and its culture. The sayings are usually a good mirror of population folklore. For instance, one of these popular sayings from the past acts this way:

*“Put green onion and garlic
in every dish, then you can
be as healthy as you wish”*

OLD CHINESE SAYING

Another example is “eat carrots for breakfast and ginger for dinner, then you will never need a doctor”. All these insights in the Chinese culinary tradition show the importance of vegetables in Chinese cuisine (Li et al., 2004).

2.2.6 HEALTH CONCEPT

As in every culture it happens, many of its element influence each other. Probably the most well-known acknowledgment is the relationship between Chinese food and human health.

Indeed, as Li et al. affirm, “the function of food resembles Chinese medicine in many aspects. Traditional Chinese physicians often explained the function of medicine and food by “the five elements theory” and “the negative (Yin) and the positive (Yang) theory”. Yin and Yang represent two complementary aspects of every phenomenon. While Five Elements refer to metal, wood, water, fire, and earth, the nature is created by the circulation and the mutual influences among the Five Elements. When applying this philosophical thinking to the Chinese food, Yin and Yang can represent two parts of the human body, while the five elements can represent five categories of food tastes: pungent, sour, salty, bitter and sweet. Eating pungent and sour food can promote the Yang in human body while eating bitter and sweet food can promote Yin. Only if the Yin and Yang in human body keep a balanced level, people can maintain their health. Hence, a healthy diet should properly combine all these five elements together (Li et al., 2004).

In particular, it is evident how food has always been linked to health, and why it still is for Chinese people nowadays.

The scholars support the phenomenon and its diffusion by arguing that “the utilization of functional food in a diet has been the main theme of Chinese food culture throughout its long history because Chinese people have believed that food is not just an energy source but a kind of medicine to be taken to cure diseases” (Li et al., 2004, p. 213).

This also justifies the wide number of traditional Chinese medicines and remedies, which are all obtained from natural resources, compared to the number of man-made ones. Of course, food is not considered a cure for serious diseases but a good remedy for everyday and long term body health.

Another evidence of the importance of health for Chinese people is offered by Leong, who, in his analysis of the possibilities for a radical shift toward sustainability to be possible, claims that Chinese people are particularly inclined to care about wealth, or being “money-minded”, and health, or being concerned with the body, which derives from the cultural notion of the five cardinal elements, described above. Hence, a possible strategy to promote sustainable solution-based business or initiatives in China should be better based on these two important concepts (Leong, 2006, as cited in Andersen, 2006).

Moreover, the already mentioned study investigating the main factors that affect sustainable food consumption intention and behavior in China, conducted by Meyer-Höfer et al., shows that Chinese sustainable food consumption intention and behavior are significantly influenced by health and price reasons. In particular, the former is acknowledged to have a long tradition in Chinese food consumption behavior and that nowadays there is a widespread common concern associated with food safety, as it is primarily linked with health issues (Meyer-Höfer et al., 2015).

Although Chinese are witnessing changes in their lifestyle and consumption habits (described in detail in the dedicated chapter) which cause many Chinese traditional foods and their knowledge to disappear because considered old-fashioned, health is still a concept of first importance (at least in the intentions, if not in practice) (Li et al., 2004).

2.2.7 CHINESE FOOD CULTURE

It is not possible to look at the consumption, dietary habits without considering, again, the cultural aspects of food, deeply rooted in Chinese society.

Indeed, "food may be considered culture while it is being produced as well as when it is being prepared and even when it is being consumed" (Martinengo, 2015, p. 10).

With this statement, the author elevates the food to a position and a role much higher than the simple physical one. Food not only satisfies one of our basic needs but it also shapes our culture and, by consequence, how we live and think.

A very clarifying contribution to the cultural role of food in the research context is offered by Ma. The author highlights the cultural roles of Chinese food by showing all its different cultural and social functions, as to establish and maintain relationships, represent social status, and express symbolic meanings.

The author claims that "food has many symbolic meanings; it not only expresses but also establishes the relationship between people and their environment as well as between people and what they believe" (Ma, 2015, p. 195).

Before going deeper into details of the different cultural functions of food, it has to be first observed that, as Li et al. reports, Chinese people have always exploited traditional foods through their long history and developed an abundant food culture. Traditionally, Chinese foods are mostly based on rice, wheat, and other grains. In addition to those materials, Chinese people incorporated as diverse food materials as possible and combined them properly to make their meals healthy and tasty (Li et al., 2004).

Ma confirms the habits and adds that while people living in the south of the country use rice as a staple food, in the north people use food made of wheat flour, as steamed bread, bread, and buns. Also, the preparation of Chinese food usually takes more time on cooking, averagely 2-3 hours per meal, compared to other (Western) countries. This is surely one of the reasons why the frequency of eating outside has considerably increased in recent years, considering also that most Chinese have three meals a day (Ma, 2015).

Another peculiar characteristic is that food consumed by one person alone is not considered a social food, and that usually (or when possible) Chinese prefer to eat together. While sharing the food, indeed, culture and atmosphere are shared, whereas eating separately is opposed to the traditional dining culture.

This is the reason why a grouped dining system, with dishes placed in the middle of the table for people to share, (a formal dinner includes 4-6 cold dishes, 8-10 hot dishes, served with soup and fruits) is used in most situations. Again, through the lens of the food culture, it is possible to explain the habit of ordering multiple dishes.

Indeed, many medical and cooking books, written thousand years ago, exalt the importance for human health of eating different kinds of food, in addition to the traditional ones, i.e. rice, wheat, and grains.

These beliefs are still valid nowadays exactly because Chinese people believe that, as reported by Li et al., “taking diverse foods is recognized as a principle of healthy diet” (Li et al., 2004, p. 214).

Then, as regards the cultural functions, food can be used to indicate the degree of a relationship between people. For instance, a service of expensive and rare foods usually shows respect to the guests, as well as social status and wealth. As we already mentioned in the chapter about Chinese cuisine, food can be used to distinguish a characteristic group, as regions, families, races or religions. Food can be also used as a symbol of meaning in many occasions, to impart different information. Peanuts are considered to give longevity, while oranges and chestnuts good luck, for instance. Finally, food can be used as a means of reward or punishment, especially towards children. For example, when a child has good school performances, parents may take them to a western fast food restaurant as a reward (Ma, 2015).

Fig.17 Chinese traditional food for the New Year (500px.com, Thy Le).



Interestingly and without any doubts, one of the main cultural factors influencing the consumption of food the most is the concept of (Chinese) "face". The concept is not intuitively, easily understandable. Therefore, in order to grasp the meaning of the term, a brief discussion over its significance will be offered hereinafter.

In the literature context, the two main acclaimed contributions to its definition date back to the last century, of which only secondary resources were found.

The first Western author to study the term was Goffman, who stated that "the concept of face refers to a social representation of a person reflecting the respect, regard or confidence others have in them which the person in question is conscious or aware of himself or herself (Goffman, 1972, as cited in Qi, 2017). On the other hand, the first Chinese author to study the term in the modern literature was Hu, who actually distinguished two components in the Chinese acceptance of the term: the "lian" (the moral component) and the "mianzi" (the social one).

Lian is defined by Hu (1944: 45) as "respect of the group for a man with a good moral reputation [...] it represents the confidence of society in the integrity of ego's moral character, the loss of which make it impossible for him to function properly within the community". Mianzi, as distinct from lian, stands for the kind of prestige [of] a reputation achieved through getting on in life, through success and ostentation. [...] For this kind of recognition ego is dependent at all times on his external environment" (Hu, 1944, as cited in Qi, 2017).

Qi, concludes its analysis on the meaning of "face" by stating that "face is an inevitable and unavoidable aspect of interpersonal encounters, connections, and relationships in almost every aspect of social life in China, ranging from informal personal interactions to the most ordered and formal elements of organisational and institutional relationships. It is one of the keys in understanding Chinese politics, economics, business, and education at every level" (2017).

Thus, the concept of "face" could be defined as the self-image that a person forms for the inner self and the outer society, based on the unquestionable importance of the opinions or appraisals of others. The concept, as said at the beginning of this paragraph, plays an important role in the food habits and consumption patterns of Chinese. Indeed, all the behavior that is related to food consumption is constrained by culture (Ma, 2015).

At the dining table, face is one of the reasons why people often over-order food and dishes, with a consequent generation of waste.

An example of the application in a real-life (common) situation, reported by Shi et al., could be that at a dinner party, the host receives much “mianzi” only if he/she prepares as much food as possible food for the guests, who in turn must eat as much as they can, without caring about how much food will be wasted (Shi, Wen, Huang, & Ye, 2011).

Another, final evidence that supports the weight that the Chinese face has in the food consumption is offered by Liu, who claims that, behind the big food waste trend at the consumer stage of today’s China, the “face” counts. Over ordering food is believed to be a way of showing respect to guests and displaying generosity, a behavior moved by the fear of losing face (2013).

2.2.8 CHINESE FOOD PRODUCTION

“The traditional understanding of food in Chinese culture is embedded in a composite character, 糗, meaning food in Chinese. This Chinese character summarizes the environmental factors that help or limit agricultural productivity in China. The subpart 米, means rice or is a collective term for cereal, which is the staple crop for Chinese people. To grow crops, 日, the sun, is needed to provide photosynthetic energy and warm temperatures, but appropriate climatic conditions (e.g. rainfalls) are also needed and thus depend on 一, a simplistic representation of the sky. Labour and agricultural inputs are added to 田, the field, but ultimately the field is composed of 土, earth, which controls agricultural productivity via constituents of the soil, its structure, and other properties” (Lam et al., 2013, p. 2).

The study of the Chinese character for food shows its powerful link to its production and all the resources and operations needed to obtain it. This rich and powerful character makes better understand why food and its supply system are at the foundation of social stability in China, expressed in the peculiar saying “to people, food is heaven” (Lam et al., 2013).

China is still today the world’s biggest food producer and consumer (UN, 2012), whose agricultural sector accounts for 8.6 of the country GDP and the 28% of the workforce (USDA, 2018). Though generally working in small plots of less than 2 hectares on average, family farmers in Asia and the Pacific produce 80% of the total food needed to ensure food security in the region (AFA 2014).

In particular, in China, the average farm size is around 7.5 mu, corresponding to 0.7 hectares (minister of agriculture, 2013).

Moreover, approximately 100 times more than the US, the number of farms in China is reported to be in the order of the 250 million units, most of them voted to the production of crops (including fruits, vegetables, and grains) and, traditionally, small (much smaller than in the US) (PwC, 2016).

However, considering the quick pace of the country, it has been observed a (still) slow trend towards the increase of large-intensive farming operations, which are growing rapidly in China, due to investment from large Chinese companies and multinationals (PwC, 2016).

HISTORY OF THE AGRICULTURAL SYSTEM

In order to understand the most recent and current happenings related to Chinese food production, a description of the last century's history of the agricultural system is hereinafter offered. The description is based on an interesting article published in the journal of Food, Nutrition and Agriculture of FAO, back to 1991.

Fig.18 Chinese agriculture (500px.com, Sirisak Baokaew).



The article reports that after the People's Republic of China foundation in 1949, a nationwide agrarian reform set to redistribute the lands, previously still managed in a feudal system.

Peasants found great incentives to accelerate agricultural production which increased steadily until 1957 (State Statistics Bureau, 1991).

After 1958, a new reform introduced the People's Commune system. Under this system, peasants within a township were organized into a commune consisting of production brigades which were divided into teams. Land, livestock and other production materials were owned collectively, and production team members usually worked together managed by a leader.

Because peasants were paid in food and perhaps in small amounts of cash, the system ended to dampen their enthusiasm and the rural economy declined: in 1961, the grain output was only 143,5 million tons, similar to one of 10 years before. The critical situation brought to the well-known Great Chinese Famine lasted for 3 years and sentenced to death millions of people. The crisis was only after alleviated to some extent by policy adjustments which led to a slow recovery.

The People's Commune system lasted until 1978 when it was replaced by a rural household production responsibility system. This new kind of system allows each rural household to use a piece of land and provide grain to the local government at the state-ordered rate according to the household's contract. The new system succeeded, and it achieved a grain output of 446.2 million tons, in 1990.

In 1991, in order to improve the population's nutritional status, the National Program for Ten-Year Planning of the National Economy and Social Development and the Eighth Five-Year Plan were issued by the Chinese Government. These pointed to goals for the year 2000: "Based on the increase of income of the inhabitants, the food consumption of urban and rural people will be further raised in both quality and quantity, and the consumption of meat, eggs, milk, aquatic products, and fruits will rise to some extent...". Finally, not only output quantity but also nutrition considerations were officially incorporated into the national economic and social development plan, which open the path to the following great growth (Ge, Chen, Shen, & Zhang, 1991).

THE GROWTH AND THE CURRENT SITUATION

In 1995, Dr. Lester R. Brown published a very criticized book about whether China could ever possibly feed its own growing population, considering the few resources of the country. The book "Who will feed China?" is still considered today a first awakening of the very urgent issue related to the ability (of humankind and the Earth) to feed the up growing global population.

Especially in China, the estimate suggests that the food demand will increase by 33% in quantity by 2050 (compared with 2015), driven by both population and income growth (FAO, 2016).

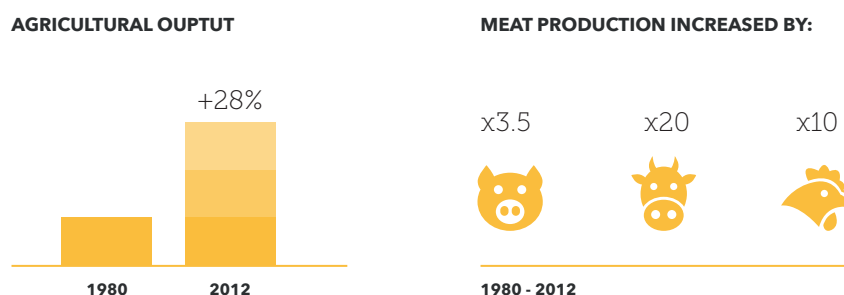
However, through implementing reforms, new open policy, technologies and material inputs, China succeeded in increasing the amounts of agricultural products so that to satisfy the huge food demands of a doubling population and growing economy, creating a miracle of feeding 22% of the world's population using only 7% of the world's cultivated land (FAOSTAT 2013).

China's total harvest, indeed, more than tripled between 1980 and 2013, while arable land increased by only 10%. The growth was due mainly to a ten-fold increase in vegetable production, which has contributed to placing China as the world's largest producer of vegetables, with over 50% of world production, and fruits, with over the 20% (PwC, 2016).

As a matter of facts, Gale and Huang report that, even if China's rapid growth of 9-10% per year suggests that its demand for food is growing faster than its production capacity, it has remained surprisingly self-sufficient in most food products. (Gale & Huang, 2007).

The total grain production grew at a rate of 28% between 1980 and 2010, beef production increased by a factor of more than 20 from 0.3 million tons to 6.5 million tons, and contemporaneously, mutton, poultry, pork, and aquatic products increased by factors of 9, 10, 3.5 and 11 respectively, finally, fresh milk and egg production have increased by a factor of 26.5 and 8.8, respectively (FAOSTAT 2013; Liwei et al., 2013). It is not hard to believe that between 1961 and 2012, the gross value of agricultural production in China increased from US\$71 billion to US\$594 billion (in 2004-2006 US dollars), representing an annual growth rate of 4.2% a year (FAO, 2014), literally astonishing.

Fig.19 Food production increase, by category. Adapted from FAOSTAT, 2013.



As for today, a very explanatory research, conducted by PwC in 2015-2016, offers a great report of the current situation of the food production system and facilities of China. The research reveals that, compared to the past, nowadays most pork and poultry comes from more than three million small and medium-sized intensive livestock farming operations, spread throughout China. Between 1980 and 2013, indeed, China's total meat production grew by 400%, coming to the point of producing and consuming more than half of the world's pork (in 2014). The study also reports that the small household farms, traditionally the main producers of pigs, still account for about one-third of today's total production of hogs.

Moreover, also the production of chicken meat has increased, exactly by more than 1200% since 1980, driven by the mass migration from the countryside to cities and the rise of the fast-food industry in the country. Today, the report highlights that it has become China's most industrialized and vertically integrated area of livestock production.

Finally, also the production of milk greatly increased, by more than 400%. Even if the majority of cows are still owned by very small farms, large corporations are slowly taking the scene (PwC, 2016).

The reasons at the base of this productive success are due to different elements. Sheng and Song believe that the productivity growth not only due to a large scale migration resulting from institutional reforms which lowered labor/land ratios, but also to technological progress and infrastructure investments (2019). Gale and Huang, instead, motivate the production success by claiming that a large proportion of China's income growth has been devoted to greater value-added in food processing and marketing rather than increased quantity (2007).

In one case or in the other, although its contribution to GDP and total employment fell over time, what is clear is that China's gross output of major agricultural commodities continues to rise (FAO, 2016). However, further improvements per unit area yield seem to be hard to achieve, considering the limited cultivated land resources and conditions, as the ongoing soil erosion and desertification (Liwei et al., 2013).

ENVIRONMENTAL POLLUTION

What has been called a productive "miracle", which vastly improved the food security in the country and greatly diminished the number of undernourished, has also generated unfavored consequences. Indeed, probably the principal reason for the (short term) success of the production power of the country is due to the abuse

and overuse of chemical fertilizers and pesticides. The aforementioned research conducted by PwC reports that China's agricultural sector is one of the world's largest users of fertilizers and pesticides, and on average its farmers apply more than four times the amount of chemical fertilizers and more than three times the amount of pesticides per hectare than farmers in the EU or the US (PwC, 2016), thus endangering the environment, the public health, and the taste of food itself. The phenomenon is not only attributable to farming, but also to meat production. Researchers at the Chinese Academy of Sciences has estimated that up to 84.000 tons of antibiotics were administered to animals in China in 2013 (Chinese Academy of Sciences, 2015, as cited in PwC, 2016).

A very interesting article, published in the National Geographic magazine by McMillan, reports that, although big, large scale farms could be an effective solution to poverty in rural areas, they are at best double-edged swords because they will certainly bring significant environmental and health risks. A 2010 census of pollution by the Chinese government found agriculture to be the largest polluter of water, greater even than manufacturing (McMillan, 2018). The widespread use of fertilizers and pesticides has, therefore, contributed to hazardous levels of pollution, and food safety is now both a key public concern and political priority (WBCSD, 2015).

To conclude, as stated by Kearney, in order to be able to sustain its growth sustainably, the future food production policies must consider both agricultural and health sectors, thereby enabling the development of coherent and sustainable policies that will ultimately benefit agriculture, human health and the environment (2010).

Fig.20 Environment and water pollution in China (flickr.com, Bert van Dijk).



2.2.9 FOOD SAFETY

At this point, it should be clear why the issue of food safety is of particular relevance for Chinese people. Food is a very important component of their culture and daily habits but, due to the elevated number of people together with unfavorable land conditions (partly because much of China's terrain is mountains or desert) and the consequent risk of short supply, food is not constantly produced safely.

Indeed, as Lam et al. recall, the rapid urbanization has had several public health effects, including dietary changes that accompany rural-to-urban migration and put pressure on food supplies as consumption of animal products increases (2013). As we said previously, because health motives are very important for Chinese and have a long tradition in their food consumption behaviors, nowadays there is a widespread common concern associated with food safety and the link with the detrimental health consequences (Liu, Pieniak and Verbeke 2013; Yin et al. 2010; Sirieix et al. 2011, as cited in Meyer-Höfer et al., 2015).

But how food safety is defined?

The major contribution to the definition of such an issue is offered by the World Health Organization, in the publication "Assuring Food Safety and Quality: Guidelines for Strengthening National Food Control Systems", prepared in 1997 to enable national authorities, particularly in developing countries, to improve their food control systems.

The World Health Organization publicly defined food safety as "the assurance that food will not cause harm to the consumer when it is prepared and consumed according to its intended use" (WHO, 1997).

More recently, even the FAO offered its own definition, by stating that "food safety is the absence, or safe, acceptable levels, of hazards in food that may harm the health of consumers. Foodborne hazards can be microbiological, chemical or physical in nature and are often invisible to the plain eye; bacteria, viruses or pesticide residues are some examples. Food safety has a critical role in assuring that food stays safe at every stage of the food chain from production to harvest, processing, storage, distribution, all the way to preparation and consumption" ("Food Safety," FAO).

To some extent, this second definition updates and complete the original one, treating food safety, not as a concept per se, but placing it within the complex scenario of the food system, where many different aspects have to be taken into consideration.

Being general (universal), food safety is, therefore, a global issue that affects the health of populations in both industrialized and developing countries alike, no matter the social status.

In under-developed and developing countries (even where the disparity between urban and rural areas are strongly evident) food safety is surely a more common phenomenon, compared to the industrialized country. Indeed, for instance, in China the water and sanitation infrastructures are at a much earlier stage of development and, thus, the risks to the food supply are much greater. In rural areas—the setting where most food production occurs—an estimated third of the population does not have access to improved sanitation, contributing, for instance, to the continuing transmission of important foodborne diseases (Carlton et al., 2012, as cited in Lam et al., 2013). In addition, the chemical pollution, due to intensive farming (the same that contributed to the incredible production growth of the country), is a major threat to both agricultural land and freshwater supplies (Zhang et al., 2010), together with the development of industrial facilities in rural areas which contaminated the fields with their industrial wastes, containing heavy metals. For instance, soil and water contamination with the heavy metal cadmium can lead to the presence of this toxicant in agricultural products that, when consumed, poses a range of health risks (Lam et al., 2013).

Analogous fate has involved the meat and processed food sectors where incidents of illegal chemical additives have led to a public social distrust of the food industry, and loss of public confidence in the regulatory system, although the government efforts to improve the production and health food conditions.

Evidently, the perception of food in China has undergone a fundamental change, along the years for both consumers and producers. From the great opening to the Western market, the liberalization of the agricultural sector and the consequent, new economic conditions, food in China has become an ordinary commercial commodity for profit-making. In search for increasing profit and margins, some producers and manufacturers went well beyond the production regulations standard, causing health-related incidents that have jeopardized the public's trust in food safety (Lam et al., 2013).

2.2.10 FOOD SCANDALS

As already recalled, rapid urbanization and changing consumption habits drove the Chinese food production to excess every kind of international safety regulatory standard. The miracle of feeding a growing population with limited resources actually happened but it came with a cost. The overuse of chemicals and substances to pump the production of food has not only deeply polluted the environment (some sources believe for many years to come) and generated products with unsafe residues (still today), but it has also affected the mindset of the producers and consumers alike. In the future, although illegal activities will surely decrease, food scandals will not completely extinguish from the country.

In this chapter, a report of some of the worst and famous food scandals that scarred the public opinion is provided. Among all, it has been decided to describe the incidents related to those food traditionally present in the Chinese food culture, like rice and pork (as today), and the pernicious incident related to milk, particularly felt as it hit children.

TAINTED MILK (BBC, 2010)

The first traces of the incident date back to 2008, when sixteen infants in Gansu province were diagnosed with kidney stones. Four months later, an estimated 300,000 babies in China were sick from the contaminated milk, and the kidney damage led to six fatalities. It was later revealed that all of them had been fed milk powder adulterated with a toxic industrial compound called melamine. The substance is known to be used to make plastics, fertilizers, and concrete, and, when added to food products, it indicates a higher apparent protein content but can cause kidney stones and kidney failure.

The Sanlu Group, one of the largest dairy producers in China, was identified as the chief culprit, with many other Chinese dairy firms implicated, for a total of 22 (one out of every five suppliers in China). The scandal has heavy consequences, as several convictions and two executions. Probably the boldest was the outrage among consumers and fraught parents which led to an international outcry about the standards of food safety in China.

Fig.21 Dead pigs floating in Huangpu river (Chinasmack.com, Fauna).



DEAD PIGS (The Guardian, 2013)

Shanghai's drinking water was under threat, when in 2013, after 16,000 diseased pig carcasses were found floating in the Huangpu river, a usual source of tap water.

The pigs were soon traced through tags in their ears to Jiaxing, the province of Zhejiang close to Shanghai. The tests that were made show that the pigs carried a common virus among hogs, not known to be infectious to humans. However, considering the condition of the water, especially in the nearby areas where the scandal occurs, many treatments and tests were conducted to the water before it could meet the national standard again.

The causes for the presence of pigs in the water were attributed to two main reasons. Because the pig industry blossomed in China, the pig farms of Jiaxing enlarged their business operations by increasing exponentially the number of animals. This brought to an increase in the mortality rate of the animals (compared to a not intensive breeding system) which have to be processed in special processing pits.

To avoid the costs of the processing, some farmers prefer to throw the dead animals in the river, not aware of the very short and long-term consequences (environmental and legal ones). The second reason is still linked to economics. Indeed, another way not to pay the costs of the processing pits is the black market, whose dealers intercept the chain, butcher the hogs and sell the meat as normal pork. Again, the result of the illegal traffic resulted in another meat scandal.

CADMIUM RICE (The New York Times, 2013)

In 2013, the authorities in the southern province of Guangdong found that more than 44% of rice or rice products tested there contained too-high levels of the poisonous metal, about twice the Chinese safety limits. Its presence in the soil as a contaminant is closely associated with zinc mining since cadmium is used in nickel-cadmium batteries of mobile phones, cameras, and computers. As a major battery producer, China is also a major consumer of cadmium.

The carcinogen substance builds up in the body and damages the kidneys and lungs and can cause bone disease.

The incident did not cause any immediate health-related illness (at least registered or directly attributable to the scandal), nor public exemplary punishment to the guilty eight rice brands and products (out of 18 tested). However, farmers and their families, villagers in the affected areas, and consumers of rice across the country were shocked again and outraged that their staple food, and, for some, their source of income, had been so carelessly contaminated with a so perilous substance. The scandal contributed to spotlight China and re-consider its food safety regulations and controls.

2.3 FOOD LIFE CYCLE

This chapter will analyze into details the life cycle of the food, i.e. the necessary steps the food passes through from the production to the disposal, and it will then focus on what has been found to be the most impactful step in the overall supply chain: the production.

Before coming to that point, first background information related to the food supply chain, and the food system with its actors and stages, are offered. Considering that much of today's attention is given to the consumption phase and the waste that it is produced there, this chapter will also treat the issue. After that, the current food chain will be analyzed for the waste and impacts of its resources. Finally, the attention will shift toward the production, its current status, trends, and typologies

In this analysis, it has been decided not to mainly focus on the Chinese supply chain for three reasons.

First and foremost, while it is true that academic contributions to the topic exist, they are rather difficult to access because of the language barrier (considering that the newest are mainly written in Chinese) and, therefore, the second sources are often limited in time (quite old to be taken as up to date, considering the fast pace changing framework of China).

Second, based on the pieces of evidence of this research, the developing countries or the (just) developed ones, as China, tend to transform their economy and systems following the more established systems of the developed countries (surely also because of political and economic dependency). This means that, although the Chinese framework is different, some of its parts reflect the western system or they will resemble it in the future.

Third, partly based on the previous reason, some of the issues described in this chapter have global interests and consequences, involving also China. When possible, indeed, a description related to the Chinese situation is offered.

For these reasons, the analysis of the Chinese food system and supply chain has been mainly tackled during the field research of this project. The chapter "Strategic analysis" will offer the representation of the Chinese framework.

2.3.1 FOOD SYSTEM

In order to offer a wide description of the food system, its actors and relationships, two different conceptualizations, focusing on different aspects will be discussed. It has to be noted that this first analysis on the food system and supply chain mainly refers to the European context, due to its wide utilization in different parts of the world and the availability of the sources.

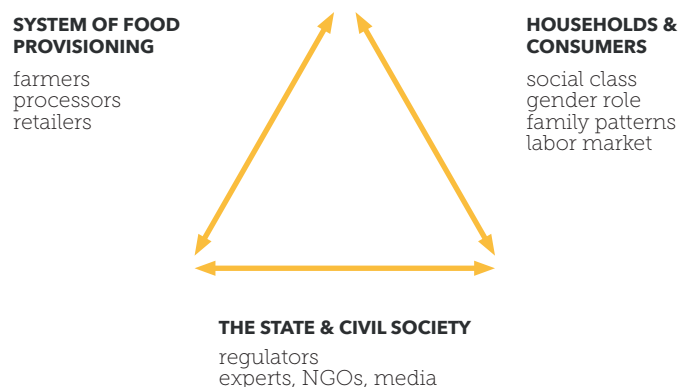
The food system is one of the oldest and traditional sectors of humankind. It is very complex and it consists of many different elements, interlinked together to form the well-known food supply chain. The system is composed of many different stakeholders with different levels of participation but all sharing responsibilities. According to Kjaernes, Harvey, and Warde, there are three main groups of actors in the system:

The actors that provide the food and can range from production as farmers and processors, distributors and retailers.

The households and consumers.

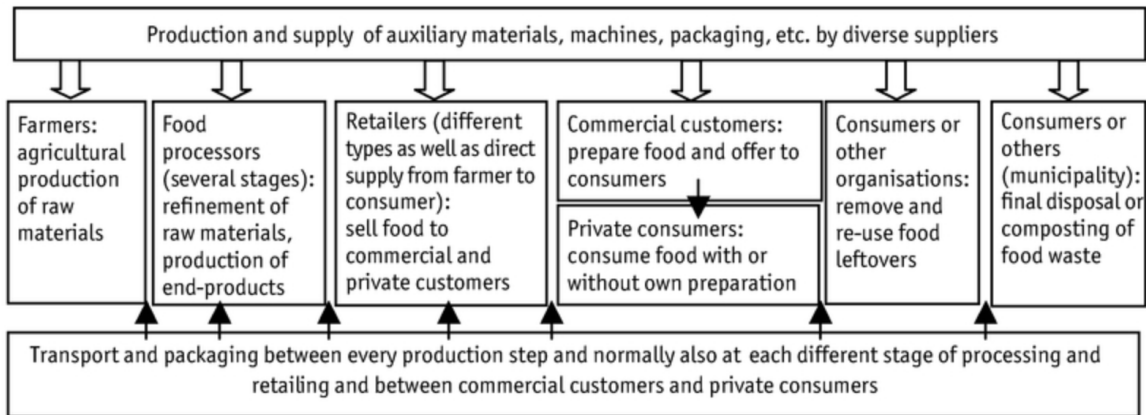
The state and civil society that are the regulators and the media.

Fig.22 The main actors of the food system, adapted from Kjaernes et al., 2007.



These three groups of actors together form the current food supply chain, as we know it today, through complex interactions and resources exchanges.

Fig.23 Food supply system (Tischner, Stø, Kjærnes & Arnold Tukker, 2010).



In this simplified version of the agricultural and food production-consumption chain, besides the activities shown, the actors in the chain have to also comply with food safety regulations, maintained by food control organizations except for end-consumers (Tischner et al., 2010).

As it is possible to notice from the image, in the center there are the steps of the chain with their actors and their main activities. To each step, both energy resources and material ones are needed (above), as well as the transport of the food from one step to the other (below). This is the system which allows us to gather the food and consume it, thus it is the system that feeds us.

STEPS AND ACTORS OF THE FOOD CHAIN

The first step of the system is the production, where different kinds of farmers (usually running large conventional industrialized farms) produce the raw materials, through agricultural and breeding activities. Europe's bio-economy (that is, the broad field of agriculture, forestry, fisheries, aquaculture, bio-based handling of resources and rural development) has an estimated annual turnover of around 2 trillion euro and employs around 18 million people (DG Environment 2018).

This step is most of the time characterized by fewer and fewer farmers manage large farms, increasing profitability and efficiency and producing higher yields per hectare, by fueling multiple external outputs, as chemical fertilizers and pesticides. In this provisioning main chain, the production is more and more industrialized;

After being collected, the raw materials go through the processing step, where they pass into the hands of the food processors. Here, different kinds of activities take place, refining the raw materials and turning them into end products like pastry, alcohol drinks, milk, chocolate, mineral water, etc. Because the processors usually compete for market shares and, together with retailers, they dictate the prices, they negatively impact in the farmers' lives and agriculture in general as they have to normally follow them to be able to stay on the market. Even in this case, the trend is to have fewer companies with very big shares of the market.

The third step is the distribution, where the retailers buy big quantities of processed food and sell it in smaller batches both to commercial and private consumers. There are many different kinds of retailers, from the big supermarket chains to the small neighborhood shop. As with the trends in the first two steps, even in this case, the tendency is to have fewer and large retail chains sharing the market and competing mainly through a low price policy, with the small local shops able to survive if highly specialized. However, recently, these big players are starting to promote themselves by offering better quality products and sustainable ones, instead of competing solely by prices. The trend is the result and the evidence of a growing interest for customers towards healthier and more sustainable food and healthy lifestyles.

The fourth step is commonly referred to as consumption, which can be distinguished into 2 levels: the food services level (the definition of food services is offered in the next chapter) the households. Hence, the two actors of this phase are the food businesses, which deal with the preparation of food and offering to consumers, ranging from conventional restaurants to ready-made meals on one side, and the private consumers on the other.

Consumers are usually in a debated position. Indeed, if on the one hand they have a stake in the game through their money, on the other, they influence nothing if they are alone (or in very small groups) and they may even be seen as responsible, through their choices, for a number of societal issues, like health, food quality, animal welfare, and environmental sustainability. What Tischner et al. in particular claim is that consumers cannot simplistically be seen as guilty of that because food is a social concept and its consumption is a composite mix of individual and societal beliefs, social structures and habits, whose practices are often institutionalized and sometimes routinized. The authors also acknowledge the influences that consumers may exert to the other actors of the supply chain, as the producers, the retailers, and even the policymakers.

The last two steps, shown in the image above, could be actually gathered under the same one. This step would be the after-consumption and disposal of food, via proper treatments.

Indeed, according to the consumption, there may be generated food waste (yes, it will) which could be re-consumed (like leftovers), or alternatively disposed of.

Usually, in the first option, citizens organizations, or NGOs in general, can be very helpful in managing the leftovers and managing the entire re-distribution of food to donate to people in need. Otherwise, more commonly, food waste is sorted and disposed of in the treatment plants.

Along the food chain there are other actors which fluctuate around and take part, directly or indirectly, to the food system. There are the media which generally inform and shape the public opinion, tests organizations which inspect products quality and company practices, hence informing consumers, the media and policy about it, labelling organizations, independent or organized by industry, which aims to help consumers to better know the products that are consumed and to give a sense of security, informing and giving credibility. However, considering their wide number, they end up confusing the consumers, who lose trust (the labeling issue will be better described in its dedicated chapter).

Finally, there is an existing extensive field of research worldwide, including universities, institutions, and businesses that helps to develop technology and increase knowledge in many of the different aspects related to the food system (Tischner et al., 2010).

A NOT SUSTAINABLE CHAIN

It is widely recognized and accepted that the current food system does not work and will not, if we consider the estimate of a growing global population, a decrease of the Earth resources and its different future conditions.

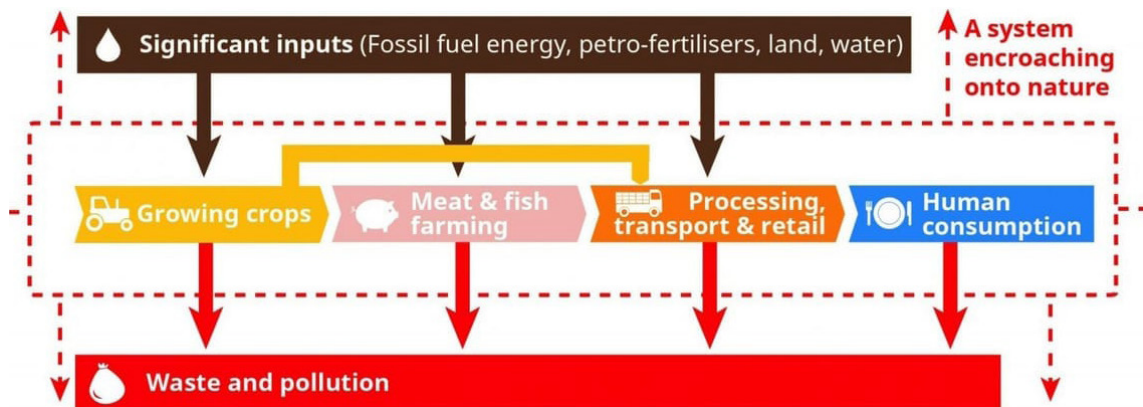
“Our food system is dysfunctional: using too many limited natural resources, and producing too much waste and pollution” (Feedback, 2019).

The food chain is, in facts, one of the most worldwide impactful sectors in many of the sustainable aspects. While it is truth that it is producing huge quantities of food that allow the majority of the living people to thrive, it is also true that it is generating negative impacts in a vicious cycle that will lead to even worse impacts and fewer foods. As a matter of facts, the multiple links of the food system reach far beyond itself and have a direct impact on many other important sectors like energy

In order to secure nutritious and delicious food for everyone without adversely impacting the environment and the society, a more collaborative environment among key stakeholders should be performed in order to improve it and transform it into a more sustainable practice, where the responsibilities are shared and accepted by everyone (examples will be presented in the chapter “Sustainable food production”).

Besides the already offered representation of the current food chain, others may be conceptualized. Indeed, another representation of the current food supply chain is offered by Feedback Global, an environmental organization that campaigns to end food waste at every level of the food system. Founded in 2013, Feedback works with governments, international institutions, businesses, NGOs, other grassroots organizations and the public to change society’s attitude toward wasting food, through their public awareness campaigns and ground pilot projects for a better food system (Feedback, 2019).

Fig.24 A wasteful supply chain (Feedback, 2019).



In the Feedback Global’s representation, therefore, the focus is evidently on the huge amount of resources needed to make the system work and on the collateral negative effects the system generates. The model is linear, and the quantities of inputs and outputs are mono-directional. In addition, the system is constantly growing, requiring more resources, including land, and further encroaching on the natural world.

What the organization firmly believes is that there is no need for a bigger system with the same characteristics as the current one, rather a different one, where the resources needed to grow, process and transport the food are fewer and reused, and the amount of food waste generated greatly diminished, if not avoided (Feedback, 2019).

The impact of food waste in the food supply chain is a well-debated topic in the academic context, not only in the West but also in China.

If in Europe scholars claim that food losses are very important issues for a better food chain, since occur at every step of the chain and represent significant energy impacts for each functional unit (i.e. for each meal consumed) (Tempelman et al. 2006, as cited in Tischner et al., 2010), China is no exception to the fact that a significant amount of food ends up not consumed along the value chain (Liu, 2014), thus burdening on the environment, society and economic dimensions.

As said, when it comes to food and sustainability, a very popular issue is food waste. This interest has given birth to multiple new initiatives, researches, and businesses, all over the world, as Feedback Global many years ago. Nevertheless, even if those initiatives took place and they continue to spread, it seems that there is still a low level of awareness among people and a low practical participation into it.

In order to advance in our analysis, the topic of food waste during the food consumption stage will be hereinafter discussed.

2.3.2 FOOD CONSUMPTION STAGE AND FOOD WASTE (WORLD AND CHINA)

As said, nowadays food, considered from a sustainable perspective, is a very hot and debated topic, which is gaining more and more visibility and popularity. Why food waste, in particular, has gained so much attention?

First and foremost, rather than other phenomena, food waste is very visible and tangible, as well as its impacts. Indeed, food affects everyone's health, planetary health and, finally, economic health. Wasting food is definitely harmful. Even in the literature, it is possible to find many shreds of evidence of the negative consequences of food waste, encompassing different fields. What is strongly acclaimed, for instance by the Environmental Impacts of Products Study, published by JRC, is its double cost in terms of environmental impacts, as it combines the impacts due to the production of food that will never be eaten, with those caused by the collection and treatment of food waste (2006).

In addition, a study conducted by FAO stated that if global food loss and waste was a country, then it would be the third-largest CO₂ emitter, after the US and China (FAO, 2013). Therefore, it is clear how this issue has actually a planetary and profound impact on the entire Earth and us all.

In the recent academic context, one of the most important contributions to food waste was given by FAO in 2011, with its publication about the quantities of global food waste. Those findings have been a particular watershed in the literature because, before that document, the majority of the studies were accusing a lack of certainty and coherency in the collected data and information. On the other hand, after "Global food losses and food waste" by FAO, almost all the new researches covering the topic of Food has been partially or completely based on that. There definitely was a big deficiency of knowledge due to the lack and difficulties of a worldwide investigation, of the uncertainty of the sources and universal criteria for assessment.

First of all, the study defines what is the meaning of food waste based on the definition of Parfitt. In his researches, the author defines "food waste" as the food losses occurring at the end of the food chain (retail and final consumption), which relates to retailers' and consumers' behavior (2011). "Global food losses and food waste" then mainly distinguishes among 7 groups of countries in the world, according to different parameters: Europe, North America and Oceania, Industrialized Asia, Sub-Saharan Africa, North Africa, West and Central Asia, South and Southeast Asia and, finally, Latin America. For any of these groups, hence, the waste of specific categories of food, i.e. cereals, meat, fruits, and vegetables, etc., is highlighted.

However, the main and surprising finding of the document is that "roughly one-third of the edible parts of food produced for human consumption, gets lost or wasted globally, which is about 1.3 billion ton per year" (Gustavsson et al., 2011).

This data is not actually that surprising if we consider for a while the lifestyle of the middle class or wealthy people and their (or ours) routine. Indeed, it happens frequently that we waste food even if we do not really realize it.

Another very important contribution of the study published by FAO is the assessment of the magnitude of the food waste during the entire food supply chain and its patterns. While in the developed countries the majority of the food gets wasted at the consumer level (retail, services, and households), in the developing countries it gets wasted at post-harvest and processing ones. It has to be noticed that the former group of countries is not only composed by North America and

Oceania and Europe but also by Industrialized Asia, which comprehends also the major urban cities of China. The food waste for this group equals at least to the 40% of the total, which is about 222 million ton of food, almost as high as the total net food production in sub-Saharan Africa, i.e. 230 million ton (Gustavsson et al., 2011).

If in those countries, where the waste is mainly produced at the post-harvest and processing levels, the urgency is to intervene exactly in those steps of the Food Supply Chain, generally by investing more and introducing new technology, in the developed and industrialized countries the urgency is focused on the consumer stage. Although these countries waste food at the processing level as well, they already have good facilities and machinery. Therefore, the focus of any plan or action should tackle the step of the food supply chain where there could be the major impact and the best rooms for improvement.

The study finally deepens its analysis by individuating the general and worldwide most common causes of food waste and by giving suggestions on how to avoid or prevent them. In doing so, the study also uses different case studies. Though, what this, as well as other plethoras of researches providing solution for reducing the food waste, misses is that the solutions are not culture-specific based (Parfitt, 2010) and, therefore, they cannot have a strong impact.

WASTEFUL CHINA

Shifting the focus of the research on China, is it possible to notice that the country is playing an important and influential role in food production and consumption worldwide. Even if China is not the most wasteful country, it is still placed in the first positions of the wasteful countries or regions ranking, after the US and Europe (BCFN Foundation, 2017; Gustavsson et al., 2011).

Indeed, according to the Food Sustainability Index 2017, by BCFN Foundation, China is generating 61 billion tons of food waste per year. The main threat is that consumer food waste could increase between 71 and 88 million tons in China if individuals who join the middle class in the country adopt habits akin to those in Europe and North America that result in more food being wasted (Parry et al., 2015). With the challenge of feeding 21% of the world's population with only 6% of global water and 9% of arable land (Junguo, Lundqvist, Weinberg & Gustafsson, 2013), China cannot really afford to increase the waste of the food it produces. In addition, in financial terms, food waste is estimated to cost the Chinese economy \$32 billion (WRAP, 2011; Zhou, 2013).

Finally, it has to be considered that the impact of this waste is even worse since the recycle and reuse are still not common practices in China and the food waste takes

up a high share in Municipal Solid Waste (MSW) in almost all cities, roughly ranging from 50% to 70% (Tai, Zhang, Che, & Feng, 2011). Furthermore, most of it is mixed with other solid waste in MSW and eventually incinerated and landfilled (Hu, Zhang, Yu, & Zhang, 2012).

Fig.25 Global food waste and most wasteful countries. Adapted from Gustavsson et al., 2011; BCFN Foundation, 2019; FUSIONS, 2016.



Drawing a comparison with the Western regions and, in particular, with Europe, studies estimate that The Old Continent is generating 88 million tons per year in the EU-28 in 2012, accounting for about 143 billion euros (FUSIONS, 2016). In Italy, estimates regarding the food waste vary between 6 and 8 billion tons (BCFN, 2017; Garrone, Melacini, & Perego, 2015), costing Italian businesses and households more than 15 billion euros (\$17.5 billion USD) a year, whose 12 billion euros (\$13.3 billion USD) are due to the consumer level (Primo Piano, 2017). Indeed, in Europe and, with a similar trend, in North America the sector contributing the most to food waste is households (47 million tons) accounting for the 53% of the total, followed by production and processing (26 million tons) accounting for 30%, food service (11 million tons) accounting for 12% and, finally, wholesale and retail (4 million tons) accounting for the last 5%. This means that the biggest portion of the food gets wasted at the consumer stage.

FOOD SERVICES

Surprisingly, deeper studies on China show that the consumption trend is different, especially at the consumer level. As a matter of facts, the majority of food waste, rather than being concentrated at the households level, it mainly takes place at the food service one. What does “food service” mean then?

This is another still debated issue, whose meaning varies according to the English or American interpretation. If, on the one hand, food service can be viewed as “the business of making, transporting, and dispensing prepared food” (FreeDictionary, 2016), on the other can be formulated as “the (serviced) provision of food and beverages away from home” (Davis, Lockwood, & Stone, 1998).

Moreover, the European study by FUSIONS defines it as the food in Hotel, Restaurants and Catering/Canteens (2016). Due to the evident lack of interpretation’s consistency among the available and discussed literature, in this analysis food service’s meaning would be closer to the one of the restaurant industry, defined as:

“the entire businesses that provide food and drink, including fast food establishments, cafes, mainstream restaurants and fine dining” (Warwick IER, 2010).

The focus of my research will be then on restaurants, whose categories are still not drawn by the author in this initial research part.

FOOD WASTE IN CHINESE RESTAURANTS

Coming back to the Chinese framework, many studies seem to agree on the fact that the major food waste production happens in food services. As a matter of facts, the “Sustainable lifestyle report”, conducted by the World Business Council for Sustainable Development in China, affirms that the most serious area of food waste is in the restaurant industry: edible food thrown out by the industry equates to 10% of China’s annual food production (2015).

Another comprehensive Chinese analysis conducted by the Organisation for Economic Co-operation and Development presents different pieces of evidence supporting this trend. Zheng, for instance, claims that mid- to high-end restaurants and public service canteens together contribute to about 90% of the consumer food waste (2011), a fact which is supported by Xu who reports that a large proportion of the food produced at the high costs of resources and environment is then wasted at the table and thrown away, a phenomenon in Chinese catering that has become normal (Xu, 2005; 2007, as cited in Liu, 2014).

Now, even assuming that these data are too weak to be taken as proof, the increasing consumption of food away from home is strong evidence which better supports the trend. Indeed, it is possible to notice how the economic transition in China is influencing the consumption patterns. In particular, Gale and Huang show that away-from-home spending rose from 8% of urban household food expenditures in 1992 to nearly 20% in 2004 and that, in 2003, the lowest income decile of urban households devoted 8% of their food expenditures to food away from home, but

The effects of the opportunity cost of time on food away from home are significant and positive for both participation and expenditure decisions. Also, changing lifestyles of increasingly prosperous consumers include eating more and more meals away from home (Bai, Wahl, Lohmar, & Huang, 2010), and food waste generated in the restaurant and catering sector has consequently sharply increased in the last years (Liu, 2014). Another confirm of this increasing phenomenon is given by the comparison of two surveys. In the early 1990s, Zhan showed that the average wastage of rice and wheat in restaurants was only 1.8-3.3% and 2.5-6.5% (varying by type of restaurant), respectively (Zhan, 1995 as cited in Liu, 2014), whereas in 2008 Zhang and Yao showed that these two ratios have risen to 9.2-22.4% and 10.8-24.7% respectively (Zhang & Yao, 2009, as cited in Liu, 2014).

Visible evidence also come from the food service market. In facts, the retail sales of the catering sector have ballooned from CNY 8 billion in 1980 to CNY 1.8 trillion in 2009 (Huang, 2017). This increase surely goes hand in hand with the increased food waste at the consumer stage and it is pushed by a substantial increase in the annual income of Chinese urban and rural residents (Liu, 2014). Finally, considering the overall market, China's Hotel, Restaurant, and Institutional (HRI) sectors recorded US\$539 billion in sales revenue in 2016, with restaurants accounting for the largest share of the sector with US\$352 billion in sales revenue (2017).

If health and price are two very important influential factors for a Chinese sustainable food consumption (Meyer-Höfer et al., 2015), the reason for the food waste at the food service level is highly influenced by the cultural factors of Mianzi and Lian (Li & Su, 2007), briefly translating into "face", with the meaning of appearance. In the Western countries, instead, the appearance plays an important role as well but, when it comes to the food service level, it is not expressed through the quantity of food ordered (and so possibly wasted) but rather on the quality of the food and the place (because of its high importance, a more detailed analysis into the cultural aspects related to Chinese food is offered in the dedicated chapter above).

Fig.26 Food waste highlights.



2.3.3 FOOD LIFE CYCLE ASSESSMENT

This chapter will analyze the impacts associated with the steps of the food supply chain, in order to assess which step is the most impactful one. The analysis reveals that the most impactful step is the production. To support the result, three different sub-analysis were conducted. The first one is based on the use of Life Cycle Assessment (LCA). Different academic contributions and LCA conducted on food products are used as evidence. The second sub-analysis focuses on the global Greenhouse Gas emissions (GHG) of both the agricultural sector and its sub-steps (the one of the food supply chain). Finally, the third analysis considers the impacts generated by food waste and the contribution to each phase of the food chain.

LIFE CYCLE ASSESSMENT (LCA)

LCA is an analysis method for calculating the input/output of a system including the environmental effects (GHG emissions, eutrophication, acidification, etc.), and for categorizing the analysis output into a format easier to interpret and compare. Every form of impact is based on an exchange of substances between the environment and the production-consumption system. Because the environmental impacts cannot be measured according to one dimension of a given product/system but on the sum of the processes that occur during its life cycle, the LCA is a very suitable and exhaustive method to determine the product/system impacts (Vezzoli & Manzini, 2008).

Today, LCA is an internationally standardized method, regulated by the ISO, which defines LCA as “a technique estimating the environmental aspects and potential long-term impacts of the whole life-cycle of products or services” (European Commission, Joint Research Centre, 2010).

Applying the LCA framework within the ISO is a process that implies mapping the goal definition, setting the scope, the allocation procedure and the system boundaries, collecting all the data regarding the criteria, calculating, analyzing and interpreting the results. In order to be able to carry out the analysis, while setting the goals and the scope of the assessment, it is necessary to define a functional unit to be referred to when balancing the inputs and outputs. LCA uses have important benefits.

Indeed, its assessment can be used to evaluate (and therefore) affect product development and improvements, draw strategic planning, and inform the public

On the other hand, however, it has to be considered that LCA has also limitations. In particular, LCA results are usually a simplification (yet close to the reality) of a given product/system, due to the impossibility to effectively measure or consider the entire spectrum of environmental impacts, and due to the reliability of the data, which are sometimes missing or of low quality. Finally, while the LCA considers the ecological impacts of a product/system examined, it does not consider its economic and social characters (European Commission, Joint Research Centre, 2010).

In the academic context, there are plenty of studies that focused on the LCA of food and its results' interpretation. What has been realized from the analysis of the available sources and assessments of the food chain is that it is not possible to conduct a unique LCA which could exhaustively represent a general assessment of the food system. Indeed, LCA assessments vary according to the kind of food (vegetables, meat, grain...) and the way it is produced, processed, and retailed (e.g. a loaf of bread purchased directly on site has a different impact than the same loaf of bread purchased in a huge supermarket chain).

Generally, it is widely acknowledged that the stage of the food chain that impacts the most is the production. Tischner et al. reports that the environmental LCAs of food products show that, normally, the main environmental impacts related to food (from pollution to resource consumption and soil erosion, etc.) are caused during the primary production stage (growing crops and raising cattle), but for energy use the most important contributions occur at other stages of the life cycle, such as production, storage (cooling) and transportation (Tischner et al., 2010). Roy et al., in their review of existing life cycle assessment on food products, report that the primary production and the transportation stages were reported to be highly significant for most of the impact categories (Roy et al, 2009).

Mogensen, Hermansen, Halberg, & Dalgaard conducted a study in 2009 to assess to what extent food production affects the environment. Their analysis is based on the application of LCA to different kinds of food products, all produced on farms in Denmark and processed in Denmark.

The study found that “from the food product life cycle research conducted globally, agriculture production is generally the largest contributor to the life cycle impact compared with other compartments such as transport and processing” (Mogensen et. al, 2009).

In order to shed lights on the impacts of food along its life cycle, two LCA analysis of different food products are hereinafter offered and discussed.

For our analysis, the kind of food taken into consideration is the one produced according to the food chain, which we have defined as rather industrial. Other production schemes are not considered here (but they will in the next chapter).

POULTRY CHAIN LCA (SKUNCA, TOMASEVIC, NASTASIJEVIC, TOMOVIC, & DJEKIC, 2018)

The chicken meat production is among the prevailing food sectors globally, as the poultry will lead world consumption of meat in the future. For this reason, the study conducted by Skunca et al. analyze the environmental performance of 119 different farms, slaughterhouses, meat processors and retailers, as well as 500 households, in Serbia. The goal of the research was to evaluate the environmental impacts throughout the life cycle of the chicken meat chain through a cradle-to-grave perspective.

The system boundaries of the poultry chain analyzed in the study are the chicken farm, the slaughterhouse, the meat processing plant, the retail and the household use. Instead, the chosen functional unit was established as 1 kg of consumed chicken meat and chicken meat product (1.35 kg of live weight chicken is transformed to functional unit according to good manufacturing process in Serbia). Finally, the environmental impact potentials calculated in the analysis were global warming potential, cumulative energy demand, ozone layer depletion, acidification potential, and eutrophication potential.

Fig.27 Average values of the Global Warming Potential (GWP) per functional unit for each of the subsystems (Skunca et al., 2018).

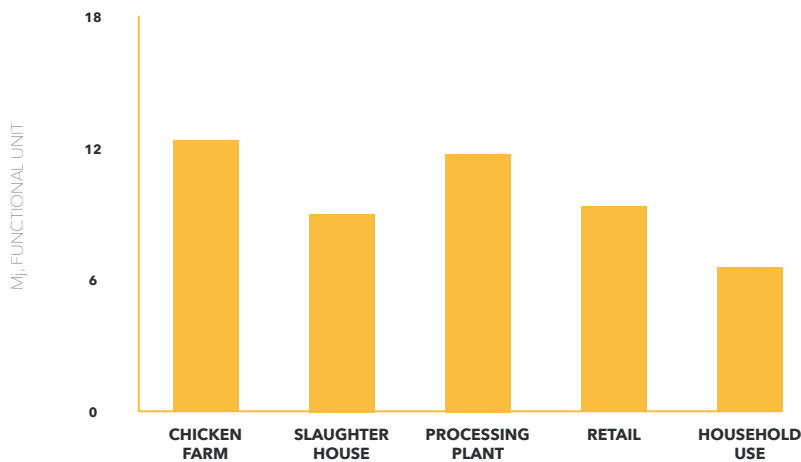
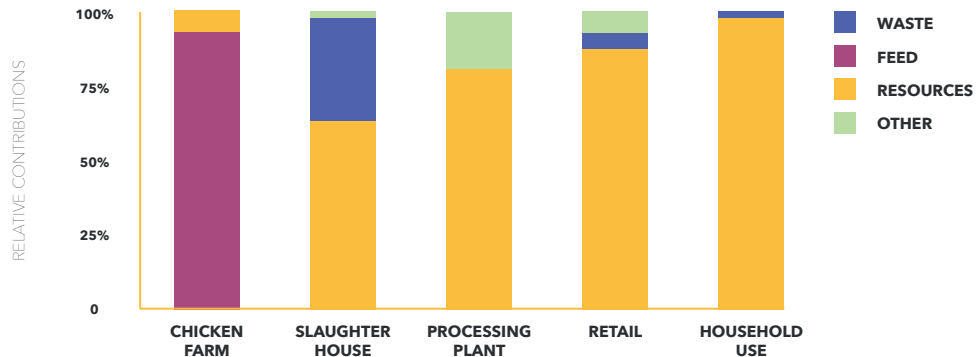


Fig.28 Relative contributions to GWP from processes involved in the subsystems 1-5 (Skunca et al., 2018).



'Feed' was identified as the largest contributor to GWP in the first subsystem (93.7%), while 'Resources', i.e. all types of energy and water used across the entire chain, were the prevailing factor for environmental burdens for retail (87.5%) and household use (98.3%).

Therefore, it is clear that the largest contributor to the environmental profile are feed production and energy usage: while the farm is the most contributing stage for feed production, the household is so for the energy usage.

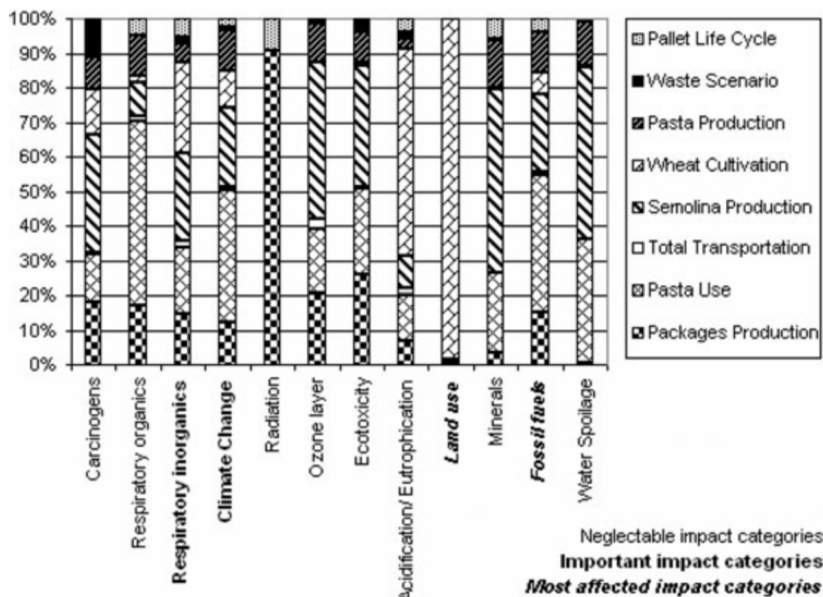
PASTA PRODUCTION LCA (BEVILACQUA, BRAGLIA, CARMIGNANI, & ZAMMORI, 2007)

In the Italian framework, pasta is definitely one of the most consumed kinds of food. Bevilacqua et al. evaluated the environmental performances of the production and the distribution of durum wheat pasta, in the Italian market. The goal of the study was to perform a complete cradle-to-grave LCA for the production and distribution of durum wheat pasta in the Italian market and to identify the subprocesses that were responsible for most of the environmental impact. The environmental impacts of the whole manufacturing process were assessed, taking into account the energetic flows, the consumption of materials and the emissions of pollutants.

The system boundaries of the pasta production chain are the whole productive processes: wheat cultivation, semolina and pasta production, packaging production, transport, storage of packages at the final distribution centers, and use. Instead, the chosen functional unit was established as 0.5 kg package of a popular brand of durum wheat pasta sold in the market (which corresponds to the most common package available).

The only consideration to mention is that the analysis assumes that, as regard the use stage of pasta, the travel is mainly done by car and that 10km is the average distance covered to get to and to return from the supermarket.

Fig.29 Contribution to the environmental load for each impact category (Bevilacqua et al., 2007).



From the chart, it is possible to see that the cultivation of wheat in intensive fields and the production of semolina at the mill are the major causes of environmental impact, followed by the production of packages and the final usage of pasta. On the contrary, the effect due to transportation, stocking and waste treatments are almost not considerable.

Fig.30 Shares of energy consumed along the life cycle of pasta (Bevilacqua et al., 2007).

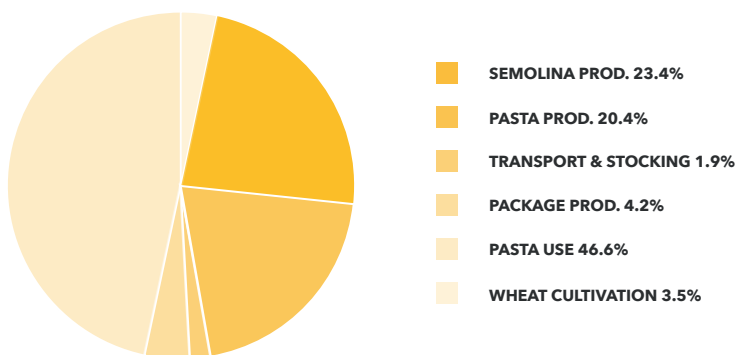


Fig. 4 shows the shares of energy consumed along the life cycle of pasta. Here, the major contributions are given by the use of pasta, followed by semolina and pasta production. If these two production processes are combined together, they equal to the use (this result can be explained considering the high value of the specific and latent heat of the water that must be boiled to cook the pasta).

The results show that the agricultural production (i.e. cultivation of wheat) and the production of durum wheat semolina were the subprocesses that accounted for most of the environmental load.

2.3.4 PRODUCTION: THE REAL IMPACT IN THE FOOD LIFE CYCLE

The two LCAs show how the production is the most impactful step of the overall food supply chain and, therefore, the step of the food supply chain where there could be the major impact and the best rooms for improvement.

“Food production is the single greatest impact humans have on the environment: the wasteful, high impact practices used by Big Food [i.e. the food chain main stakeholders] to produce our meals are driving deforestation, draining our freshwater reserves and exhausting our soils – and account for over quarter of our global greenhouse gas bill. Meanwhile, around a third of all food produced worldwide is wasted. This is a dangerously reckless approach to feeding the world – and it can’t last. Quite simply, food production driven by profit is destroying our chances of feeding ourselves in the future” (Feedback, 2019).

GREENHOUSE GAS EMISSIONS

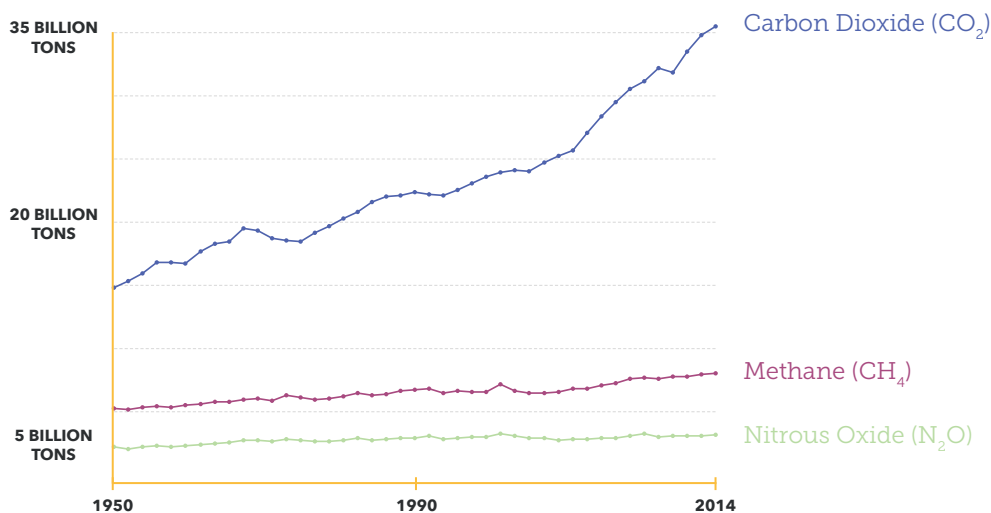
In order to offer additional proof of the heavy impact of the food supply chain and, in particular, of the food production, a brief analysis of the current Greenhouses Gas (GHG) emissions is offered. It has been decided to use the greenhouse gases as measurement unit because they are the main contributors to global warming and climatic change and because of the availability of the data. All the data come from "Climate Change 2014 Synthesis Report" conducted by the Intergovernmental Panel on Climate Change (IPCC), and on the interpretation and visualization of its key insights by the article published by Ritchie & Roser in 2017.

The key greenhouse gases emitted by human activities are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and fluorinated gases (F-gases).

As of 2014, the global GHG emissions amount to 49 billion tons (IPCC, 2014). The gas which makes the most of the GHG is CO₂, reaching around 75% of the total, or around 33 billion tons. Methane equals to the 16% of the total, the nitrous oxide the 6%, the F-gases the small rest.

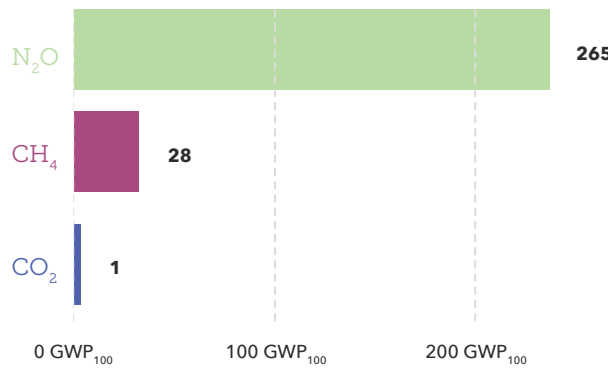
However, the relative contributions of the key greenhouse gases to global warming are not equal. In order to compare their weight in the GHG, it is possible to use a metric called 'Global Warming Potential' (GWP). GWP can be defined on a range of time-periods, however, the most commonly used (and that adopted by the IPCC) is the 100-year timescale (GWP100) (IPCC, 2014).

Fig.31 Greenhouse gas emissions by gas, in the world. Adapted from Ritchie & Roser, 2017.



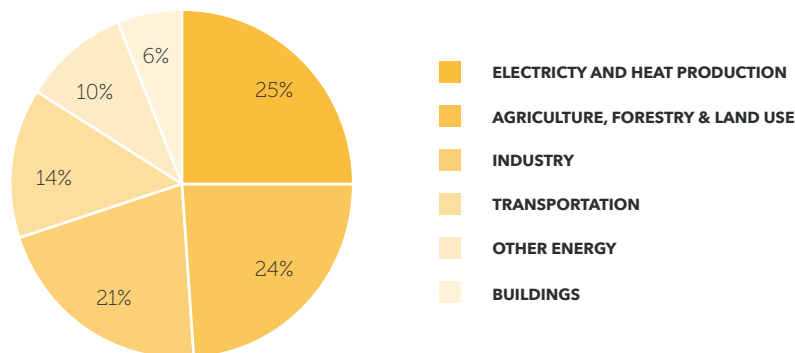
GWP measures the relative warming impact of one unit mass of a greenhouse gas relative to carbon dioxide.

Fig.32 Global warming potential of greenhouse gases over 100-year timescale (GWP_{100}). Adapted from Ritchie & Roser, 2017.



The first two biggest contributors to GHG (not shown in the image) are both fluorinated gases (SF₆, PFC, while HFC ranks fourth). From the chart, it is possible to notice that N₂O and CH₄ contribute 265 and 28 times more than CO₂. This means that, for instance, methane has 28 times the warming impact of one ton of carbon dioxide over a 100-year timescale. Going deeper with the analysis, it is possible to observe the global GHG emissions by economic sector.

Fig.33 The most impactful sectors to GHG emissions. Adapted from IPCC, 2014.



As it is possible to observe from the image above, agriculture is the second sector affecting the most the GHG emission, accounting for 24% of the total, or around 10 billion tons.

Moreover, if we analyze the levels of the different greenhouse gases' emissions by sector, we can see that, while agriculture accounts (only) for the 8% of the global CO₂ emissions, it ranks first in both the global CH₄ and N₂O emissions, respectively the 42% and the 66% of the total (IPCC, 2014; Ritchie and Roser, 2017). These gases impact considerably in the overall GHG emissions.

FAO, indeed, reports that the GHG from agriculture (mainly CH₄ e N₂O) are the result of biological activities linked to bacterial decomposition processes in cropland and grassland soils and in livestock's digestive systems. Emissions include processes linked to enteric fermentation, manure management, rice cultivation, synthetic fertilizers (requiring fossil fuels to be produced), manure left on pasture, manure applied to soils, cultivation of organic soils, crop residues decay, prescribed burning of savannahs and field burning of crop residues (FAO, 2014).

Tischner et al., in particular, recognize that food products with high global warming potential are cheese, followed by meat and eggs, whose causes are the use of fertilizers involved in the production of the animal feed, transport, cooling, a high degree of processing, highly packaged products, animal-based (cattle and pigs) products (from methane emissions) and nitrous oxide from manure (2010).

Mogensen et al. confirm Tischner et al. claim, highlighting the differences in impact between the same quantity of a given product. Producing 1 kg of animal products like meat produces much more greenhouse gas emissions than producing 1 kg of plant-based products like cereal or potatoes. The higher impact connected to meat products is related to the animal feed itself together with the emissions of nutrients and GHG from the livestock (Mogensen et. al, 2009)

GHG EMISSIONS OF THE FOOD CHAIN

The current information also permits to carry out an analysis of the GHG emissions related to the different stages of the food supply chain. This analysis is particularly significant for this thesis project since it supports the focus on the production of the food, rather than on other stages.

The most important contribution to the analysis of the GHG emissions related to the food supply chain is given by FAO, in the paper called "Energy-smart food for people and climate", published in 2011. The paper, indeed, discusses how the entire food sector, from the farmer's field to the consumer's plate, can become more 'energy-smart'. Two, in particular, are the insights useful for this analysis.

First, among the different food chain steps, the main contributor to the GHG is the production. Indeed, around half of these emissions come from agricultural production and the other half come from food processing, packaging, transport, retail, commercial food services, home preparation, and food waste disposal.

Fig.34 Global shares of GHG emissions along the food supply chain. Adapted from FAO, 2011.

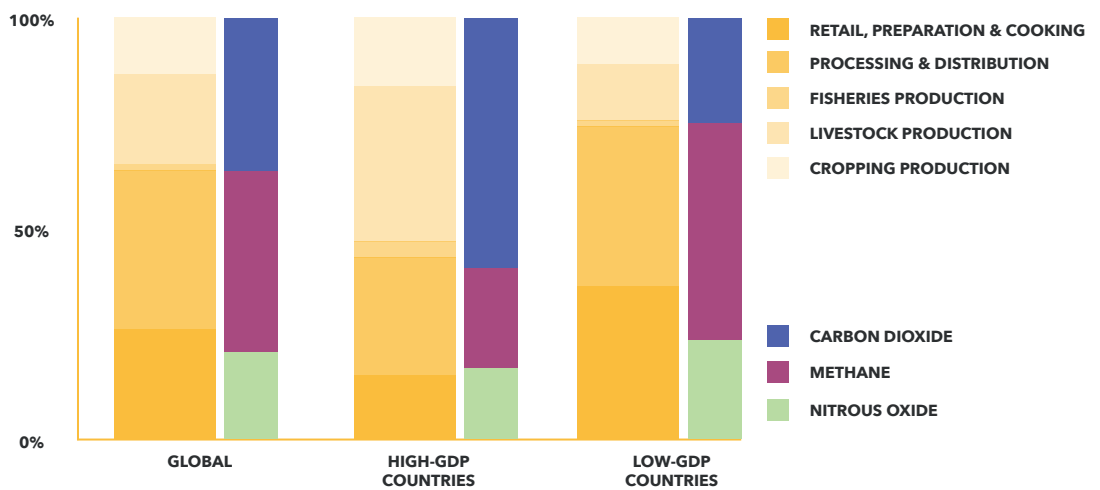
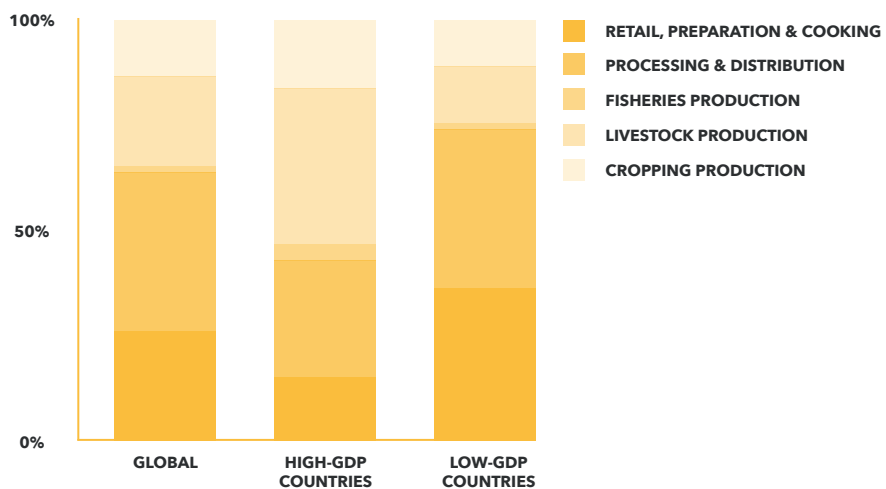


Fig.35 Indication of global, shares of end-use energy demands throughout the food supply chain showing total final energy for the sector. Adapted from FAO, 2011.



Second, while the production ranks first as GHG emitter, the end-use energy demand of the global food sector is around 32% of current total global final energy demand, with the production only accounting for a small percentage compared to the phases of processing and retailing.

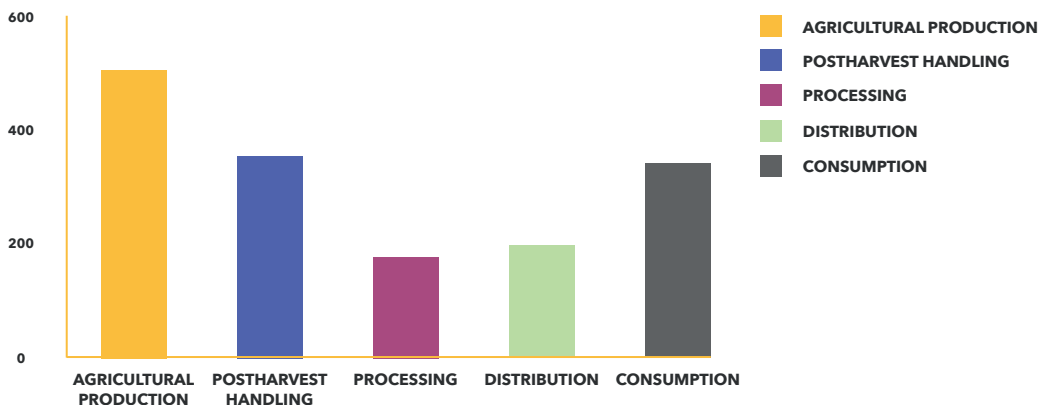
The lesson learned from this more specific analysis is that the potential efforts towards reducing the energies needed in the phases of processing and retailing will not significantly diminish the GHG emissions, failing to solve the urgent problem of the global warming. Rather, the attempts towards a more sustainable production could have more profound positive impacts, not only in the decrease of the GHG emissions but, possibly, also for the energy use in the other phases (changing the way the food is currently produced could change the way it is processed, stored, distributed and consumed).

WASTE IMPACTS

A final consideration about the impactful stage of the food production is related to its waste and losses. Indeed, we have already reported the pieces of evidence of the food losses happening along the entire food supply chain in the previous chapters. In order to show its negative impacts and consequences, with a focus on the role of the production stage, a very exhaustive study published by FAO in 2013, called "Food wastage footprint", will be used for this analysis.

In particular, the study conducted by FAO reports that the total agricultural production is about 6 billion tons, of which 1.6 billion tons of "primary product

Fig.36 Food wastage volumes, at world level by phase of the food supply chain. Adapted from FAO food wastage footprint, 2013.



equivalents” get wasted, while the total wastage for the edible part of food is 1.3 billion tons (FAO food wastage footprint, 2013). Out of this quantity, different measurements can be done.

First of all, Liwei et al. observe that food waste contributes considerably in the GHG emission, from the decomposition of wasted food in landfills, to the emissions associated with its production, processing, transport and retailing (2013). The study conducted by FAO, instead, focuses on the carbon footprint of food wastage, which is estimated to 3.3 billion tons of CO₂ equivalent, ranking as the third top emitter after the USA and China (FAO food wastage footprint, 2013).

Of this wastage, the agricultural production is responsible for the greatest amount of total food wastage volumes (around 33%) and, together with the post-harvest handling and storage (upstream wastage), represent the 54% of total wastage. On the other hand, processing, distribution, and consumption (downstream wastage) is 46 % of the total (the study refers to the global situation. This information is not in contrast with the ones shown in the chapter about food waste. Indeed, in developed/industrialized countries, as the major urban cities of China, most of the waste is generated at the consumption phase).

The study reports that the highest carbon footprint of wastage occurs at the consumption phase (37% ca), whereas the consumption only accounts for 22% of the total food wastage because food wastage sums up all the impacts of the previous phases.

Fig.37 Contribution of each phase of the food supply chain to food wastage and carbon footprint. Adapted from FAO food wastage footprint, 2013.

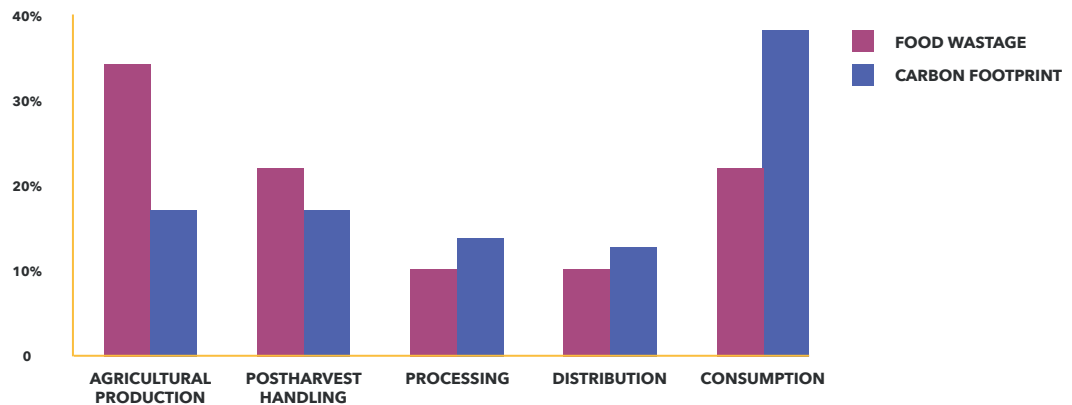
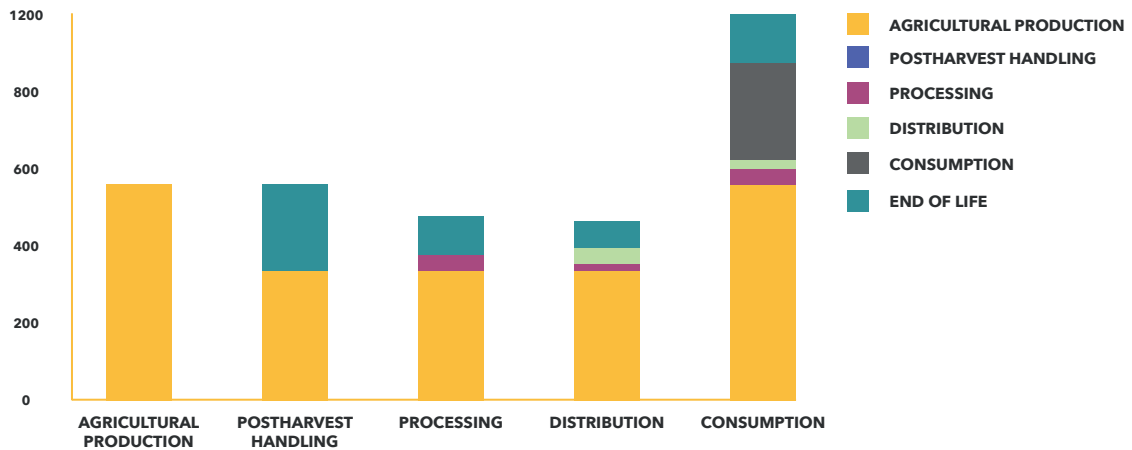


Fig.38 Carbon footprint by phase of the food supply chain with respective contribution of embedded life-cycle phases. Adapted from FAO food waste footprint, 2013.



Another very interesting insight of the study is that globally, the blue water footprint (i.e. the consumption of surface and groundwater resources) of food waste is about 250 km³, or 3.6 times the blue water footprint of total USA consumption. Finally, the study concludes that “produced but uneaten food vainly occupies almost 1.4 billion hectares of land; this represents close to 30% of the world’s agricultural land area. While it is difficult to estimate impacts on biodiversity at a global level, food waste unduly compounds the negative externalities that monocropping and agriculture expansion into wild areas create on biodiversity loss, including mammals, birds, fish and amphibians” (FAO food waste footprint, 2013).

Other academic contributions strengthen the relevant impact of food waste on the environment and the key role of the production.

Gustavsson et al., indeed, claim that in addition to the actual food wasted, resource inputs (arable land, irrigated water, fertilizer, oil, coal, natural gas) and environmental emissions (CO₂, NXO, CH₄) embedded in the whole food supply chain are also wasted (2011), while Kummu et al. calculated the resources cost associated with food losses and waste within the food chain, reporting that the global produced food lost and wasted represents the 24% of total freshwater resources used in food crop production, the 23% of total global cropland area, and the 23% of total global fertilizer use (2012).

Finally, food waste is a relevant factor also in China. Liu et al. report that 19% of grain produced was lost food across the food supply chain, of which the consumer

segment contributed significantly (7.3%). Also, the water and arable land costs from food loss and waste were 135 km³ and 26 million hectares, respectively (2013).

So, as demonstrated in the data above, it should be clear that, when it comes to food waste, the real problem is not the treatment of the waste, rather its production. While it is undoubtful that focusing on food waste reduction or re-use could be beneficial, on the other hand, it will not fix the problem at its origin (i.e. it will not change the system, nor its main impactful stage).

For these reasons, the author believes that it is better to focus on a sustainable production of food, rather than on a better treatment of conventional food (that gets wasted).

2.3.5 FOOD PRODUCTION

In this analysis, food production is therefore considered the most important step of the food supply chain.

When it comes to the production of food, the first consideration that can be done is that it primarily concerns agriculture. Therefore, this chapter will treat the topic of food production through the lens of agriculture, showing its role, relevancy, and impacts for our society. It has been decided to focus on agriculture because it is the point that binds almost all the food chain (without the production of fruits and vegetables, there can be no livestock production, without livestock there is not any possibility to produce dairy products, etc.), and because it represents more than one third of the global land use.

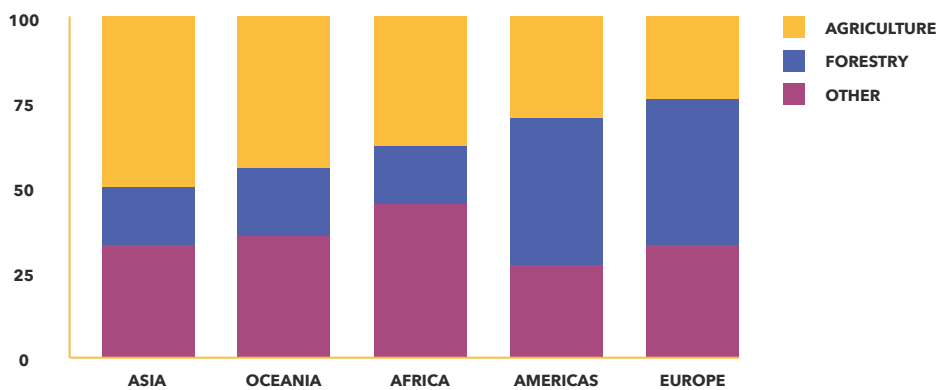
Agriculture, indeed, is the single largest employer in the world, providing livelihoods for 40% of today's global population. It is also the largest source of income and jobs for poor rural households, with around 500 million small farms worldwide, providing up to 80% of the food consumed in a large part of the developing world (UNDP, 2019).

As regards its diffusion, the global land area is 13.2 billion hectares (ha). Of this, 12% (1.6 billion ha) is currently in use for cultivation of agricultural crops, 28% (3.7 billion ha) is under forest, and 35% (4.6 billion ha) comprises grasslands and woodland ecosystems. Out of the total land area, the low-income countries cover about 22%. FAO points out that the fact that there remain some 2.7 billion ha with crop

crop production potential suggests that there is still scope for further expansion of agricultural land. Indeed, FAO estimates predict that global arable land use will continue to grow to 2050, but at a slower rate than over the past 50 years. Most of this growth is projected to result from developing countries, meanwhile arable land use in developed countries is likely to continue its decline (FAO, 20112).

In Asia, FAOSTAT reports that agriculture uses more than 50% of total land, but less than 25% in Europe.

Fig.39 Carbon footprint by phase of the food supply chain with respective contribution of embedded life-cycle phases. Adapted from FAO food wastage footprint, 2013.



Also, the statistics show that twenty countries represented more than 70% of total arable land (cropland used for annual crops such as cereals and soybean), with India, United States of America, Russian Federation, China and Brazil alone reaching 40%. A different set of 20 countries have over 70% of the world permanent crops area (the portion of cropland planted with tree crops such as oil palm or orchards), with Indonesia, China, India, Malaysia and Brazil alone covering nearly the 40% (FAOSTAT 2019).

“WE ARE WHAT WE EAT” - (PLANEAT, 2010)

What do we produce on our lands?

Out of the 12% of the land used for cultivation of agricultural crops, the overwhelming

majority is used for cereal production, followed by coarse grain and oilcrops. Out of the 12% of the land used for cultivation of agricultural crops, the overwhelming majority is used for cereal production, followed by coarse grain and oilcrops. What is astonishing is that almost half of the land used for cultivation of agricultural crops is dedicated to cereals, in particular to only three main ones: maize, wheat and rice (FAOSTAT 2019).

These three cereals are surely among the main contributors to the astonishing increase in yields over the past decades. In the case of maize (corn) the yields have increased more than five-fold since 1940, reaching today the production of 1 billion tons of maize, followed by 771 million tons of wheat, and 756 million tons of rice (FAOSTAT 2019). There are different factors for this increase: fertilizer application, irrigation, increased soil tillage, and improved farming practices. However, a key driver in the initial rise in yield is considered to be the adoption of improved corn varieties from plant breeding developments (Ritchie & Roser, 2017).

The success at the base of the corn expansion is surely the high yields rate per hectare and the high content of calories compared to the cost of its production (apparently...without considering the overall picture, i.e. its impacts at a global scale).

As reported by Pollan, originally, corn was cultivated by the Native Americans but then, even during the America conquest by Europeans, "corn won over the wheat people because of its versatility, prized especially in new settlements far from civilization. This one plant supplied settlers with a ready-to-eat vegetable and a storable grain, a source of fiber and animal feed, a heating fuel and an intoxicant. [...] Mashed and fermented, corn could be brewed into beer or distilled into whiskey; for a time, it was the only source of alcohol on the frontier" (2006, p. 25).

After its adoption by the new settlers, the corn slowly became more widely cultivated thanks to the possibility to easily accumulate it and, hence, to trade it. The possibility to treat corn as both food and a commodity allowed many farmers to make the leap from a subsistence to a market economy (Pollan, 2006).

Lately, because of the sheer volume of its production, the commodity crop was soon turned into animal feed, enabling an unprecedented production of beef, pork, and, chicken. The phenomenon led the way for the establishment of what is today called the "Corn-CAFO complex", i.e. the concentrated animal feeding operations, mainly fed on corn, where the majority of the meat products we eat is bred (Tickell, 2010).

It should be now clearer why Pollan, as well as other writers and researchers, claims that humans today (at least Americans since in North America there are the major maize plantations) could be defined as corn persons (Pollan, 2006): corn is the main ingredient of sweetened foods and it feeds the animals that we eat.

Indeed, as roughly reported by Tickell, about 43% of the corn harvested in the US goes into animal feed, 28% into ethanol fuel, 13% is exported, 11% goes into processed food and beverages (mostly as corn syrup), and the remaining 5% goes into industrial chemicals and things like biodegradable plastic cup (2010).

INDUSTRIAL FOOD

Today, following the predominant economic model, food production has become much more industrialized, increasing the economic performances and adding numerous steps between the farmers and the consumers.

As Tischner reports, the “conventional agriculture worldwide is becoming more intensified, characterised by greater use of synthetic fertilisers, pesticides and technical devices and by an increasing average farm size. Materials are being transported over large distances, being processed in countries with low labour cost, with growing amounts of packaging and transportation, more and more product diversification and so on. The input of energy and water has increased dramatically, as has the global spread of diseases and plagues. Furthermore, a lot of efficiencies in the system are delivered at the cost of exploitation of people, soil and resources and by compromising the ‘naturalness’, quality and taste of the food products” (Tischner et al., 2010, p. 2.1.2).

What the food supply chain is witnessing is a trend towards concentration in fewer and fewer but larger players (stakeholders, farms, production/processing plants, stores...), outpacing diversity and small scale (but generally more sustainable) operations.

An already mentioned study conducted by FAO highlights the phenomenon, claiming that the concentration increased at all levels of the food marketing chain in all agricultural sectors since the 1980s. The data are staggering. Less than 2% of the farms account for 50% of total sales in 2007. At the food processors' level, for instance, the market share of the largest four hog slaughtering firms increased from 36% in 1982 to 63% in 2006.

At the production level, large-scale CAFOs account for nearly two-thirds of poultry meat production, 50% of egg production, and 42% of pork production in the US, with concentrations occurring quickly in developing countries as well.

Finally, at the retail level, the share of grocery store sales held by the largest four firms more than doubled, from 16% in 1982 to 36% in 2005 (UN, 2012).

“Industrial agriculture has supplanted a complete reliance on the sun for our calories with something new under the sun: a food chain that draws much of its energy from fossil fuels instead” (Pollan, 2006, p. 7).

The current agricultural and food production model has resulted to be highly unsustainable. Indeed, it is based on the principle of mass exploitation of the Earth to obtain as many products, i.e. profits, as possible. The industry is not interested in the environmental and social impacts it generates, even when the results of these impacts negatively affect the production itself.

As we already said, the food supply chain generates a negative vicious cycle. In order to produce more, tons of pesticides and chemicals are sprayed on the fields, animals are bred in stock by using huge quantities of antibiotics and medicines, and forests are continuously flattened in order to start a new cultivation of one of the three or four most common crops.

What the industry is blinded to is that the chemicals end up not only in the produces and, consequently, in our body, but also in the soil and in the water, polluting the lands and the aquifers which could not be re-used in the close future. The same is valid for the animals: the chemical substances they are given end up in our body once we eat meat, and their manures polluted the waters. Finally, deforestation accelerates the desertification process, which causes droughts and floods.

At the end of the day, however, the most damaged actors in the chain are the least powerful ones: the farmers (and the low skilled workers in general).

Tischner et al. offer an exhaustive image of the situation, reporting that “more and more farmers are aware of the problems of intensive agriculture: increasing dependence on energy and fertiliser inputs as well as on transportation, fewer jobs in the countryside, increasing levels of environmental pollution and soil erosion and so on. Instead of selling food to their neighbours, farmers sell into a long and complex marketing chain of which they are a tiny part and are paid accordingly” (2010, p. 2.1.2.1).

Even if farmers acknowledge the obvious unsustainability of the system, they are in a tight position since they suffer from big economic pressure, caused by the production quotas of the Common Agricultural Policy (CAP), combined with the ongoing centralization trend, previously mentioned.

The CAP is a “European policy as Member States pool resources to operate a single European policy with a single European budget, whose objectives are: to increase agricultural productivity; to ensure a fair standard of living for the agricultural community; to stabilize markets; to assure the availability of supplies; to ensure that supplies reach consumers at reasonable prices” (DG Environment 2018).

The CAP represents about 44% of the EU budget (e.g. €43 billion scheduled spendings for 2005) (BCC, 2009, as cited in Tischner et al., 2010), which is bestowed under the form of subsidies with the goal of guaranteeing a minimum price to producers' output. However, subsidies are generally paid on the area of land growing a particular crop rather than on the total amount of crop produced, and, therefore, farmers are not pushed to change crop type or change the way they currently farm (as well as to diminishing overproduce).

In the US there is an analogous system, called the Federal Crop Insurance Corporation (FCIC), which aims to support the farmers in case of negative outputs value, by providing a baseline fallback price, established by the government. FCIC annually makes a list of insured crops based on which, usually, farmers decide what to grow. If, as is often the case, the crop produces less than the expected per acre quantity set by the government, farmers file a loss report, the insurance gets activated and the premium gets paid by the federal government. Hence, farmers receive their “loss payment”, making the cycle start again over and over (Tickell, 2010).

A similar system exists in China.

MAIN ISSUES IN THE CURRENT AGRICULTURAL PRODUCTION

It is here presented a brief description of the most impactful issues and consequences related to agricultural and food production activities.

AGRICULTURAL LAND DEGRADATION AND WATER SCARCITY

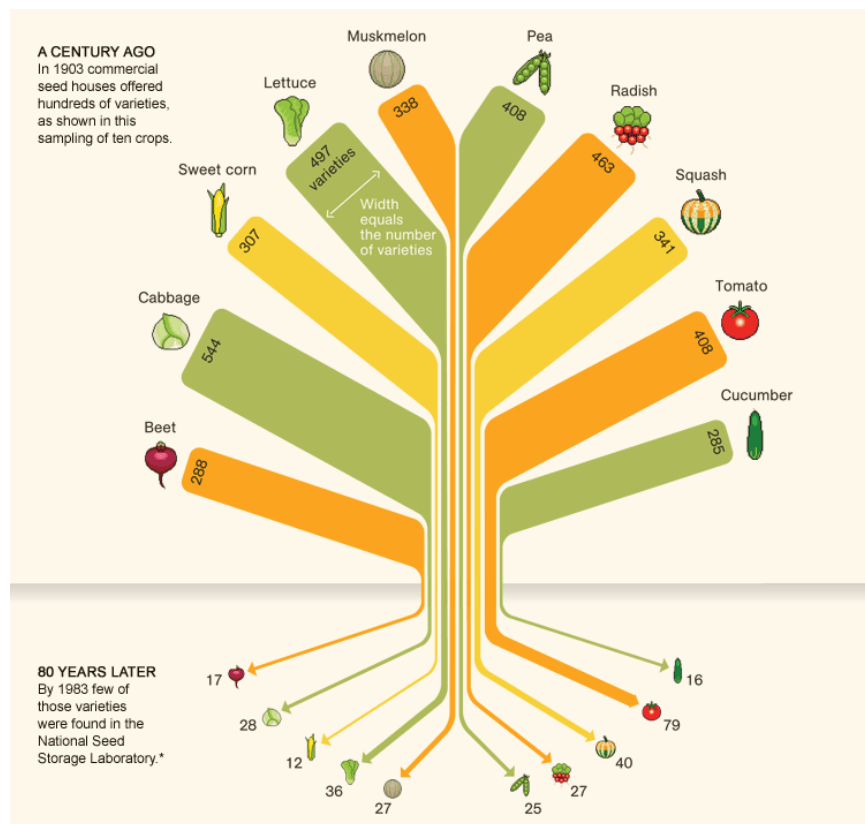
Agricultural growth is directly threatened by the depletion and degradation of the natural resources on which it depends. Not only the land itself but also the water. The study conducted by FAO about “Food and Agriculture: the future of sustainability” reports that around 20,000 and 50,000 km² of potentially productive lands are lost annually through soil erosion and degradation, many more have reduced yields, and 2.9 million km² are considered at very high risk of desertification, much of it in developing countries. According to UNEP, this degradation and conversion of cropland for non-food uses could reduce the available cropland by 8–20% by 2050. At the same time, the study reports that water scarcity, due to plants and livestock

diseases (which contaminate the water), may reduce yields by an additional 5–25%. Considering that agriculture is the human activity which requires the most quantity of water and that in some countries the water extraction rate is already exceeding the rate of natural replacement, water scarcity could be the most powerful crop yield reducer. UNEP warns that in the coming years we may lose up to 25% of food production due to environmental breakdowns (UN, 2012).

BIODIVERSITY

The food supply chain is threatening the number of plant living species. As shown above, most of our food is cereal, in particular, only three kinds: corn, wheat, and rice. FAO reports that we rely on only 15 plants for 90% of our food, with rice feeding more people than anything else and with corn being the most diversely used, in particular in the US.

Fig.40 Comparison of USDA commercial seed varieties sold in the U.S. in 1903 with those in the U.S. National Seed Storage Laboratory in 1983. About 93% of the varieties had gone extinct (UN, 2012).



FAO warns that “since the 1900s, some 75% of crop diversity has been lost from farmers’ fields. Better use of agricultural biodiversity can contribute to more nutritious diets, enhanced livelihoods for farming communities and more resilient and sustainable farming systems” (UNDP, 2019).

Biodiversity is very important because it allows the world’s ecosystem to adapt and react to changes, thus avoiding famine when mono-crop cultivations suddenly have a plague, for instance. In the same way, it allows farmers to withstand a collapse in the market for any one of those mono-crops failures. The decrease in biodiversity not only destabilizes the ecosystems at many levels, but it also brings to a loss of cultural diversity and food traditions. A very big stake of the responsibility is attributable to multinational food producers, who are the main actuators of mono-crop cultivations.

ANIMAL WELFARE

Animals have become commodities as well. The current hyper industrialized breeding operations (CAFOs) disrespect their source of income. In these warehouses, animals are stored one close to the other, with very limited possibility to move and to express their instinctive behavior. In almost every kind of industry-specific sector, animals suffer from discomfort, pain, injury and disease, fear and distress, even the way they die or are killed.

LACK OF TRANSPARENCY

With very complex global production and retail chains, the transparency of the agri-food system for consumers is lost. Thus, it is very difficult for consumers to understand and take responsibility for the consequences of their food choices (Tischner et al., 2010). Globalization has also affected the food sector. In today’s supermarkets, it is possible to find almost any kind of food, from the local to the exotic ones, raw or already processed or cooked. Also, even if a food is originally “local”, it does not mean that come from nearby areas. Hence, it is very difficult for consumers to gather information about the sustainability levels of the food choices that they make.

The two state-of-the-art solutions to support consumers in their decisions are labeling and being in more direct contact with the producers (typically in an Alternative Food Network scheme).

LABELING

As previously mentioned, labeling is one of the doable solutions to support consumers. A label, governmental or independent one, is meant to organize and clearly show the information of a given product throughout the entire supply chain. However, as reported by Tischner, they have limited impact on consumers.

“A large number of consumers do not know or do not trust eco-labels, and they need other more political and emotional communication around sustainable solutions to get excited about and ‘fond’ of them. As with conventional products the special qualities of more sustainable products and the associated benefits for consumers have to be communicated in an understandable and transparent way. Unlike in pure and often counterproductive ‘greenwashing’ campaigns, the genuinely more sustainable products usually have a good story to tell and this can be expressed by designers and marketing experts in product communication and packaging design to help consumers understand and ‘feel’ the difference” (2010, p. 2.2.2).

SOCIAL ISSUES AND LABOR RIGHTS

The agricultural and food production processes suffer from two main issues, in particular.

The first is the conditions of working of low skilled workers. In many parts of the world, especially low-income countries, legislations are still too soft, i.e. not ensuring the health of the workers, who often have to work many hours per day, under physical, psychological or environmental conditions (and/or for very low wages). Sometimes even children work or are forced to work.

In this framework, big corporations take a competitive advantage by saving money on the first stages of the production process.

The second issue is related to the aging population, which will not only affect the future food production, but it also affects the current agricultural sector, which is aging as well. 52% of farmers are more than 55 years old and just 7% are younger than 35 (Eurostat Farm Survey, 2016). The worrying data, however, is that very few young people want to become farmers, thus leading to an abandon situation of the pillars of the food industry (Tischner et al., 2010).

CONSUMERS COUNT

By 2025, continuing population growth and current agricultural practices will lead to more and more countries suffering from either cropland or freshwater scarcity. There is a growing depletion of the key natural resources, including land, water, and biodiversity, that are fundamental for sustainable production, with agriculture being the main human energy-consumptive activity (UN, 2012).

UNDP reports a similar fact, claiming that the Earth soils, freshwater, oceans, forests, and biodiversity are being rapidly degraded, as well as the climate change which is putting even more pressure on the resources we depend on, increasing the risks associated with disasters, such as droughts and floods.

The report states that there is an urgent need to rethink how we grow, share and consume our food. Indeed, if we (humans) will find a suitable, feasible way to do it, agriculture, forestry, and fisheries can provide nutritious food for all and generate decent incomes, while supporting people-centered rural development and protecting the environment (UNDP, 2019).

It is clearer and clearer, even among academics, that our industrialized agriculture, and food production in general, is definitely not sustainable.

However, there are possibilities for change.

When Tickell states that “food is power” (2017), he is implicitly arguing that consumers do have a stake in the food system. What we choose to eat every day influences how the food is produced and sourced in the first place. Our choices as consumers contribute to all the hidden costs, issues, and impacts of food. Going on in his point, he believes that “companies fear the buying power of a consumer base scorned” and that “it is time for us [consumers] to lead with our dollars and our choices. Some companies will ignore this disruption as an interruption while others will embrace it. Those who embrace it will succeed” (Tickell, 2017).

In another extract of Pollan’s book, the author discusses with a well-known American farmer, Joel Salatin, promoter of a more natural, more sustainable agriculture, about the relationships between food prices and consumers choices: “cheapness and ignorance are mutually reinforcing. Of course, the global economy couldn’t very well function without this wall of ignorance and the indifference it breeds. Society is not bearing the cost of water pollution, of antibiotic resistance, of food-borne illnesses, of crop subsidies, of subsidized oil and water—of all the hidden costs to the environment and the taxpayer that make cheap food seem cheap. [...]

***“You can buy honestly
priced food or you can buy
irresponsibly priced food”***

JOEL SALATIN, AS CITED IN POLLAN, 2006, P. 243.

There are indeed alternatives to the current food supply chain, especially in cities or in the nearby areas. They represent an alternative, more natural and sustainable production model and provision of food, where customers (most of the time) can connect with the producer of their food and pay the real value of what they eat.

2.4 SUSTAINABLE FOOD PRODUCTION

Based on the considerations drawn in the previous analysis of the current dominant food production chain, this chapter will shed light on the existing, (more) sustainable alternatives. At first, an analysis of the most discussed and potentially sustainable production models will be offered. Subsequently, the focus will shift to the production itself, especially, on agriculture, as we have claimed to be the core issue within the production step of any supply chain.

Finally, a brief report about the state-of-the-art sustainable food production in China will be discussed.

2.4.1 SUSTAINABLE PRODUCTION MODELS

The unsustainability of the current food supply chain, due to its embedding into the economy of scale model (more production outputs, fewer production costs), has led to various efforts towards alternatives. In the literature, there are two main acknowledged alternative models, with potential environmental and socio-economics benefits: Distributed Economies (DE) and Alternative Food Networks (AFNs).

Johansson, Kisch, & Mirata, the first scholars to have described the term, have defined DE as “a concept that has been developed as a response to the current industrial production systems, that promotes the development of small-scale, decentralized, flexible units that are synergistically connected with each other and make use of local resources” (Johansson et al., 2005, 13, 971-979).

A study, conducted by the International Institute for Industrial Environmental Economics (IIIEE), adds that DE strives for innovative regional development strategies, where “regions” are defined as small-scale operating entities that are brought together into networks offering the advantage of being much more flexible and resilient to respond to change (IIIEE, 2009).

By being local for definition, these economic/productive models also help to revive the sense of ownership and belonging within (local) communities.

The definition of DE has been reorganized, within the LeNSin project, the International Learning Network of networks on Sustainability (2015-2018), in the analysis of promising sustainable new models, as:

“Small-scale production units, located by or nearby the end-users, whether individuals, entrepreneurs and/or organisations/institutions, i.e. the producers are the same end-users or nearby them. If the small-scale production units are connected with each other to share various forms of resources and/or goods (physical and knowledge-based ones), they become a Locally Distributed Economy Network, which may in turn be connected with nearby similar networks. If properly designed they are promising to promote locally-based sustainability, i.e. Sustainable Distributed Economies (S.DE)” (LeNSin, 2018).

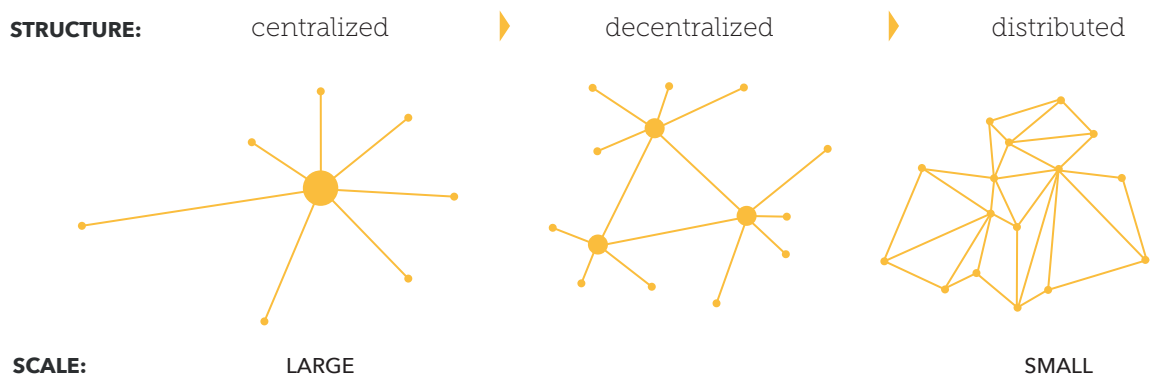
Differently from the dominant centralized production system, DE represent a paradigm shift to the state-of-the-art scheme, by being small-scale, locally-based offer models, eventually network-structured.

It is possible to recognize three kinds of economic/productive models, shifting from the current to the DE one: Centralized, Decentralized and Distributed Economies.

Centralised Economies could be defined as large-scale production units that controls essential activities and deliver their goods (physical and/or knowledge-based) via great distribution networks, to very many (often) far away customers, whether individuals, entrepreneurs or other organisations/institutions.

Decentralised Economies could be defined as small-scale production units that deliver their goods (physical and/or knowledge-based ones) directly to nearby customers, whether individuals, entrepreneurs or other organisations/institutions.

Fig.41 The paradigm shift from centralized to distributed locally-based systems (LeNSin, 2018).



Distributed Economies (DE) could be defined as (very) small-scale production units of goods (physical and/or knowledge-based ones) located by the end-users (that become the producers, i.e. prosumer) that have the control on essential activities.

Distributed Economies in comparison to Centralised Economies could be distinguished in term size, proximity, structure, resilience, responsiveness, diversity of solutions, locally-based sustainability potential (LeNSin, 2018).

The key reason why DE represent a sustainable potential alternative to the current system is that they imply that the stakeholders involved in the new system (consumers as well) have a direct interest in economically profiting from their operation while minimizing pollution, waste, toxic emissions, hence safeguarding the local resources. Also, involving locals in the production systems in their territories (for them and their lands) foster the economy of low-income countries, which, in turn, benefit the local workers as well. The potential benefits are those of creating a resilience network that is capable of adapting while owning a customized solution that increases value in the local economy.

However, it has to be considered that not all the DE are sustainable. Indeed, as reported by Johansson et al., there is the need for knowledge, guidelines and criteria in order to orientate design towards beneficial sustainable solutions, that is why rather than the abolishment of large-scale production, the argument concentrates on finding a renewed balance between large and small scale and between resource flows that take place within and across regional boundaries (2005).

DE APPLIED TO FOOD

According to the LeNSin research, there could be identified two different types of DE: hardware/natural resources-based DE, and knowledge/information-based DE. While the second typology refers to intangible assets, as software, information, and design skills, the first entails physical assets, like energy, water, manufacturing facilities, and food.

In particular, the research applies the term and concept of DE to food, Distributed production of Food (DF), defining it as:

“A Distributed production system of Food (DF) is a small-scale production unit, located by or nearby the end-users, whether individuals, entrepreneurs and/or organisations/institutions. If the small-scale production units are also connected with other DF (e.g. to share the food production), they become a Local Network of Food Production Units, which may in turn be connected with nearby similar networks” (LeNSin, 2018).

Differently from the standardized and centralized system, DF is characterized by:

Small size: shift from large production and distribution systems to small.

Proximity: local distribution close to the consumers.

Structure: from hierarchical to a non-hierarchical structure.

Resilience: from the vulnerability against changes to flexibility.

Responsiveness: from static to flexible production units.

User equals producer: individuals use the production for personal feeding.

Sustainability: use the potential of local resources.

In particular, the objectives of such a system are the availability and accessibility of (healthy) food and the condition of being self-reliance, possible due to a more direct link between consumers and producers. Also, the more local (regional), the more employment and business opportunities, which, according to the definition itself of DE, imply protecting resources and the environment as well (LeNSin, 2018).

The second alternative to the current food system is what is called Alternative Food Networks (AFNs), a term emerged in the 1990s as a reaction against the standardization, globalization, and unethical nature of the industrial food system.

“AFNs seek to diversify and transform modern food provisioning by connecting ethical producers and consumers in more local, direct ways. AFNs endorse the creation of new exchange models that support a return to community food production and demonstrate a commitment to social, economic, and environmental justice along the food chain” (Ferne, 2016, p. 1).

As said, the DE model applied to food is, in other words, a network of actors sharing the production and provisioning of food. In these terms, it is therefore possible to consider the AFNs as the embodiment of DE in practice.

A very popular example of the expression of an alternative food network embodied in/as a distributed economy is the Slow Food movement, born in 1986 as a protest against the arrival of the McDonalds' restaurant chain in Rome. Slow Food, indeed, is a comprehensive set of ideas that has been put into practice in various ways, among which are Community Supported Agriculture (CSA) and Urban Farming (UF) (IIIEE, 2009), but also farmers' markets, fair trade, urban agriculture, specialized forms of organic agriculture, and direct farm retail.

The term AFNs gathers together many different kinds of alternative agricultural relationships and practices, all sharing some peculiar characteristics.

Part 1: Contextual framework

First of all, usually, these models are built on environmental and social sustainability and justice, and on animal welfare. Secondly, their key focus is on providing quality products and on establishing trust.

“Quality and trust are based in the transparency between the relationships of local producers and consumers. As such, “local” food in AFNs implies produce that is fresh, ethical, and environmentally friendly, as it conveys knowledge of what the produce contains and how it was grown” (Ferne, 2016, p. 3).

Produce from AFNs is often considered to be fresh, diverse, organic, quality, and “slow,” while networks are perceived as small-scale, short, traditional, community, local, and embedded (Goodman, DuPuis, & Goodman, 2011).

Thus, the similarities of AFNs with DE and their mutual embodiment.

Fig.42 Example of alternative production/distribution models (dialogochino.net, 2019).



2.4.2 SUSTAINABLE AGRICULTURE

According to Tischner et al., sustainable agriculture is defined as:

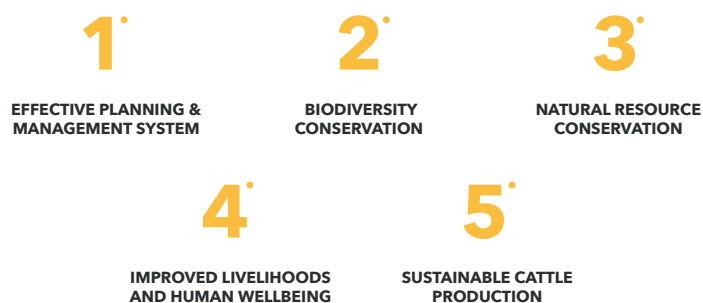
“a way of producing or raising food that is healthy for consumers, does not harm the environment, is humane to workers, respects animal welfare, provides fair wages to farmers and supports and enhances rural communities” (2010, p. 2.1.3).

Another very interesting contribution, widely acknowledged, is the one given by the Sustainable Agriculture Network (SAN) and the 5 principles identified for a sustainable agriculture standard.

The SAN is a coalition of leading conservation groups based in Latin America, with The Rainforest Alliance being one of the most well-known ones. The collective vision of the SAN is that the concept of sustainability recognizes that the well-being of societies and ecosystems is intertwined and dependent on development that is environmentally sound, socially equitable and economically viable (SAN, 2017). One of the key activities for the organizations within the SAN is sustainable agriculture and, for this reason, they have set up a transparent and rigorous standard and certification program that provides and helps farmers to farm in the respect of the environment and the social conditions.

The objective of the standard is to provide a measure of each farm’s social and environmental performance and best management practices. The 5 principles of the SAN standard for a Sustainable Agriculture are:

Fig.43 The five principles for a sustainable agriculture (SAN, 2017).



1: EFFECTIVE PLANNING AND MANAGEMENT SYSTEM

Objectives and outcomes: The certified operation implements an integrated farm planning and management system that effectively addresses environmental and social compliance and risk, establishes procedures and systems for ensuring conformance to the Rainforest Alliance Standard, and supports continuous improvement toward sustainable agriculture.

2: BIODIVERSITY CONSERVATION

Objectives and outcomes: This principle contributes to the protection of biodiversity¹³, natural ecosystems, and their conservation values on and around certified farms. Farms protect on-farm natural ecosystems and do not contribute to deforestation. Diverse native shade canopies for shade-tolerant crops (such as coffee and cocoa) help conserve biodiversity and increase farm resilience. For all crop and cattle production systems, farms conserve or restore trees and other native vegetation.

3: NATURAL RESOURCE CONSERVATION

Objectives and outcomes: Farms conserve natural resources as the basis for sustainable farming while minimizing environmental pollution. Farming practices minimize soil erosion and compaction and maintain or improve soil health, including stocks of soil organic matter. Soil fertility is managed in a way that promotes crop and soil health. Improvements in soil organic matter, soil health, and water and pest management increase farm resilience to climate change.

4: IMPROVED LIVELIHOODS AND HUMAN WELLBEING

Objectives and outcomes: Farms protect workers' rights, as defined by ILO core conventions¹⁵. Farms do not use forced labor or engage in labor discrimination. The health and wellbeing of all workers (and young workers in particular) are protected, and minors below 15 years of age are not hired as farmworkers.

5: SUSTAINABLE CATTLE PRODUCTION

Objectives and outcomes: Cattle are raised following responsible practices from birth to slaughter. Certified farms keep track of animals and have herd health and nutrition programs respecting Rainforest Alliance prohibited substances. Pastures are selected and managed based on agroecological parameters, resistance to pests, nutritional value and production rates to ensure optimum growth and avoid pasture degradation. This principle applies to semi-confined cattle systems only (SAN, 2017).

Besides every kind of definition or standard, in order to propose an alternative to conventional agriculture, different (new) farming techniques have risen, organic

agriculture being the most popular and discussed one. Hereinafter, these alternative agricultural typologies will be presented and discussed.

ORGANIC AGRICULTURE

Organic agriculture is considered a more sustainable kind of agriculture, because of several benefits, such as reduced environmental impacts, healthier food outputs, improved biodiversity, and more ethical animal welfare.

International Federation of Organic Agriculture Movements defines 4 principles for organic agriculture: health as sustainment and enhancement of soil, plants, animals, humans, and the planet; ecology based on the natural cycles of nature, emulating and preserving them; fairness as the relationships that ensure fairness towards environment and life; and care as the responsibility and precautionary manner to protect environment (IFOAM, 2019).

In recent years, organic farming and its products have witnessed a giant growth worldwide. Yet still representing a small portion of the total cultivated land, the agricultural land used for organic cultivation has increased almost five-fold, from a mere 0.3% to 1.4%, between 1999 and 2017. Australia comes in at number one with 35.6 million ha of organic agricultural land, followed by Argentina with 3.4 million ha, and China with 3 million ha. Also, the area of organically managed land in China is expected to reach 1.5 % of total agricultural land by 2020, making China the leading producer of organics worldwide. As regards the market, retail sales for organic food were reported to be the highest in the US at 43 billion euros and Europe at 37.3 billion euros, followed by China (Willer & Lernoud, 2019).

Its great success is surely caused by products being healthier, perceived as fresher or safer. Indeed, organic agriculture does produce healthier products for the human body, affecting both the consumers and the producers (who do not stay in contact anymore with huge quantities of poisons and chemicals). On the other hand, however, the same cannot be completely said for environmental health (on a long term period).

Tischner et al. explain that organic production has gained so much success and visibility that its main actors, becoming more professional in running their businesses, cooperating within agricultural policy, and strengthening their retailing and marketing, have consolidated the industrial processing of organic food (2010).

“food chain [organic one] that might appear to be preindustrial but in surprising ways turn out in fact to be postindustrial”

POLLAN, 2006, P. 8.

In his discovery path in the agricultural production, Pollan observes how organic practices have indeed become just a matter of substituting inputs: rather than chemicals, natural products. Surely, he and other scholars, acknowledge that organic agriculture brings more beneficial aspects and consequences on human health but, also, that it has more and more become based on the same principles and mechanism of the conventional one, made of few and huge industrial farms. Hence ending up contradicting its same founding ideals.

Although the organic movement started with good premises and solid principles, nowadays “organic” has become only a standard, shown under the image (or guarantee) of a label.

THE ORGANIC LABEL(S)

Labels are mass-communication tools that play an important role in the business–consumer dialogue in the market of food and agricultural products, facilitating the decision-making process of consumers. In addition, they are not only a symbol

Fig.44 The organic labels of different countries/continents (different sources).



which helps consumers to choose, but they are also a symbol of political, social or environmental consciousness (Tischner et al., 2010).

However, today there is an incredible number of labels certifying organic productions, which, in turn, has brought to an even more difficult decision process and trust.

Among the first ones, the USDA organic certification has been a watershed in the organic movement. Originally, indeed, the first theorization of the organic philosophy is probably attributable to Sir Albert Howard (1873-1947), an English agronomist, who in 1940 wrote a very influential book for the time, called "An Agricultural Testament". Although the author did not mention the term "organic", Pollan reports that it was possible to tease out all the many meanings of the word, as a program for not just agricultural but social renovation, from his writings (2006).

The word came into being around 1945, thanks to Jerome Rodale, the founding editor of Organic Gardening and Farming magazine (and afterward the founder of the Rodale Institute), who introduced the term in his publications, implying that nature rather than the machine should supply the proper model for agriculture.

In the following years, the movement under the name organic grew, yet slowly, until it acquired political and social connotations. Indeed, the refusal of the use of chemicals in agriculture became a sign of refusal of the war (since the pesticides and herbicides manufactured by Dow Monsanto were also used during the war in Vietnam). Hence, the organic movement ended up establishing not just an alternative mode of production but an alternative system of distribution and even an alternative mode of consumption, until it generated so much attention and market, to start a new industry.

The origin of the label dates back to 1990 when, after the shocking news of the carcinogen effects of a pesticide called Alar used in apple orchards across the US and the consequent huge public demand for organic products, many companies/producers began using "organic" labels on everything. To solve the situation, the American Congress passed the Organic Foods Production Act, which laid the basis for the creation of a national standard (a unique label).

After many years of discussions between the old, original movement and the new industry, in 2002 the US Department of Agriculture created the USDA organic certification, which was rather a success for the new industry. Indeed, the standard allows the use of numerous substances and agricultural practices which were in contrast with the original movement (which asked for stricter rules). Although not being perfect, USDA Certified Organic represents the strictest set of food standards in America and one of the strictest sets of standards in the world.

Eventually, the defeat of the original organic movement in the dispute against the new raising industry pushed many of the movement's founders to move beyond organic (Pollan, 2006; Tickell, 2017).

ORGANIC VS CONVENTIONAL

The heated discussion today is often related to the truthful more beneficial and sustainable aspects of organic agriculture and production, compared to the conventional one.

Indeed, while most of the studies and LCAs conducted on organic production acknowledges that the environmental impacts are lower (Cederberg & Mattsson, 2000; Meier et al., 2015; Foteinis & Chatzisyneon, 2015), they also reports that organic systems usually require more land to produce the same amount of produces compared to the conventional one (Tischner et al., 2010; Kniss et al., 2016; Kearney, 2010). In other words, that organically-produced crops produce significantly lower yields.

In order to shed light on the debate, two LCA analysis comparing the production impacts of different kinds of food, produced conventionally and following the organic standard, are offered. It has to be noted that the analysis comprises organic industrial farm (commercial ones), as previously discussed.

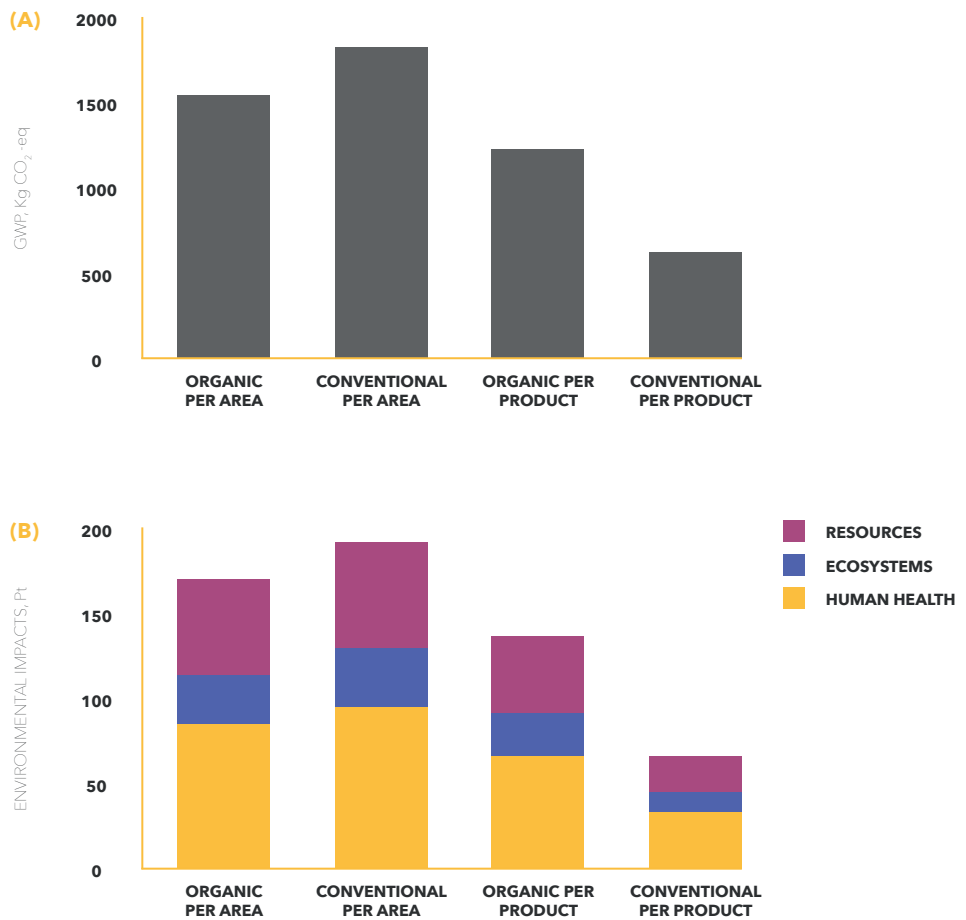
CONVENTIONAL VS ORGANIC LETTUCE CULTIVATION LCA (FOTEINIS & CHATZISYMEON, 2016).

Lettuce has always been an important vegetable in the human diet. Particularly in Greece, lettuce cultivation has been sharply increased by 50% from 2009 to 2012, both in conventional and organic productions. For this reason, the study analyzes the sustainability of both the systems by assessing their environmental impacts, with A cradle-to-gate approach. Indeed, the boundaries of the investigation are all processes that take place in the field, from sowing to harvesting, without including post-harvesting activities, such as packaging, transportation and disposal of the packaging material (the transportation of the fertilizers and of the pesticides, herbicides, and fungicides to the field was taken into account by assuming a distance of 30 km).

As regards the functional unit, two were actually established. Specifically, the environmental impacts of lettuce organic and conventional open-field cultivations were estimated per (a) hectare of cultivation and (b) ton of lettuce produced, so that to compare both cultivation systems per unit of area and per product unit.

Finally, the analysis is carried by using two different impact assessment methods, namely IPCC 2013 v 1.0, for a time frame of 100 years, and ReCiPe v1.01 (the former being the methodology used by the Intergovernmental Panel on Climate Change – the United Nations body for assessing the science related to climate change –; the latter being the successor of Eco-indicator 99 and CML-IA methods).

Fig.45 Comparison of organic vs. conventional lettuce cultivation per unit of area (ha) and per product unit (ton), using (A) IPCC 2013 and (B) ReCiPe impact assessment methods. Adapted from Foteinis & Chatzisyneon, 2016.



The images show the comparison of the two systems analyzed by the GHG emissions, and the environmental impact on three categories: resources, ecosystem, and human health. The result is clear: organic is more environmentally friendly than conventional lettuce cultivation when its sustainability is assessed per cultivation area unit, while results are inverted when sustainability is estimated per ton of lettuce produced. The result can be explained by considering the high(er) yield of conventional cultivation.

CONVENTIONAL VS ORGANIC MILK PRODUCTION LCA (CEDERBERG & MATTSSON, 2000)

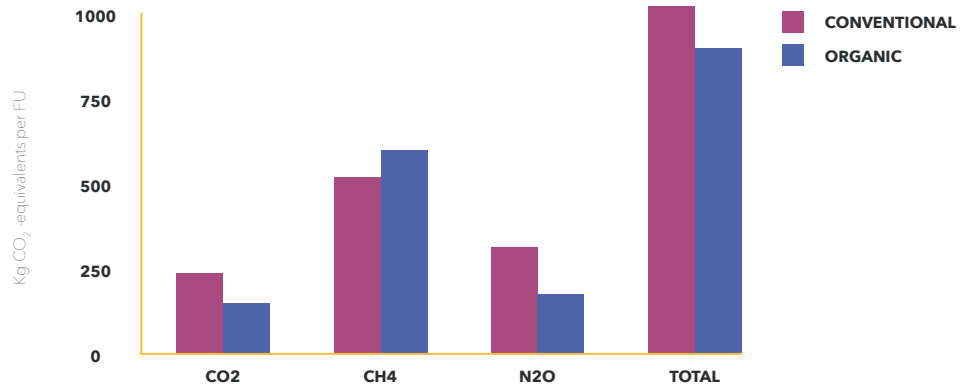
The milk production industry is one of the most important food sectors in Sweden, whose conventionally bred dairy cows are among the highest yielding in Europe. Besides, the organic milk production industry is thriving, with the objective of reaching 75% of Swedish milk produced by 2021. To assess the impact of the (new) organic production, the study conducted by Cederberg and Mattsson analyzes the environmental performances of the organic production compared to the conventional one. The goal of the investigation was to identify the parameters which have the largest environmental impact in the systems studied, and to find out which one performs better.

The system boundaries of the analysis are the steps of the life cycle of the milk production, from the production of the materials and energies (diesel, pesticides, fertilizers, seeds, fodder), the breeding of the cows, to the production and transport of the milk. Instead, the chosen functional unit was established as 1000kg of energy corrected milk (ECM) leaving the farm gate (ECM is a correction factor generally used by the dairy industry; it considers both the fat and the protein content of the milk). Finally, the environmental impact categories considered in the study were resources (energy, material and land use), human health (mainly pesticides use), and ecological effects (global warming, acidification, eutrophication, photo-oxidant formation and depletion of stratospheric ozone).

The image shows that, as for the GHG emissions, organic performs better, except for the production of methane. Also, the use of pesticides and fertilizers in the conventional system is the main contributors to the gas emitted. As for the acidification, organic performs better, with a 10% less acidification potential than conventional farming.

Finally, the nitrogen pollutants ammonia and nitrate are major sources for eutrophication and acidification in both of the systems studied.

Fig.46 The potential contribution to global warming, kg CO₂-equivalents per Functional Unit, with a time horizon of 100 years. Adapted from Cederberg & Mattsson, 2000.



To conclude, the study demonstrated that the organic system performs better than the conventional one (even if they both need measures to reduce their impacts), but it needs a bigger area (to grow crops and graze the cows). Therefore, the study suggests that this may be a limitation of organic practices in general, as the land does not have the same yields as the conventional one.

The analysis shows that while organic averagely performs better because of lower GHG emissions, it is not necessarily (or always) better. Indeed, on a per hectare basis, a monoculture grown with chemicals and additives cannot be outperformed by the same monoculture, above which least powerful additives were laid (currently, indeed, the organic substances that can be used in the certified organic production are least powerful of the conventional counterparts) (Pollan, 2006; Tickell, 2017).

In facts, as we already reported, the industrial organic agriculture, while being better than the conventional one, it is still not the best solution either, because based on the same economic principles of mass production, and therefore, of a simplification of nature (uniformity rather than diversity and complexity). In order to have similar yields to the conventional one, industrial organic agriculture heavily relies on external inputs.

Indeed, in order to weeding, but without the possibility to use chemicals, industrial organic agriculture heavily relies on tillage, more than the conventional one (the best ecological option would be weeding by hands, however, it is obviously not

economically viable for large scale operations). Tilling destroys the tilth of the soil and reduces its biological activity, releasing huge quantities of nitrogen into the atmosphere. Since nitrogen is essential for the soil, organic fields require a lot more nitrogen fertilizer than their counterparts.

In a less disturbed, healthier soil, nitrogen-fixing bacteria would create much of the fertility that industrial organic growers must add in the form of compost, manures, etc....external outputs (Pollan, 2006).

When compared on a per hectare yield, therefore, the debate is often around whether organic agriculture could ever be the solution to feed the growing number of people that will inhabit the planet in the close future (given that the conventional one could not because of its huge impacts). The question may be fundamentally wrong in its nature. The problem, indeed, is not in the productive capacity of one technique or another, rather on the availability of the land itself, mined by the ongoing desertification process.

Therefore, the answer to this complicated question is probably in the health of what makes the same discussion about agriculture exist: the soil.

2.4.3 SOIL HEALTH AND BEYOND ORGANIC AGRICULTURE

The several discussions about the farming techniques do not consider that actually what it really matters is the health of the soil.

Indeed, as we said, both the conventional and, especially, the organic agriculture relies on tillage. However, intensive tillage is reported by several studies to degrade the fertility of soils, cause air and water pollution, intensify drought stress, destroy wildlife habitat, waste fuel energy and contribute to global warming (Tischner et al., 2010).

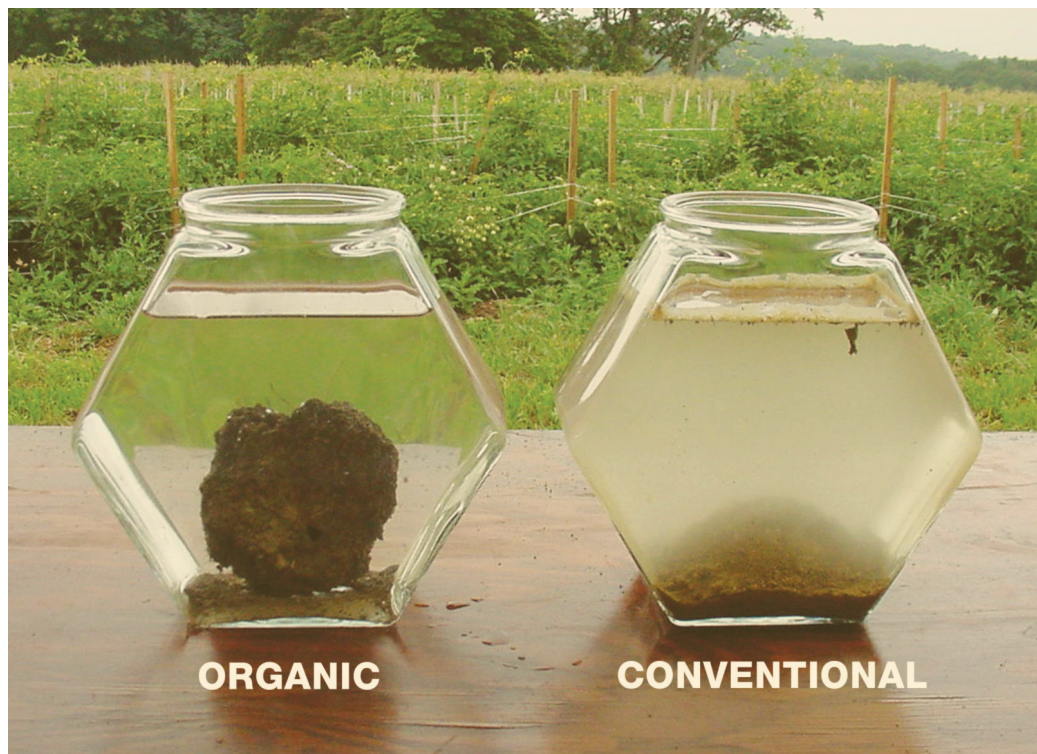
As a result, most tillage-based systems are not sustainable in the long term because of the declining soil quality caused by the tillage.

Tischner et al. report that “research and farmers’ experience indicate that continuous no-till is the most effective and practical approach to restoring and improving soil quality. With continuous no-till, soil organic matter increases, soil structure improves, soil erosion is controlled and, in time, crop yields increase substantially from what they were under tillage management, because of the improved water relations and nutrient availability” (2010, p. 2.1.3.1).

Also, another more than ever fundamental aspect is the potential of this way of treating the soil to sequester the carbon from the atmosphere and put it into the ground. By reducing tillage, leaving crop residues to decompose where they lie, and growing winter cover crops such as grains or alfalfa, a farmer indeed can slow down carbon loss from a field. The microbes generated from the decomposition process not only rescue carbon from the atmosphere, but they also contribute to increasing the retention of the water of the soil (Pollan, 2006). Thus, richer soil, richer outputs and least possibility of desertification.

The issue of tilling is so important that Tickell believes that being organic with heavy tillage is possibly more destructive to the soil than being conventional with zero tillage (2017).

Fig.47 The soil health conditions of different farming techniques. Organic, no-tilled soil is compact: it better absorbs and retains water (The Rodale Institute, 2019).



The Rodale Institute, an American nonprofit that supports research into organic farming, is currently conducting the longest-running research project in agriculture, which compare different kinds of agricultures in terms of yields, economic viability, energy usage, and human health.

In particular, after 30 years of the Farming Systems Trial project, Rodale Institute has demonstrated that organic farming is better equipped to feed the growing population. In fact, their research shows that:

Organic yields are competitive with conventional yields (after a 5-year transition period)

Organic outperforms conventional in years of drought.

Organic farming uses 45% less energy and is more efficient.

Conventional systems produce 40% more greenhouse gases.

Organic farming systems are more profitable than conventional.

Organic farming systems build rather than deplete soil organic matter, making it a more sustainable system.

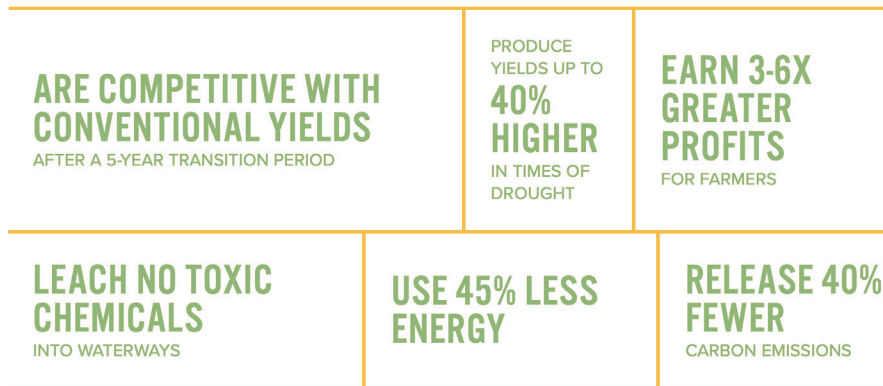
The research is particularly important for the organic movement in general for two reasons. First, the Trial has given (and gives) the organic movement a scientifically verifiable, long-term study of the viability of organic farming. Second, it highlights the role of the soil as a fundamental resource.

Indeed, the Institute reports that “Healthy soil contains aggregates that help it bind together, preventing erosion and run-off. It can hold more water, so plants fare better in drought. It contains more bacteria and fungi that help plants fight diseases and pests. And healthy soil also contains more minerals and nutrients that feed plants. Because organic systems don’t use chemical inputs, toxins stay out of the environment and fewer fossil fuels are used. Methods like organic no-till keep energy costs down, too” (Rodale Institute, 2019).

The Rodale Institute activities are about a different kind of organic agriculture, one that can possibly regenerate itself: the regenerative organic agriculture.

This kind of production, together with all the other alternative production techniques originated from the original organic movement (as biodynamic), are more commonly referred to as “beyond organic”. The term serves as an umbrella to indicate all those farming techniques which, differently from the industrial organic farming, are based on a self-sustaining system which follows the cycles of nature and do not rely on the massive use of external inputs.

Fig.48 The Farming System Trial results (The Rodale Institute, 2019).

ORGANIC SYSTEMS:**REGENERATIVE AGRICULTURE**

Taking a holistic approach to organic agriculture, regenerative agriculture is designed to improve soil health and fertility, as well as increase biodiversity, enhance ecosystems, improve water quality, reverse climate change and empower farming communities (Mintel, 2019).

Because soil, despite its importance, is being lost faster than it can be replenished, regenerative agriculture focuses on building soil through four pillars: trees, managed herd grazing and compost, cover crops, and “no-till” agriculture systems. The Rodale Institute has even established a special certification. Using the USDA certified organic standard (or its international equivalent) as a baseline requirement, Regenerative Organic Certification adds important criteria and builds off these and other standards in the areas of soil health and land management, animal welfare, and farmer and worker fairness (Rodale Institute, 2019).

It is hence clear its holistic character, not focusing solely on one aspect (like the crops and fields yields) but on the overall picture, trying to mimic nature rather than simplifying it. Moreover, since building soil requires huge quantities of carbon, regenerative agriculture holds the key to moving the carbon that is currently in our atmosphere back into the ground (Tickell, 2017).

Today, there are different names to indicate the food produced according to such principles and agricultural method. However, the most accredited and used one is probably “real food”, a powerful name that expresses the naturalness of the food and its production, as when it was produced in the past, before the mass industrialization of our food system.

Fig.49 The three pillars of the Regenerative Organic Certification (The Rodale Institute, 2019).



SOIL HEALTH



ANIMAL WELFARE



SOCIAL FAIRNESS

Regenerative agriculture, however, while being an accredited potential method for agriculture, it also poses different issues.

Indeed, according to its guidelines, regenerative organic agriculture aims to recreate an ecosystem, where natural elements (plants, animals, etc.) are used to balance natural phenomenon and to sustain the farmer. Because of that, the management of the farm results difficult, surely much more than the conventional one, where farmers deal with simplicity (not complexity and diversity). The time needed to make a farm running under these principles is surely considerable.

Second, the acceptance by farmers represents another obstacle. It is surely not easy for a farmer, who brought up and was educated inside a certain system of agriculture, to change and switch to no-tillage (and regenerative in general), also because it has reported that during the first year(s) the yields are lower due to increased weed and disease infestations (Tischner et al., 2010).

Another issue is related to the activities that have to be carried on the farm. Regenerative organic agriculture is based on no-tillage. Combined with the impossibility to use chemicals, this promising kind of farming is surely more labor-intensive. The final costs of this agriculture may be higher but it has to be considered that the cost of inputs is drastically reduced (if not deleted).

Finally, the use of animals, in particular cows, is a well-debated issue. Indeed, while in the regenerative organic agriculture framework cows are essential to make the grass reproduce and protect the soil, on the other hand, however, they are the main responsible for the methane emissions, which impacts 28 times more than CO₂ as a greenhouse gas.

Obviously, when dealing with sustainability it is not easy to fully understand which system is better than the other, considering all their explicit and implicit impacts.

A NEW MODEL OF DISTRIBUTION AND CONSUMPTION

As we said, the harsh debate between big industrial farms (the organic industry) and small ones (the organic movement), and the defeat of the second has brought many of the movement's founders to move beyond organic (Pollan, 2006).

The original organic movement has then eventually created a new kind of business or practice, based on a stronger and closer relationship with consumers.

Indeed, Tischner reports how "alternative forms of distribution are becoming more common, such as farmers' markets and box schemes, aiming at returning to a more direct relationship between producers and consumers" (2010, p. 2.1.3.6).

As a matter of facts, most of the not-industrial organic farms deeply engage in a direct, face-to-face relationship with their customers, exclusively local. In order to go beyond the label and to gain trust, these farmers welcome people to their farms, to look at their operations, and to get informed about how they produce their food. One of the key innovations of organic food was to allow some more information to pass along the food chain between the producer and the consumer, previously confined to only the price. This, consequently, fostered these farmers not to certify their produces anymore.

"My certification is by my consumers. I honestly think that the consumption of food and the act of selling food to a consumer is trust. That consumer trusts that the product I'm producing is as healthy as I can produce it" (Gabe Brown -North Dakota organic regenerative farmer- as cited in Tickell, 2017).

Among the different sub movement or expressions through which the original organic movement is spreading, the communication between producer and consumer is always a cornerstone, even for regenerative agriculture.

2.4.4 SUSTAINABLE FOOD PRODUCTION IN CHINA

On top of what has been already discussed in the previous chapters of this document, the analysis about the sustainable food production in China will start from the current state of organic production and it will then cover one particular phenomenon which is taking place evidently: the spread of Community Supported Agriculture (CSA).

The CSA is one of those models belonging to the alternative food networks, which we have discussed above. This analysis will clarify the status of sustainable production in China, however, due to lack of information and sources, it will be confined to the mentioned topics.

First of all, China is the world's leading market for fresh food as for 2016, with total volume sales of 705 million tons and 35% of the global market. Globally, vegetables were the best performer, increasing by 4% and contributing 51% of absolute fresh food volume gains. The success of vegetables was largely attributable to a 4% growth in China, which alone accounted for nearly 40% of global fresh vegetable volume sales in 2016 (Euromonitor, 2017).

Together with this, also the organic market arose.

Indeed, the estimates report that the area of organically managed land is expected to constitute 1.2 to 1.5% of total agricultural land by 2020, making China becoming the leading producer of organics worldwide. Market analysts forecast a share of up to 3% in the domestic food market and a share of 1-1.5 % of exports. On the back of food scares and scandals involving counterfeit goods, organic products are perceived as a guarantee of reliability and premium quality by Chinese consumers, whose sales often outperform conventionally sourced alternatives (Euromonitor, 2017).

From the data it is clear that healthier products are entering in the diets of Chinese people, mainly urban consumers, and, thus, it can be grasped that also the production is moving towards a cleaner one (even if the food supply chain is still largely based on conventional production).

A very interesting study on alternative approaches to food, conducted by Krul and Ho, reports that due to the urbanization growth, the decrease in agricultural work, and the growing population, China's food systems faces three main challenges:

The already reported food safety

The high rates of population growth and dietary changes.

The country reduced and degraded volumes of water and land resources.

By consequence, the emerging issues and dissatisfaction with the food system have given rise to new civil society-led approaches to organizing the food system, among which the CSA.

The model of CSA is characterized by a community that supports the farm operations so that the farm becomes community-owned or stewarded. While the "supportive" aspect can entail physical labor, it is mostly on a subscription basis that members participate. They make an advance payment in the form of shares to cover the anticipated cost. In return, members receive deliveries directly from

the farm at frequent intervals. In this model, the members share both the risks of poor harvests and the benefits of successful harvests (Krul & Ho, 2018). The study also reports that such initiatives can be successful in creating jobs, enhancing food safety, and improving the quality of farmland. The first form of CSA in China has emerged only in 2008, being a sort of adaptation of the Western model (where it born many years before).

Differently from the Western one, the Chinese CSA and other alternative systems tend to be more driven by consumers and based on the food safety issue. Another significant finding is that Chinese ones do not directly oppose the dominant food system but aim to complement them instead (Si et al. 2015, as cited in Krul & Ho, 2018). Generally, in China, it has been acknowledged that the development of CSA was paired with numerous benefits as young people coming back to the farm, farmers gaining more access to markets, and incomes raised.

One of the main exponents of the CSA rapid spread in China is Wen Tiejun, ex-young farmer who founded the Rural Reconstruction movement. He believes in:

“[a] socialized agriculture: embedding social capital into agriculture to shape local, small-scale, traditional and decentralized farms. By doing so, the interviewees emphasize that it is not the government, but the people, and especially China’s middle class, that should take responsibility for this change” (Krul & Ho, 2018).

A barrier for consumers to take responsibility is caused by a low level of information among the majority of the population, yet showing positive attitudes towards sustainable products (Meyer-Höfer, 2015).

Another limitation is represented by the lack of certification of the CSA product. Although the CSA model aims to create more awareness about environmental and rural issues, re-establish trust between consumers and producers, and make urban dwellers more interested in agriculture, the way it has consolidated in China is more a producer-customer relationship, interested in safety food.

As for the new model of distribution and consumption described before, Chinese farms too consider the relationship with consumers to be the key and strive to build trust by encouraging consumers to visit and assess the farm operations.

Although CSA is not an answer to population growth or dietary changes, direct engagement with the local population makes the model more adaptive to evolving dietary needs and provides urban citizens with more influence over the food system (Krul & Ho, 2018). Ultimately, considering its rapid growth, the system is surely promising.

2.5 SUSTAINABLE PRODUCT-SERVICE SYSTEMS (S.PSS)

This chapter is dedicated to the analysis of one of the most promising approaches, adopted by designers, to deal with sustainability-centered projects. Before going into details with the S.PSS, their characteristics, and benefits, a background research context is offered, aiming to better understand the concept and its origin.

2.5.1 PRODUCT-SERVICE SYSTEMS

The first definition of Product-Service System was given by Goedkoop, Van Halen, Riele, & Rommens in 1999, who described it as:

“a marketable set of products and services capable of jointly fulfilling a user’s need. The PS system is provided by either a single company or by an alliance of companies. It can enclose products (or just one) plus additional services. It can enclose a service plus an additional product. And product and service can be equally important for the function fulfilment” (Goedkoop et al., 1999, P. 18).

In its analysis, the author also offered a description of its three main founding terms:

Product: a tangible commodity manufactured able to satisfy a user’s need. It can be anything of physical which can be owned and stored by individuals or a group of individuals.

Service: an activity with an economic value performed for others. It is most likely intangible and does not result in ownership of something.

System: a group of elements connected together by a relationship. One key conceptual component of PS system is the “functional unit”, a standardized quantity of measurable function fulfilled by both PS system and reference system, which enables the comparison between different design solutions.

More recently, that first definition was implemented during the UNEP sustainable consumption program, aiming to promote an understanding and greater use of life-cycle thinking.

Manzini and Vezzoli defined PS system as “the result of an innovation strategy, shifting the business focus from designing and selling physical products only, to selling a system of products and services which are jointly capable of fulfilling specific client demands” (UNEP, 2002, p. 4).

At the basis of this definition there is the assumption that users do not really want a product or a service per se, rather, they want what this product or service could enable them to do. Hence, the aforementioned utility or functional unit, which changes the perspective through which to conceive any new project.

Vital to the PS system development is the creation of new forms of relationships among the actors involved on the value production chain

“[...] new interactions are mandated with the client, and innovative partnerships are needed with other producer/suppliers, public bodies or not for profit organisations. Hence, introducing PSS requires communicating and providing information to ‘new’ stakeholders. Thus with this approach, the producers or the service providers, extend their interests beyond their usual boundaries, in terms of both product life cycle phases (pre-production, production, distribution, use and end-of-life) and connections with other products and services, which, taken together, will result in an integrated solution for the customer” (UNEP, 2002, p. 5).

Another important consideration about PS system in the academic research is that it has a great potential to “score a decrease in environmental pressure. In case this is combined with an attractive economic value of the new system, a system change has the potential for unlinking environmental pressure from economic growth (Goedkoop et al., in 1999).

Indeed, PS systems allow to better answer the user needs based on what they want to achieve. This makes the producers rethink the overall life cycle of its offering and, in some cases, to substitute a product with a service, greatly increasing the opportunities to lighten the environmental burden.

However, as Manzini et al. highlights, the “PS system do not necessarily lead to sustainable solutions. They only have the potential to do so: in other words, PSS offer us a useful and promising concept to move in the direction of sustainability; but this potential must be verified on a case by case basis. It is only when a PSS actually assists in re-orienting current unsustainable trends in production and consumption practices, that it can be referred to as a Sustainable Product-Service System” (UNEP, 2002, p. 5).

2.5.2 SUSTAINABLE PRODUCT SERVICE SYSTEMS

Sustainable Product Service Systems (S.PSS) are widely considered in the academic context a promising alternative to the current economic system which is only centered on profit, excluding, most of the time, the possibility of being sustainable. S.PSS are considered to be a potential way to create value (also economic) while decoupling it from material and energy consumption.

Only after several years of research debate, the S.PSS today are defined as

“...offer model providing an integrated mix of products and services that are together able to fulfil a particular customer demand (to deliver a “unit of satisfaction”), based on innovative interactions between the stakeholders of the value production system (satisfaction system), where the ownership of the product/s and/or its life cycle responsibilities remain by the provider/s, so that the economic interest of the providers continuously seek new environmentally and/or socioethically beneficial solutions” (Vezzoli et al., 2018).

During the years, from their first conception, the S.PSS has been also taken as promising offer model to extend the access to goods and services even to low- and middle-income contexts, enhancing social equity and cohesion. This is the reason why they are considered to be a win-win model, combining the three pillars of sustainability: economy, environment, and socioethics.

Even though the design of a proper S.PSS relies on specific methodologies and tools, three fundamental features work as background principles and that identify three innovative approaches:

1) THE SHIFT FROM PRODUCT TO “UNIT OF SATISFACTION”

This kind of solution allows decoupling the fulfillment of user needs from the traditional design of a single product to reframe it into a mix of products and services that deliver satisfaction through their integrated benefits. These new models are rooted in a satisfaction-based economic model, where each offer is developed/ designed and delivered in relation to a particular customer “satisfaction”.

2) THE SHIFT FROM TECHNOLOGICAL INNOVATION TO STAKEHOLDER CONFIGURATION

The innovative component within S.PSS is not narrowed just on technologies, but it considers a breakthrough in the whole stakeholders’ network related to the unit of satisfaction.

Three main configurations have been studied and established as the most

to generate relevant system innovations (all based on new stakeholder interactions): product offer combined with product life cycle services to customers, offer as enabling platform for customers and final results offer to customers.

3) THE SHIFT FROM INDIVIDUAL OWNERSHIP TO ACCESS

Instead of traditional selling processes, S.PSS offers access to certain products or services, in which the provider keeps the ownership of goods. Therefore, they have an intrinsic eco-efficiency potential, where it is the company's economic and competitive interest itself that may lead to a reduction in environmental impact.

2.5.3 S.PSS TYPOLOGIES

There is constant research about the business approach that could generate a viable and sustainable PS system.

PS system "can be seen as strategic innovations which companies may choose in order to separate resource consumption from its traditional link to profit and standard of living improvements; to find new profit centres, to compete and generate value and social quality while decreasing (directly or indirectly) total resource consumption. In other words, PSS as win-win solutions: winning for the producers/providers, the users and the environment" (UNEP, 2002).

In particular, Vezzoli et al. identify three main types of business approaches for the creation of S.PSS, which are favorable to eco-efficiency and promising in terms of their win-win potential (2014):

Product-oriented S.PSS: services providing added value to the product life cycle.

Use-oriented S.PSS: services providing 'enabling platforms for customers'.

Result-oriented S.PSS: services providing 'final results' for customers.

PRODUCT-ORIENTED S.PSS

The first typology is the product-oriented S.PSS, which is defined as: "A company (alliance of companies) that provides additional services to guarantee an extended life cycle performance of the product/semi-finished product (sold to the customer)" (Vezzoli et al., 2018).

This kind of S.PSS represents a new way of selling goods, that add to the traditional way other services that increase the value to the life cycle of the product. The manufacturers upgrade their interaction with customers through support services like maintenance, repair, upgrading, substitution, that reduce customer responsibilities, while increasing the company competitive interest. Indeed, the core of this S.PSS typology is that the offer provider is therefore continuously seeking for environmentally beneficial new solutions (reduce materials and resources consumption) because, in doing so, it also increases profit.

PRODUCT-ORIENTED CASE: WILKHAHN AFTERSALE SERVICES

Together with the design of a premium-quality office chair, Wilkhahn wagers a lot on aftersale services to keep monitored products' working conditions along five years after the purchase. In this period, three visits by a Wilkhahn technician are included and the old product could be updated according to user needs. At the end of life, the company provides take back and recycling services which costs could be canceled if a new chair is bought by the customer. Consequently, Wilkhahn doesn't push on the number of sold chairs, but on lifecycle services: they prevent additional costs for production of new products (Vezzoli et al., 2018).

Fig.50 Wilkann office chairs (Wilkhahn.com).



USE-ORIENTED S.PSS

The second typology is the use-oriented S.PSS, which is defined as: "A company (alliance of companies) offering access to products, tools, opportunities or capabilities that enable customers to meet the particular satisfaction they want (in other words efficiently satisfying a particular need and/or desire). The customer obtains the desired utility but does not own the product that provides it and pays only for the time the product is actually used (Vezzoli et al., 2018).

Use-Oriented S.PSS are characterized by a concession of rights to the customer, that can use the product on a time-period or number-of-uses basis. The innovative interaction between the company and the client can be driven by the interest of looking for environmentally beneficial solutions that are highly efficient, long-lasting or reusable.

USE-ORIENTED CASE: GOVOLT E-SCOOTER SHARING

GoVolt is an innovative service based in Milan that provides access to electric scooters, spread around the city. The fleet is owned by the company and users can move around a large urban area. Scooters can be unlocked through a mobile app and the effective use is paid with a minute-based rate or through longer subscription packages. GoVolt takes the responsibility of recharging batteries, maintaining the scooters and guaranteeing insurance. The system makes urban mobility more agile and accessible, intensifying the use frequency of the single-vehicle and consequently reducing the number of cars in the city (Govolt, 2019).

Fig.51 The fleet of GoVolt e-scooter sharing service (Govolt.it, 2019).



RESULT-ORIENTED S.PSS

Finally, the third typology is the Result-oriented S.PSS, which is defined as: "A company (alliance of companies) that provides a customised mix of services (as a substitute for the purchase and use of products), in order to provide an integrated solution to meet a particular customer's satisfaction (in other words a specific final result). The mix of services does not require the client to assume (full) responsibility for the acquisition of the product involved. Thus, the producer maintains the ownership of the products and is paid by the client only for providing the agreed results" (Vezzoli et al., 2018).

In these kinds of S.PSS, the provider does not offer any physical product per se. Rather it offers a result or a capability. The customer, on the other hand, does not own anything but pay for an agreed result (pay to achieve the final satisfaction). In this way, the customer is free from any sort of responsibility in relation to products and services, and the provider, because it keeps the ownership of its product(s), is constantly pushed to optimized and operate an efficient, long-lasting system (which results in fewer costs and resources use).

RESULT-ORIENTED CASE: PHILIPS LIGHT-AS-A-SERVICE

From the encounter between Frans Van Houten (Philips CEO) and Thomas Rau from Turntoo (circular economy expert), the company developed a new offer, based on the supply of light as a performance outcome. Philips take care of both production and management of the lighting system, that is requalified using LEDs technologies, while business customers pay "per lux", a fee that includes the light consumed.

Moreover, the whole lifecycle services (design, equipment, installation, maintenance, and upgrades. Again, the economic interest of the provider is to design for the longevity of the system: the more it is efficient, long-lasting and cheap, the higher is the profit. The customer is also motivated to save energy, enhancing other sustainable practices in terms of consumption. Last but not least, infrastructures may be given back to Philips to be used again.

The model has been already applied to relevant projects like Washington DC metro system, UK's National Union of Students and RAU Architects Studio in the Netherlands (Lightning.philips.com, 2019).

Fig.52 Application of Light-as-a-service within RAU Architects studio (Signify.com).



2.5.4 DESIGN CRITERIA FOR SYSTEM ECO-EFFICIENCY: S.PSS SUSTAINABLE PRIORITIES

It has been already observed that not every PS system is eco-efficient. In order for a PS system to be sustainable, a set of criteria and guidelines has been defined. These criteria aim to steer the (new) system towards a sustainable solution and to assess a PS system according to its positive or negative impact. They can be synergistic but also in contrast. Indeed, depending on the satisfaction unit, some criteria are more relevant than others in fulfilling a satisfaction unit, and, hence, they have to be designed according to the system preferences or urgency.

As defined in the MEPSS4 EU research project, six criteria can be listed according to their orientation towards eco-efficiency:

1. SYSTEM LIFE OPTIMISATION

System life optimisation refers to the design of stakeholder interactions for a particular satisfaction system leading to extending the sum of the products' lifespan and intensifying the overall sum of the products' use (Vezzoli et al., 2014).

2. TRANSPORTATION/DISTRIBUTION REDUCTION

Transportation/distribution reduction denotes the design of system stakeholders' interactions leading to a reduced amount of transportation and packaging. This type of innovation could be enabled for example by creating partnerships that optimise: long distance activities (use, maintenance, repair), use of local resources (info/data transfer), on-site assembly or production (info/data transfer), and/or remote controlling for maintenance/repair of products (Vezzoli et al., 2014).

3. RESOURCE REDUCTION

Reduction of resources refers to the design for system stakeholders' interactions that reduce the sum of the resources used by all products and services of the system. [...] It is obvious that a reduction in the use of resources determines the avoidance of environmental impact regarding what is no longer used. Using less material diminishes impact, not only because fewer materials are manufactured, but also due to avoiding their conversion, transport and disposal. In the same way, lower energy use diminishes impact, thanks to a smaller amount of energy that has to be produced and transported (Vezzoli et al., 2014).

4. WASTE MINIMISATION/VALORISATION

Waste minimisation/valorisation entails the design for system stakeholders' interactions to improve the total amount of the system's recycling, energy recovery and composting and reduce the total amount of the waste produced. Recycling is when secondary raw materials are used to manufacture new industrial products and composting when secondary raw materials are made into compost (Vezzoli et al. 2014).

5. CONSERVATION/BIOCOMPATIBILITY

Conservation/biocompatibility entails the design for system stakeholders' interactions that improve the overall amount of the system's resource conservation or renewal. The very same material can qualify as renewable in one case and non-renewable in the other case. It can be summarized that renewable depends on specific re-growing speed and extraction frequency. Therefore we can define that: 'a resource is renewable when the consumption rate is smaller than the natural re-growing rate.' (Vezzoli et al. 2014).

6. TOXICITY REDUCTION

Reduction of toxic emissions involved in the system stakeholders' interactions that reduce or avoid the gross total of toxicity and harmfulness among the resources utilised or emitted by the system (Vezzoli et al. 2014).

Fig.53 The six environmental sustainability priorities (Vezzoli et al., 2014).



Sustainability is a complex topic which cannot be observed only through the lens of the environmental dimension. In fact, a PS system may be environmentally sustainable, yet it cannot be defined sustainable if it does not take into consideration the socio-ethical dimension.

As for the environment, different criteria were developed in order to steer the (new) system towards a sustainable (socio-ethical) solution, and to assess a PS system. Indeed, even in this case, some priorities are more relevant or appropriate than others in relation to a satisfaction unit.

Six criteria can be listed according to their orientation towards ensuring socio-ethical sustainability:

1. IMPROVE EMPLOYMENT/WORKING CONDITIONS

When speaking about employment/working conditions we mean a system design that promotes and enhances these conditions within the enterprise and also at suppliers, e.g. job security, health and safety at work, adequate working hours, fair wages, and conditions enhancing the satisfaction, motivation and participation of the employees. These are issues determined by company goals and requirements but still, the designer must be aware of relevant issues and active when possible in terms of enhancing (Vezzoli et al. 2014).

2. IMPROVE EQUITY AND JUSTICE IN RELATION WITH STAKEHOLDERS

Improve equity and justice in relation with stakeholders refers to design promoting and enhancing fair relations within the partnerships, upstream, downstream and in the community where the offer takes place (Vezzoli et al. 2014).

3. ENABLE RESPONSIBLE/SUSTAINABLE CONSUMPTION

Enable responsible/sustainable consumption entails a design promoting and enhancing responsible and sustainable client or final user choices or behaviour (Vezzoli et al. 2014).

4. FAVOUR/INTEGRATE THE WEAK AND MARGINALISED

A system design promoting and favouring in order to integrate people such as children, the elderly, the differently abled, the unemployed, the illiterate or any other minority or marginalised social group (Vezzoli et al. 2014).

5. IMPROVE SOCIAL COHESION

Improving social cohesion denotes a design promoting and favouring systems that facilitate social integration: in neighbourhoods, between generations, between genders and between different cultures. This could happen for example by promoting neighbourhood systems of sharing common goods and maintenance, co-housing systems or co-working systems (Vezzoli et al. 2014).

6. EMPOWER/VALORISE LOCAL RESOURCES

It denotes a design promoting and favouring systems that regenerate and empower local economies. This could happen for example by respecting or enhancing peculiar local cultural characteristics, developing systems to encourage and foster local economies, regenerating or enhancing unused and discarded artefacts, adapting or promoting systems using regenerated local natural resources, and promoting local-based and network-structured enterprises or initiatives (Vezzoli et al. 2014).

Fig.54 The six socio-ethical sustainability priorities (Vezzoli et al., 2014).



2.5.5 S.PSS BENEFITS AND LIMITS

Now that the guidelines to develop (and assess) a Sustainable Product Service Systems are clear, we can better understand their benefits and the limits.

In order to offer an even clearer picture, the benefits are organized according to the three sustainability pillars (economy, environment and socioethics), followed by the limits of the S.PSS.

SPSS ENVIRONMENTAL BENEFITS

The environmental benefits embed in S.PSS are a consequence of its intrinsic model. By selling a unit of satisfaction rather than a product, the providers keep responsibility for its life cycle and have economic and competitive interests in optimizing and reducing the environmental impacts of their offerings.

S.PSS present environmental benefits for each of the six eco-efficient criteria or priorities. For instance, S.PSS, offering a license of use or a shared use of a product, push the providers to design products to last longer or to have easy-to-fix components; also, S.PSS, offering the access to a product and to the resources it consumes, motivate the producers to offer products that optimize the resource consumption and the use of renewable energies; eventually, S.PSS, offering a product together with its final life cycle treatment, foster the providers to design their products to be easily disassembled (so that to be reused) or easily treated.

SPSS SOCIO-ETHICAL BENEFITS

The socio-ethical benefits of the S.PSS mainly relate to the increased accessibility to final users and entrepreneurs in both wealthy contexts and low- and middle-income ones. In this case, S.PSS present benefits related to the six socio-ethics criteria or priorities, all resulting in a wider or easier accessibility. For instance, S.PSS, selling the use of the products rather than their ownership, avoid the initial and/or maintenance costs of the products, allowing low- and middle-income people to possibly access the products.

This ultimately ends up in improving employment/working conditions (adequate working hours, fair wages, etc.) and in enabling a responsible consumption of the products thanks to a better transparency of the system.

SPSS ECONOMIC BENEFITS

As said, in order to be truly effective and possibly implemented, S.PSS has to demonstrate a business potential. In particular, two positive aspects can be recognized. First of all, because the S.PSS model offers a service or performance along the entire life cycle of the product, it generally establishes a longer and

Part 1: Contextual framework

stronger relationship with the customers, hence increasing the customer fidelity. Second, S.PSS represent new models of offering and delivering a product or a service. Therefore, contrary to the traditional offer models which are in a saturated

Fig.55 S.PSS model fostering the design for lifespan extension. Adapted from LeNSin, 2018.

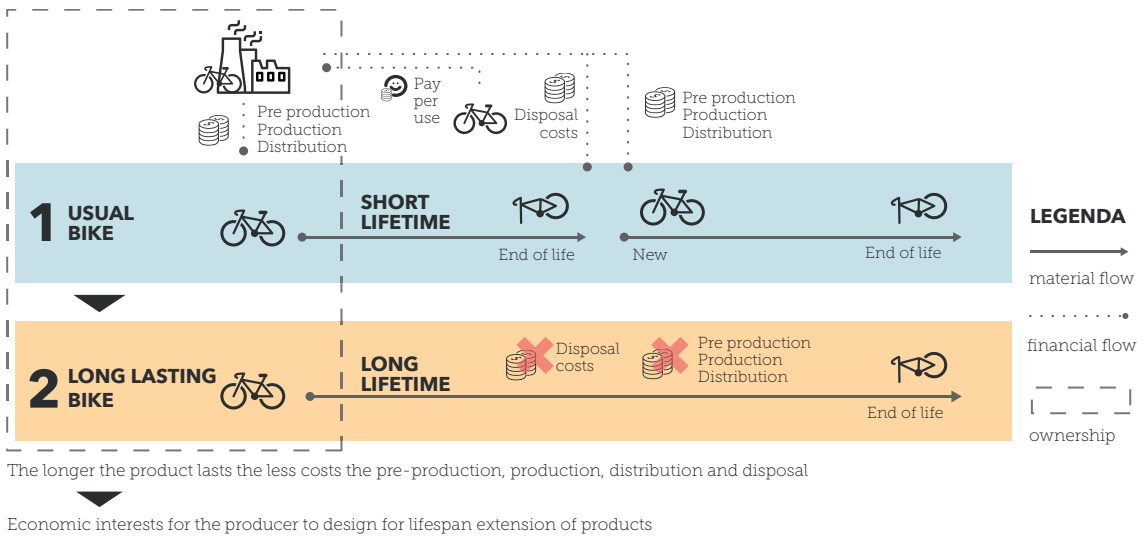
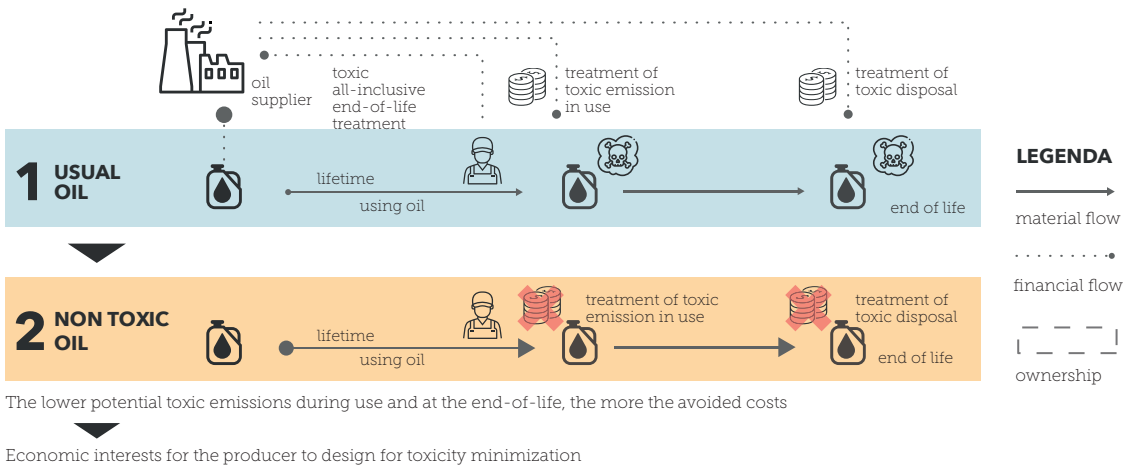
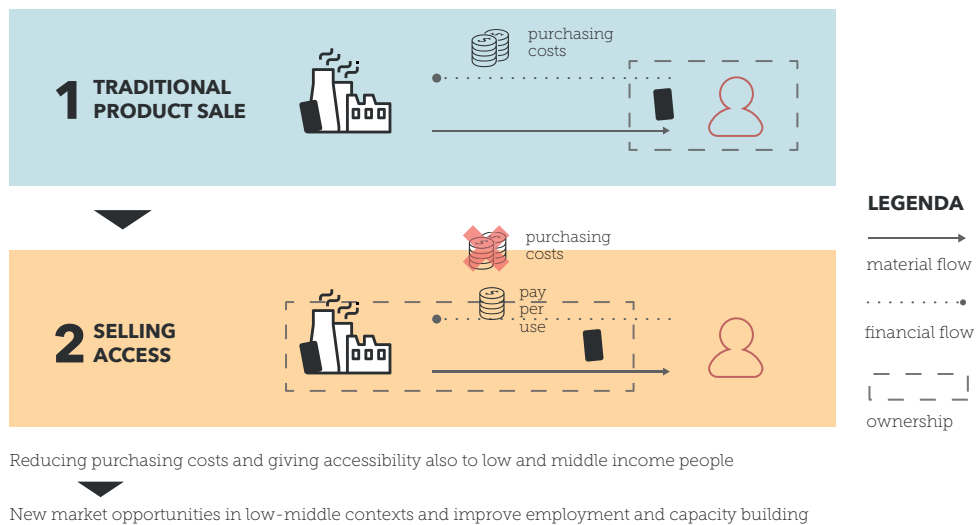


Fig.56 S.PSS model fostering the design products minimising resource consumption in the use phase. Adapted from LeNSin, 2018.



market they can open up new business opportunities, empowering strategic positioning. Finally, being mainly local and focused on socio-ethical issues, S.PSS can enhance the use and involvement of local resources, promoting and regenerating the existing (or new) communities (Vezzoli et al., 2018).

Fig.57 S.PSS model fostering the design for lifespan extension. Adapted from LeNSin, 2018.



S.PSS LIMITS

As already stated, not all the PS systems are sustainable, even if they adopt one of the strategies (or business model/approach) described above. As a matter of facts, because of their complexity, many are the aspects that may influence the sustainability of a PS system. This is the reason why it is important to assess the overall impact of a new PS system, by considering its whole components. Indeed, in specific cases, PS system may generate unwanted side effects, usually referred to as rebound effects (Vezzoli et al., 2018). In other words, it seems that the new system is performing great according to the main eco-efficient priorities, while actually it negatively impacts the environment or, more often, the socio-ethical dimension. In addition, considering the disruption of these new models, there may be other unwanted consequences, as consumers misuse of the offering or changing (not expected) stakeholders interactions.

Depending on different actors, some precise barriers that prevent S.PSS diffusion could be identified.

As regards companies, offering S.PSS often entails internal and external re-organization of processes and of mindset. The change from a traditional way of offering goods to a service-oriented one requires knowledge, management efforts and risks. Companies are usually reticent to extend their responsibility beyond the point of sale of their product, worrying about cash flow and possible further investments. Furthermore, the quantification of SPSS advantages in terms of economics and sustainability is still an obstacle for proper promotion and relationships-establishment among stakeholders.

Finally, the concept of selling a unit of satisfaction, rather than a product, makes the pricing strategies more difficult and the fear of absorbing risks, previously assumed by customers, real.

Also for customers, S.PSS represent a new way of accessing or using goods. Here the main barriers are due to the acceptance of using a product rather than owning a product. Nowadays, this conceptual shift is taking place in the main industrialized and developed countries but it still surely not widely accepted yet. Indeed, product ownership not only provides a function, but it also expresses status and social positioning.

People, finally, usually also lack knowledge about goods lifecycle in terms of the economic impact on the final value, and this prevents them from perceiving the benefits of access-based solutions.

To conclude, as regard governments, the barrier to foster the creation of S.PSS offer models relies on the still-low level of priority given to the environmental issues. Laws and policies still do not strongly recognize nor reward environmental efforts taken by companies. Moreover, it seems difficult to implement drivers to facilitate the diffusion of this kind of system innovation (Vezzoli et al., 2018).

2.5.6 S.PSS APPLIED TO DISTRIBUTED ECONOMIES (DE)

The characteristics and benefits of Distributed Economies (DE) have been already described in its dedicated chapter. In particular, it has noted how the current movement towards centralization actually results in being environmentally and socioethically unsustainable. It has also noted that, even if promising, not all DE are sustainable.

A very interesting ongoing research, part of LeNSin project, the International Learning Network of networks on Sustainability (2015-2018), is investigating the promising opportunities of applying Sustainable Product-Service System to Distributed Economies, in different contexts around the world to couple environmental protection with social equity.

The EU-supported (ERASMUS+) project involves universities from Europe, Asia, Africa, South America, and Central America, and aims to promote a new generation of designers and educators, capable to effectively contribute to the transition towards a sustainable society for all.

The research, indeed, states that: "A S.PSS applied to DE is a promising approach to diffuse sustainability in low/middle-income (all) contexts, because it reduces/cuts both the initial (capital) cost of DE hardware purchasing (that may be unaffordable) and the running cost for maintenance, repair, upgrade, etc. of such a DE hardware (that may cause the interruption of use), while increasing local employment and related skills, as well as fostering for economic interest of the producer/provider to design low environmentally impacting DE products, resulting in a key leverage for a sustainable development process aiming at democratizing the access to resources, goods and services" (LeNSin, 2018).

The core benefits of such an application result evident, in particular, for low and middle-income contexts. The DE are typically characteristic of less industrialized contexts where they are already economically and socially embedded, and the S.PSS usually offers the possibility to more easily access to goods and services.

As for the environmental benefits depicted before, the same reasonings are applied for DE producer/provider, who, according to the kind of offering, have economic interests in extending the lifespan of a product, designing it for an easier final life treatment, minimizing the energy and the necessary resources, as well as reducing the product or system toxicity.

Although there could be many possible combinations resulting from the application of the different approach for S.PSS (product oriented, result oriented, use oriented) to the all the different DE, there surely are 2 common paradigm shifts:

From traditional product sale model to S.PSS, i.e. the shift of customer perceived value from individual ownership to access to a mix of products and services (systems) fulfilling a given unit of satisfaction;

From centralized to decentralized/distributed systems in which a small scale unit of production is locally-based, i.e. nearby or at the point of use, and where the user can become a producer.

**PART 2:
THE DESIGN
PROCESS**

3 STRATEGIC ANALYSIS

“Strategic analysis” is the first stage of the MSDS process, whose aim is to collect and elaborate useful information to generate potentially sustainable ideas, related to the “demand”, i.e. the need that the user wants to satisfy.

This chapter will firstly describe the results of a preliminary field research conducted in and around the restaurants, aimed to start grasping the consumption patterns of consumers in such businesses. The initial perspective through which the activities were conducted was the observation of food waste.

The initial research question was established as “How to increase a conscious food consumption in China, starting from restaurants?”

During this research, it had been realized that actually the most impactful step of the food supply chain is not the waste, rather the

food production food. Hence, the brief changed accordingly. Indeed, the focus shifted to the “outside” of the restaurant, the food supply chain in Shanghai. To report it as exhaustively as possible, the field research activities were accompanied by literature research. After having reported the current system with its actors and relationships, a description of the main (current) trends influencing the system is offered. The system has been assessed according to the sustainability priorities, and the most important or urgent ones have been selected as guidelines for the project development.

Finally, the chapter will present the elaboration of the collected information and the design opportunity that has been found laying there. Together with the opportunity, also other research results, related to the opportunity, will be reported.

3.1 PRELIMINARY FIELD RESEARCH

During the first months of the investigation, several activities were carried out to evaluate and understand the consumption patterns in Chinese restaurants. The initial "demand" was established as "eating at restaurant: consuming food comfortably out of home with the necessary facilities and without preparing anything/cooking by yourself".

The tools that have been used for the investigations were an online questionnaire, direct observations of eating behaviors inside different kinds of restaurants, formal interviews to restaurant owners or managers, and informal interviews with consumers. These activities allowed the author of this document to scratch the surface of the topic under analysis, and to form a background knowledge of the Chinese framework related to consumption habits.

The preliminary knowledge was the awareness of different restaurant typologies, and of two main food consumption patterns: eating individually or by sharing.

The differentiation in restaurants' typology was based on the size and appearances of the shop, and the quality of the food. The restaurants' categories identified were low-end, mid-end, high-end, and western restaurants.

As regards the consumption patterns, the former stands for eating a dish or (typically) a lunch set by yourself. Alone or with other commensals, here, eating individually means that everyone consumes his/her own dish(es). On the contrary, eating by sharing means consuming food from different dishes, usually placed in the middle of a round-spinning table, in the company of other people.

In order to understand better these two consumption typologies and to assess which one tended to generate the majority of food waste, direct and multiple observations were conducted.

Fig.58 Most common Chinese food consumption patterns.

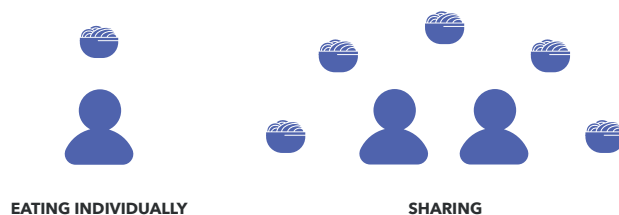


Fig.59 The categorization of Shanghai's restaurants (different sources).



小饭馆 **XIǎO FÀNGUǎN**
(LOW-END)



中档餐厅 **ZHōNGDǎNG CĀNTīNG**
(MIDDLE-END)



高档饭店 **GĀODǎNG FÀNDIÀN**
(HIGH-END)



西餐厅 **Xī CĀNTīNG**
(WESTERN)

3.1.1 OBSERVATIONS IN RESTAURANTS

Direct observations were conducted by the author during the internship period, for one month time, and in different kinds of situations (alone, in group, lunch, dinner, low-, mid-, high-level restaurants, etc.). The objective of such activity was to see, in person, and understand how Chinese people usually eat at the restaurant. The observations were carried out at the same time as the online questionnaire, aiming to compare and verify their results at the end.

The observations were carried out at the same time as the online questionnaire, aiming to compare and verify their results at the end.

The number of different restaurants that were visited was 18, some of which multiple times. The kind of investigation was purely qualitative, compared to quantitative. The general framework that has been adopted during the visits was based on noting down the following aspects:

1. kind of restaurant

2. situation

3. other restaurant characteristics (number of people, the size, the position in the city, the kind of consumer, the cost of the dishes, the kind of tables, the tableware...)

4. time (lunch, dinner, weekday or weekend)

5. number of people the author was eating with

6. kind of meal (if individual or shared)

7. number of dishes ordered by everyone/the group

8. size of the dishes that arrived on the table

9. quantity of food left on each dish at the end (this was done by looking. No particular methods or tools to measure with precision were used. Only pictures and direct observation and comparison between how the dishes were when they arrived and how they were when the waiter took them from the table)

EATING INDIVIDUALLY

Individual eating mainly happened during the working days, and the number of dishes ordered was mainly one per person. Together with the visits to restaurants, in this case also the food ordered in the office (or at home) was considered. Indeed, almost all the restaurants in China offer their food both in-store and online (through Eleme, Meituan, or Sherpa apps) and they sell the same food. This is particularly evident for those restaurants, like *xiao fànguan* (low end) or *zhōngdàng cāntīng* (middle end) and it is also particularly evident at lunch since they often sell lunch sets (which are the same as in-store). Usually, these lunch sets are made up of rice and meat, sometimes followed by some sides (vegetables like algae or broccoli or eggs or a soup).

Fig.60 Eating individually in different kinds of restaurant, mainly low-end.



EATING BY SHARING

Eating by sharing usually happened with other 7-8 people, and it was a mix of lunches and dinners (usually lunch on weekdays and dinner on weekends).

Fig.61 Eating by sharing dishes (multiple restaurants. At the bottom-right the hotpot).



CHINESE EATING IN FOREIGN RESTAURANTS

A final, yet important, observation about sharing food was also done in a foreigner restaurant (Italian one).

This investigation allowed to understand the behavior of Chinese people in a foreign restaurant and to draw some comparative reflections with western consumption habits.

Indeed, even in a foreign restaurant, the way of eating is the same as the Chinese one when eating altogether: eating by sharing all the ordered dishes.

This is strange because Italian dishes (in this case) are not meant to be shared, rather to be eaten by one person, and the portions are therefore slightly smaller. Finally, even if in Italy, as well as in many other western countries, there usually is an "order" of eating the dishes (starters, first plate, second plate, side dish, and dessert), Chinese people tend not to follow any order, very similar to their eating habits.

Fig.62 Chinese eating in a foreign restaurant (Bella Napoli, West Nanjing road).



RESULTS

These observations aimed to identify the Chinese consumption patterns and assess which one generates food waste the most.

These activities revealed that, on average, when eating individually, the quantity of food wasted was usually more than when eating by sharing. However, it was not the consumption pattern which generated the most food waste, according to the author experience. The major quantities of food that got wasted regularly happened in three particular situations (quite common in China and for the Chinese lifestyle).

Fig.63 Difference in waste, for the two eating consumption habits. Left=eating individually; Right=by sharing.



Indeed, the waste generated in the eating by sharing pattern really depends on the situation and the level of familiarity of the commensals. In the author's experience, eating by sharing generally produced lower quantities of waste except for three situations:

1. very formal business meeting (where the food waste was equal to 1 third of the entire food);

2. dinners arranged with the office where everyone knew each other well but the boss, in order to show his appreciation for the work done, over-ordered, without any concerns of the commensals (here the food waste was almost equal to 1 fourth of the entire food);

3. finally, two people meal, whether with the boss, partner or friend.

In these occasions, the food mainly wasted was basic food such as rice and, at the second place, the side food (like vegetables).

Fig.64 The three most wasteful eating-by-sharing situations (left=1; right=2; bottom=3).



What differs between the three situations are the reasons why food waste was generated. In the first case, it is a matter of (low) familiarity among the people at the table, and the Chinese “face”, or image (see chapter 2 of the research background, “culture”).

In the second case, it is the image as well since the intention was to celebrate the occasion itself and food is a powerful mean of communication and expression, both in Chinese and Italian culture. Finally, on the third occasion, the reasons differ according to the eating partner. Factors as familiarity and the image represented the biggest reasons (and they happened especially with the boss and the friend - both of them Chinese), whereas with the partner, and in smaller proportion with Chinese friend as well, it was mainly a matter of unknown quantity of the dishes (too much considering the total order).

INSIGHTS FROM THE COMPARISON

Out of these observation activities, these were the reflections and insights that have been drawn:

Fig.65 Insights from comparison.



3.1.2 ON-LINE QUESTIONNAIRE TO CONSUMERS

In order to start collecting information from people, a questionnaire was prepared and distributed online and offline. The aim was to start getting information from consumers, while carrying out other activities as the observations and the interviews with other actors of the restaurant, as the owners. Also, the questionnaire was meant to build an initial knowledge framework, and, as well as the observations, it was meant to investigate the reasons for food waste when eating outside.

The questionnaire was prepared on an online Chinese platform (wjx.cn) and it ran for almost three weeks.

In particular, because it represented one of the first research activities and tools, the questionnaire was designed in order to collect the information from as many categories of people as possible. This is the reason why it was bilingual and realized in two versions: one for Chinese and the other for foreigners (living in China), both anonymous.

The questionnaire was structured into three main sections. After a brief introduction related to the project and the aim of the activity, general personal data were collected, like age, gender, job, income, and nationality. Then, questions related to the eating

behaviors were asked, including, for instance, the frequency of eating outside, with whom, the kind of occasion, the ordering habits. The stress of this part was surely on eating by sharing pattern since it was hypothesized to be the most wasteful one. Finally, the third section focused on waste and its generation at the table.

The main differences between the two questionnaire's versions were some adjustments in the questions (or in their tone) and a very brief, additional section in the foreigners' version about the analysis of the touchpoints inside the restaurant, like the menu.

The questionnaire was distributed digitally, through WeChat, and physically, through flyers.

Fig.66 The physical distribution of the questionnaire (Xintiandi, Shanghai).



RESULTS

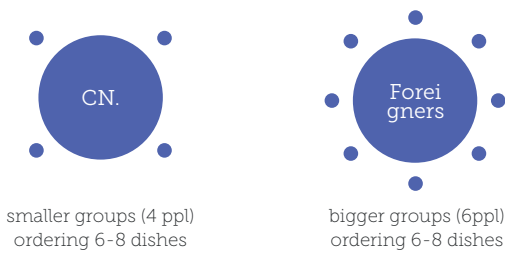
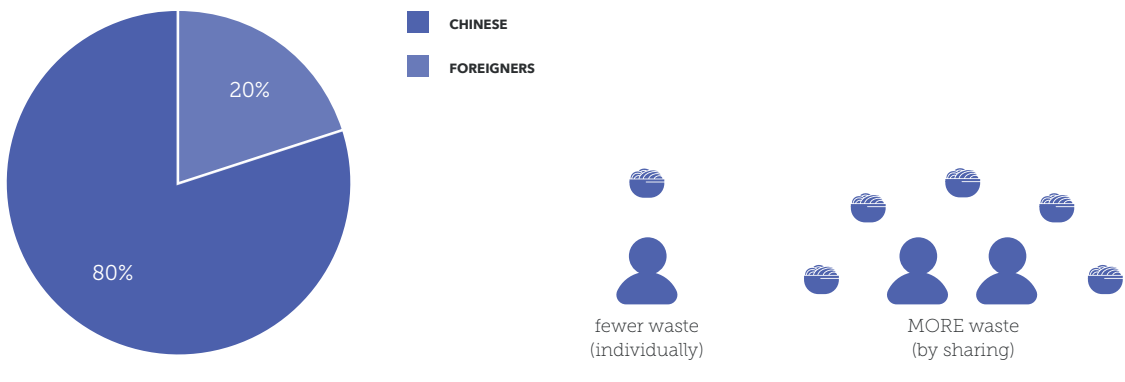
The analysis of data from the questionnaire, being mainly quantitative, generated many other qualitative inquiries related to reasons behind certain behaviors or choices.

The survey was very useful to get to know (on a bigger scale) how people behave in restaurants, how they think and why they may waste food. In addition, the survey was useful also to know how foreigners in China behave in Chinese restaurants and to have a small comparison between Chinese and Foreigners.

Part 2: The design process

The questionnaires received 113 answers (the majority of which from students). All the other results are reported below, while the full questionnaire's raw results are shown in the Appendix.

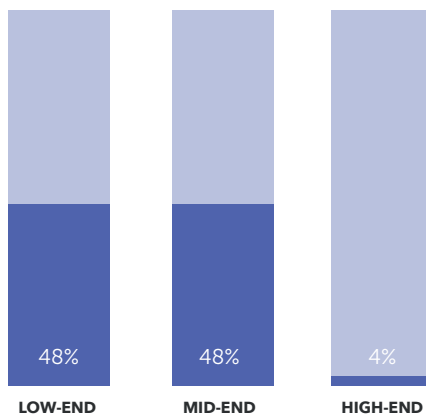
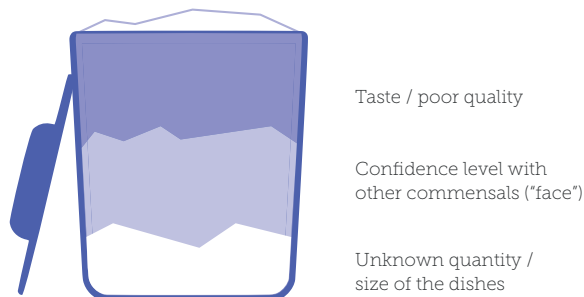
Fig.67 The main results from the questionnaire.



RESTAURANTS KINDS WHERE SURVEYEES USUALLY GO IN GROUP AND EAT BY SHARING:



ACCORDING TO THE SURVEYEES, THE 3 MAIN FOOD WASTE CAUSES ARE:



The results add to the observations insights but are essentially coherent with them. Indeed, when eating by sharing, the main reasons for food waste to be generated were the Chinese “face”, or image, together with more difficulty in ordering for a big group, especially because the qualities of the food in each dishes is generally not known until the dish comes to the table.

The data of the questionnaire, together with the observations and visits to Chinese restaurants, therefore confirmed some of the initial assumptions related to the main reasons for food waste.

3.1.3 END USER AND ITS SATISFACTION

The collected information laid the ground for the understanding of the consumer (end user) satisfaction when eating outside in a restaurant.

In order to visualize it, it was decided to use the tool of the customer journey map. This tool essentially supports the researcher in listing the different steps the user goes through (journey) while trying to satisfy a need. Hence, the researcher, together with the observed subject, can deeply examine each step of the journey, scout any touchpoint the user interacts with, and assess the level of satisfaction (ease/difficulty) related to each step.

In the case of this analysis, the journey represents the usual path the customer goes through when he/she eats in a restaurant, and it was firstly drawn based on the information of the previous activities and then validated and refined together with users (in person and also digitally).

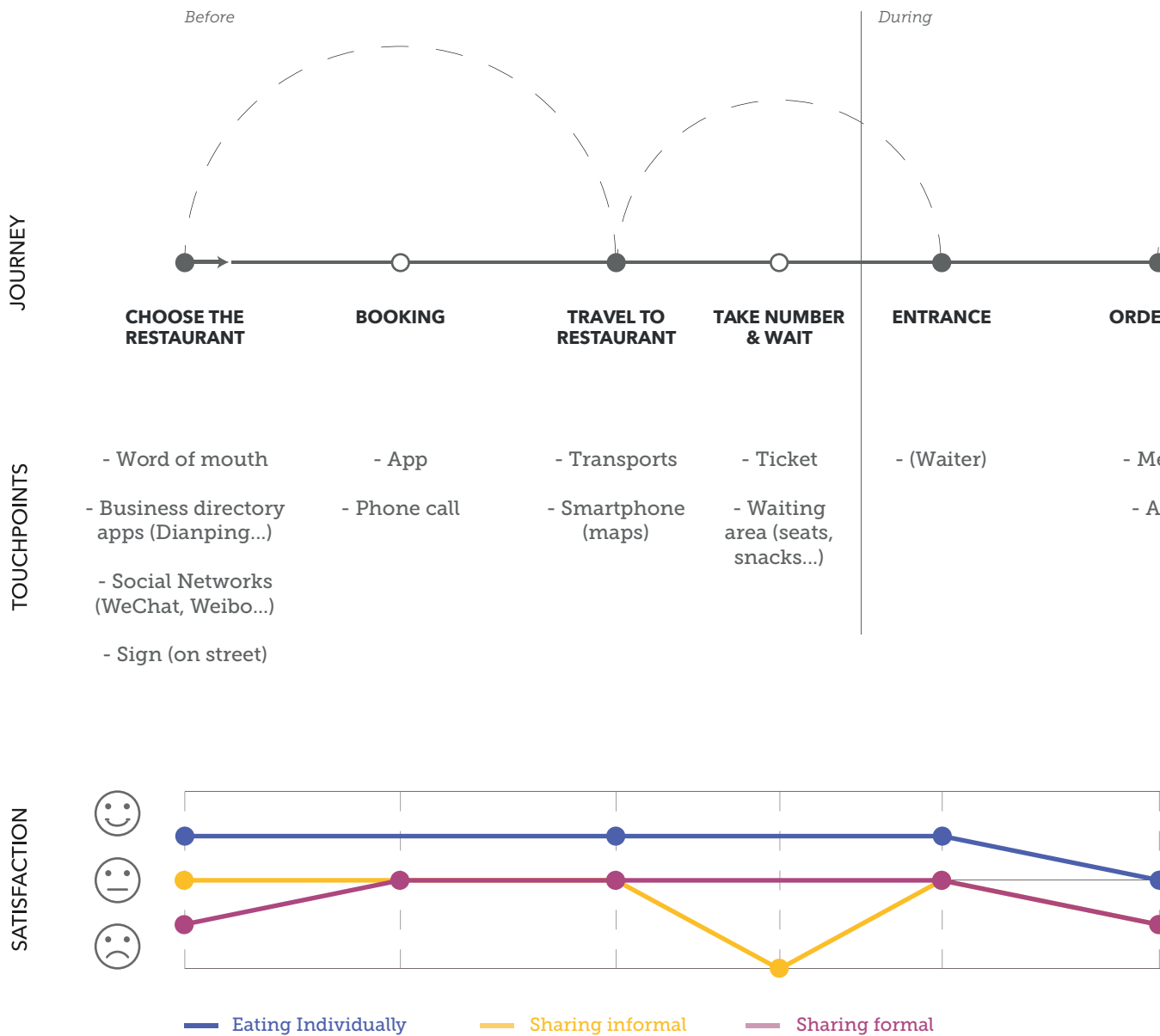
Usually, each journey is unique as it refers to a particular need’s satisfaction. Considering China, one journey related to all the different kinds of restaurants could have been drawn. However, it was noticed that, actually, the aspect that influenced the most the consumption behaviors was not the category of restaurant, rather the situation of the consumption. For this reason, a unique journey, in terms of steps, was drawn (of course, still considering the number of restaurants, some steps, graphically represented with an empty dot and the dotted curved line above, are considered optional, as not always take place).

Therefore, the journey was analyzed according to 3 very different situations: eating individually, eating by sharing informally, eating by sharing formally (all displayed together here for a quick comparison):

INSIGHTS FROM THE COMPARISON

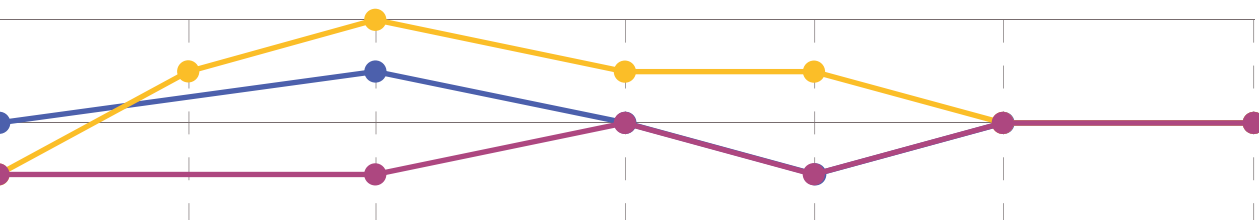
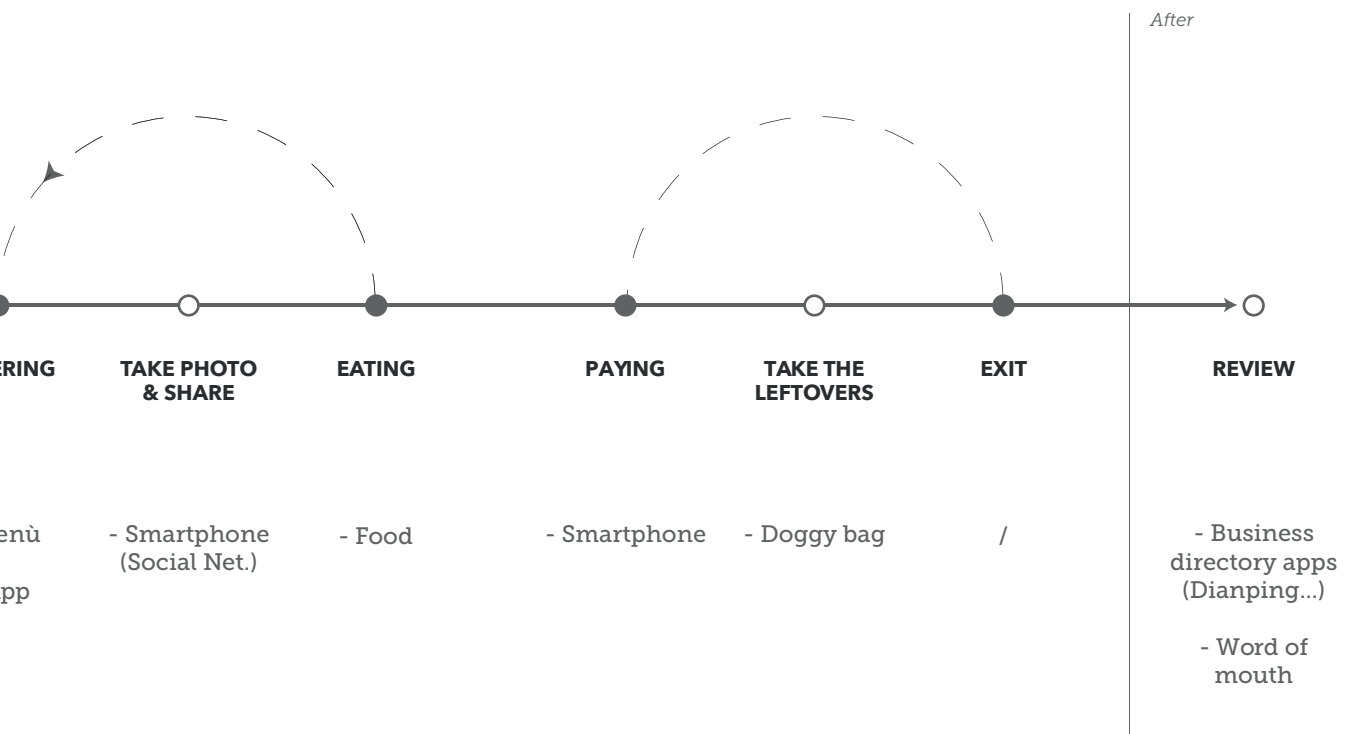
Out of these observation activities, these were the reflections and insights that have been drawn:

Fig.68 Customer journey map of consumers in restaurants according to 3 different situations.



As it is possible to see from the image above, the journey is divided into three blocks: the "before", i.e. before entering in the restaurant, "during", i.e. from when entering to going out, and "after", i.e. once already outside.

Moreover, the touchpoints that the user encounters along the journey are listed below each step. Finally, the satisfaction level related to each step is highlighted in different colors, according to the kind of situation.



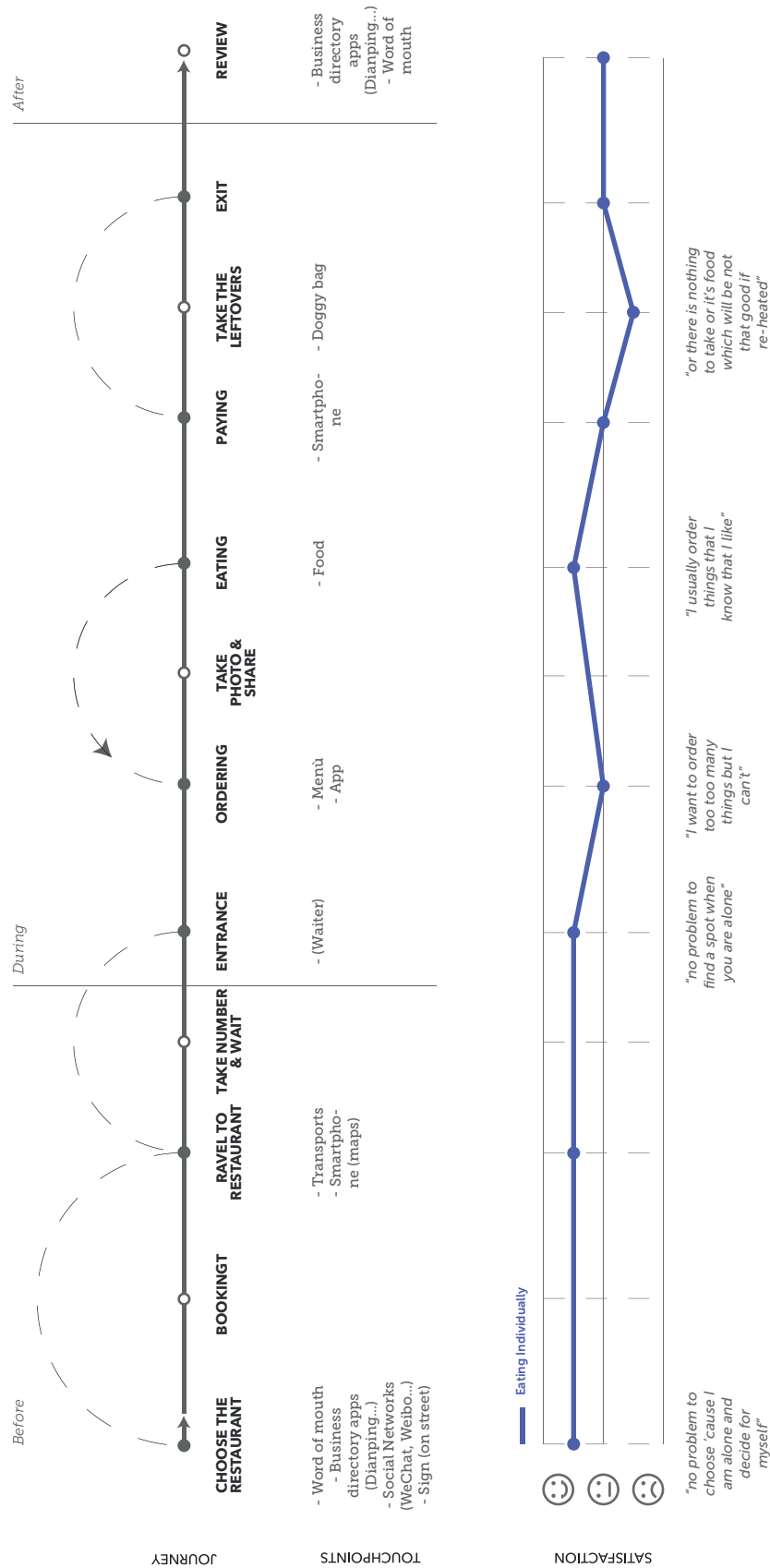


Fig.69 First CJM.

EATING INDIVIDUALLY

The first journey represents the situation of consumption of eating individually. In this kind of situation, usually, the consumer eats in a low-end restaurant, at lunch, with the aim of consuming the food quickly. Compared to the other two kinds of situation, it is averagely better since it does not involve affecting other people's meal.

Going into details, it is possible to see that the weakest points along the journey are the ones related to the "ordering" phase and "take the leftovers" one. Indeed, very often when eating individually, it is not possible to try many different things, and thus ordering may result a bit difficult for this reason (consistent with the Chinese culture). Taking the leftovers result inconvenient as well because the food consumed in such a situation is not that precious, rather functional, and usually not comfortable (to carry for the rest of the day).

Besides, also a visualization of the average quantity of waste produced is shown. In this case, however, as we previously found out, the quantity of food that gets wasted really differs person by person.

EATING BY SHARING (INFORMAL)

The second journey represents the first "eating by sharing" kind of consumption pattern, i.e. eating by sharing informally, the most common situation between the two. In this kind of situation, consumers, usually a group of friends, eat in a mid-end restaurant, both lunch or dinner but more often in weekends, with the aim of spending quality time together or celebrating something. Because the focus is not on the functionality of the consumption, the place where to go and eat is a well known or a popular, reviewed one. That means, however, more people and consequently more waiting time, averagely up to 40 minutes (this waiting time is usually spent by sitting on one of the restaurant's chairs nearby the entrance, and by having a look at the display with the counting numbers).

It is therefore clear why, in this situation, "take the number and wait" is surely the worst point in the journey, followed by the "ordering" time. This is a problem because it results difficult to choose according to everyone's tastes and preferences, and among all those choices in the menu. The rest of the journey works quite well and the waste produced is usually low/medium.

EATING BY SHARING (FORMAL)

The third journey represents the second "eating by sharing" kind of consumption pattern, i.e. eating by sharing formally. This situation happens less frequently than the other two. However, it generates the biggest quantity of food waste.

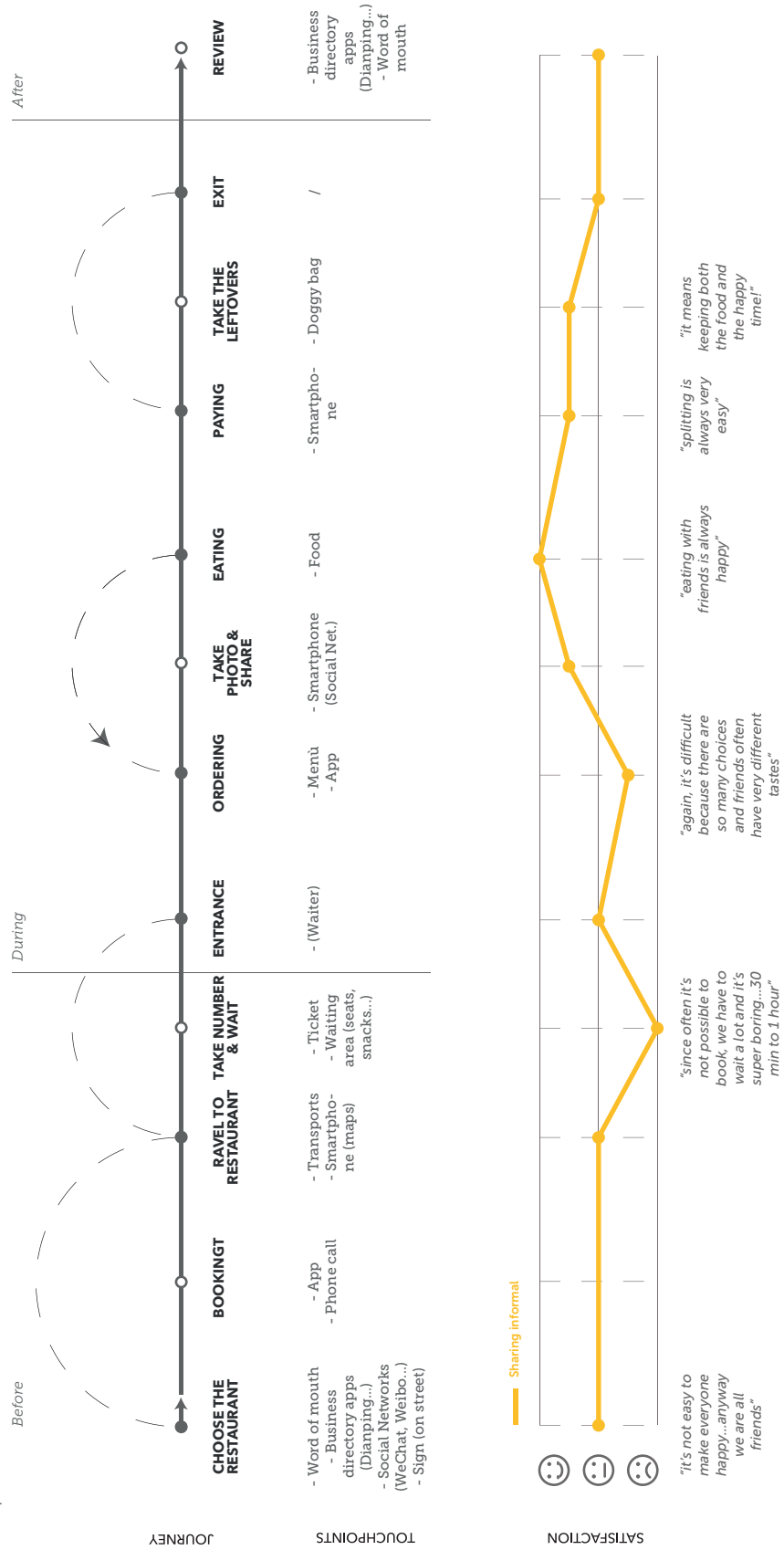


Fig.70 Second CJM.

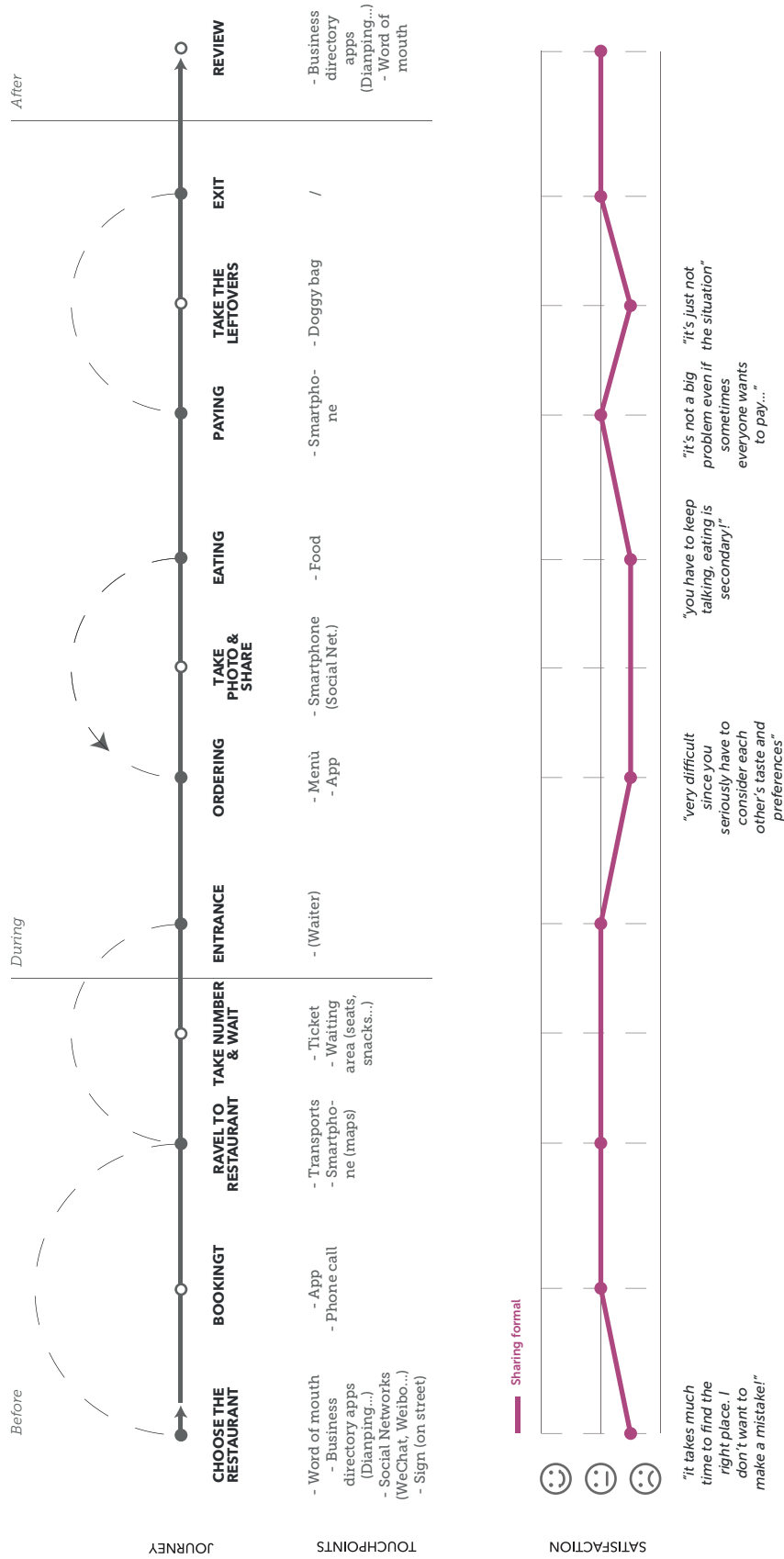


Fig.71 Third CJM.

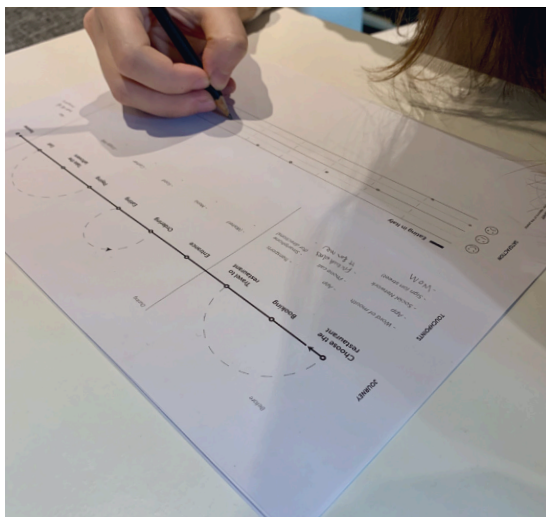
Part 2: The design process

In this kind of situation, consumers, in couple or in group, eat in a high-end restaurant, both lunch or dinner, for a particular circumstance. Indeed, it is usually a business lunch (or work-related meal) or an official event, like two families meeting.

Among the three situations, this may be even defined as an unpleasant meal. As a matter of facts, there are multiple weak points, starting from the choice of the place, difficult because of the importance of the situation, to the "ordering", because people want to show off and well serve the other commensals (often the invitees), to the final step of "take the leftovers", which is usually not appropriate or not that respectful (caring more about the food than your commensals).

The journeys were realized together with the users, during in-depth quality sessions. While the first draft was drawn based on the previous research activities evidence, the final version was realized with a number of users involved equal to 5, all Chinese.

Fig.72 Users' involvement in the design of the customer journey maps.



In the Appendix, it is possible to see the different maps realized together with users.

To sum up, the most problematic steps of the overall experience are:

Choose restaurant (not always easy to find a right place for everyone)

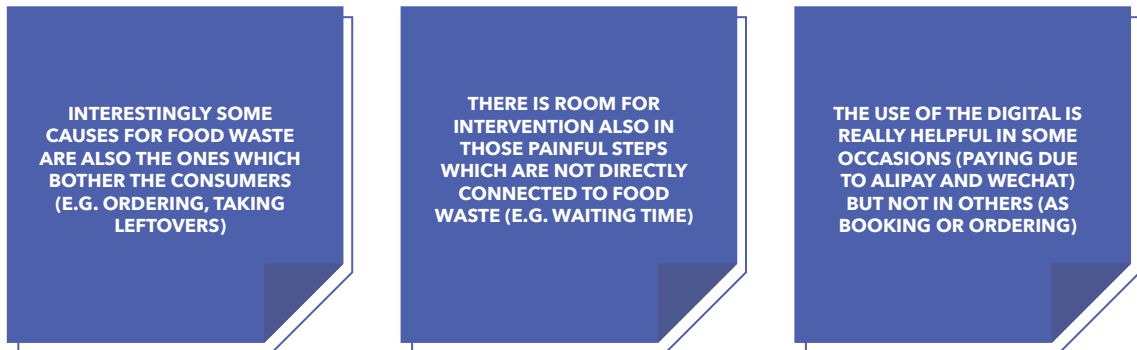
Take number & wait (very long time passed just by waiting your turn)

Ordering (hard to match and satisfy everyone's expectation and taste)

Take the leftovers (very awkward or not suitable for some kind of food)

Finally, the reflections and insights that have been drawn based on this activity are:

Fig.73 Insights from the customer journey maps.



3.2 SHANGHAI FOOD SYSTEM

This chapter presents the results of the investigation about the food supply chain and its main actors in Shanghai, with a focus on restaurants. The final outcome of this phase is the representation of the current food supply chain of restaurants in the city.

The chapter will first explain the research activities and tools that were used and, then, it will present the information collected with the final representation of the food system.

3.2.1 RESEARCH PROCESS AND BRIEFING

The preliminary field research was accompanied by a desk and literature research as well. Thanks to it, it was possible to realize that, actually, the most impactful step in the food life cycle is not the waste, nor its treatment. Rather, the most impactful step is the production of the food, because of its emissions (greenhouse gases), of the impact of chemicals used in the agricultural production and animal breeding on the natural resources (water and land), and, finally, because of the energies and resources (inputs) needed for the food production which are commonly generated from fossil fuel sources (see "Research Background"). Hence, the initial research question has been reformulated in the form of a design brief, as:

"Define and foster the most sustainable food system in Shanghai, able to induce the consumer to a good behavior".

Accordingly, it has been decided to enlarge the focus of the investigation, researching the average food supply chain of restaurants in Shanghai, with a focus on producers. In order to represent the overall picture, different research activities

were carried out, using different research tools. At first, literature research was done, aimed to form a background reference knowledge about the Chinese food system. Indeed, as the accessible information about production and distribution were a bit dated, it was necessary to implement the information through visits and interviews with the main actors of those first steps. Hence, direct observation of places like farms, a wholesale market, smaller shops, and the Shanghai food bank were conducted, together with interviews with the professionals working there. Based on a definitely up to date source, also the path of the food waste was identified.

It has to be noticed that, because of the language barriers, many of these interviews or activities meant to collect information were carried out with the help of Chinese colleagues, and, when needed, with the help of printed papers with the questions (in Chinese) or schemes useful to facilitate the conversation. Others were carried out digitally, mainly by using WeChat as an exchange and communication platform.

Thanks to all these research activities, a draft of the system was first drawn. Due to the involvement of some of the actors previously interviewed, the system representation was validated and refined, so that to obtain the state-of-the-art Chinese food supply chain of restaurants. It has to be observed, however, that the representation of the system is a simplification of the overall picture. Indeed, it was obtained by aggregating some steps or, especially, actors, and by visualizing only the most relevant to the supply of restaurant businesses in the city.

3.2.2 SHANGHAI FOOD SUPPLY CHAIN

In order to start building the reference framework of the food system of China, it is possible to start from the production stage.

A very useful and interesting description of the first steps of the food chain is offered by Zhang and Pan, who, in their analysis, focus on the latest changes in the urban vegetables retail sector in China, taking Shanghai as a case study. First of all, the authors acknowledge that the food production and distribution chain of China is highly fragmented, because made up of many different smallholders (farmers), intermediates and agents operating in the wholesale market, and because of the huge quantities of products that impose a city as Shanghai of having multiple and gradually scaled-in-size wholesale markets and shops.

Also, the authors report that the liberalization of agricultural production in China

led to the decline of peri-urban vegetable farming, as the peri-urban areas not only lost vegetable land to urban expansion but also labor force to more rewarding non-farm jobs. In addition, regional, large-scale production units in rural areas distant from urban markets arose, making up, by early 2000s, 80% of China's vegetable production areas (Zhang & Pan, 2013).

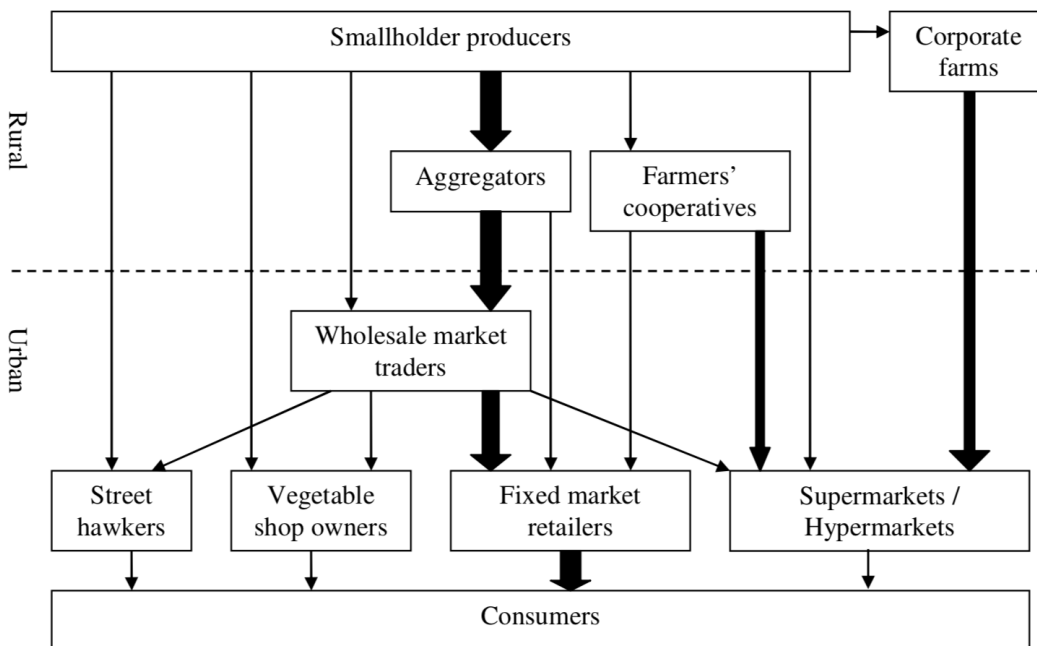
These changes made self-sufficiency in vegetable production untenable so that in 2010 the self-sufficiency rate of most large cities was lower than 30%(Liu and Wu, 2011, as cited in Zhang & Pan, 2013).

From a state-owned market, the municipal governments opened to private players who entered the vegetable retailing and operated then the market places. Figure 73 presents the actors in the fresh vegetable trade in urban China, as for 2013.

In Shanghai, the analysis reports that there were three types of retail channels through which observe the urban vegetables retail sector's transformation:

- first, the traditional fixed markets – wet markets and small vegetable shops, which used to monopolize the urban vegetable retail;
- second, the newly emerged supermarkets and private vegetable shops;
- third, street vegetable hawkers in the informal market.

Fig.74 Vegetable supply chains to consumers in Chinese cities (Zhang & Pan, 2013).



The authors also report that, currently, it is estimated that 80% of vegetables come from small farmers and are distributed via ten vegetable wholesalers in Shanghai to the wet markets. On the right part of the scheme, it is possible to notice the development of large integrated chains, in which supermarkets buy directly from large producers (corporate farms) (Zhang & Pan, 2013).

WHOLESALE MARKET(S)

The wholesale market of agricultural products has become the mainstream channel and main mode of agricultural products circulation in China, and there are 4,500 wholesale markets of agricultural products in 2010, and more than 70% of our agricultural products have entered the people's basket through the wholesale market.

The wholesale market of agricultural products is divided into the primary wholesale market, level two wholesale market and level three wholesale market. The first level is a wholesale market that buys agricultural products directly from the origin and sells them to intermediate wholesalers or agents. The secondary and the third level of the wholesale market are composed by wholesalers from the previous levels who re-sold to intermediaries or retailers, smaller and closer to citizens (Baidu, 2019).

WET MARKETS

Wet markets are physical medium size, covered market, where different vendors sell their vegetables, exposed in different stalls. The name come from the wet floor which ensures that the food does not spoil fast. Wet markets are the traditional outlet for people to purchase fresh and perishable food products, including vegetables, meats, and fruits, at usually low prices (Sun, 2016).

With the rapid urbanization, the average number of residents that each wet market serves has increased by nearly 50% from 17,000 to 25,000 units in 2013, most of them privately operated. The opening up of the urban vegetable retail market, together with liberalization in vegetable production, increased the variety and quality of vegetables sold in cities, reduced seasonal fluctuations, and improved service quality. These improvements aside, the privatization of vegetable retail facilities, however, also led to rising vegetable prices in Chinese cities. Part of the price increase went to cover the rising costs of longer transportation, better quality, and improved services (Zhang & Pan, 2013).

At wet markets, vendors buy their vegetables around four o'clock in the morning and constantly trim, spray, clean, and sort the vegetables to keep them fresh. Also, wet-market vendors do not have or use refrigerators for storage and thus have to replenish their inventory with fresh supplies every day.

SUPERMARKET

The rise of supermarkets changed urban China's retail landscape and created a new lifestyle for affluent consumers. However, as for 2013, Zhang & Pan report that the fresh food sector of supermarkets did not impact on the new supermarkets' chains market. While consumers have started to shop in the supermarkets, they still rely on wet markets for fresh vegetables. Indeed, many Chinese consumers still have a cultural preference for purchasing fresh vegetable daily in small quantities and consuming them without refrigeration. Supermarkets simply cannot stand and equal the freshness of the food in wet markets (Zhang & Pan, 2013).

As regards their food provisioning, supermarkets have just started to build vertically integrated food supply chains, from food production to distribution. The trend, however, is expected to grow as China continues its development path. However, for now, they still have to rely on the wholesale markets to meet the variety demanded by consumers.

SMALL SHOPS

Small shops are characterized by offering a small number of the most often consumed vegetables, by only stocking limited volumes, and by being close to urban residents. They usually have some sorts of direct-supply arrangements with peri-urban producers and get vegetables at lower costs than wholesale markets.

Compared to wet markets stalls, small vegetable shops hardly compete with them on scale and variety and, thus, play a marginal role in the food offering to consumers (Sun, 2016).

Fig.75 A street hawker selling strawberries in a walkway (Pudong, Shanghai, 2019).



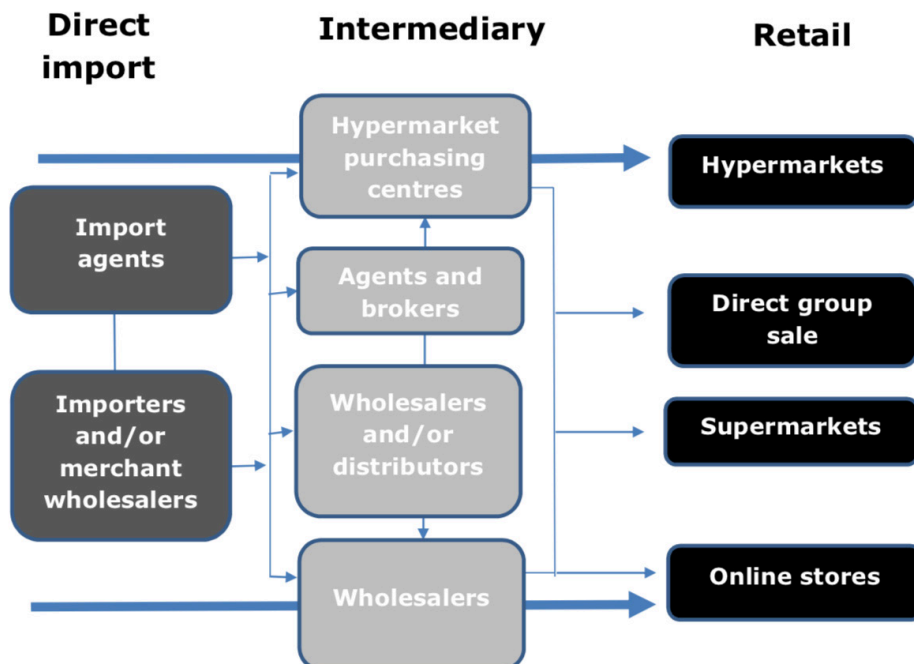
INFORMAL MARKET

Informal markets are all those not official marketing channels, mainly represented as street vendors. The hawkers are usually small vendors or peri-urban farmers selling their fresh produce on streets. While in the past the informal market contributed to the overall food retail sector, today, however, it is restricted and opposed by governments as it is responsible for blocking up traffic, producing wastes, and creating noise (Zhang & Pan, 2013).

IMPORTS

Another important element to take into consideration in the analysis of the Chinese food supply chain is the role and contribution of the import sector. As a matter of fact, Sun reports that considering the low level of trust of Chinese consumers in Chinese food products, together with the concerns in food safety, there are many business opportunities for foreigner importers (2016). Also, the author reports the current import distribution system.

Fig.76 Distribution system flow chart of imported food (Sun, 2016).



This system is composed of three types of importers:

Specialized importers and agents whose responsibility is to facilitate import documents preparation and handling. These are often used by wholesalers or distributors who do not have import licenses.

Wholesalers, hypermarket and cooperatives who have import licenses and import food to serve their own businesses.

Food processors or abattoirs who have import licenses. In the case of meat, they often import the whole carcass or semi cut for further processing according to their customer specifications.

As it is possible to see from the image above, after having passed through the hands of the importers, the imported food is ready to move to the second sector of the chain, which is the wholesale market or the intermediary trade, an area conducting business to business marketing and distribution. This sector involves three types of firms:

Wholesalers who function as agents on behalf of importers. They do not take responsibility for delivery. They do not own the product they are selling and only take commission from importers;

Wholesalers/distributors who have the ownership of the products they are selling and provide service for delivery if requested; and

Distributors who provide storage and delivery service to importers, wholesalers or retailers.

Finally, the food gets retailed in one of the physical or online stores, which usually do not include the small shops (small shops mostly sell local food) (Sun, 2016).

FOOD WASTE FLOW

Another very interesting source helps to shed light on the path of the food that leaves the restaurants in the form of waste. The Collective Responsibility research about Shanghai's Food Waste Management, published in 2018, offers an exhaustive description of the food waste flow.

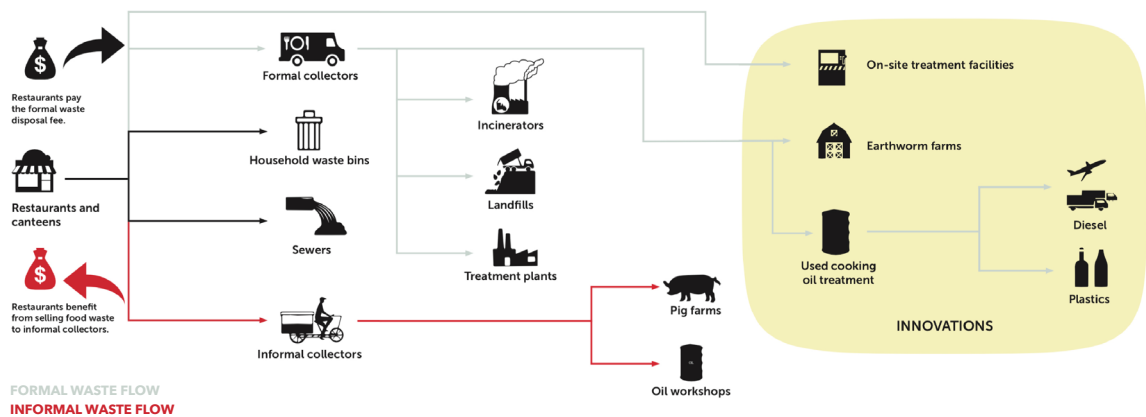
The research reports that, in recent years, the quantities of food waste increased exponentially compared to the past, forcing the government to dispose of it through landfills and incineration. The two methods are both highly inefficient and not properly designed to respect pollution-control standards (Zhang & Zhang, 2018).

As regards the restaurants, there are no national standards on the collection and disposal fees of food waste. Sometimes the fees are calculated according to the

property size, some others to the volume of food scraps. In Shanghai, in addition, owners need to report their total food waste production once a year and pay a disposal fee based on the average waste volume.

In general, restaurant managers are required to separate food waste from other general waste and to record the waste type and weight and the disposal methods daily.

Fig.77 Food waste management system in Shanghai (Zhang & Zhang, 2018).



The figure above shows the waste flow of food leaving the restaurant. As it is possible to observe, there are two main distribution channels: the formal collection system and the informal one. In addition, not virtuously, restaurants can dispose of their waste of through households channel and public sewers (black lines in the middle of the scheme).

FORMAL COLLECTORS

About 90 collection companies in Shanghai are currently responsible for district-specific collection and transportation of food waste. Operating with thin profit margins, formal collectors at times face the dilemma of also competing with informal collectors, who get to restaurants earlier than they do and collect the higher-quality waste. Consequently, formal collectors are often left with food scraps of less quantity and poorer quality, resulting in huge gaps between waste production quantities and collection volume.

The three main destinations for the food waste are landfill and incineration plants (which however cannot process all the quantity of food waste), and the resource recovery plants, as the compost plants.

Together with them, lately, new innovative ways of disposing of the waste of have started to rise. Examples are facilities meant to treat the waste in loco, i.e. directly on the business's site, the earthworm composting, and a kind of waste digestion, whose extracted oil components can be processed into biodiesel, that can potentially be used as fuel and to produce plastics.

Although the formal collection system works, because of the cost of waste disposal (about 54 RMB or 8\$ per 240-L bucket - Shanghai Municipal Pricing Bureau, 2013 -), many businesses are economically forced or pushed to throw their food waste into standard municipal streams, or sell it for up to 1,000 RMB per ton (140\$) to the informal waste management system (Zhang & Zhang, 2018).

INFORMAL COLLECTORS

Informal collectors are often individuals who cycle through the main streets of the city, pouring food waste into bins attached to their bicycles or tricycles. They have established strong networks with dozens of restaurants, particularly those vendors at popular night food markets.

These informal collectors usually bring the waste to pig farms or illegal oil workshops, located in suburban areas of Shanghai, which feed hogs or reprocess it into oil products that can be sold back to the cities (Zhang & Zhang, 2018). Obviously, these reprocessed foods may cause severe consequences for human health.

Fig.78 Informal collector sorting food waste from a wet market (Xintiandi, Shanghai, 2019).



The research then concluded by stating that, in order for Shanghai to be able to properly and safely dispose its food waste of, new partnerships have to be created at the city level and the government needs to incentive restaurants to get more involved in the formal system and stop food waste from flowing into the informal market.

3.2.3 OBSERVATIONS ALONG THE FOOD SUPPLY CHAIN

Here, the observations related to the food supply system of Shanghai, especially the food distribution, will be presented. These observations were carried out informally, during real-life situations.

SHANGHAI AGRICULTURAL PRODUCTS CENTER WHOLESALE MARKET, 20TH APRIL 2019

The Shanghai Agricultural Products Center is located in Pudong, a very big district in the south of the city. The time of the visit was late afternoon, thus some of the businesses were already closed or were going to close soon. However, the visit was useful to touch with hands this reality.

The observed wholesale was composed of different sections, covering almost all the necessary and popular food categories. The biggest areas were the ones dedicated to meat (especially pork), to fruits and vegetables, and to seeds, grains, and processed food (as soy sauce).

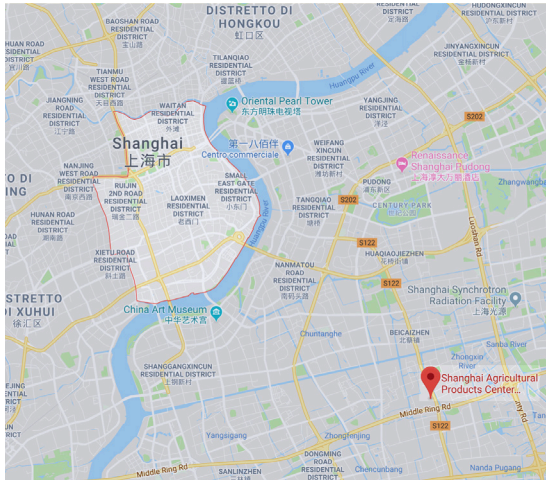
In general, the wholesale market was very big in each section, including the parking lot outside, used for the loading and unloading of many, big boxes of goods.

Inside, the food was stored in slightly smaller boxes than the ones carried by the trucks outside, and it was processed by the professionals working there. For example, pigs were carried in entire and they were cut in different pieces. Vegetables and fruits were cleaned, packed and stored in fruit boxes so that to be sold to agents, who then transport them outside.

Considering the size, the state of the food before entering the market and after leaving it, and the location, the Shanghai Agricultural Products Center was probably a first or second level of the wholesale market.

Part 2: The design process

Fig.79 The wholesale market (Shanghai, 2019).



Here, the observations related to the food supply system of Shanghai, especially the food distribution, will be presented. These observations were carried out informally, during real-life situations.

BUSINESSES FOOD SUPPLY, DIFFERENT DAYS, 2018-2019

During the author's stay in Shanghai, different real-life occasions related to the steps of the food supply chain, its actors and their actions, were spotted. In particular, the most meaningful occasions were related to the food supply of small vegetables and meat shops, the supply of restaurants, and, finally, to the dispose of the waste and its management.

As regards the first two situations, they present many similarities. Indeed, both in the case of small shops and of a restaurant (medium size, mid-end), the supplier directly comes to their shops with a medium-size minivan. Then, the food, which is already packed somehow, is weighted on a scale placed on the street in front of the shop, and if it respects the ordered quantities, is transferred inside the shop. In the case of small shops, this transaction happens in the very early morning (between midnight and 5 o'clock according to the observations), whereas in case of the restaurant, it happens in the late night.

Fig.80 Two different restaurants' supply moment (Shanghai, 2019).



Part 2: The design process

Fig.81 Small vegetable and meat shops's supply moment (Shanghai, 2019).



On the other hand, as regards the dispose and the management of the waste, as for the observations, the waste is generally gathered in bins or boxes, placed on the street beside the restaurant. When processed through the formal channel, a medium-size truck passes by the street and collects the contents of the bins.

Fig.82 Small vegetable and meat shops's supply moment (Shanghai, 2019).



3.2.3 OBSERVATIONS ALONG THE FOOD SUPPLY CHAIN

In order to fill some information gaps, due to the scarce availability of literature resources, it has been decided to visit different places belonging to the food supply chain. On those occasions, when possible, the principal actors working there were interviewed.

Indeed, interviews with the actors of the system were conducted, both during the preliminary and the secondary field research. Concerning the interviews conducted during the preliminary field research, it has been decided to present them here because they mainly addressed the business owners or managers, and they were not focused on the waste generation but mainly on the overall management of a restaurant and its food supply chain. Therefore, they were particularly useful to frame the food system in Shanghai.

Along the entire design process, many interviews were conducted with the actors of the system, in different phases of the project and with different objectives. In this section, it has been decided to present the interviews related to the first phases of the project, i.e. the ones aimed to understand the food consumption patterns of Chinese in Chinese restaurants, and the ones aimed to define the current food system in Shanghai.

Some of these interviews were therefore conducted during the preliminary field research, in a formal and informal setting. The former was conducted with users while eating altogether during the observation time (and were useful for acquiring the knowledge presented in the previous chapter). The latter were conducted with restaurant owners, but their contents have been more useful for the identification of the food system, presented in this section. Also, they could not have been done without the help of the author's Chinese colleagues, and the questions had been refined round after round, in order to be more effective.

In order to facilitate the conversation, and, in some occasions to permit the conversation itself, some printed papers were used to visualize the questions (in Chinese) or the draft of the food system, realized with the information available at that time.

Hereinafter, a list of the interviews with the actors of the system is reported, organized by typologies. The first typology is the restaurant businesses, which are divided in two: the preliminary interviews conducted in different restaurants nearby Tongji University, and the secondary interviews, much more structured (because of more time available or the English language).

Afterward, the main visits arranged during the research will be shown, including two different farms in the suburbs of Shanghai, and a (big) wholesale market, in the suburbs as well.

RESTAURANTS' OWNERS/MANAGERS (PRELIMINARY)

Owner of a small, low-end restaurant (小饭馆/xiao fànguǎn)

Owner of a medium, mid-end restaurant (中档餐厅/zhōngdàng cāntīng)

Owner of a medium, low- to mid-end restaurant (中档餐厅/zhōngdàng cāntīng)

RESTAURANTS' OWNERS/MANAGERS (SECONDARY)

Thomas, restaurant manager at TheMe.

Guido Esposito, restaurant owner Bella Napoli.

Claire, restaurant manager at Voce Café.

Chef Thomazini, chef manager at Nike canteen.

FARMERS/FARMS' COORDINATORS

Jane, Bio Farm coordinator.

Tang, farmer and farm coordinator.

OTHERS

Eve, Shanghai Food Bank coordinator.

Old lady, small vegetable shop owner.

RESTAURANTS NEAR TONGJI UNIVERSITY, 8TH DECEMBER 2018

The preliminary interviews to restaurants owners were conducted in December, in some of the restaurants near Tongji University.

These first interviews were realized with the help of Zidi Bai, an author's Chinese colleague. Because they represented the first round of interviews, their content was a bit poor, yet they were useful to better phrase the questions for the second round and to getting started.

These interviews were composed of three categories of questions: the general questions related to the restaurant (number of customers, kinds of customers, timetables, etc.), the ones related to their supply chain (where the food comes from), and the ones related to the waste.

All the three restaurants mainly serve students and professionals working in the area, during the weekdays. Therefore, most of the time their customers eat individually.

All of them order food every day, one through a middle man from the wholesale, the other two directly from the wet market nearby. In each case, however, once they run out of food within the same day, they rely on the wet market or the small

shops. One restaurant, in particular, claimed to have a 20 years long relationship with a vendor in the wet market. Often, the quantity of food to order is based on the previous day and it is decided by the chef or the owner.

Finally, all the three restaurants reported to dispose of their waste, usually accounting for a 5 to 10% of the total food per table, through the governmental service (formal collectors). For that, they have to pay 69RMB per bin (10\$ ca.), even if they do not know where the food scraps will go.

Fig.83 First restaurant owners' interviews (Tongji University, 2018).



THEME RESTAURANT, 26TH DECEMBER 2018

A very important interview, already belonging to the second round, was conducted with more time availability and the possibility to visit the kitchen, at the restaurant of the design campus inside Tongji University. The restaurant, called TheMe, is a small business chain of medium size, mid-end shops. TheMe is a mix of foreign food and local one, with a Western-inspired kitchen style, where much attention is dedicated to quality, of the service and of the food. It is, therefore, more expensive than the other restaurants in the area.

Even in this case, the interview was realized with the help of Zidi Bai, and it covered the same points of the preliminary interviews but in a much more structured and organized way.

Thomas, the restaurant manager, reported that the majority of people comes during the weekdays, they are a mix of students, teaching staff, and employees, mainly is

Chinese (even if, in proportion, there is a good number of foreigners).

Also, as regards the food, Thomas said that Chinese food, vegetables and fruit are ordered through the app Meicai (美菜), whereas the Western one through importers. Meicai is great but it is not always trustable since the quality of the food is not constant. The quantity of food to order is established by the chef.

About the waste, he observed an average of 10 to 20% of waste per table, whose main cause he believed to be the Chinese "face". As for the kitchen, they do not waste much food also because they are well prepared: they have 18 refrigerators where the food is well stored/preserved (the meat lasts 3 to 5 days; fruit and vegetables used maximum within the day after). The few waste is then collected by a company which collects it for the entire campus.

Probably the most interesting part of the interview was the off-time one. During that open and free thoughts session, Thomas said that food waste is related to economic issues, and to health awareness. In China, however, there is not a health education and people do not know how much and what is suitable for them. They only eat for happiness and the sake of the taste. The reason why people usually order more is to be more satisfied.

Also, Thomas suggested looking into health awareness education (to teach how to protect and well sustain the body and what it needs), since he is witnessing a change in how people consume food. Now, they generally want to have a more balanced diet (with different kinds of nutriments), but the quantity of the food of the dishes did not change accordingly. Therefore, he concluded that if people want to eat diversified, they have to order more dishes, which in turn may regenerate much more waste.

Fig.84 Interview with Thomas, the restaurant manager at TheMe (Shanghai, 2018).



Fig.85 Interview at Bella Napoli restaurant (Shanghai, 2019).



GUIDO ESPOSITO, RESTAURANT OWNER BELLA NAPOLI, 26TH JANUARY 2019

A third round of interviews with restaurants owners to managers was conducted later on. In particular, in order to grasp and map the food supply chain of a foreigner restaurant in Shanghai, an interview with one of the most popular Italian restaurants was scheduled. The aim was to complete the food supply chain framework of restaurants in Shanghai.

The interview was structured in four sections: the general information of the place and its customers, the info related to the food supply, the ones about the food orders and the management of the food, and the ones related to food waste.

Guido explained the story of the restaurant, opened already 10 years ago. Because of that, Bella Napoli has loyal customers who visit the restaurant constantly, relying on a well-set menu and quality of the food. This is something that the staff has achieved over time. Indeed, for almost any aspects, they are well working and their mechanisms are oiled. Guido in person is responsible for managing the qualities of food to order and for the relationships with the suppliers, who are already tested and trustable as well. As regards the food waste, the staff do not observe big quantities (around 5%) left at the tables, and they rely on the governmental service for its disposal. However, they are not aware of where the food waste goes.

CLAIRE, RESTAURANT MANAGER AT VOCE CAFÉ, 24TH APRIL 2019

A brief interview was conducted with the restaurant manager of Voce café, a medium-size, western bar/restaurant. Because of the language barrier, the questions were translated in Chinese and written on a paper that guided the conversation. While Claire was replying, the author was recording her answers so that to be translated afterward. The few questions were focused on the management of the food inside the shop, from the ordering to the disposal.

Claire said that they mainly order the food through an agent, who take it from the wholesale market. In case a restaurant is big, it is also possible that it may more directly interact with the producers. Also, she claimed that the owner orders the food by looking at the number of customers they have daily and the quantity of food that gets consumed. In general, however, it is an ongoing process and learning that takes much time before calculating it well.

About the food waste and the possibility to donate the food rather than throwing it away, she said that if the food is cooked you may prefer not to donate to avoid any possible (legal) problems.

Fig.86 Interview with Claire, the restaurant manager at Voce Café (Shanghai, 2019).



CHEF THOMAZINI, CHEF MANAGER AT NIKE CANTEEN, 30TH APRIL

The last interview, from the restaurant side, conducted during the research was the one with Chef Thomazini, a Brazilian chef living in China since years, who was the owner of a Brazilian restaurant and now the manager at Nike canteen. This interview was the only one with a proper chef, and even if currently working for a company canteen, it was insightful. The interview was conducted via phone call, and it covered the usual points.

The chef said that at Nike they arrange two thousand plates x day, mixing the buffet and a la carte. The food is also a mix of western and Chinese, but the second represents almost 90% of all dishes/food.

As for the supply, vegetables and grains come from China, from (intermediates and distributors in contact with farmers. Fish and meat are mainly imported because the Chinese ones are of low quality (like chicken) and because sometimes it is cheaper (like seafood). Importing sometimes is cheaper because China has many agreements with outside countries for food import.

The only organic food that they have is fruit, coming from outside China (like bananas). Indeed, the chef reported that in China, to get organic products there is the need for "labels". However, he said that no food at all in China is certificated internationally. About waste management, they have to consume what they buy. Usually, they buy a bit more than the number of people but they still have a low amount of wastage. In the kitchen, they may have losses reaching maximum the 5% of the total food, considered overproduction.

Because of strict rules and food regulations, they must throw the losses or the food waste away, through the formal collection system.

When asked what could be the link between food production and food consumption, the chef replied that eating consciously is a cultural issue, related to cultural background, and education. Along the supply chain, he believes that if the entire network of actors works well (producers, distributors and storage, etc), then there could obviously be the possibility to prevent much food to get wasted. Inside the kitchen, instead, the waste is about training the staff and engaging them. An obstacle in the engagement is surely the very high rate of turnover in China.

FOOD BANK, 15TH APRIL 2019

As the first direct visit to one of the actors of the system, the Shanghai Food Bank "Oasis" is the only of this kind in the city. It is located in the Pudong district, in a central area. The visit was not scheduled and, therefore, apart from the observations, information were collected in loco and the day after through WeChat. Indeed, some questions were asked to Eve (Li Bing), the Chinese leader of the food bank, during

the visits and some other the next days. First of all, from the observation and first questions, it was discovered that the staff collects food mainly from food producers and sometimes from bakeries. These products are on average already packed (probably because it is much easier to collect and store it). Then, they organize and divide the food in shopping bags that they give to needy families. This happens or directly there in their space or through community centers or through food agencies that take care of the transport.

They are a no-profit organization which is not funded by the government, even if sometimes they receive money from it. Therefore, the money mainly comes from the donations of "cooperatives", groups formed by companies. They currently do not work with restaurants, hotels or other "businesses or organizations" since she said it is difficult: hot or cold transport is too expensive to manage. Restaurants usually do not have enough amount of food because they only have surplus food. Inside their space, they organized their food through labeling. They have a room (with also a fridge) and they also use the main hall. Hence, the space is almost all filled with bags and food cartons. In the hall, they also have a kind of vertical fridge or vending machine through which it is possible to take some little food.

The kinds of products that they usually manage are: rice, oil, soy sauce, drink yogurts, pasta sauce (pesto), healthy snacks (cereal bar), water bottles, some biscuits and something stored in the fridge.

According to Eve, donors give away food close to the expiring date or simply to make a good action. In every case, they have to upload their certificate and sign an agreement with the food bank to guarantee the quality of their food.

Finally, Eve was available to check the draft of the system of food in Shanghai and she validated it.

Fig.87 Visit at Oasis Food Bank (Shanghai, 2019).





BIO FARM VISIT, 20TH APRIL 2019

The second direct visit of the research was arranged with Bio Farm, an organic farm in the suburb of Shanghai, growing very fast in terms of size and business.

The visit was conducted during the weekend since the farm offers a visiting path and present different facilities. Indeed, Bio Farm, beside the fields and the main office, has a restaurant, an area for children to play and to attend classes, and finally a small internal market. Most of the products that can be found at the restaurant and at the market directly come from the farm itself. Others, such as the meat and the mushrooms, come from nearby trustworthy producers who, together with Bio Farm, form the "China river eco-village".

Luckily enough, during the visit the author came in contact not only with Jane, the farm coordinator, but also with Above Farm, an independent communication organization based in Shanghai, that promotes healthy organic living and that it is currently mapping the soil condition of different farms, aiming to create a database and a map of the good, healthy farms in and around the city.

The visit was structured in the following way: a quick tour of the farm, while the professionals of Above Farm collect soil samples, lunch altogether, and then interviews time (usually, however, there is also the possibility to pick your own veggies).

During the visit, it was found out that Bio Farm is a private (profit) organic farm, with 3 headquarters in China, for a total of 40 hectares, but only two-third arable. Between 2004 and 2006 they got the certificate of organic farm.

Part 2: The design process

Bio Farm is the main and first in Shanghai, opened 11 to 15 years ago, with currently 100 employees (60 in SH), including families living there, and volunteers. They currently have 300 kinds of produce, vegetables, fruits and flowers, and no animals. Bio Farm born as a CSA (even if actually in China the CSA model is more a customer-producer relationship, much less participatory than in EU or US). They currently

Fig.88 Visit at Bio Farm and interview with Jane (Shanghai, 2019).



have 400 prepaid families, some hotels restaurants and 25 supermarkets. They do not receive funds from the government, and after 3 years from the achievement of the certificate, they started to make money and invest in people/farm. However, as regards the opening of new farms, the process is usually slow because they first have to train who is going to become the “manager” of the farm, for three years. Managers, as well as people working or living there, have to be trained at interacting with the public.

Concerning their operations, they do not practice conventional agriculture. They buy fertilizers and seeds (which are organic as well) from certified suppliers, and they have small machines to work the soil and to create a compost made up by wasted beans and mushrooms. Nearby the farm, there are small roads and a river which keep Bio Farm well separated from the nearby potential polluted land.

After lunch, it was time for some questions. With the occasion, the questions asked were about their background, their system (to understand better how the farm and their business model works), the management of their restaurant and its waste, and, finally, about other farms as theirs.

Jane replied that the farm is based on the CSA model, whose customers are families. In addition, they also serve high-end hotel restaurants (Park, Grand, Bund Hyatt), and some supermarkets like Metro and City Super, through which they may have food agents (who just link). In that case, each product has the Bio Farm logo but only 80 out of 200 products have the label “organic” because it is very expensive. Finally, considering the farm size and productivity, they are also able to serve some vegetarian restaurants or groceries like the very famous Hunter Gatherer.

About the overproduce and losses from the fields, she resulted to be very enthusiast about donating it to charity, as the Food Bank. However, some products operations (cleaning, transporting) should be properly discussed.

Probably the most insightful thing, she said that she believes the answer to food waste at the table is food education, from the farm to the table. Indeed, at the farm, they show the customers how they grow their food. They can also experience it. In this way, consumers will treasure and appreciate the food and the act of growing the vegetables, and they will not waste much in respect to that.

Finally, she was aware of other CSA farms in Shanghai, also because they were pioneers and others often came and visit them to see how they operate.

As for now, they are separated from them but maybe one day, if they grow very big, they could be interested to sell their goods in a platform. What she underlines was that they were not in the wholesale market or conventional supply chain.

Indeed, she claimed that that agriculture should be independent and profitable (no middle-men).

TANG FARM, 28TH APRIL 2019

Located in Chongming, an island in the north of Shanghai, the farm of Tang was the third direct visit and the second interview to a farmer. The farm is the one providing produces to a group of foreigner people called AMAP (Association pour le Maintien d'une Agriculture Paysanne (association for maintaining small-scale family farming), which the author had the chance to enter in. Tang is the farmer involved in the community exactly because the farm is based on the CSA model. The visit was conducted alone (no other AMAP members) and, after a tour of the farm and a lunch, it was the time for some questions. As background information, the farm is very small, less than 1 hectare, opened 5 years ago, and it employs around 5 people. The farm is separated from the nearby others by a water channel and streets.

From the conversation with Tang, it has been found out that at the farm they do everything based on the original principle of organic agricultural and beyond actually. Their agricultural model was pretty similar to the degenerative agricultural one but without animals. She said: "the land here purifies itself". Consequently, they do not have any organic certification since they defined themselves beyond it, as if it would confine the nature of their operations.

Indeed, she and the other farmers only use cleaned water and the natural process of organisms decomposition to fertilize. They do not use anything from outside the farm because they believe that it would not be sustainable. Thus, not fertilizers or compost (because these energies are not from them and may contain traces of chemicals or hormones and antibiotics. She is also convinced that organic farming cannot be very big otherwise, considering the intrinsic nature of organic and its labor-intensive demand, you lose quality.

She also reported that the farm has troubles in finding new customers, especially Chinese because it is hard to make them understand why they should choose organic food and/or CSA products. Chinese are simply averagely not aware of the quality and the benefits for the health. Otherwise, they would certainly move to organic. Tang at the moment only directly sell to consumers, through the AMAP WeChat group. They do not sell via the wholesale market, because she believed to be much better to be independent (not depending on the market and its fixed prices). But they also do not sell to restaurants (unfortunately).

When asked what could be the connection between food production and food consumption with its waste, she pretty confidently said that the link could be that people do not know where the food is from and how it is produced/harvested. If they would know how difficult and long it is, they would not waste it.

As regards their food losses, she reported that sometimes they have but it very depends on the period. Sometimes they have more, some others not. When they have, it's because plants grow very fast and more (in numbers) than what they could sell to their AMAP members. When they have little, on the other hand, they just give it back to the soil, as fertilizers.

When she was asked to check the draft of the food system and supply chain in Shanghai, she said that the system was more or less ok, and suggested some little adjustments. As a very small farm, it would be better to be in direct connection with customers and hopefully with restaurants.

Finally, she said that, in the future, they would be willing to cooperate with other organic farms so that to share clients and introduce new ones.

Fig.89 Visit at Tang Farm and interview with Tang (Shanghai, 2019).



Fig.90 A honestly hard interview with a small shop owner (Shanghai, 2019).



OLD LADY, SMALL VEGETABLE SHOP OWNER, 16TH APRIL 2019

In order to verify some of the distribution steps of the food system, some questions were also asked the owner of a small vegetable shop, located in the city center. Because of the language barrier, the questions were translated in Chinese and written on a paper that guided the conversation. While the lady was replying, the author was recording her answers so that to be translated afterward. The few questions were mainly about her distribution channels.

Out of the mono-directional conversation, it was found out (or verified) that the products came from the wholesale market, from a small trustable producer. The owner usually ordered the food trough an app firstly and then, once the courier comes, she weights the products and confirms the order. She said she knows well the courier (who usually comes every day in the very early morning). The shop sells food to consumers and some restaurants alike. Finally, with the not sold food of the day, or they keep it for the day after or, if it is not fresh or good to eat anymore, she gives it away or throws it away.

Interviews' questions and answers are reported in the Appendix.

MAIN INSIGHTS

To sum up, the main reflections and insights that have been drawn from the observations, visits, and interviews to the actors of the system, aimed to understand the food system in Shanghai were:

Fig.91 Insights from the observation and interviews.



3.2.5 SYSTEM VISUALIZATION

Thanks to the information collected during the research activities, it has been possible to draw the food system in Shanghai. In order to offer a more exhaustive report of the conducted activities, it has been decided not only to show the food supply chain related to restaurants, but also a slightly wider one, including other actors operating close to restaurants but not connected to them. It is exactly this system which will be shown at first.

The system map above can be read from left to right, with the arrows indicating the direction of the arrow. Different actors of the system are highlighted in different colors according to the different steps of the food chain: blue for the actors belonging to the food production step, black for the big distribution, green for the small one (here intended as distribution to consumers, i.e. small quantities), and gray for the waste treatment. In the middle, in a bright yellow color, the restaurant is placed.

Starting from the producers, food comes from animals breeding farms, agricultural farms, and from import agents. Conventional farms are divided into big and small ones, to respect the difference of today's China production (averagely, many but small farms in the agricultural sector, and few but big farms in the animals' farms). In a city as Shanghai, imported food also plays an important role, and this is the reason why it has been decided to show.

The other two producers which are not directly in contact with restaurants are the integrated, vertical corporate farms which serve the big supermarket chains (especially foreign), and the small organic farms, usually serving consumers directly, based on a CSA model.

From the producers, food gets processed in manufacturing plants, and then distributed (and it represents the majority of the food donated by the food bank), or it goes to the wholesale market. Here, differently from the average, the food passes through three kinds of the wholesale market, different in size and closeness to the city center. From there, the food gets distributed to smaller retail, as the small vegetables or meat shops, wet markets, and to street hawkers, which serve the urban population, including the restaurants.

Finally, out of the restaurants, the food can be disposed of via the formal and informal channel. In the first case, it goes to incineration, landfill and compost plants, in the second, it goes to pig farms or illegal oil workshops.

Fig.92 Representation of the food system in Shanghai.

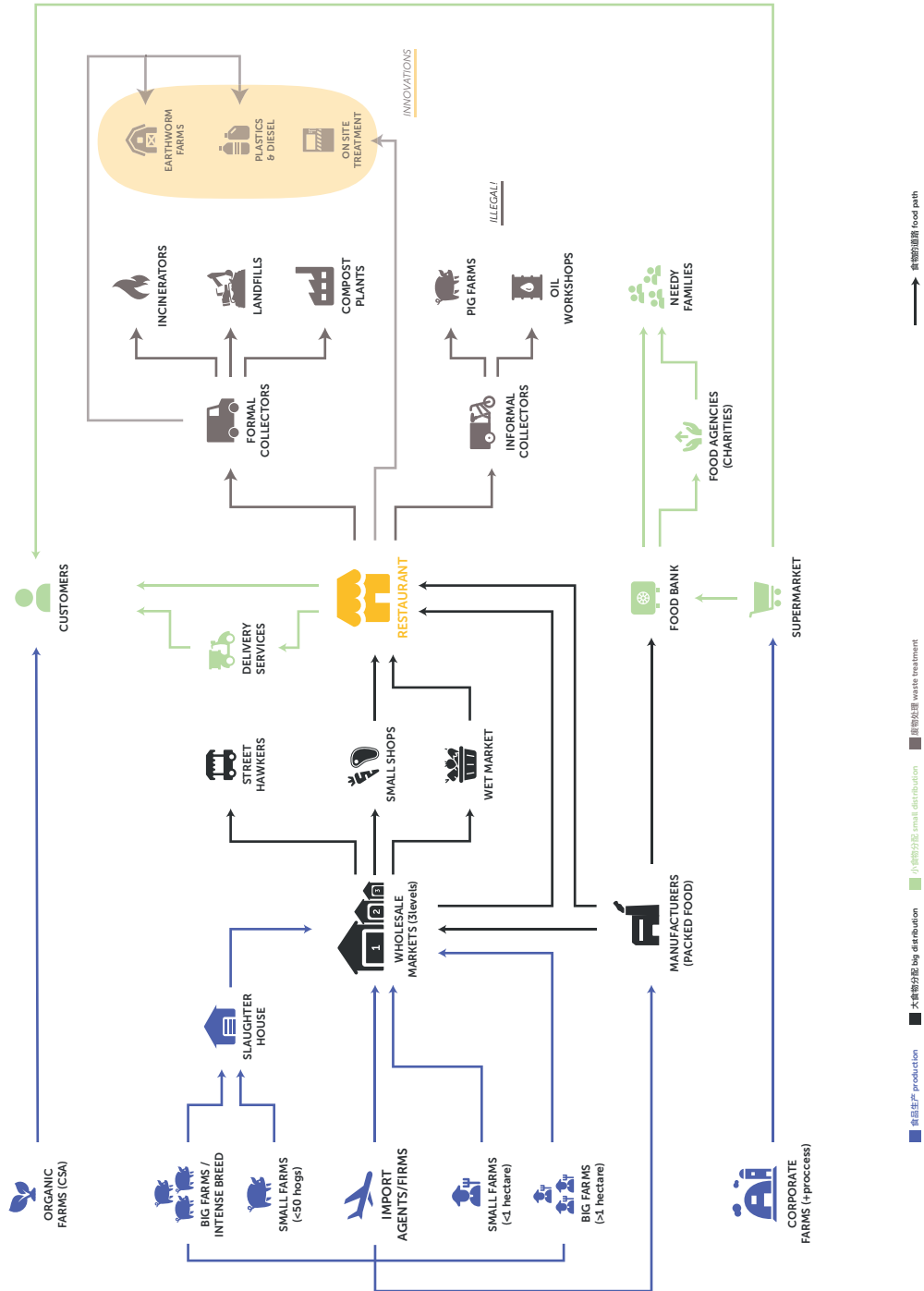


Fig.93 Representation of the average food supply chain of Shanghai restaurants.

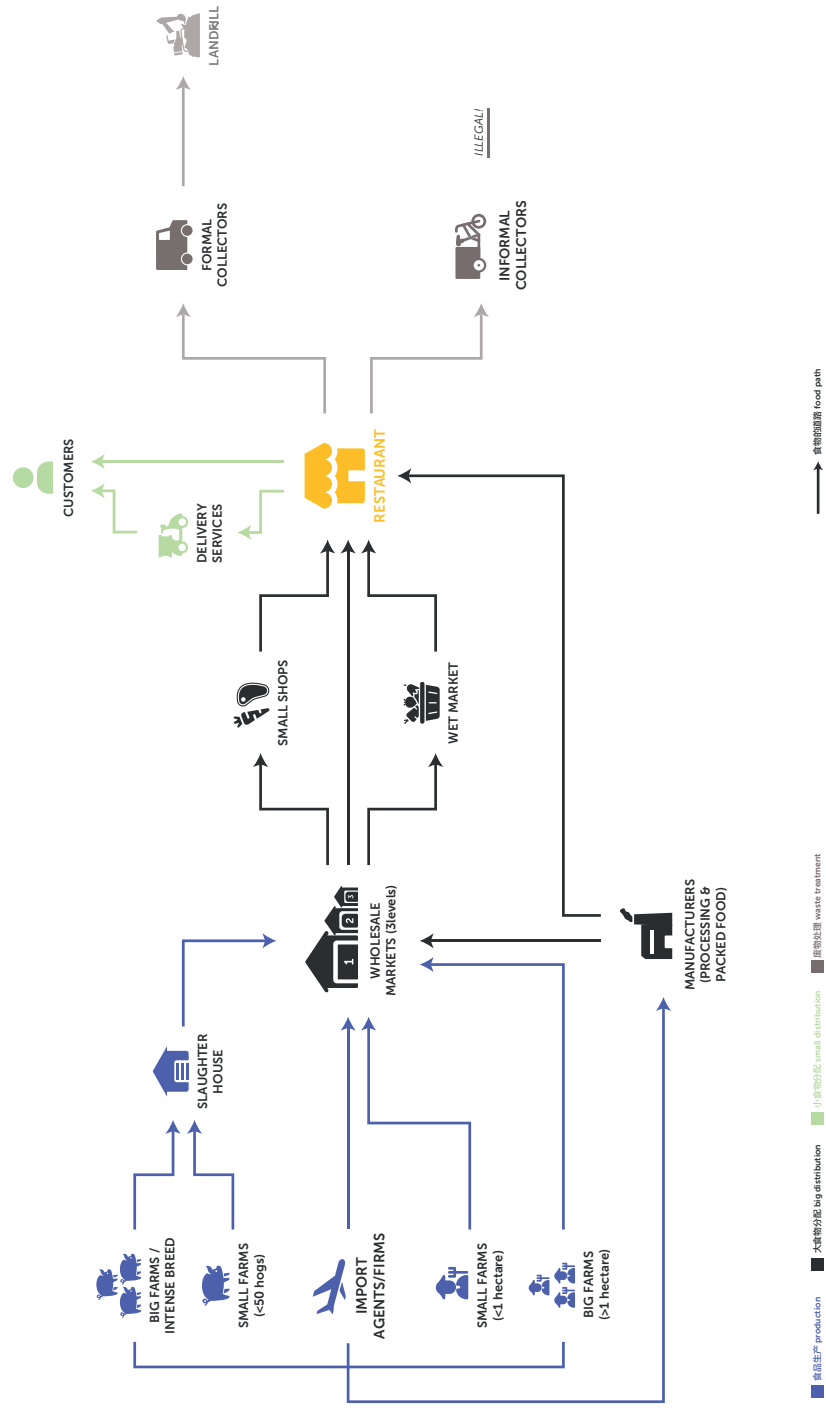
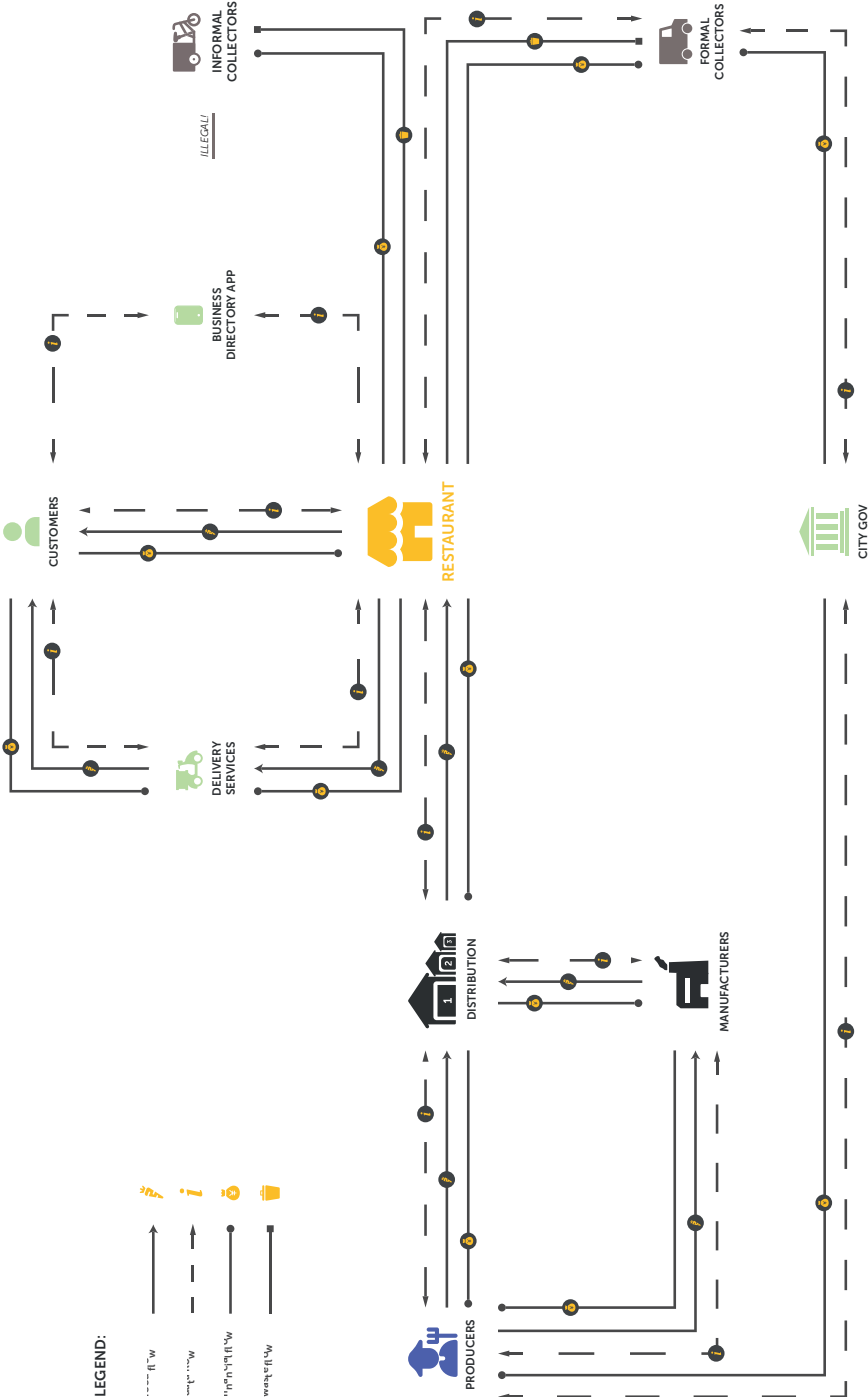


Fig.94 Relationships between the main actors of the food supply chain.



Finally, it has been decided to represent the relationships between the main actors of the restaurant food supply chain. In the image above, the different actors belonging to the same category have been almost all grouped under one category (e.g. "producers").

Different arrows represent different kinds of relationship or exchange, visualized in different styles. The classic arrow represents the flow of the food from one actor or step to the other; the dotted arrow represents the information flow; the straight one ending with a circle represents the financial flow (i.e. money exchanges); the straight one ending with a square represents the waste flow.

As it is possible to notice, the food goes from the producers to the restaurant, passing by the distribution. From the restaurant, the food goes to consumers and to the waste collectors. Food may directly reach the consumers or, frequent as well, it first passes through an online delivery service. In both cases, consumers usually rely on business re-directory apps to guide their choice, not only of the restaurant itself but also of the dishes to order.

From the analysis of the food supply chain, it is possible to understand that the system is highly fragmented due to the numerous steps between the source and the consumption of food.

Also, averagely, restaurants are not in direct contact with producers. This generates two main issues. The first one is that considering the fragmentation of the system, the reliability of the food is lower because the quality of the products is not always constant. The second, instead, is that the price of the food for restaurants is usually higher because of the fees to be paid to the intermediators.

EXPERTS VALIDATION

In order to come up with a final, yet simplified, version of the food system in Shanghai and the restaurants' food chain, the representation had been discussed with some of the same experts interviewed during the research phase. In particular, the system was reviewed by 2 restaurant managers, Bio Farm and Tang farm coordinators, and the Food Bank coordinator. Their feedbacks were integrated into the versions of the systems shown in the previous section.

Fig.95 Validation of the system together with some of its actors.



3.3 INFLUENCING TRENDS

3.3.1 CURRENT TRENDS

As described in the methodology, the aim of the “strategic analysis” is to understand the status quo of the topic investigated, its actors, relationships, and the dynamics which bind them all. In other words, the socio-economic, technological and cultural macro-trends.

Hence, as a synthesis of the research, conducted during the strategic analysis, it is possible to clearly show what are the trends behind the reference context, which characterized and influence it. These trends are the result of the combination of different information and source collected during the literature and field research.

FRESH FOOD

Chinese obsession with fresh food (vegetables and fruit) and its any-time availability leads to waste or not use much food (not that fresh anymore).



Fig.96 Common market stall of fresh vegetables (500px.com/Morten Byskov).

FOOD SAFETY

Due to the demand for a huge quantity of food, the food production methods are not always "healthy" (many food scandals occurred in the past). Hence, consumers' trust in local brands is very weak.



Fig.97 Food controls (foodnavigator-asia.com, 2015).

WESTERN DIET

Influenced by Western habits (and the Fast Food industry) and due to the income raise and the market opening, the Chinese diet, composed of grains and vegetables, has shifted to a meat-based one.



Fig.98 Influence of Western dietary habits (shutterstock.com, 2019).

MASS DIGITALIZATION

Real-time data, accessible fast connection and its multiple uses, made the smartphone the most essential tool for a variety of every day and working tasks (as managing food supply, ordering food, etc).

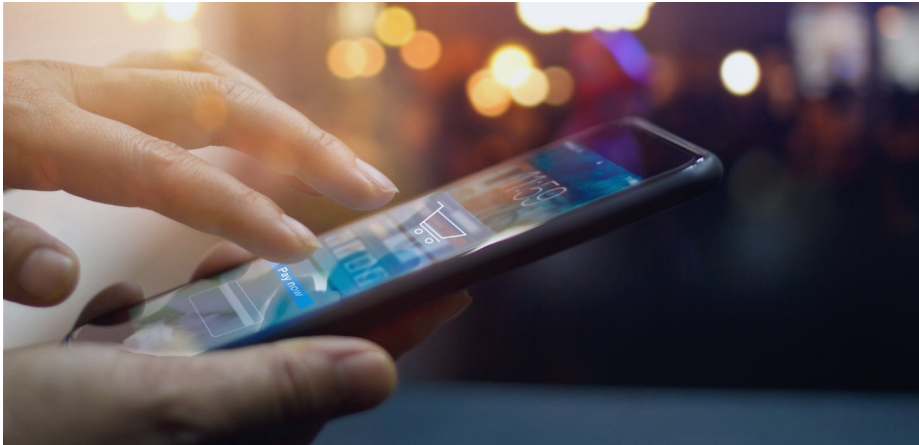


Fig.99 Smartphone has become a fundamental tool in today's China (Chron.com, 2018).

FOOD DELIVERY

Food delivery is a big phenomenon in China, due to the ease, comfort, and convenience of the delivery services (which are based on a well-established infrastructure and workforce).



Fig.100 Delivery service bringing food to an office (nikkei.com, 2016).

REVIEW & RATING SYSTEM

The reviews from other users on the most popular apps (as Dianping), highly influence the purchasing and consumption decisions (here, not only the choice of the restaurant, but also of the dishes!).

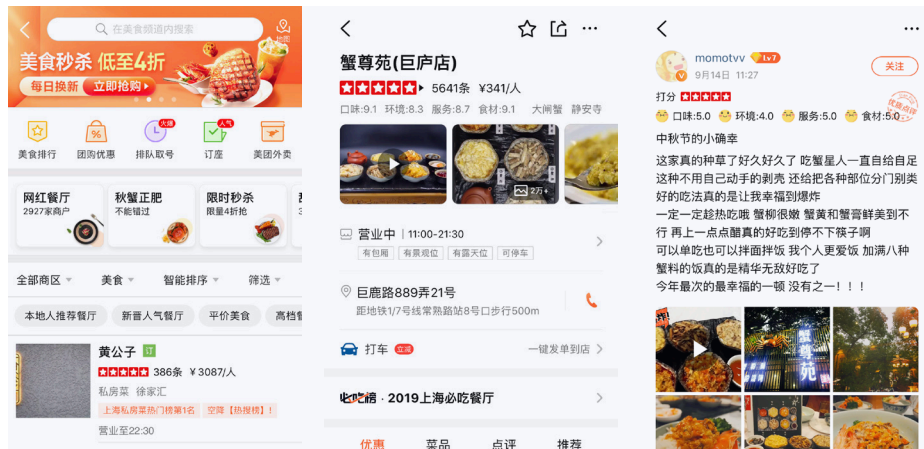


Fig.101 Reviews often guide the decision of Chinese consumers.

3.3.2 FUTURE TRENDS

Before entering into the conceptual stage, it has been decided to also briefly report those trends that, according to the research activities and research shreds of evidence, are considered to possibly influence the system in the close and medium future. Indeed, the aim of this design step is to spot opportunities and promising drivers which could guide and inspire the following creative phases.

ORGANIC FOOD AND CSA MODEL

Community Supported Agriculture model is spreading more and more in Shanghai and it will in the future, especially focusing on organic produces (as the answer to the safety food issue).



Fig.102 Alternative food networks are taking place in China (dialogochino.net, 2019).

FRESH FOOD E-COMMERCE

Together with the food delivery of already cooked meals, also the delivery of fresh food is slowly spreading. There are still tech and infrastructure limitations but also opportunities for big growth.



Fig.103 Shopping fresh vegetables online (yiguo.com, 2019).

NEW WAYS OF ENGAGING CUSTOMERS

Due to the increasing number of wealthy people and the market booming, brands, including restaurants, need to find new ways to attract customers, by offering engaging and involving experiences.



Fig.104 Lights, scents and materials are powerful engagement tools (telegraph.co.uk, 2019).

YOUNG FARMERS' MOVEMENT 返乡青年

Opposite to the big urbanization, young Chinese are slowly coming back to the countryside in order to reconnect with the land and start their own farming activity, very often organic.



Fig.105 Young farmer (stocksy.com, 2015).

HEALTHY LIFESTYLE

Busy schedules and work are changing the lifestyle of urban consumers who begin to care more of their physical and mental well-being. They are increasingly opting for balanced healthy solutions, as in the nutrition and sports fields.



Fig.106 Healthy diet, physical exercise and meditation are becoming widespread practices for urban Chinese (500px.com/Luis M. H. Aldana).

3.4 EXPLORING OPPORTUNITIES

“Exploring opportunities” is the name of the second stage of the MSDS process, whose aim is to identify potential guidelines for the development of promising new ideas/systems, based on the information collected during the previous stage. In particular, this chapter will draw some reflections about the insights and pieces of evidence shown during the research phase, and, based on that, it will present what has been defined as the main design opportunity, i.e. the organic food.

In addition, a further research exclusively focused on such a product will be offered, so that to better understand the background motivations which led to the definition of the opportunity. Indeed, during the previous research, the existence of different kinds of organic farms emerged. This has been afterward verified through a deeper desk investigation (see “Research Background”), and a field one, consisted by the analysis of the two different kinds of organic farms’ produces and of the few organic restaurants chains in Shanghai.

Hence, it was possible to answer the brief defined during the research, describing its connection with the organic. After the definition of the opportunity and the guidelines for the new (sustainable) system, it has been decided to show and describe some current examples of excellence, or case studies. Their analysis, indeed, would be useful for building a reference background of existing practices that may guide or inspire the conceptual phase.

Finally, based on this newer information, the trends possibly able to influence the system in the future will be briefly presented. As for the case studies, they would be useful for an understanding of the general direction of the Chinese organic panorama (and therefore inform the conceptual phase).

3.4.1 ORGANIC FOOD AS DESIGN OPPORTUNITY

By analyzing the food supply chain of restaurants in Shanghai, it was clear how the current chain does not represent an overall sustainable system. Indeed, nor the food itself, nor its distribution positively impact on the environment but also on businesses and consumers alike. However, during the investigation, another kind of producer was found out: the organic farms.

Organic farms in Shanghai differ from other producers not only because of the more sustainable and healthy produces but also because of their distribution channels. Indeed, these farms do not usually rely on the conventional wholesale market, and have a much stronger relationship with their customers. As a matter of facts, very often, they are based on the Community Supported Agriculture (CSA) model. The CSA model consists of people (usually urban citizens) supporting a farmer and its farm by paying the harvests in advance so that to share the risk of the production. If something happens to the field, both the farmer and the member of the CSA lose their money. However, in a usual, positive scenario, members receive their produces every week, contained in a box delivered to their home or to a collection point.

There are actually different schemes of relationships with the farmers, one being farming yourself on the farm. In China, however, the most common relationship between the members and the producers is the typical vendor-customer one. In other words, Chinese members of these CSA pay the produces in advance and receive them weekly. Another very interesting characteristic of a CSA is that members have usually the possibility to go and visit the farm, getting to know the producer of his/her food and even conducting activities there, as farming.

This lets members, or even just curious people visiting the farm, to see how the food is produced and how much attention and cure it takes.

Fig.107 Picking vegetables during the farm visit at Tang farm (Shanghai, 2019).



During the visit to the two organic farms, both their coordinators believed that Chinese people have lost their knowledge of food, in terms of nutrition intake and health-related influences. They both agreed that food education is widely needed and that the direct experience with the food is a very powerful learning experience.

Thus, organic food has been individuated as a promising design opportunity.

The reasons that made the author opted for organic were two: the use of natural products/substances (not chemicals) which makes not only the food healthier but also the life of the farmers and the land, and that organic food, based on the current supply framework, already comes followed by a better consumption behavior since its consumers, and especially CSA members, are more aware of the food that they eat and how it is produced. This is not only due to a greater consumer interest but also to the first-hand learning you may acquire on the production site, i.e. the farm.

3.4.2 DIFFERENT ORGANIC SYSTEMS

Because of the few information collected during the field research about organic farms, it was fundamental to deepen the knowledge about organic, in particular through desk research. By consulting different resources (see Research Background), it became clear that the two farms, visited during the field research, were actually representative of two quite-well distinct organic systems: the industrial organic and "beyond" organic. The two systems, however, are not two completely defined, different sides of the same coin. As a matter of facts, there are many declinations of the two, with contamination frequently happening.

In China, the situation is not different.

Indeed, it is possible to recognize those two kinds of organic production system. The main difference is that, in China, the industrial model is rather a semi-industrial one, since it commonly promotes and distributes its products in different-from-conventional channels and modalities. They are both the result of a clear influence and inspiration of the USA models, where the two organic systems firstly generated, which have been adapted to suit the local context.

The semi-industrial organic production system in China is generally embodied by big farms (bigger than 5 hectares), which are certified with the local labels, and able to produce a big quantity of food. Not always born with an industrial system as objective, these farms are today structured, organized and profit-driven, with a

clear scaling up business orientation. The transformation is surely attributable to the huge market success of organic food, as a solution to the many food scandals and food safety concerns among the public opinion. These farms usually present different facilities, as a proper office, restaurant, internal market where to buy the processed products of the farm, workshops spaces where to conduct learning activities with visitors, and others which differs from farm to farm.

These farms are not completely industrial, however, since they do not rely on the conventional distribution of the food chain (as the truly industrial in the US). Rather, over time, they have built their own channels which are most of the time autonomous and as much direct as possible.

During the interview with Jane, the Bio Farm coordinator, it was found out that the farm has multiple customers, as consumers, specialized shops, and even supermarkets and some restaurants, with whom the business relationship is independent (no agents).

“Agriculture should be independent and profitable! When you grow, you don’t want intermediates, nor in the B2C or B2B market” (Jane, Bio Farm coordinator)

In facts, farms as Bio Farm are as independent as possible (they do not even get supported by the government for that reason) both with business clients and with their consumers. Exactly the consumers represent their customer base (the first customer) through which they grew over time. With them, these farms still have a direct relationship based on the CSA model. However, due to business growth, they averagely do not deeply interact with their community anymore. Members can obviously visit the farm and interact with farmers but the kind of relationship has become closer to a commercial one. In other words, a commercial relationship (vendor-customer) with the CSA modalities (paying in advance the produces).

This is something which is highlighted by these farms business orientation, now seeking for fewer but bigger and constant orders. Other activities or minor market channels are conceived as important for the branding of the farm, another aspect demonstrating the business perspective of their operations.

Communication and marketing are important aspects of the business as well. Completely different from other not organic or small farms, they rely on multiple channels as the word of mouth, a proprietary website, the WeChat official account, and the presence and advertising inside supermarkets.

As regarding their products, they are usually delivered in nice boxes to members of the community, already cleaned and prepared. In supermarkets or in shops, instead, they are usually well presented, perfectly looking, cleaned and perfectly

packed, with a final cost up to 3 to 4 times than the conventional one. There, the only information they can communicate to customers is through the label, showing the organic certification, but hiding all the story behind.

Fig.108 Organic certified products in a supermarket (Shanghai, 2019).



To conclude, semi-industrial farms are surely better than conventional ones because they do not rely on the use of chemicals and have a more direct relationship with customers. However, in China, due to the low restrictions over the production methods (also the organic), still few substances can be legally used. Hence, it is up to the farm itself to decide whether to use it or not. Also, using completely cleaned and natural substances or not, these big farms are based on the same economy of the scale model, relying on huge quantities of external inputs to be able to possibly obtain outputs possible able to satisfy an increasing demand of organic food.

*The beyond organic system has
been individuated as a promising
sustainable design opportunity*

3.4.3 BEYOND ORGANIC

The other kind of system has been called “beyond” organic. This is a term which actually gathers together many different kinds of organic farming techniques.

Generally speaking, they all share a common feature: the refusal of the organic certification. The other kind of system has been called “beyond” organic. This is a term which actually gathers together many different kinds of organic farming techniques. Generally speaking, they all share a common feature: the refusal of the organic certification. Indeed, these other organic practices have been originated out of the establishment of USDA organic certification which pushed the original organic movement (that generated the organic industry) to re-invent itself by promoting practices which were beyond the ones permitted by the certification. Regenerative organic and biodynamic are two examples of such kind of different practices that have been generated and become popular within the beyond organic movement. All those farming techniques which, differently from the industrial organic farming, are based on a self-sustaining system which follows the cycles of nature and do not rely on the massive use of external inputs.

In China, this second system is composed by small farms (less than 2 hectares), growing small quantity of very different kinds of food, so that to use the plants to control and balance the harvests. They are usually not structured, nor well organized, with few facilities. What these farmers have are the fields, their plants, and a strong passion and belief in their practice as a truly sustainable production model for food.

“If you are a good farmer, you need to take care of each plant in the farm. If the farm is too big. Quality good food also comes from the hearth of the farmer. They really need to be very focused on what they grow, giving hearth, and time”. Tang, farmer and coordinator.

They are surely not wrong in that, as these practices are mainly voted to the conservation and cure of the what makes agriculture itself work: the soil. The downside, on the other hand, is the long period of time before getting the fields produce an output comparable to the conventional cultivations (see Research Background).

The beyond organic farms do not rely on the conventional distribution of the food chain and they are strongly based on the CSA model, as their primary, and often solely, revenue stream. Even in this case, the farmers prefer to be independent from the wholesale market because of an economic and principle reason. Not having (nor wanting) any certifications forced them not to pass through the wholesale market since this would imposes the fixed prices of the conventionally produced food. However, beyond organically produced food is more labor intensive, resulting in slightly higher costs, and, thus, these farms cannot economically survive in the conventional market.

This is the reason why they strongly rely on the members of their community (CSA).

This is also the reason why the relationship between the farms and their members is usually much stronger and closer than the semi-industrial one. The author actually entered in one of such communities (Tang's farm) and witnessed it in first person.

“Relationships and trust are the base. Only by knowing each other and visiting the farm, members can see how we farm and understand the value and health of the food”. Tang, farmer and coordinator.

Of course, this strong bond is also the result of the real interest of members (or potential customers) in alternative produced food. This usually means that these CSA are sustained by already informed, or expert, people, who know the value of this food.

This is also caused by the few resources that these small farms have, both for the marketing and the communication. Indeed, the main marketing mean is the word of mouth, initiated by the members within their social circle. For the communication, as well as for the management of the orders and the community itself, the averagely used channel is WeChat.

Through WeChat groups and mini programs (WeChat light softwares launched inside WeChat), the food is ordered and, hence, distributed.

“it's very difficult to find new customers because they usually do not know why organic is better and healthy, and because we do to have much resources to promote the farm”. Tang, farmer and coordinator.

As for the products appearance, they are usually not beautiful as they may be in

Fig.109 Beyond organic products delivered at home (Shanghai, 2019).



supermarkets. They have scratches, strange shapes, over-sized dimension, and some soil residues. This is due to the fact that the relationship between the farmers and the community members is closer to the one of the first CSA model-based farms, where members have a stronger involvement in the production. In the case of the author's community, the produces are not completely cleaned or prepared so that to lighten the work of the farmer and to share it with the community.

Because of the more sustainability aspects related to these kind of system, it has been recognized as a more promising opportunity to focus on.

3.5 BEYOND ORGANIC MARKET ANALYSIS

To conclude my research about the organic context and collect more pieces of evidence from the restaurants' side, it was decided to analyze the already existing organic restaurant chains in Shanghai. Inspired by the case study of The Hunter Gatherer, the analysis covered other two chains, assessing the interiors and exteriors of the shops, the menu with its dishes and its costs, and their way of communicate. After the description of those observations, some common insights were drawn and presented.

Hence, this chapter will answer to the four questions of the inquisitive framework, used as a reference to conduct the actors' validation and market analysis activities. Thanks to that, it was possible to develop a refined concept, based on a more mature and complete understanding of the context, its actors, and dynamics.

3.5.1 ORGANIC RESTAURANT CHAINS ANALYSIS

Inspired by the case study of the restaurant aiming to build its own farm to table chain, it has been decided to deepen its analysis, as well as the analysis of the other (few) well-known restaurants chains in Shanghai. This investigation aimed to examine the market and to understand the strengths and the weaknesses of such running and successful businesses.

As for the restaurant observations conducted during the preliminary field research, even in this case, a framework to guide the research was established before the visits. This time less-detailed, the framework focused on the observation of the exteriors and the interiors of the restaurants, their menu, their dishes, and the final price (plus other peculiar characteristics that could be found there).

THE HUNTER GATHERER OBSERVATION

The Hunter Gatherer is surely one of the most complete restaurant chains, in terms of branding, communication and physical store. Also, it is the restaurant chain with

the highest number of shops. The restaurant examined is the one located inside the Hubindao, a mall in downtown Shanghai. The shop offers different spaces. At the entrance, there are small tables mainly aimed to chill out and relax while drinking smoothies or a cappuccino. Inside, instead, in a cozy space, there are bigger tables aimed to consume a meal. Besides there is their shop, which is managed in collaboration with Yimishiji. The shop exhibits a mix of fresh and packed food, local and imported one.

Fig.110 The Hunter Gatherer at Hubindao (Shanghai, 2019).



As for the menu, only a couple of pages describes the kitchen and the concept of the restaurant. However, they are exhaustive to have an idea of what is going to be eaten.

The choice of dishes is quite wide, with a style-oriented cuisine. The majority of the dishes are, indeed, meant to be consumed individually, rather than in the more common Chinese setting (eating by sharing).

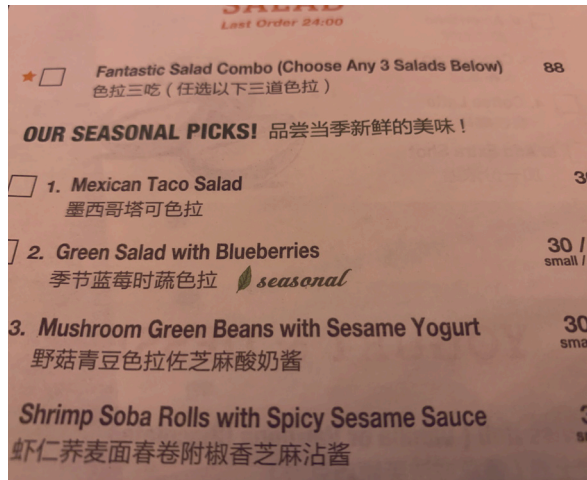
GREEN & SAFE OBSERVATIONS

The second chain object of the analysis was Green&Safe. Two shops were visited, both in downtown Shanghai. They both present similarities with The Hunter Gatherer, in terms of appearances and the menu. In both the shops, the appearance was very cured. The arrangement of the tables was mixed and distributed all around, creating a chill but noisy atmosphere.

Also, as for the other chain, close to the entrance, there was a display of the products of their market. Even in this case, the products were a mix of fresh and imported ones, most of them frozen. However the menu contains much less information, displaying only some labels with misleading or absent meaning, nor the staff was prepared to answer questions related to it.

Fig.111 Green & Safe at Xintiandi (Shanghai, 2019).





The menu, similarly to The Hunter Gatherer, presented a wide selection of western-inspired dishes, mostly to be consumed individually.

The dishes were well presented and served, with a mix of ingredients, more reasonable quantities and at a cost similar to the previously analyzed chain.

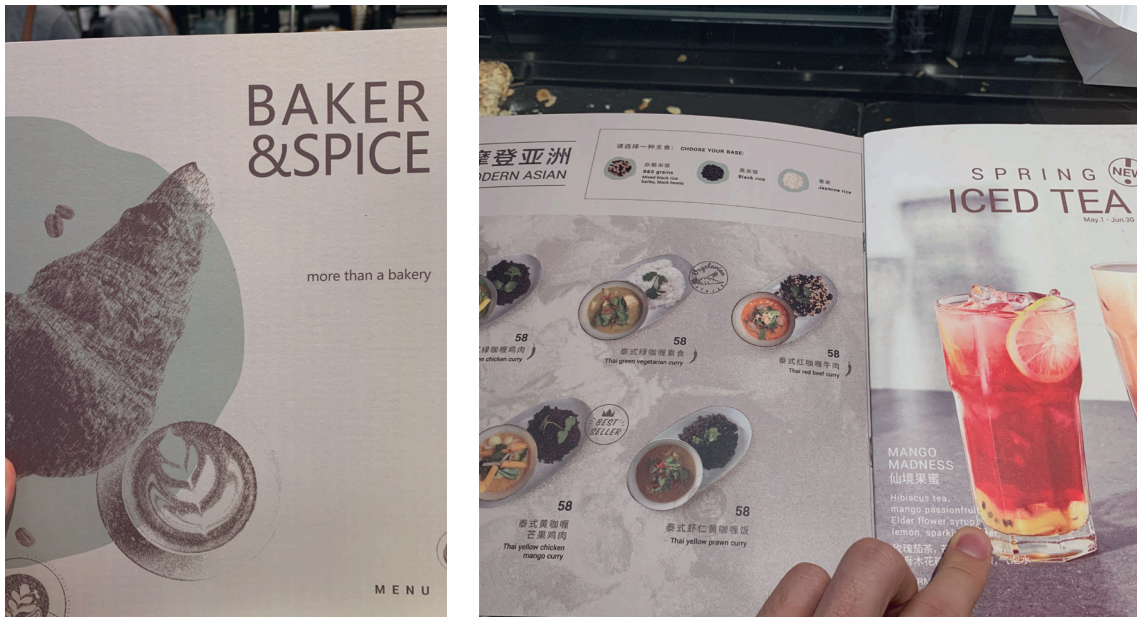
BAKER AND SPICE OBSERVATIONS

The last chain that was analyzed was Baker and Spice, which differently from the previous two, is more a cozy cafe rather than a restaurant. Indeed, it mainly offers breakfast and bakery products, to be accompanied by a cafe or a smoothy. However, the communication style and the kind of business organization were pretty similar to the other chains. Also, it presented a similar pattern of tables typology and distribution, except for not having an internal market.

Although this chain does not promote itself as organic, its menu also contains a section offering dishes similar to the other chains. In this case, the main dishes are in few numbers and more Asian oriented, yet they are meant to be consumed individually as well.

No particular information were offered about the production of the food or the concept of the restaurant.

Fig.112 The menu of Baker and Spice at LuOne (Shanghai, 2019).



INSIGHTS

Based on the observations of the organic restaurant chains in Shanghai, some common patterns or features were recognized. First of all, their menu is in each case very well designed but it does not contain much information related to the food and it presents the same dishes all year round. Rather than telling the story of the food, the information shown in the menu are rather functional or for obvious marketing reasons.

Indeed, very often the icons stand for "seasonal" or "vegan" without actually explicating their real meaning. Also, as we mentioned, there are not seasonal dishes, since they do not change over the year. Moreover, the ingredients that they use are not local, as it is easy to find salmon in every menu or some kinds of meat which is explicitly imported. Therefore, it is obvious that these chains, averagely, offer organic food driven by the market opportunities, rather than a mission towards sustainable food, often offering a misleading communication about organic food.

"In general, I don't trust those organic restaurants because in the end, they are actually not that organic...indeed, they have the same menu all year round and they use not local ingredients, like the salmon. They should display seasonal products menu. So, I see it from the menu if to trust a restaurant or not". Juliette, CSA member.

The lack of good, truthful communication was supported by the products sold in their internal market. These products averagely show the same information of conventional ones, and, even when the products show more information, no information at all refer to the production techniques.

Finally, as regard their dishes, nothing bad can be said. Indeed, they present abundant portions of well-served food, heterogeneously composed. The price is equal to al the three chains analyzed and, even, the dishes themselves (and the ingredients) were quite similar. The very only critique that can be done is that the quantity of food per dish is unknown before it reaches the table. This may cause the generation of unwanted food waste.

3.6 SUSTAINABLE FOOD SYSTEM DEFINITION

Thanks to these research activities, it has been possible to build a consistent knowledge background behind the word "organic" and to possibly orientate the focus of the project towards these small farms operating by the principles or philosophy of the original organic movement, in fuller respect of the nature. Therefore, it has been possible to identify the behind organic food as design opportunity and consequently answer to the initial brief, by defining the most sustainable food system, possibly able to represent a valuable alternative to the current one.

The most sustainable food system in Shanghai is a system focused on "beyond" organic food, produced locally and made available with the minimum number of processing operations and intermediates.

3.7 ANALYSIS OF BEST PRACTICES

This chapter will present a brief list of case studies, representing interesting examples close to the author's definition of the most sustainable food system. Each case study shows peculiar characteristics, which may inform and inspire the conceptual, creative phase. They are all based in China, in particular in Shanghai, so that to understand how a system, close to the defined one, can take place and happens. The first case is related to a popular restaurant chain in Shanghai, offering organic certified food; the second is a hub installed in a rural area of Shanghai, generation multiple initiatives related to the food and the territory; the third is an online platform selling the products of selected farms to consumers; the last one is a conceptual project of a hub in the city of Shanghai, experimenting new ways of producing food and involving the local community.

All these cases have been selected as representative of organic small distribution and consumption system.

THE HUNTER GATHERER



Hunter Gatherer is a restaurant and retail food space, opened in 2014, built around a transparent supply chain, from farm to table to grocery shelves. It offers "real food": the ingredients are chemical-free and come from known and trusted sources (they also set up 2 organic farms). If not consumed on the table, the real food can be purchased in their marketplace, inside their restaurants. Although it is currently physical, they plan to launch it online to reach more customers and to create trust with them.

Mission: serve people real food and help build a more local and sustainable food system in Shanghai and beyond

Target(s): Shanghainese middle (wealthy) class

Stakeholders: restaurant owners and staff, farmers, Shanghai citizens, (other) "real food" producers

Takeaways: vertically integrated supply chain, strong brand identity

Downsides: low customer involvement which results in a weak education over food consumption and production

<https://www.behuntergatherer.com>

DESIGN HARVESTS



Design Harvest is an open, innovative platform to link urban and rural area, designed and funded by Tongji University and launched in 2007. As an open and innovative platform, Design Harvests is coordinating the participants in the project, including the local government of Chongming Island, village communities, entrepreneurs and university resources to establish a connected product and service system between urban and rural area including healthy food, agricultural tourism, natural experience, and local art. This project not only offers local and healthy food to citizens but also brings people from cities to experience a more sustainable way of living and producing in rural areas.

Mission: connecting urban and rural areas, by leveraging on and strengthening the local resources

Target(s): local farmers and Shanghai citizens

Stakeholders: farmers, Shanghai citizens, local government, entrepreneurs, university

Takeaways: wide stakeholders involvement

Downsides: poor participation of citizens over the long term due to the distance to the city

<https://www.desisnetwork.org>

YIMISHIJI



Yimishiji is a service connecting Chinese organic farmers to consumers. Opened in 2015 in Shanghai, Yimishiji focuses on transparency, providing details about each farmer and their farms, along with results from lab testing to prove the products are free of chemicals, rather than an organic label. The goal of the service is to create the first farm-to-table e-commerce platform that not only sells organic produce but also educates consumers about food through a transparent supply chain and a smooth user experience. Hence, inspiring more conscious eating behaviors. Indeed, the website publishes the address of each farm it works with, and it also organizes farm visits for its subscribers to build trust and encourage them to think about where their food comes from.

Mission: providing healthy and safe food while educating toward its consumption

Target(s): Shanghainese middle (wealthy) class

Stakeholders: farmers, Shanghai citizens, test labs

Takeaways: strong community involvement to ensure trust, continuous controls over the farms

Downsides: not local producers involvement

<https://www.yimishiji.com>

SUNQIAO URBAN AGRICULTURAL DISTRICT



Sunqiao Urban Agricultural District is the conceptual city plan of a 250-acre agricultural district, which will function as a space to work, live, shop, and farm food, located in a suburb of Shanghai. The masterplan was conceived by Sasaki, as part of a larger plan to turn a portion of the city into an agri-tech hub. Like other cities in China, the rapid growth is threatening the long-established production system of smaller-scale production units located in the peri-urban landscape, resulting in a significant loss of agricultural land within city limits. Sunqiao aims to contrast the transformation of the land into urban areas, by vertical farms that grow fruit and vegetables. The concept, indeed, which will be brought to life in 2020.

Mission: shifting the trend of urbanization and agricultural operations moving away from the city

Target(s): Shanghainese middle (wealthy) class

Stakeholders: Shanghai citizens, local government, entrepreneurs, maintainers.

Takeaways: city hub experimenting new ways of food production, integrated into the city tissues

Downsides: (probably) the low quantity of food produced, able to satisfy few people/families

<http://www.sasaki.com/project/417/sunqiao-urban-agricultural-district/>

3.8 DEFINING THE SUSTAINABLE PRIORITIES

In order to design a Sustainable Product Service System, as specified in the methodology and in its dedicated chapter of the research background, the investigation has been narrowed down towards the sustainable priorities. Those have been the guidelines that informed the following design activities. Indeed, the previously collected insights have been generated from activities based on research questions that included both the topics of food and its conscious consumption, and food production. This allowed to go further and analyze research results in relation to the three dimensions of sustainability: environmental, social and economic.

Hereinafter, the chapter will present the assessment of the priorities, describing the ones selected as most relevant (or urgent) to intervene on.

ENVIRONMENTAL SUSTAINABILITY

Research results highlighted that the most important variable within the environmental dimension regards the lifespan of products, in this case of food, and the toxicity related to its production methods. Indeed, there are multiple stages where the food can be spoiled, wasted or lost. The least parts of a given food are used, the least the chances to waste it. On the other hand, the less the intensity of use of the food, the higher the chances to waste it. If food gets wasted quickly, or even before its intended end, other food needs to be produced, distributed and, generally, cooked (including the energies and resources needed for the production, which has already been demonstrated to be the most impactful step of the food supply chain).

In the current system, the food does get used/consumed not intensively, when it does not get wasted or lost during the phases of production and distribution (considering the different levels of it).

Also, but for similar reasons, lowering the chemicals and the poisons involved in the production of the food is clearly necessary. China's agriculture is highly polluting the lands and the water reserves, considering the high amount of chemicals the farmers use in the conventional practice.

This would ensure not only safe food (and avoid future food scandals) but also the capacity of the land to produce food in the future, and, thus, it would ensure food security.

SOCIAL SUSTAINABILITY

As regards the social dimension of sustainability, a high priority has been assigned to enabling a responsible/sustainable consumption and empower/valorize local resources. The former is important because it has been reported during the research that Chinese consumers, today, waste huge quantities of food especially at restaurants. The causes are lack of awareness of food waste and healthy food. Simply educating is not sufficient, since there are already some organizations (sometimes also supported by the government) working on that but with limited results. The intervention needs to be done not only on an informative level but also on a practical one, i.e. together with education, it is necessary to give the tools and the concrete possibility to consume more consciously. Better consuming would result in fewer costs, economic and environmental ones. Also, as for environmental sustainability, wasting food causes new food to get produced quicker, and, thus, an intensive use of new energies and resources needed for the production.

The latter, instead, is relevant because, to keep up with its growth, the city needs to be self-sustaining as much as possible. The trend is towards huge megacities and, in the author's opinion, such cities cannot rely on external sources of energies or resources because otherwise fated to collapse. Therefore, it is fundamental for a city to invest and push its potentialities, even for the food and its production. Valorizing the local realities would also benefit the social conditions of less powerful people, generating value and work for them. Also, but for similar reasons, lowering the chemicals and the poisons involved in the production of food is necessary. China's agriculture is highly polluting the lands and the water reserves, considering the high amount of chemicals the farmers use in the conventional practice. This would ensure not only safe food but also the capacity of the land to produce food in the future, and, thus, it would ensure food security.

Fig.117 The chosen sustainability priorities



4 SYSTEM CONCEPT DESIGN

“Designing system concepts” is the name of the third stage of the MSDS process, aimed to conceive and explore different ideas of promising new systems, and to select the most promising one. This chapter, hence, will show the creative process which brought to the final concept, described in the next chapter. The process has been very iterative, as, once a promising direction was taken, other research activities were conducted to deepen the knowledge related to it.

The process, indeed, started with a first question, aimed to trigger the generation of possible solutions, able to offer a concrete solution to the system framework previously defined. The definition of the sustainable food system played an important role. It has to be observed that, that definition, although answering the initial brief, does not specify how the system could really work. After the initial

ideas generation, the first general concept was developed. In order to better define it and understand its potentiality, a second round of interviews with the main actor of the concept was scheduled. The activity was truly useful and led to the definition of a second, more refined concept. Still, the concept lacked clear definitions and involvement of the other actors of the new, proposed system. Therefore, it has been decided to iterate the research process and to conduct a detailed research together with the involvement of the actors.

With these information, it has been possible to map the specific actors involved in the system and to recognize their main problems. The conducted activities also led to the definition of the final concept.

This chapter will describe in details this process, and its activities, and it will conclude with the statement of the final concept.

4.1

IDEAS GENERATION AND CONCEPT DRAFTS

Making a step back, the design brief, described during the strategic analysis was formulated as "Define and foster the most sustainable food system in Shanghai, able to induce the consumer to a good behavior". The answer to this query, found during that research, was a system focused on beyond organic food, harvested and sourced locally, made available with the minimum number of processing operations and intermediates (steps or people).

Starting from this definition, the first activity that it was decided to do was an individual brainstorming and brainsketching session. In order to be able to conduct such a session, it was fundamental to ask the right question. Indeed, the definition of the sustainable system was quite general and simply offered the guidelines for the development of a more concrete idea.

Therefore, a first round of "What if?" question was conducted. Out of this preliminary session, a promising intuition came to the mind.

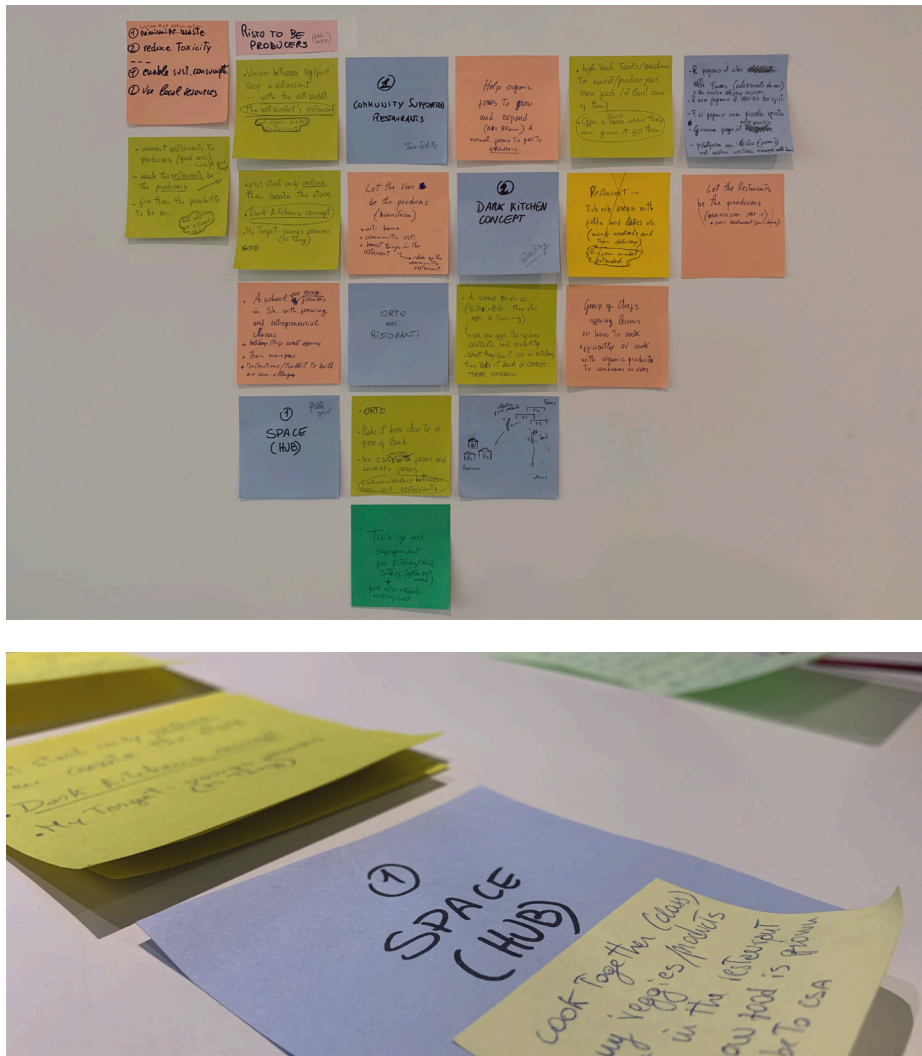
"What if the producer becomes the restaurant (and vice versa)?"

This question contained promising aspects. Indeed, since the sustainable system entailed the minimum number of steps between the producers and the restaurant, the intuition was removing ALL the steps in between, making the producers becoming the restaurant itself, so that to reach more potential customers. Of course, this was only an initial inspiration. Indeed, it was chosen as a question to trigger the brainstorming session.

Out of the creative session, three, in particular, were the ideas worth to explore a little bit better. They were the result of conceptual clustering among all the ideas produced, and once selected, a deeper individual exploration was conducted.

The three interesting concepts were "Community Supported Restaurant", "Kitchen cloud concept", and "Sustainable food hub".

Fig.118 Brainstorming session and ideas clustering.



The first idea consisted of reversing the concept of the CSA, applying it to restaurants rather than to farms. Hence, the concept was a community space (popular in China as spaces or building owned by the government but given to the neighborhood community for social-related activities and services), able to produce its own food or to gather the food from beyond organic producers, and to make it available for the community. Members, indeed, sponsored and supported it by paying in advance and then having the possibility to go this place and cook them by themselves or have it cooked by the staff.

The second idea (Kitchen cloud concept) consisted of the adoption of the homonymous concept but exclusively targeted to farmers. The concept, indeed, consisted of a space in the city where farmers could bring their products and cook them in shared kitchen, so that to sell it on one of the food delivery platforms. Considering the inexperience of farmers running a restaurant business, the space could also offer training and consultancy services. After an initial period of trial selling through deliveries, farmers could finally be supported to set up and open their own restaurant in the city.

The third idea (Sustainable food hub) consisted of a network of spaces offering different services and spreading awareness about food and its consumption. Both farmers and chefs could use the facilities of the space to cook for customers, pushed to visit the hub by ongoing activities and events, aimed to spread food education. Differently from the previous concept, in addition to cooking classes and training, the hub also presented a marketplace where farmers could exhibit and sell their products. Hence, in this case farmers were taking less the role of chefs and more their own one.

In order to advance in the concept development, the second idea was chosen as most promising one. However, it was decided to integrate also some interesting aspects of the other two ideas. Therefore, a very first concept was formulated, trying to express the ideas behind those three initial ones:

a service helping organic farmers to grow and market their products by entering the restaurant industry and getting the consumers closer to them, by offering different services, as training, supporting, marketing, consultancy, and engagement.

As it is possible to notice, this initial concept was obviously general and very wide. Compared to the three starting ideas, no promising aspects were worth to be excluded, considering the initial stage of the creative session.

However, because of its wideness, it was fundamental to explore it further together with its main target: the farmers. Indeed, being very wide and not defined, the first concept needed to be discussed and better explored together with the farmers, the target of the idea. Before presenting the idea to them, the concept was slightly more elaborated and presented by describing it more.

The concept was described as an idea able to create a connection between organic farmers, restaurants and consumers, based on transparency and engagement.

Consumers can have complete information about the restaurants and its food (where it comes from) and about the farms and can get in touch with them (by visiting the farms and do activities there);

Restaurants can get in contact with the organic farmers (so that they can start buying from them) and attract new consumers;

Farmers have finally easier access to the market and its consumers and to the restaurant industry.

To showcase their products to both restaurants and consumers, farmers can have access to the kitchen of the restaurants (for one night, for instance) and cook their products for the consumers.

In this way, the organic farmers can more easily find new consumers and restaurants clients (which is one of the pain points for organic farms) and engage more deeply with them by these cooking showcases and visits to their farms. Consumers can have easier access to trustworthy and real organic food, can be more engaged by the visits to the farms and product showcases (and so better understand the value of this food) and discover new restaurants. Restaurants can be strongly advertised as good food restaurants and start a new supply contract with trustworthy organic producers.

Fig.119 First concept discussion with the two farmers.



4.1.1 FARMERS VALIDATION

In order to better clarify the direction of the concept, the two farmers interviewed during the previous research were contacted again, this second time only via phone call.

JANE, BIO FARM COORDINATOR

Because the concept could have been applied also to every kind of organic farm, the investigation started with Jane. Once she heard the idea, she was pretty positive about it. Indeed, she stated that restaurants could be a good meeting point to show off the products of the farm and make them try. However, she believed this could better fit small and medium-size farms, not a big one as Bio Farm.

As a matter of facts and as already reported, big farms seek for fewer but bigger and constant orders. Being a restaurant for spot occasions would not impact significantly their business. On the other hand, she recognized that it would be a very nice but also powerful activity for the branding of the farm, rather than for the business. Also, about the system, she believed that a sustainable food system is still a long way to go but it could be fostered by supporting small local farms. An example could be a platform aimed to showcase and show off their products, especially targeting small/medium local restaurants that need quality rather than quantity (no chains but strong brands, niche places).

Finally, she noted that, while commonly consumers want to know some stories from the producers of the food that they are consuming, is not necessary for farmers to come to the restaurant. Indeed, farmers sometimes are not good speakers or good chefs, and if they improvised as such, it may be even worse. She suggested making people do what they are good at.

TANG, FARMER AND FARM COORDINATOR

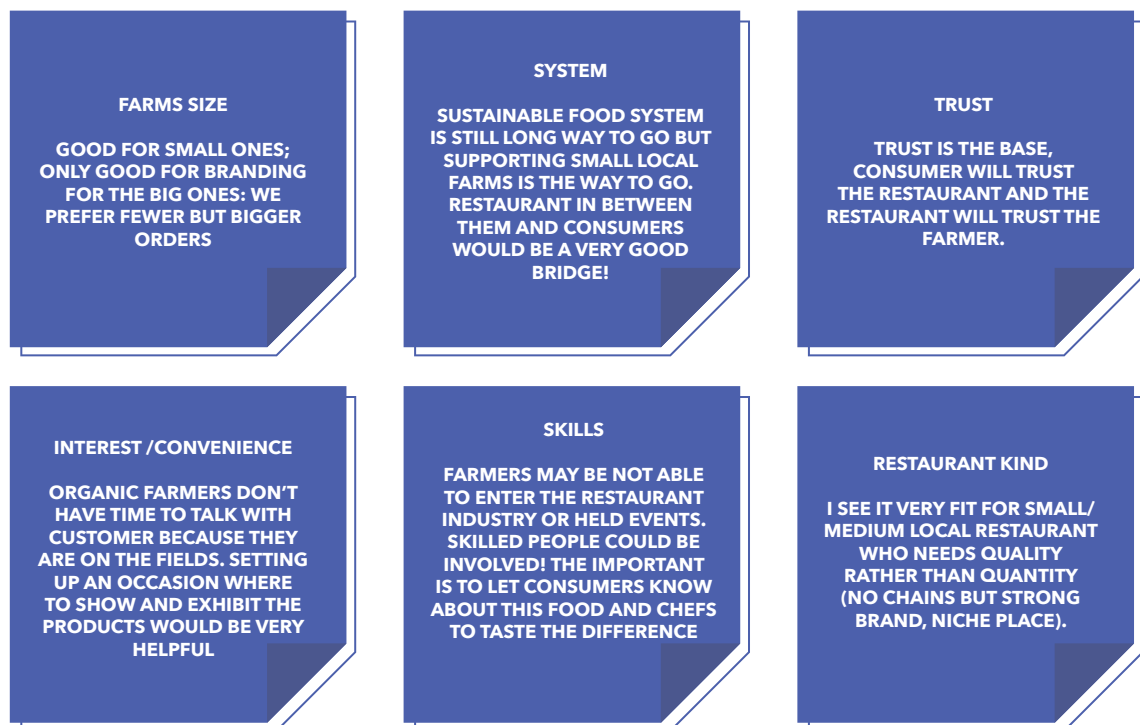
The second interview was conducted with the farmer of the CSA the author joined in his staying in Shanghai: Tang.

Considering the suggestions received during the previous interview, Tang was very enthusiast about the general idea. In her opinion, restaurant in between the farm and the consumers or members would be a very good bridge. Indeed, according to her, the staff or the chef can really say to consumers why that food is really healthy and good for them, and the chef, in turn, can really taste the difference between good and bad food. The idea is promising since organic farmers usually do not have enough time to talk with customers because they are on the fields. Setting up an occasion where farmers can show up and exhibit the products would be interesting/helpful.

Rather than focusing on who cooks, the important is to let the consumer knows that the food is good and where it comes from (that is organic). This implies that education would play a fundamental role in this framework.

Finally, she concluded by noticing that in the US there are restaurants which are very transparent about their products, stating which food come from which farms. She believed this way to be promising and correct but uncertain if, in China, consumers would trust what the restaurant says. Trust would be a fundamental issue.

Fig.120 Insights from the second round of interviews with the farmers.



4.1.2 SECOND CONCEPT

Based on these insights and farmers' suggestions, it was possible to better define the concept as:

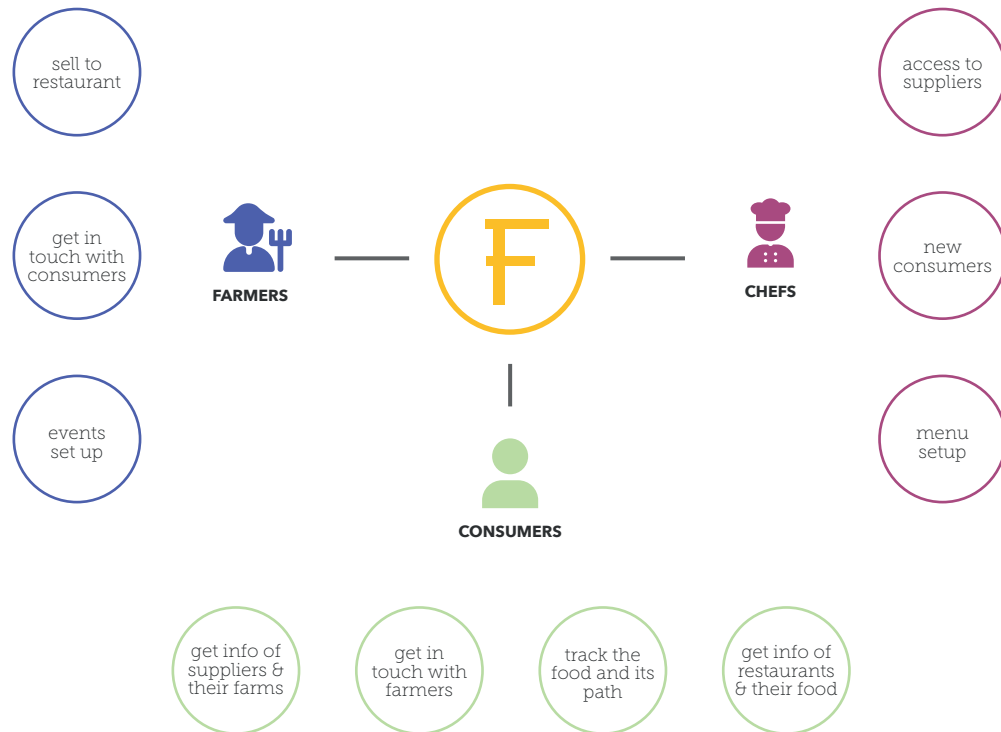
“FarmsCook, a service which allows local beyond organic farmers to sell their products to restaurants, build a trustworthy relationship among them and enable consumers to a good consumption, through a platform”.

The name was pure inspiration from the previous phase, but also a powerful mean of concept communication. Indeed, the idea was to make restaurants use organic food and to arrange spot events where both consumers and chefs could get in touch with the farmers. Moreover, through the “F” platform, consumers can access all the info related to the farmers, their products and the restaurants using their food, and get in touch with them through the FarmsCook events. Farmers can easily market their products to chefs and showcase them to consumers. Chefs can reliably buy organic products and attract new customers accordingly.

The conceptual solution was consistent with the sustainable system definitions as the concept aims to foster a sustainable food system in Shanghai, based on organic product and with the least number of transformation and intermediate steps, enabling the consumer to a good consumption. The target of such a platform or severe were firstly small/medium size organic farms (up to 5 hectares), small/medium size local restaurants (no chains), and mid to high level Informed, wealthy urban consumers.

Fig.121 The main actors' problems (farmer, consumers, chefs) and the offering map of the concept.





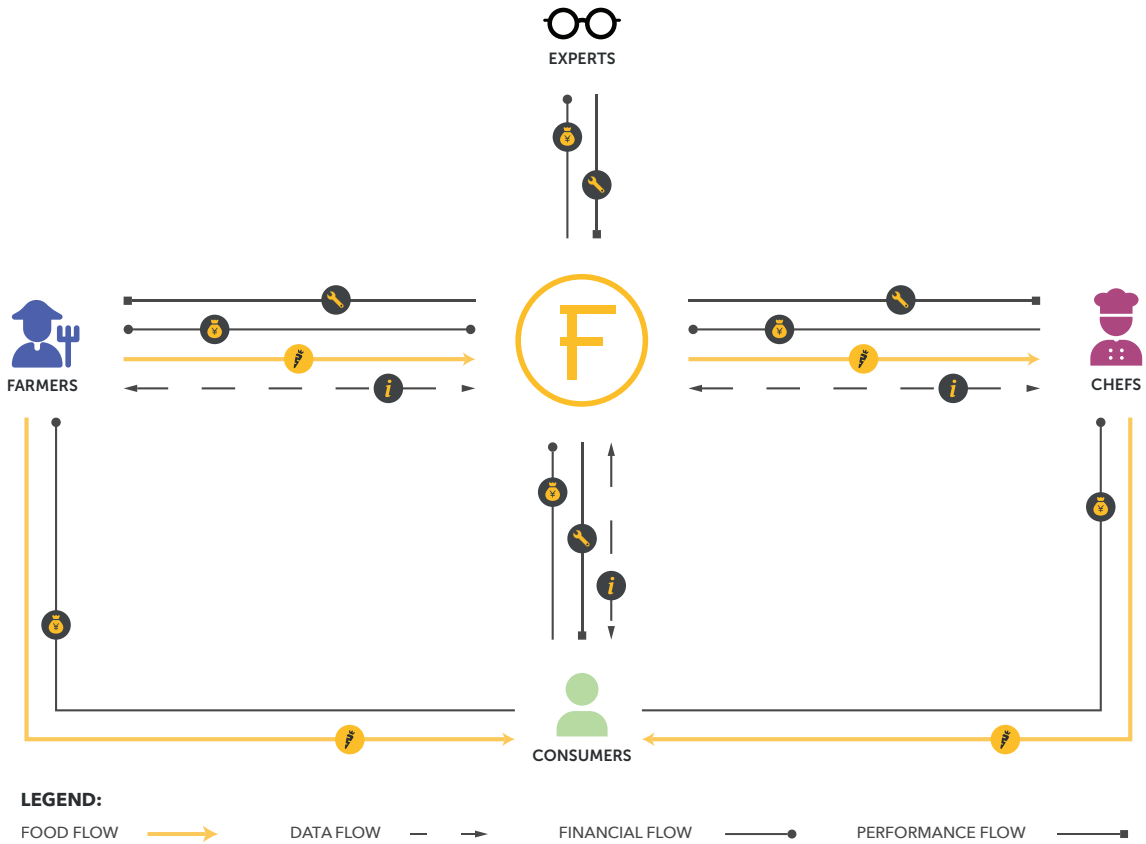
As it is possible to notice, the map shows the services offered to the three main actors of the system, solving their main issues. Starting from the left, thanks to FarmsCook farmers can sell their products to restaurants, getting in touch with consumers, and be supported in setting up the event in a restaurant.

Chefs have access to the suppliers, attracting new clients, and receive support in setting up the menu. Finally, consumers can get in touch with farmers, getting information about both suppliers and their farms and the restaurants' food, and tracking down the path of the food (transparent chain).

The kind of design intervention on the concept was double. On the one hand, the focus was on the macro-level (the system), composed by the relationships, exchanges and interactions between the actors of the system; on the other, the focus was on the micro-level (the details), as the services offered (events and menu arrangement) and the interaction with the platform.

As for the macro level, the relationships between the actors were visualized in the map in the next page.

Fig.122 System map of the concept.



The map shows four kinds of interaction or exchanges: the food flow, the information (data) flow, the economic flow, and the performance flow.

In order to make people do what they are good at, a fourth kind of actor was involved in the system: the experts, helping to organize or managing the spot events.

As for the economic flow, FarmsCook would earn money both from the farmers, the restaurants and the consumers, as a fee per order. Also, another revenue stream was represented by the single events or services (as the menu setup) organization. Consumers would receive information and the possibility to join the organized events; farmers would receive the access to new clients, both restaurants and consumers (during the visits to their farms); restaurants would receive the access to the suppliers and to a growing community of consumers interested in the food offering. The information would have been a common tread to all the actors of the system, ensuring trust at 360 degrees.

Instead, as for the micro-level, the elements to consider and design would have

been the events, including the “FarmsCook night” (the farmer is hosted in a restaurant to showcase/ cook his products), and the farm visits, aimed to build trust with consumers. Besides, also the menu would have been designed, considering it digital, with walkthrough and suggestions for ordering the dishes, and the display of nutrition/waste-related information. In other words, a menu that could facilitate consumers to waste less.

This second refined version of the concept was surely more structured than the previous attempts. However, it still lacked clear definitions and, above all, contributions from the other main actors of the system. That is why it was fundamental to conduct a second round of interviews (a third with farmers) with those actors, to discuss the concept itself and, when possible, arranging co-design activities with them.

4.2 CONCEPT CO-DESIGN: ACTORS' FEEDBACKS

The second concept that was generated after a second round of interviews with farmers still lacked clear definitions and, above all, of contributions from the other actors involved in the new proposed system. Considering that the focus of the field research was not organic food (it was simply one examined part), it was fundamental to deepen the knowledge about the organic context, figuring out the main actors and their problems in greater details, than what was done until that point. Therefore, in order to further develop the concept, different research activities were arranged and conducted, accompanied by a desk and literature research (see Research Background).

If the activities related to the validation of the concept differed from actor to actor (involved), the investigation aimed to deepen the knowledge about the organic context was based on a common inquisitive framework. The framework was based on four questions which were answered during the elaboration of the last collected information. Of course, those four questions guided and shaped each activity's design. In other words, the interviews and the other activities were designed to answer those four questions, useful for building a complete understanding of the organic context.

4.2.1 ROUND TABLE WITH CSA MEMBERS AND FARMERS

In order to better analyze the context of organic food, a round table with the members of the author's CSA and their farmers was arranged in a cafe in downtown Shanghai. The activity was structured in a very informal setting in three different sections. In the first one, the members discussed altogether with the farmers to get to know which issues the community was having, not only in relation to the food, but also in relation to members' involvement and members' turnover. This was an opportunity to understand better the internal dynamics of such a community and scout the possible hidden needs or problems of both the groups.

The second part was dedicated to a double interview to two members of the CSA, aimed to understand their motivations behind the choice of joining the community and their behaviors inside and outside the community itself.

The last part was a third, brief interview with the farmers, aimed to better grasp their issues or problems in managing the community and the produces.

Fig.123 Round table with farmers and the community members at Voce Cafè (25/05/19, Shanghai).



GROUP INSIGHTS

By discussing altogether, it was possible to found out that members reported some issues with the state of the product they received, as if sometimes it was too early or too late (the food ripened quickly). Farmers, on their side, reported having some troubles in sending the exact quantity of products in perfect conditions because of the different harvesting time of different plants. Also, they were struggling to find a trustable and quality delivery service not excessively expensive.

Finally, both the parties were lacking a sense of participation and involvement in the community, i.e. both members and farmers wanted to engage more with each other.

The discussion brought many positive things, among which some ideas to overcome the issues. Indeed, it was decided to lighten the work of the farmers by making them send the products only slightly cleaned, to try to deliver the products twice a week so that to be able to ship the food in the best moment, and to set up a WeChat account to communicate and send updates of the activities happening at the farm (thoughts, poems, pictures, new produces, recipes,...).

MEMBERS INSIGHTS

The two interviewed members of the community were Juliette, 32 y.o. French, living and working in China for 7 years, and Elise, 42 y.o. French, living and working in China for 4 years, divorced with a 6 y.o. kid.

The questions asked were about their relationship with the CSA farm and product, and their eating behavior. They first got to know the farm by word of mouth, thanks to friends. They both place authenticity in the first place when it came to the trust issue. Indeed, they said that they can trust the farmers and their products by the products themselves (they find insects, there is still a little of soil, they perish after a very few time), and secondly by going to the farm and see how the products are grown and talk with the farmers. Thus, relationships are the key.

This kind of close relationship is something they could not find in other bigger organic farms in Shanghai.

As regards their eating behaviors when they go to the restaurant, that they actually do not look that much if the food is organic or not. Yet, once there they would pay more for safe and quality food, as long as they could trust the source. Again, a matter of talking with the chef or with the producer to establish a relationship.

FARMERS INSIGHTS

The focus of the third interview with Tang was on their farming and community management issues. Differently from the previous times, in this occasion, the aim was to scout any possible technical issues afflicting the farmers, that could inspire a design solution or that could orientate the existing concept.

What the farmers (3 in total, including Tang) reported was that they have issues both in terms of quality and quantity. Indeed, it was clear the difficulty in balancing the quantity of products to deliver in each box and the right time to harvest them. Sometimes, indeed, they need to harvest produces which are not that ready or that could grow a bit more, or which are already a bit old.

To fix the problem, the key was found to be flexible, both in terms of the day (when the products are delivered) and of quantity (this time maybe 1.8kg, next time 2.2kg). Finally, as previously reported, they said that they lacked the involvement of the community as if the two were too distant and too rarely they meet each other. This was also one of the reasons why they concluded by saying that meeting halfway, as in a restaurant or a bar, could be a really good way to do it.

4.2.2 CONSUMERS ACTIVITIES

It was time to involve and interact with not CSA consumers. Different kinds of consumers were reached, with whom different activities were conducted.

CONSUMERS CO-DESIGN

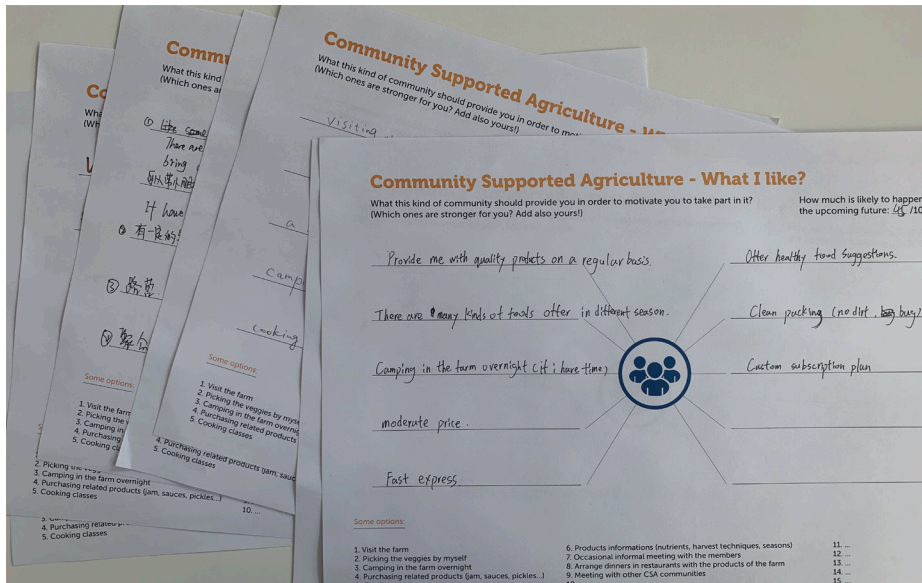
Together with the author's Chinese colleagues, two different activities were conducted. Such activities aimed to understand their level of knowledge related to food, and organic food in particular. The participants were all young Chinese, between 22 and 28 years old, two women and five men, both living with the family or alone in shared apartments. Only one had already her own family. All of them working in the creative industry. First of all, an introduction to the current organic food and the organic market was presented. Afterward, some questions were asked in order to know if they were familiar with the topic. Out of 7 people, only one knew some information about organic. In general, however, the interest in the topic was not that high. The reason for this low interest in organic is that they commonly said that they already trust the products on the market. Thus, talking or knowing the farmer would not be that important. They also considered that they are probably not that interested in organic since at the moment they do not place health in the first place, as the top priority. Finally, they said not to be interested also because they usually don't cook at home because they do not have the skills to do it.

Fig.124 Co-design activities with consumers at RONG, design agency (29/05/19, Shanghai).



Part 2: The process

Fig.125 The first co-design tool and the main insights



NOT INTERESTED OR AWARE CONSUMERS PREFER TO HAVE THE USUAL RELATIONSHIP BUSINESS-CLIENT

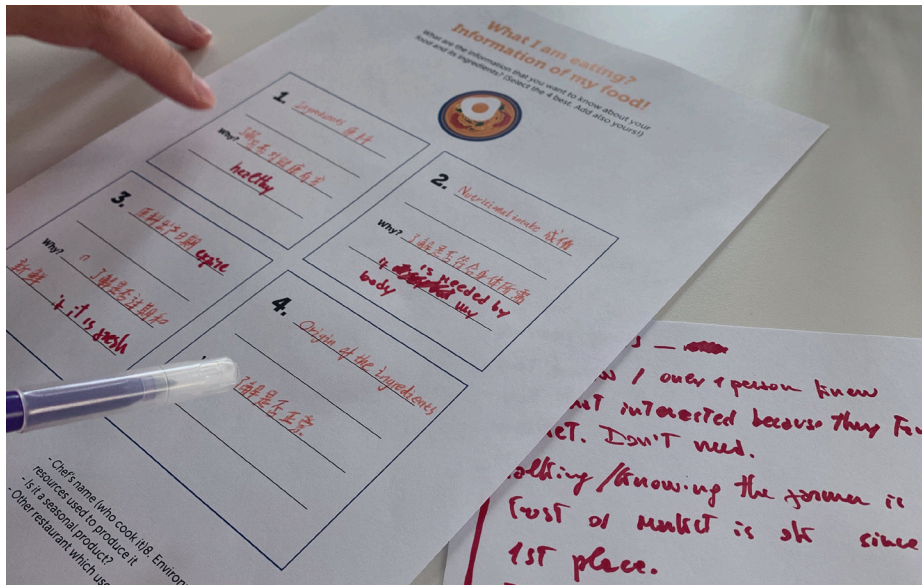
THEY WOULD NOT BE INTERESTED IN THE COMMUNITY BUT RATHER ON THE PRODUCTS

VISITING THE FARM AND LEARNING INFORMATION ABOUT THE FOOD AND HOW TO COOK IT ARE THE BEST AND MOST INTERESTING ACTIVITIES

The second tool was another card, asking for a ranking of the most needed information about the food that they eat. The card presented four different spaces where it was possible to write the needed information down. Even in this case, participants could fill the card on their own or by choosing between some suggestions at the bottom of the paper. Such a tool aimed to understand what kind of information was necessary for them to discover about organic food.

Full activities details are reported in the Appendix.

Fig.126 Second co-design tool and the main insights.



INGREDIENTS, EXPIRE DATE, ORIGIN AND INTAKE ARE THE 4 MOST PICKED INFORMATION

HEALTH AND AUTHENTICITY ARE THE TOP MOST IMPORTANT CONCERNS

HOWEVER THESE WANTED INFO AND CONCERNS ARE NOT RELATED TO THE PRODUCTION METHODS OF THE FOOD

THEY NEED LESS SPECIFIC INFORMATION TO MAKE THEM TRUST THE FOOD

CONSUMER INTERVIEW

The same day, an interview was conducted with Li, the boss of the design agency where the consumers previously mentioned worked. He is a 34 y.o. Chinese man, married with two young kids. Differently from previous interviews, the same introduction to the organic topic and the same cards were used to trigger the conversation. Li revealed to be very concerned about safe and healthy food since he was young. Also, it was found out that he was very informed about organic food and organic farms, in and around Shanghai.

Starting with the first card, he said that the most important activity which contains also the others is visiting the farm itself. From there, indeed, it is possible to conduct many other activities. He also suggested that the way to make these small farms succeed is through creating a movement and pushing the community to bring farms together to make the trend grow and become popular. Instead, as for the second card, he said that the most important info would be where the food is from and, therefore, where the farm is and how it operates.

These initial tools actually spurred a longer conversation. Indeed, also the concept (FarmsCook) was discussed and interesting points of view were registered.

First of all, Li believed that while promoting small organic farms is interesting and useful, it is difficult to supply restaurants because they usually have many costs, and, in case the cost would be transferred to the consumers, it will be too elite/premium. Also, he noted that because Chinese cuisine uses several spices, the quality of the food is particularly difficult to assess: the way organic food is eaten and cooked makes the difference. About the consumption of organic food at the restaurant, he acknowledged that he actually does not look specifically for organic restaurants, and that, when he goes there, he could trust a restaurant which says or writes that its food is organic but he cannot recognize it by eating.

Finally, he exposed his concerns about the events, where farmers join the chefs in their restaurants to showcase their products, stating that it risks to be invasive and not to respect the ritual of the meal.

Fig.127 Concept discussion and interview with Li, concerned and informed consumer (29/05/19, Shanghai).



4.2.3 RESTAURANT MANAGER INTERVIEW

A final second interview was conducted with Claire, the restaurant manager at Voce cafe, already interviewed during the strategic analysis. This interview focused on the concept, intending to understand the level of interest and feasibility of the idea. Also, to possibly grasp the issues that restaurants may face in offering organic food. The interview was conducted with the help of Zidi Bai, an author's Chinese colleague.

About the idea, she was quite positive about it, saying it was nice and feasible but she hardly admitted to conceiving that all their vegetables would be substituted by organic since many of their dishes are without veggies. At that moment, they were satisfied with their suppliers so that they would not change it. About the cost of organic food, she knew organic cost more but she said that the final cost would not be much higher (just a bit) since they would be more in contact with the producers. When asked if it would be possible to do/offer a seasonal menu to the consumers, she replied that having some seasonal products could be fine but that they prefer to have the main dishes constant all year round.

During the interview, it was also possible to discuss the transparency of the system and the supply, and Claire said that for them knowing and let customers know where the food comes from does not represent a problem since they already know where and what other restaurants nearby order and from whom.

Part 2: The process

What she also added was that having more than one suppliers would not be a problem as long as the products are then collected by a unique supplier. That means that they would be fine to receiving the food from different farms but that they would prefer to receive it as shipped from only one farm. The very last question was about the possibility of supporting the farm by paying some months in advance the produces and sharing the risks with the farmers. In other words, if they would be interested in entering a B2B CSA. She answered that even the restaurants have certain costs that would not allow for such kind of relationship.

As a conclusive reflection, it was possible to notice that restaurants as Voce have to find the organic farms/farmers and products out somehow, especially when they are already fine with their existing suppliers. Therefore, it is fundamental to convince or show them the difference and also the benefits of organic veggies (which are not only related to the taste or quality of the product but also to the distribution system, which would be much closer than the average).

Fig.128 Concept discussion and interview with Claire, Voce Café restaurant manager (01/06/19, Shanghai).



4.2.4 INSIGHTS ELABORATION

Once all the available information were collected, it was the time to elaborate on them. In order to do it, an inquisitive framework was used. However, before being able to effectively use it, it was fundamental to recognize “groups” the actors interviewed could belong to. This operation was useful to reflect on the activities just conducted and to distinguish patterns of behavior, motivations and thinking, that could simplify and order the results of the analysis.

Indeed, by going into details with the organic market, the 2 main kinds of organic farm, already described during the definition of the opportunity, were distinguished: (usually) small beyond organic farms (without a certification and closer to the organic principles), and big (industrial or semi-industrial) farms (usually with the certification). Then, it was also possible to define 3 kinds of consumers: not informed but concerned, informed and concerned, and expert consumers.

The first two kinds of consumers are people who are concerned with their health or who value the importance of food but who have a different level of knowledge about it. That is why they were divided into informed and not informed. The third kind, on the other hand, is represented by people who are already in the organic context and already consuming this kind of food (as members of a CSA).

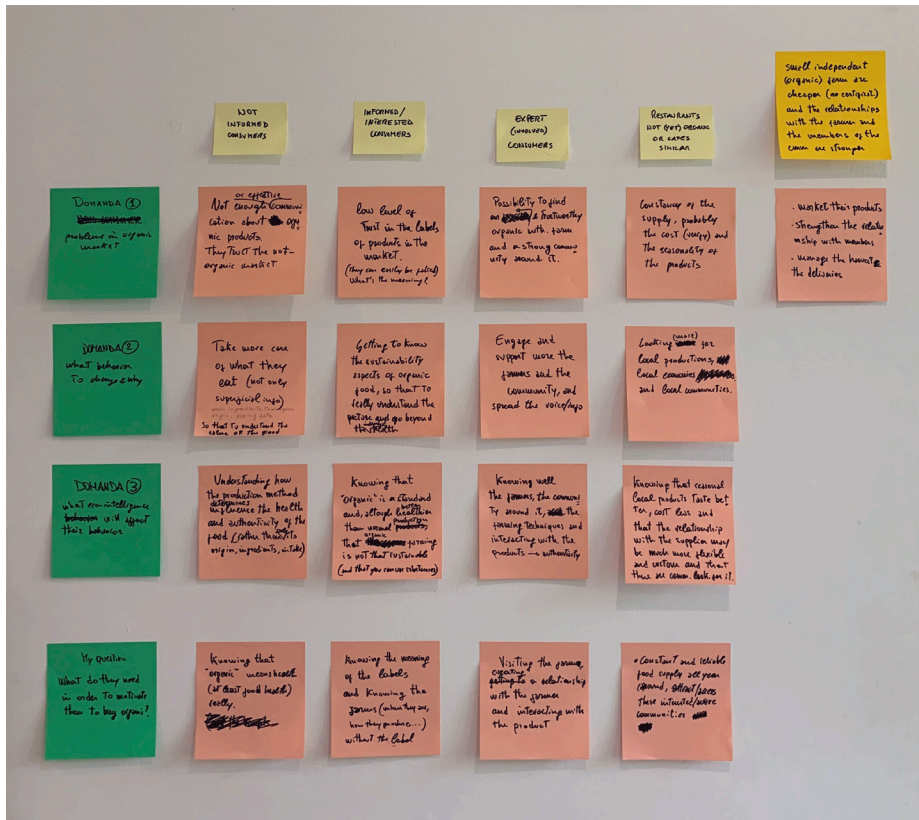
Finally, restaurants were divided into organic restaurants, and not (yet) organic restaurants.

The first category is actually mainly composed by the restaurants’ chains previously analyzed, while the second category is represented in particular by new restaurant owners of medium size, mid to high-end restaurant, about to launch a new business soon. This choice was due to the fact that setting up a new business is usually one of the most important (and difficult) parts, as it often determines the success or not of the venture. Also, it represents the best time to intervene, and the most successful one (rather than doing it once the business is already running).

Once the actors were defined, it was possible to answer the 4 key questions of the inquisitive framework, referred to each actor of the organic context. The four questions which helped elaborate the information were:

1. what is his/her problem in the current organic market?
2. what behavior should change in order to make him/her actively engage in the (beyond) organic market or context?
3. what key information would change their behavior?
4. what would motivate him/her to buy organic?

Fig.129 Cluster of the main actors and elaboration of their insights, according to the inquisitive framework.



The analysis of the farms has been rather simple as they were already examined in details in the opportunity chapter and the first refinement of the concept. The only question that was asked and answered was the first one. Based on the collected information, three main problems were highlighted: market their products, strengthen the relationships with the community, and manage the harvests and the deliveries. Subsequently, during the definition of the key actors and problems, it was decided to mainly focus on the first one, as identified as most impactful.

As regards the consumers, the analysis was broader. Indeed, the four questions were asked for each of the three consumers' categories. Starting with the least informed consumers, their problem related to the organic market was a matter of knowledge. As a matter of facts, they trust the conventional market, meaning that the organic market is failing to effectively communicate its values and health benefits to them (something they are actually interested in).

The behavior they should have is to take more care of what they eat, without only focusing on superficial info (as the name of the place where the food comes from, rather than how it got produced). This would allow them to understand the value of organic food. Finally, the information that would motivate them to buy organic food would exactly be understanding how the production method determines the health and authenticity of the food, not only its origin, ingredients, and intakes (the most voted information of the co-design session).

The problem of the second kind of consumer, the informed and concerned, is the low level of trust in the labels, as he/she does not know their meaning and believes that they could be easily faked. What should they change in their behaviors is to get to know the sustainability aspects of organic food, so that to really understand the big picture and move to beyond organic (which is not only healthier for their body but it also represents a more sustainable production and distribution system). The information that would motivate them to buy organic would be knowing the meaning of the labels and knowing the alternatives (and meeting with the farmers for instance).

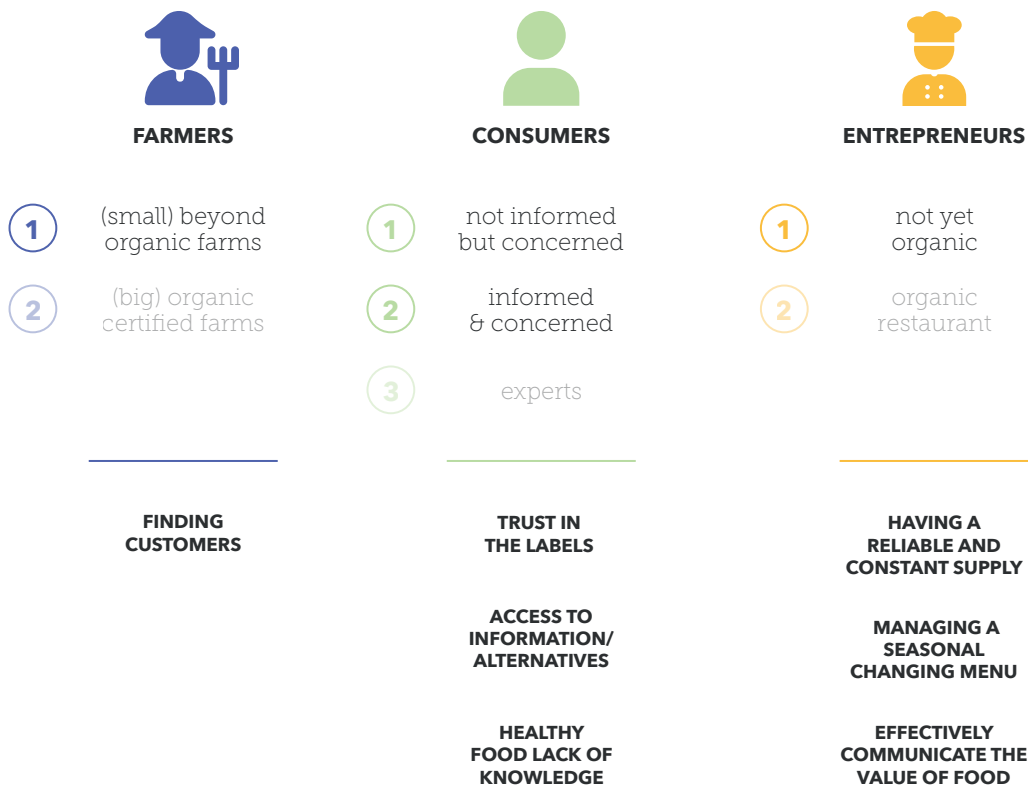
The third kind of consumer, the expert, faces the problem of finding an authentic and trustworthy farm, with a strong community behind it. Since they are already involved in the organic context, the behavior that they should improve (not change) is to engage and support more the farms and the community, spreading the voice about it, as to promote it. Finally, the information that pushes them to continue to buy organic food is knowing well the farms and the farmers and interacting with the products (to determine the authenticity).

The last category of actors that was investigated was the restaurant. The four questions were obviously asked to the not yet organic ones since the organic restaurants are already well managed and running. Therefore, it was found out that the problems for not organic restaurants were the constancy of the supply, the costs, and the seasonality of the products. What should they change in their behavior is to look more for local producers, so that to empower the local economies and communities, they are also part of. Finally, the information that could motivate them to buy organic would be knowing that seasonal local products taste better, cost less, have a promising market with interested consumers and that the relationship with the suppliers may be much more flexible and customized.

4.3 KEY ACTORS AND PROBLEMS DEFINITION

Based on the analysis of the organic market, its actors and their problems, it has been decided to target, directly and indirectly, 3 main actors, and to highlight their key problems to focus on.

Fig.130 The main actors selected and their key problems to address.



The reasons behind both the choices of the key actors and their key problems were driven by an "impact" criteria. What is the most impactful kinds of actors to focus on? About them, what is/are the main problems whose solutions could achieve a greater impact?

These were the questions that have been asked in order to help facilitating the individuation of the key actors and problems to focus on.

It has been decided to focus on the first kind of farmer because they represent a sustainable (and healthy) food production system which reflects the typical Chinese one (made of small and scattered but numerous farms/production units), and because they are more principles driven rather than profit driven.

The focus on consumers is in particular on the first two categories because they have a partial or absent awareness and represent the majority of people. Making them improve their behavior will have a strong impact. Experts, on the other hand, already have a good awareness of food and its consumption. Targeting them would not be so impactful.

Finally, the focus is on not yet organic restaurants, in particular new restaurant owners (of a medium size, medium to high-end restaurant) because setting up a new business is one of the biggest challenges, the best time to intervene, and the most successful one (rather than doing it once already running).

4.4 FINAL CONCEPT

Based on the information collected during the third round of research, both field and desk one, and based on their elaboration and the involvement of the actors, it was possible to formulate the new requirements for the development of a refined version of the concept, and the reasoning behind it.

To conceive the final idea, a conceptual recall of all the previous steps was carried out. By re-going through the main conceptual passages of the project, it was realized that the problem of the environmental pollution in China, caused by the current food production, could be soothed by fostering the production of organic food, in particular, the one defined as beyond organic. The beyond organic food, indeed, not only entails a cleaner production but it also entails a better, more powerful and direct communication (often physical interaction), which, in turn, results in more conscious consumption behavior. Thus, the beyond organic food was found to be promising and potential also to bridge the very first investigation quest of the food waste and the further one about the food production.

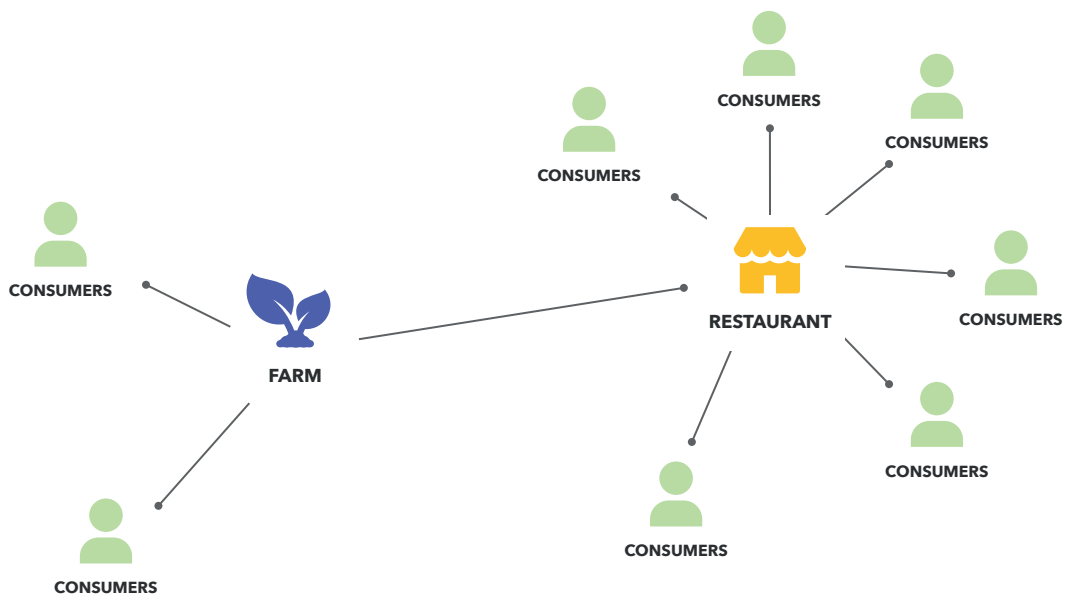
Based on these observations, it was easy to set the goals of the new, final concept. The final concept, indeed, in order to effectively make a difference, needed to aim to firstly make good food (sustainably produced) to come to the city, close and available to consumers, and to secondly make people aware of the food that they eat. Together, the achievements of these two objectives would result in a constantly self-nourishing sustainable system.

Fig.131 The goals of the concept.



In this framework, restaurants would play a fundamental role. Because they are closer to where people are (city), and are appealing and popular among Chinese, they can potentially reach a wider number of consumers.

Fig.132 The strategic role of the restaurants.



To conclude, a last consideration was drawn according to the “impact” criteria. The final concept that will be presented in the next chapter aims to represent a design solution able to achieve the highest possible impact. The key reasoning was that proposing a solution focusing on one single restaurants or production unit would not achieve a great impact, nor represent a real relevant sustainable system. The general objective was to propose a solution able to foster and trigger a bigger change.

**PART 3:
FINAL
RESULTS**

5 "SHANGHAI ORGANIX" SYSTEM

"Designing the system" is the fourth and last step of the MSDS process. In this chapter, all the necessary details to enable the concept to be implemented will be outlined. Starting from the definition of the concept, its values, and offerings, the presentation will then describe the system and its actors, showing how the system could work effectively, based on existing service models and through partnerships. Hence, the interaction between these actors and the system will be

explained, describing in details the main touchpoints, followed by a market analysis meant to highlight the business opportunities and the feasibility of the concept. Finally, the new system will be assessed according to the sustainable priorities and it will be compared with the current system (defined during the strategic analysis) so that to be informed about its impacts and to draw final reflections and conclusions about the research and the entire design work.

5.1

SYSTEM DEFINITION

Shanghai OrganiX is a restaurant accelerator which helps entrepreneurs to set up their new restaurant businesses, offering sustainable healthy food and spreading awareness about its consumption.

The name "Shanghai OrganiX" ['jæŋ'haɪ] [ɔ:r'gæniks] is evocative of the locality where the business will be first set up (Shanghai), of what it is about (organic), and of its character expressed through the final capital letter. The "X", although it is pronounced as [iks], recalls the abbreviation of the word "accelerator", which is, in fact, written as "x" but pronounced differently, as [eks]. Shanghai OrganiX also recalls the main values behind the concept, like sustainable food, the context of reference, and the business acceleration. The goal was to intuitively offer a hint of its meaning and main operations.

The mission is to foster a sustainable production of food and food consumption by turning restaurants into learning spaces and halfway meeting points between beyond organic farms and urban consumers.

5.2 OFFERING

Shanghai OrganiX offerings target 2 different actors: entrepreneurs, willing to set up and launch their new restaurant business and beyond organic farmers.

The acceleration program offers entrepreneurs 3 main services: the possibility to join the network of beyond organic food producers; the training for the staff, both in the kitchen and outside the kitchen; and finally, as a second level of intervention and support, the arrangements of particular activities meant at the involvement and activation of the community of the new restaurant.

The farmers are the actors who make the network and the supply of beyond organic food possible. Shanghai OrganiX indeed offers them 2 services: the possibility to join the network of restaurants (so that to have access to new business clients); and the support for setting up the visits to their farms.

Entrepreneurs have the possibility to supply their new restaurant business with beyond organic food from the network (see the image in the next page).

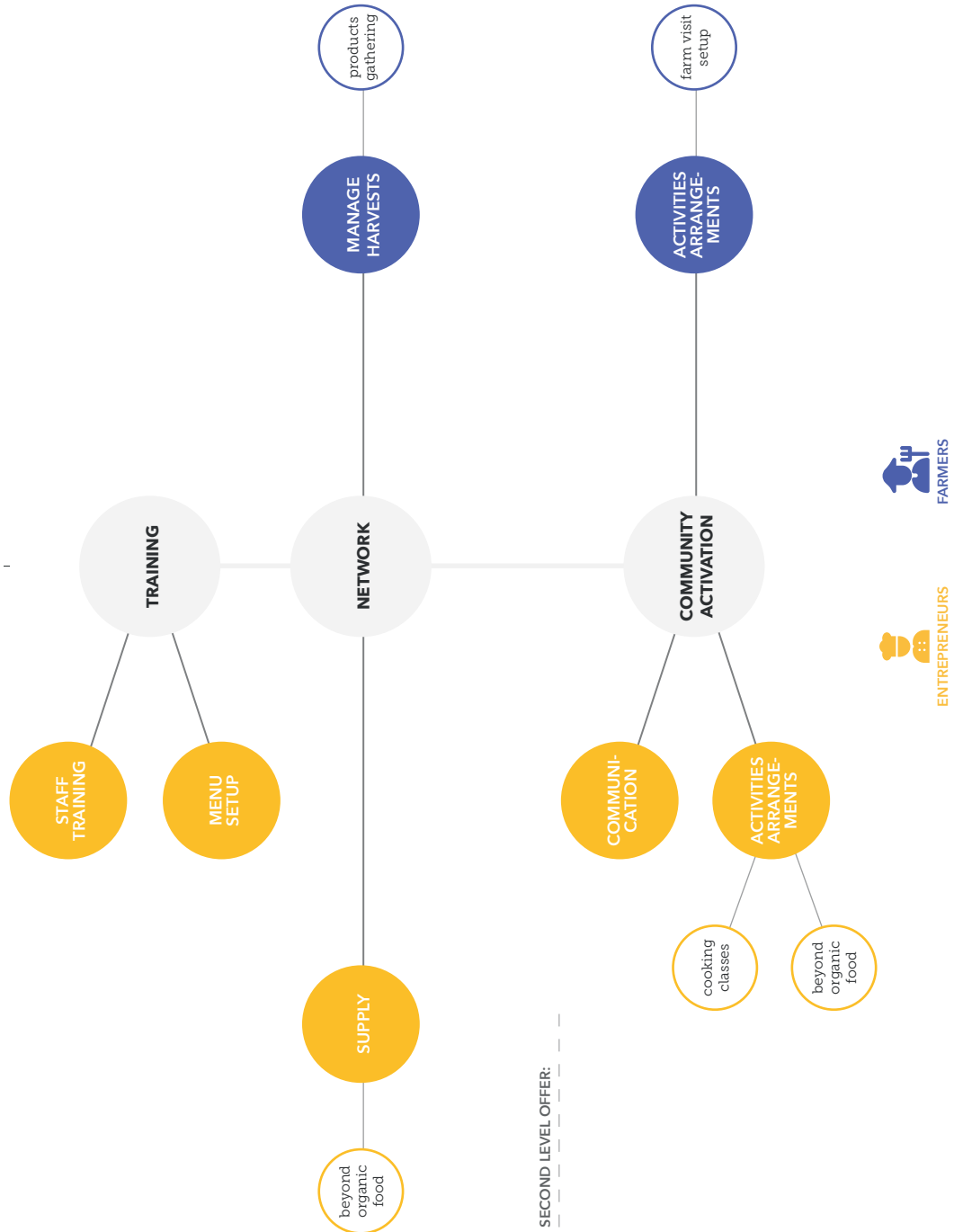
Besides, their restaurant staff and chefs are trained to manage a seasonal and changing menu (at least 4 times per year) and to effectively be able to communicate the value of their food offering to the clients.

On the other hand, farmers who join the network receive a tool which enables them to better manage their harvests and, above all, to gather their produces together with other producers. In this way, they can better satisfy the restaurants' demands. Indeed, as small and local producers, individually they may not be able to constantly reach the requested quantity of products. By gathering their produces (when needed and possible) they can satisfy the restaurants' requests.

As the second/third level of intervention and offering, entrepreneurs are given guidance to effectively communicate with customers (digitally through the design of the restaurant's WeChat official account), and are supported in arranging activities and tools to create and activate the community of the restaurant. These activities are meant to inform the customers about the food offered and to involve them in the restaurant's operations. The goal is to create a strong relationship with consumers and make them willing to come back over time.

According to consumers' preferences, scouted during the user research, the most attractive activities are cooking classes and visits to the farms (which supply the restaurant). With the help of Shanghai OrganiX experts, restaurants can arrange cooking and learning classes to their clients, taking advantage of the space of their restaurant (especially during the least busy days) and, maximizing their profits.

Fig.133 Shanghai OrganiX offering map.



In order to smoothen the process of visiting the farms and to empower the farmers to be able to connect with customers, Shanghai OrganiX offers them the right support and coordination for the set up of such visits, taking into account each farm's characteristics (space, facilities, etc).

5.3 SERVICE MODELS

Shanghai OrganiX's offerings are based on several service models which show how the offered services work, entirely or in some of their parts.

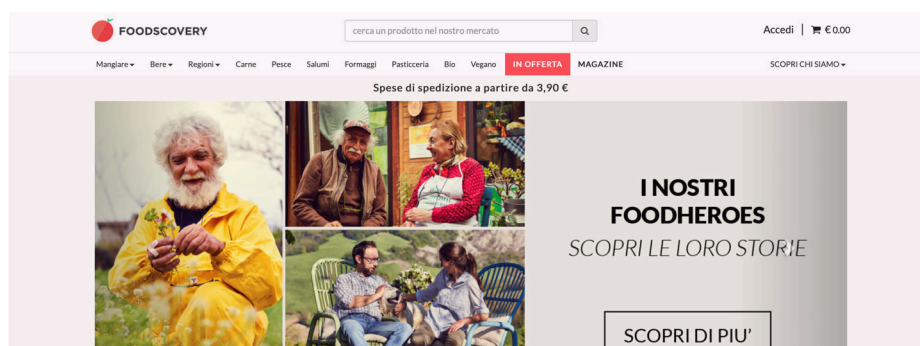
FOODSCOVERY

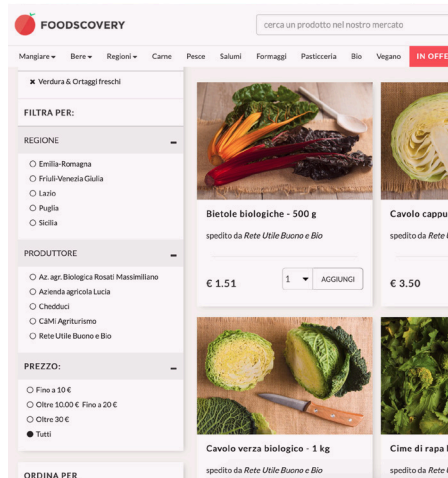
Foodsccovery business (b2b) is an online marketplace that gathers together small regional food producers' products, skipping all the steps of the traditional supply chain (without being a "distributor" economically, according to their business model). It was launched, and it is still supported, by Slow Food Italia.

Foodsccovery model was taken into account as inspiration for the offering of the network. Indeed, the most interesting aspects of this model are the gathering of small producers in one online marketplace with limited adhesion, and their business model. As a matter of facts, the restricted selection of the business clients who can join the network not only ensures that the producers can keep up with the demand but it also protects and maintains the network over time, with only like-minded professionals involved. As regards their business model, their revenues do not come in the form of a fee per order, as it may be expected. Rather, their revenues come from the possibility for the producers to advertise their offerings on the platform and to benefit of other services offered on the platform, as the pricing, purchasing and delivering services.

Obviously, since Foodsccovery does not play the role of intermediary, the costs of the products remain as they are, both for restaurants and for producers, giving the platform a competitive advantage over the competition.

Fig.134 Foodsccovery service model (foodsccovery.it).





JING REPUBLIC

Jing Republic is a one-stop home experience that combines stylish home accessories, special gifts, and culinary classrooms experiences. In other words, it is a design shop which offers multiple experiences and services. Since the launch of their restaurant, Jing Republic has been able to deeply engage with its new and former community by cooking, baking, floral, bartending and wine tasting courses, and introducing new menus every season.

Jing Republic's cooking classes were taken as reference for their arrangements in the restaurants accelerated by Shanghai OrganiX. Indeed, they are not simply practical lessons, rather, they are a mix of practical exercise, tasting trials and theoretical contents. The peculiarity of these cooking classes, therefore, makes them the perfect kind of activates, able to attract a wider number of customers and to inform them at the restaurant, before going and visiting the farms.

In this way, the education of the consumers starts in the city so that they are prepared in advance once they may visit the farms (and so that the welcoming/job of the farmers is easier).

Fig.135 Jing Republic service model (jingrepublic.com).

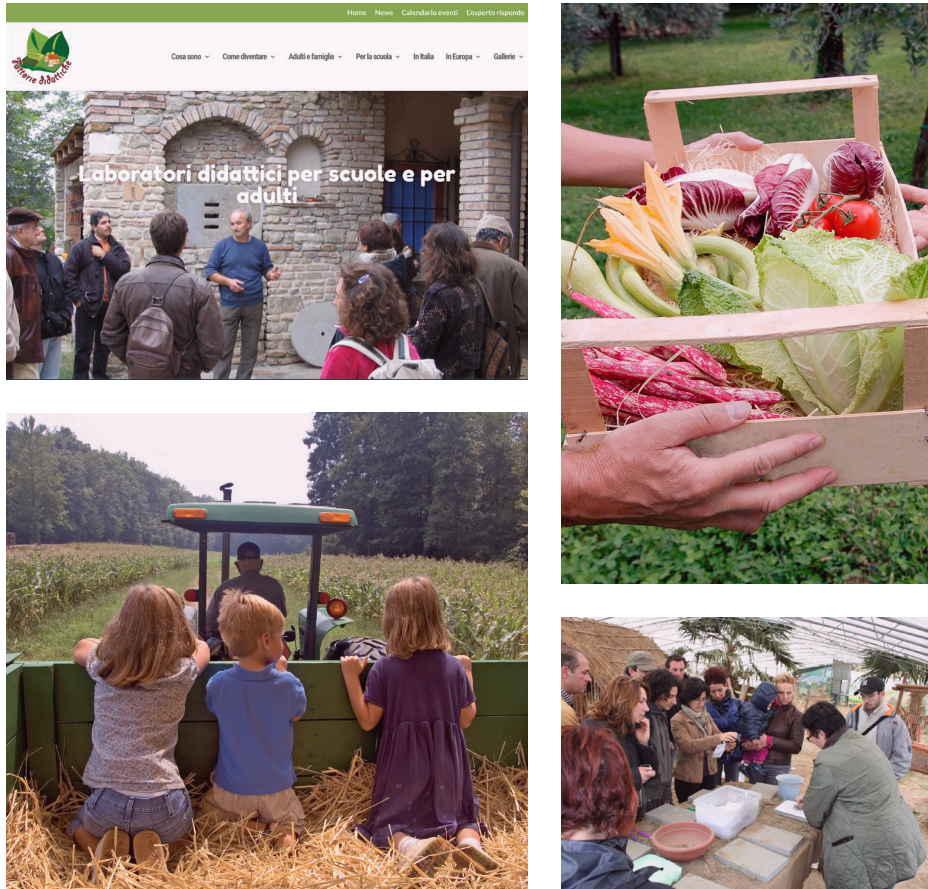


FATTORIE DIDATTICHE

Alimos is an Italian cooperative which coordinates the project Fattorie Didattiche (educational farms), a group of farms which, besides their agricultural activities, welcome people and offer them different learning activities, aimed to make people discover the local agriculture, its products, and practices, closing the gap between the consumers and the producers.

The organizational system of Fattorie Didattiche served as the reference model for the first set up of the visits to the farms of the Network and their coordination over time. In particular, the role played by Alimos reflects the Shanghai OrganiX's activities and responsibility towards its farms. In fact, Shanghai OrganiX supports the farmers in the first assessment of the kind of activities the farm can host, according to its space, facilities, and location, and then in their coordination. Operating in this way not only means better, more organized farms' visits, easier to manage and set up for the farmers but also less effort for the restaurant owners, who only need to promote the event.

Fig.136 Jing Republic service model (jingrepublic.com).



5.4 PARTNERSHIPS & STAKEHOLDERS

To deliver its services, Shanghai OrganiX benefits from the collaborations of different partners.

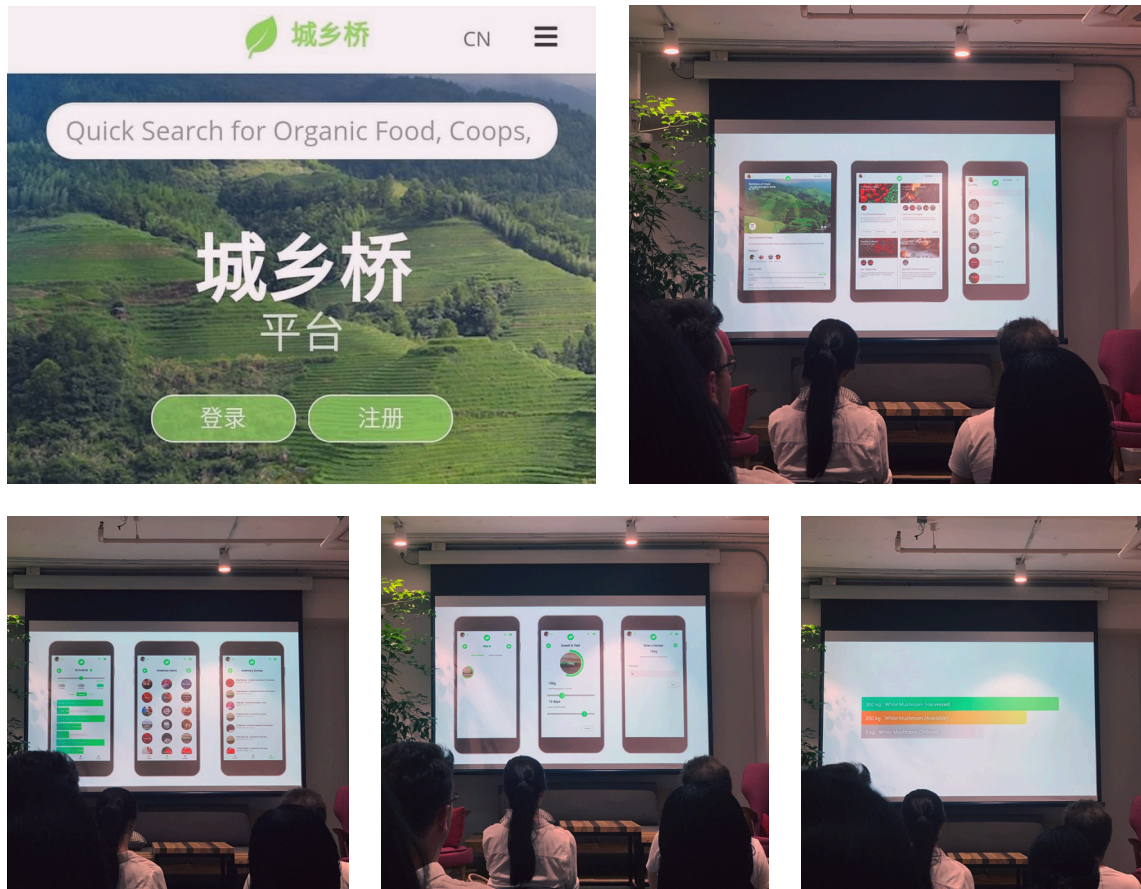
URBAN RURAL BRIDGE

Urban Rural Bridge is a social impact internet tool, that builds balanced and sustainable communities in both rural and urban areas. It allows farmers to manage their crops and their harvests (time, quantity, orders) and to make their products visible and sellable to customers (mainly businesses), through the app, solving real-time information, communication, and distribution problem.

UR Bridge is ultimately the tool which enables the Network to work. Indeed, the UR app (their main touchpoint) allows the Shanghai OrganiX farmers to better manage their plots and produces, and to post them online so that to inform in real-time the restaurant owners of the Network about the available products. Getting to know the available quantities of produces of different farmers creates the possibility to combine them together, in case the orders exceed the quantity of one single producer. The app also serves as another important link between these 2 actors: it connects them closer and more flexibly. As a matter of facts, the Network constitutes the bridge between the two. This close connection can also bring to on-demand order of particular kind of products to the producers, giving the restaurant owners more possibilities, and the farmers more revenues stream.

Finally, it has to be noticed that UR Bridge app is still not public, operating in or outside the market. They are currently approaching a phase of refinement of their business model and of testing their application.

Fig.137 Urban Rural Bridge presentation at Green Initiative event at WeWork@Hunan Road (Shanghai, 30/05/19).



KAIXIN COOKING

Kaixin Cooking is a small collective of chefs which offers hands-on, cooking training courses to businesses and, to a lesser extent, to consumers. This collective is different from other agencies or organizations that offer the same service. Indeed, Kaixin Cooking teaches to eat healthier by making delicious Chinese cuisine by using only quality healthy foods. Therefore, being focused on Chinese cuisine and on the use and spread of healthy food, it is the perfect partner for the formation of the restaurants' staff.

Fig.138 Kaixin Cooking (kaixincooking.com).

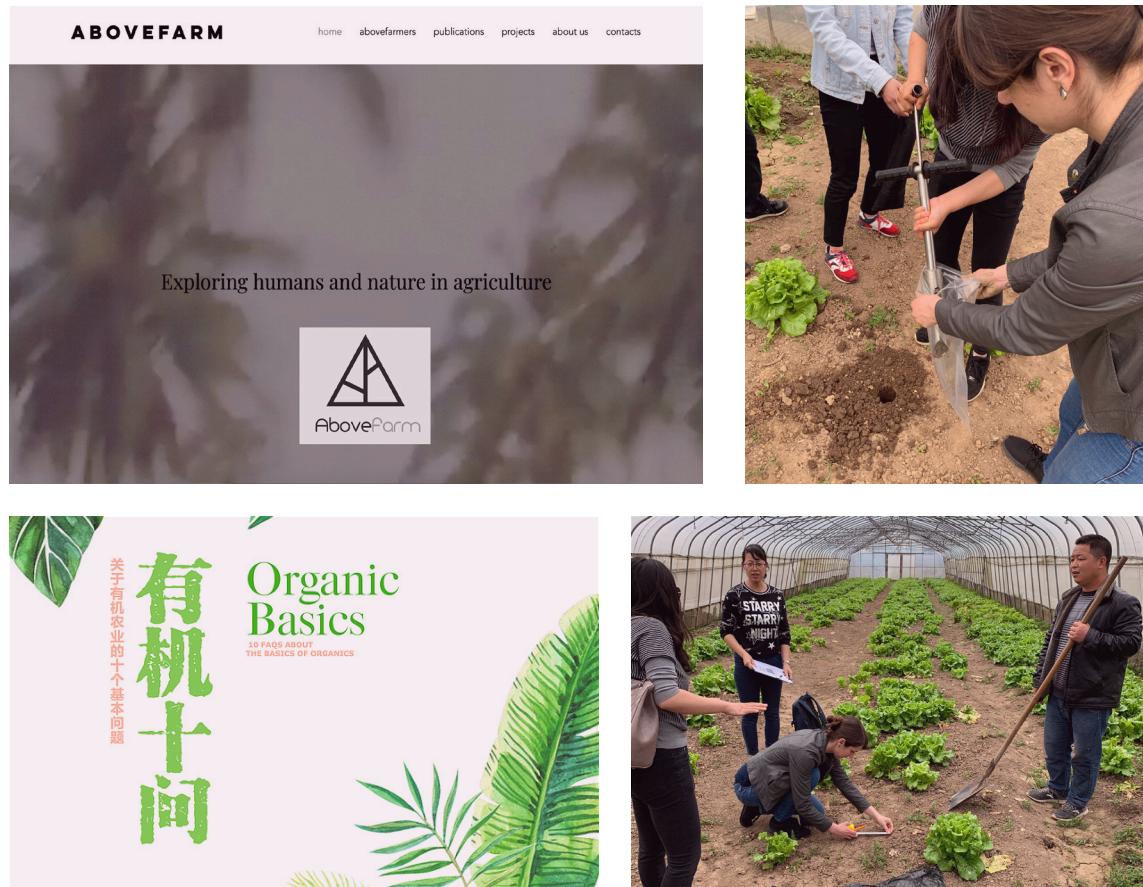


ABOVE FARM

Above farm is an independent communication organization based in Shanghai, that promotes healthy organic living and engages in harmonic relationships between urban and rural area. It acts as a resource gathering center of the latest strategies of the organic movement and progresses and it is currently mapping the soil condition of different farms. Above farm is able to quickly conduct an assessment of the soil directly on the spot, however, it usually takes advantage of its own partnerships (like research and test centers).

They allow Above farm to deeply assess different farm's soil conditions and to create a database and a map of the good, healthy farms in and around Shanghai.

Fig.139 Above Farm, met during the visit to Bio Farm (Shanghai, 30/05/19).



MEITUAN-DIANPING

Meituan-Dianping is a huge Chinese group buying website for locally found food delivery services, consumer products, and retail services. Born in 2015 from the merger of Meituan and Dianping, the group is now strengthening its presence in different markets, but it is still operating its two main platforms separately. Meituan offers different services, among which the leading food delivery service in China. Dianping is a business re-directory service (as TripAdvisor), very popular for restaurants' reviews. The platform plays a fundamental role in the decision making of Chinese consumers, in the choice of the restaurant and of the dishes to eat. Since the food delivery market is getting very competitive, Meituan-Dianping is possibly on the lookout for new and promising businesses opportunities.

Fig.140 Meituan-Dianping (meituan.com).



The stakeholder motivation matrix beside shows what are the benefits, motivations, and opportunities that the Shanghai OrganiX partners have in joining the system. The yellow boxes show the ultimate goal for each stakeholder to join in.


UR Bridge will give us their management tool in exchange for the possibility to test their tool and to expand their network.

Kaixin Cooking will offer their expertise to train the chefs and restaurants staff, in the communication, use of the food in the kitchen, and arrangements of the menu and the cooking classes. In exchange, they will have access to Shanghai OrganiX network of suppliers and they will be paid for their training and expertise.

Above Farm will be responsible to test the soil of new producers potentially able to join the Network. On the other hand, they will have access to new data, related to beyond organic producers, and the possibility to promote their activities by using the space of the restaurants accelerated by Shanghai OrganiX.

Meituan-Dianping will serve as the hook to attract new customers to the restaurants and to communicate with them at first, through their restaurant redirectory platform (Dianping). What they will benefit from is the exclusive use of their delivery service (Meituan) from the restaurants, and the possibility to explore the new business area of the fresh food delivery (see the trends in chapter 3).

Fig.141 Stakeholders motivation matrix.

 GIVES TO	 UR BRIDGE	 KAIXIN COOKING	 AboveFarm	 Meituan-Dianping	 OrganiX
<ul style="list-style-type: none"> - enlarge the producers network - pilot project (service test) 	<ul style="list-style-type: none"> - business (new client) - start new collaboration (commercial partnership: promoting the service during trainings) 	<ul style="list-style-type: none"> - sign new collaboration (it can bring to commercial partnership: food supply) - business (training) - access to the healthy food suppliers 	<ul style="list-style-type: none"> - sharing information of organic beyond farms (their location, size, produces...) - start new collaboration (it can bring to sharing the space for communication events) 	<ul style="list-style-type: none"> - business (new clients) - business (new clients) 	<ul style="list-style-type: none"> - tool for harvests' management - staff training (teach how to cook with healthy seasonal food) - menu set up
 AboveFarm	<ul style="list-style-type: none"> - sharing information of small good farms (not yet in the network) - soil tests 	<ul style="list-style-type: none"> - start new collaboration (it can bring to promoting the service during events) 	<ul style="list-style-type: none"> - getting information about new producers - promotion and use of the spaces 	<ul style="list-style-type: none"> - start new collaboration (it can bring to explore new business areas: information collection) 	<ul style="list-style-type: none"> - soil test and analysis (to scout and select the farms)
 Meituan-Dianping	<ul style="list-style-type: none"> - start new collaboration (it can bring to transport and deliver their food products) 	<ul style="list-style-type: none"> - start new collaboration (it can bring to transporting the food supply) 	<ul style="list-style-type: none"> - start new collaboration (it can bring to collecting info of healthy food deliveries/transport) 	<ul style="list-style-type: none"> - business (delivery) - explore new business areas 	<ul style="list-style-type: none"> - food transport service - restaurants' advertising
 OrganiX	<ul style="list-style-type: none"> - access to producers network - possibility to test the service - promotion 	<ul style="list-style-type: none"> - access to beyond organic and healthy food suppliers (useful for its others trainings/activities) 	<ul style="list-style-type: none"> - information on producers - restaurants space for awareness or communication events 	<ul style="list-style-type: none"> - business (food delivery) - possibility to implement/test a new delivery service of fresh food 	<ul style="list-style-type: none"> - make sustainably produced food come to restaurants - make people aware of food (so reducing waste)

5.5 SHANGHAI ORGANIX SYSTEM

As depicted in chapter 4, Shanghai OrganiX focuses on 3 main actors: the farmers, the consumers, and the restaurant owners. In particular, it focuses on small, local and independent beyond organic farmers in Shanghai; on urban consumers, concerned about what they eat, both informed and not informed about the food that they eat; new entrepreneurs willing to open their new restaurant business. Shanghai OrganiX offers these actors the tools and the possibility to connect to each other in a slightly complex system.

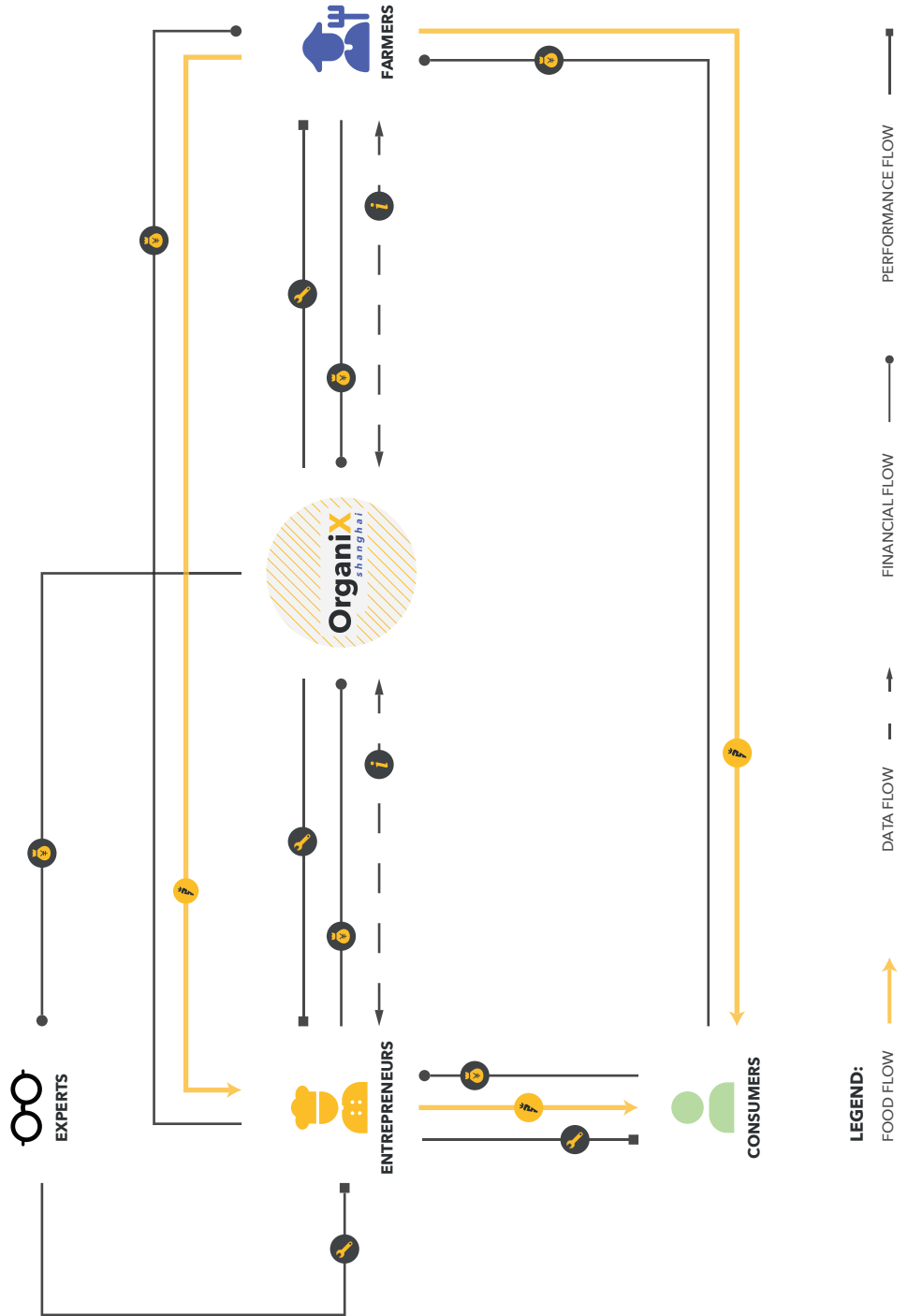
The map above represents the relationships between the main actors of the system, according to 4 different kinds of connection.

The food flow stands both for the raw food produced by farmers and cooked/prepared one by the restaurant of the entrepreneurs. The data flow refers to the exchange of information (especially quantities of products, farms and restaurants' names, consumers' data, events...) between the actors. The financial flow represents money. Finally, the performance flow represents any service (or performance) offered by any actor to another (as the training, the possibility to join the Network, the support in setting up the events, etc).

Starting from the performance flow, Shanghai OrganiX offers its services to the restaurants' owners who join the acceleration program in exchange of a first initial price (like a subscription) and shares of the new restaurant venture. The appropriate training for the restaurant staff is given by the experts (who are the Kaixin Cooking chefs, added to this map because of their active role in the system and interconnections), which receive monetary compensation and the access to the Network of producers. Finally, Shanghai OrganiX offers the farmers the possibility to join the Network so that to be able to better manage their harvests and to get in contact with potential clients. They will be also offered support and coordination to arrange visits to their farms.

As regards the financial flow, as it is possible to notice, Shanghai OrganiX does not play the role of intermediary between the restaurants and the producers (even if it will play it initially - see the business strategy -). The goal is to keep the costs as they are, to have a competitive advantage over other ways of supply and sale, and to keep the parties, in particular, the farms, independent (a will registered during the field research). Looking at the bottom part of the map, consumers are in contact with the entrepreneurs when they eat at their restaurants and join their

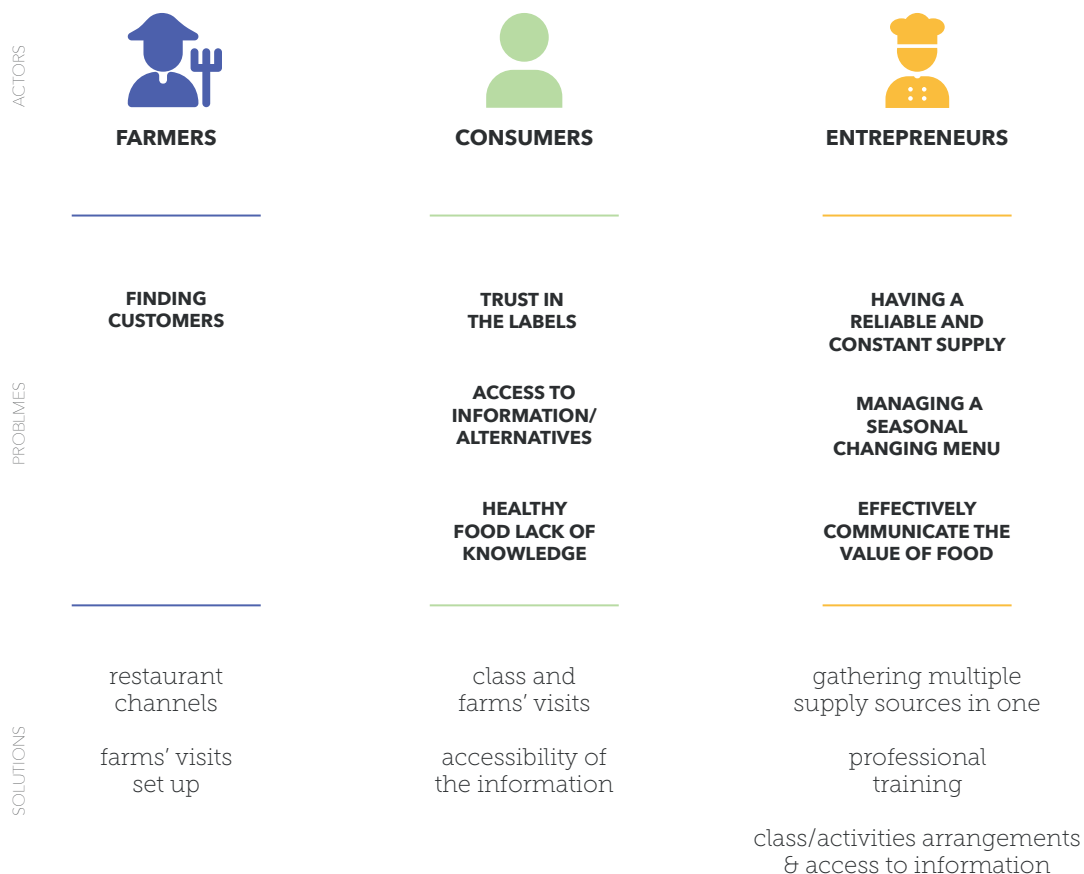
Fig.142 System map.



activities (both food and performance flow). Intuitively, when the consumers participate in one of the farms' visits, they have the chance to meet the producers and to join their communities (Community Supported Agriculture) so that to support the producers in their activities and receive healthy food from them.

As regard the data flow, finally, the information exchanged by the actors of the system is useful for Shanghai OrganiX to support at best the restaurants of the acceleration program and to make the supply of food working.

Fig.143 The benefits of the main actors involved.



5.6 TOUCHPOINTS

Going more into details in the way the main actors, involved in the system, interact with the offered services, it is possible to focus on the touchpoints that have been designed specifically for them. These touchpoints digitally or physically represent the contact that the actors of the system have while coming across the Shanghai OrganiX's offerings while using and interacting with the system.

The main touchpoint that has been designed is the (communication) point of contact between the restaurants and the consumers. This is a WeChat official account that is created for each restaurant business of the acceleration program. WeChat, indeed, is the most widely popular Social Network in China, which is currently used for multiple functions, as chatting, sharing posts, paying, opening other applications, and even following each own's favorite organization, company or brand. Over the years, it has definitely become a powerful communication and marketing tool, right in the hands of the people. Through WeChat, the user can "follow" the official account of its favorite company so that to constantly receive news, updates, and discounts. An official account does not only provide a constant and powerful engagement, but it also offers additional information of the company, hence integrating the in-store (physical and digital) experience. Eventually, thanks to the function of scanning QR codes (which has become a routine for Chinese people), WeChat is an everyday life enhancer. For these reasons, a WeChat official account has been chosen as the principal touchpoint and communication tool for the restaurants.

The WeChat official account of the restaurants is composed of different sections, accessible through the menu.

The first voice of the menu regards the general information of the restaurant, as the location, the contacts, the description, and the menu. Each sub-voice in the menu is then connected to another page, displaying more detailed information.

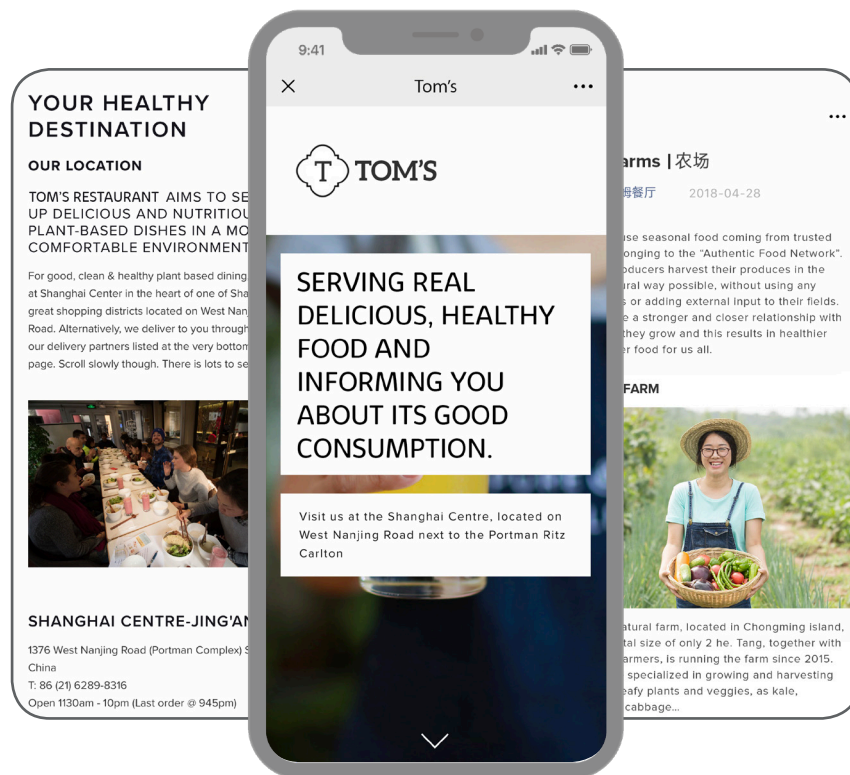
The second section of the menu is about the food offered, its origin and producers, and useful resources aimed at informing and educating the customers to good and healthy food consumption.

The third section shows the past and upcoming events, such as the cooking classes and the visits to the farms (which supply that restaurant). In this section, it is possible to get more information and details about the activities as,

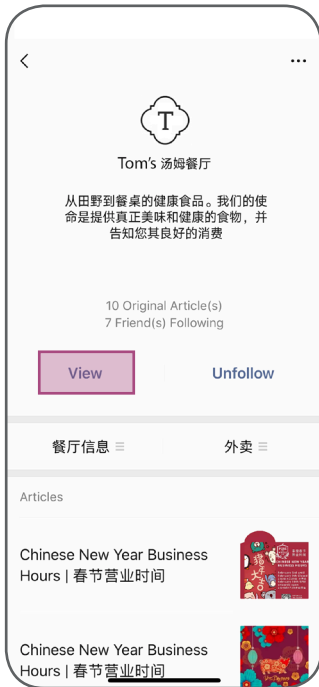
instance, their location, time, contents and price. Indeed, it is ultimately possible to register and pay them, directly on WeChat.

(In case a restaurant is not yet ready or willing to benefit from the “community activation” service of Shanghai OrganiX, the third section of the menu will be omitted. However, there will still be the possibility to add this section afterward).

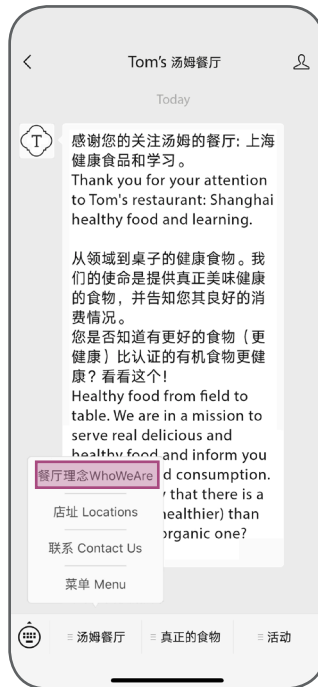
Fig.144 WeChat official account sample of the accelerated restaurants, with the user flow (next page).



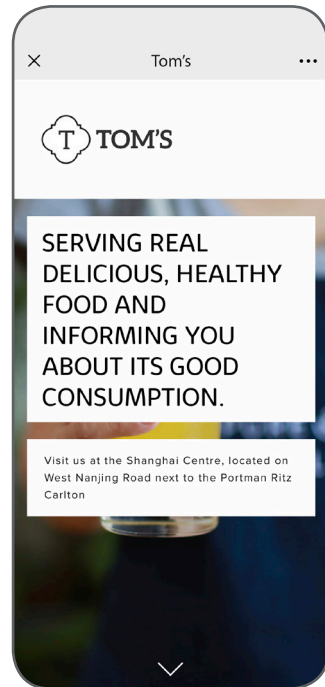
Part 3: Final results



WeChat official account page of "Tom's restaurant".



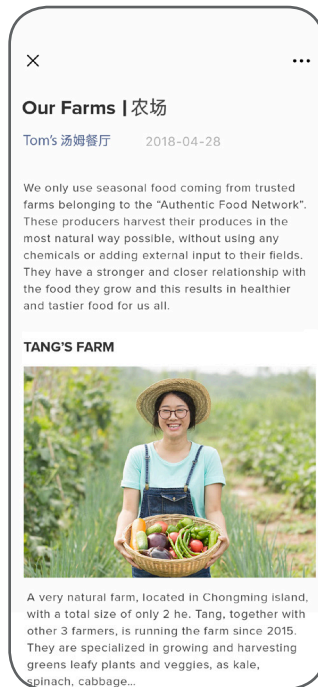
The menu has three sections. The first is the "about" with info related to Tom's.



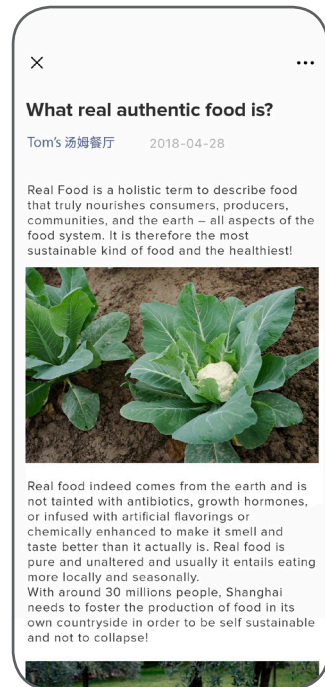
Tom's homepage



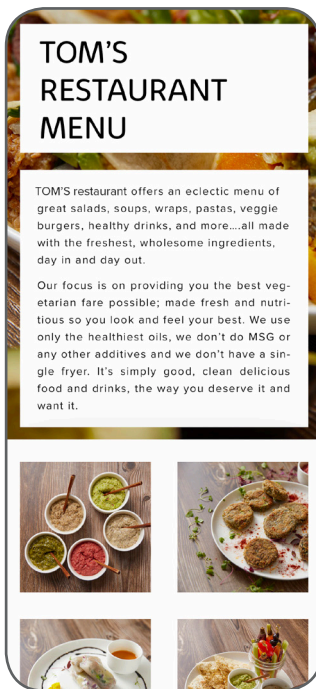
The second section represents the "learning" and shows the info about the food offered by Tom's.



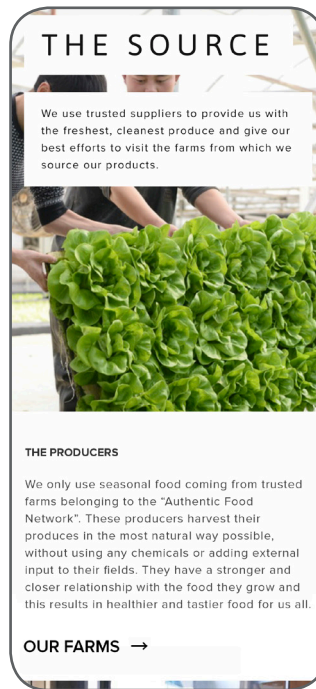
A focus on the producers who supply the restaurant with beyond organic food / real food.



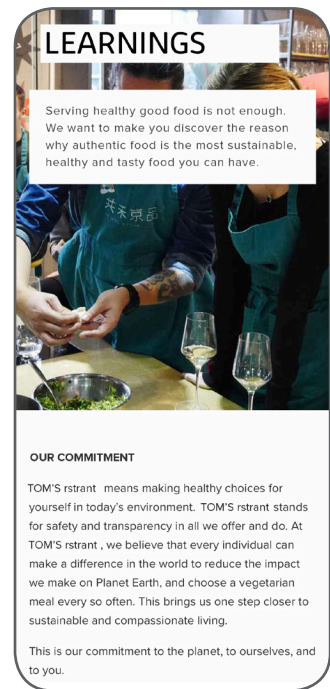
And the explanation about it and the presentation of the network of suppliers (transparency & trust).



Details of the homepage.



Details of the homepage.



Details of the homepage.



The third section is the "community activation", where it is possible to join the events...



as cooking classes, when they are and what they are about.



Eventually, it is possible to view the details and subscribe by scanning the QR code.

5.7

MARKET OPPORTUNITIES

In order to prove the market feasibility and potential of the concept, a market analysis has been conducted, touching different points. At the end of each discussed topic, a clear statement of the market opportunity is highlighted. Together with these market potentialities, also some of the future trends described in the “Exploring Opportunities” chapter support and highlight the business opportunities in the market.

The signals that may consolidate the market potential of the concept are the future trends of the organic market and CSA models (together with the young farmers’ movement), the growth of the healthy lifestyle market as well as of the fresh food e-commerce, and the constant new ways of engaging Chinese consumers.

RESTAURANT INDUSTRY

Shanghai welcomes thousands of different licensed (and not) restaurants and eateries of any kind, from the smallest and cheapest to the biggest and most expensive ones, both local and foreign.

Local cuisines, in particular, still dominate the market, although western cuisines are becoming popular in Tier1 cities, like Shanghai, Beijing, and Shenzhen.

Considering the overall market, China’s Hotel, Restaurant, and Institutional (HRI) sectors recorded \$539 billion in sales revenue in 2016, with restaurants accounting for the largest share of the sector with \$352 billion in sales revenue, of which around one third only in Shanghai (USDA, 2018). Moreover, in 2017 the restaurant industry alone increased by 11.3% compared to the previous year (Meituan-Dianping, 2018). If, on the one hand, the restaurants market is still attracting new investments and is definitely increasing, on the other, it is becoming more and more competitive, with many new players joining in. This has resulted in a high business turnover, whose causes a report by Meituan-Dianping considers to be the poor management (especially of franchise chains) and the poor offering differentiation, measured as food and customers involvement’s innovation. Indeed, considered the sheer size of the country, it is everything but easy to accurately keep under control every store of a chain. For instance, hygiene failings at just a few franchises or in the supply chain can damage an entire business reputation.

As regards the kind of offering, the majority of restaurants offers Chinese cuisine, using standard Chinese ingredients. That means that there is surely a high demand

for the local cuisine but also the room for innovative food offerings (still Chinese). For all the reasons listed above, it has been decided to focus on single restaurants (and not on chains) and to support them in offering Chinese cuisine-style dishes, prepared with healthy good ingredients, and in arranging activities, as well as the communication, in a new and engaging way.

CONSUMERS SENTIMENT

By considering the main targets of the restaurants accelerated by Shanghai OrganiX, it is fundamental to analyze the sentiment of the market, what people feel and say. As it has already been highlighted in chapter 2, in recent years the mistrust towards food available or produced in China has steadily increased. A study, conducted in 2016 by McKinsey in the principal cities and regions of China, reported that 72% of consumers worry that the food they eat is harmful to their health, up from 60% compared to 2012 (when they conducted their previous study), with more than 50% of consumers focused on eating healthy and nutritious food (McKinsey, 2016). Another study, conducted in 2018 by China Youth Daily, underlined the issue of trust, finding out that 70% of respondents believed organic food could easily be faked (Kan & Chen, 2019). In this framework, it is not surprising if another source reported that 86 percent of Chinese consumers consider food safety when buying food products and 52 percent consider it as the primary factor when buying or choosing food (ChinaBriefing, 2019).

Fig.145 The market opportunities.



This lack of trust in the food of the market eventually results in consumers ready to pay extra for food deemed healthier, paying up to 1/3 more of the conventional food price.****

In addition, "Organic/green food" has become one of the top criteria Chinese consumers use to identify the safety of food, with 38% of consumers mentioning this attribute among their top three criteria when doing their groceries (Yin, Wu, and Chen, 2010).

It is therefore clear that the consumers are asking for good and healthy food, which may go beyond the labels or certifications. They need to have the possibility to verify, in person, the source of their food. Hence, offering them food, produced without any chemicals or poisons, coming from a transparent supply chain, together with the possibility to get more information and to touch it with hands, is surely a promising new business possibly able to answer this market gap.

FOOD PRODUCERS

The ongoing urbanization led to China's urban population exceeding its rural counterparts for the first time in history in 2011 (Statistical Yearbook Shanghai 2018). However, agriculture still accounts for around 30% of the workforce and there are still millions of people engaged in it (USDA, 2018). In particular, at the end of 2016, the permanent resident population in the rural areas of Shanghai was 2.5667 million, with around 4'000 family farms (most of them small ones) and 375'000 people engaged in agricultural work (Shanghai Agriculture 2017). Even if it is surely a small proportion if compared to the urban population and urban areas, today in Shanghai about 55% of the city's land area is still dedicated to food production. Indeed, the newly adopted 2035 Shanghai Master Plan, the municipal government has reiterated its policy of a local food system that grows about 50% of its fresh fruits and produces, and 30% of its overall food supply (Cornell University, 2018). In particular, in 2016, the city produced 2816 million tons of vegetables, addressing the Shanghai's food market (Shanghai Agriculture 2017), with a gross output value of around \$450 billion (including the overall food production). The majority of this food, around 80%, is produced by small family farmers, operating plots of less than 2 hectares (on average) (AFA, 2014).

What is happening today is that a number of these small farms is turning to more sustainable farming techniques, as organic or beyond organic. This movement is nurtured also by the popular urban consumer trends of organic food (to contrast the food safety issue) and the movement of young farmers coming back to the fields, to start their new farming business. Indeed, most of the time, these younger generations opt for the newest and most sustainable farming practices, often based on the CSA model.

Unfortunately, it is not yet possible to assess the overall number of these sustainable small producers, because of their overall numbers and of the absence of a standard through which classify them. Nonetheless, different authors, including the one of this document, witness their presence, based on on-field observations and participation to different events (markets, talks, etc) where these producers were present.

The opportunity hidden in the numbers and reasons described above is related to the proliferation of these new and sustainable farms, and the market opportunities that they have. Indeed, in China, as well as in Shanghai, this kind of production unit represents the core agriculture force, and they are already intertwined within the local food production system. As said, being small, they can adapt and transform their productions and farming techniques more easily than huge and industrial production units (the only limit is the time, research background). Therefore, they represent the perfect farms to involve in the Network of healthy and sustainable food producers.

5.7.1 COMPETITORS

In order to prove the market feasibility and potential of the concept, a market analysis has been conducted, touching different points. At the end of each discussed topic, a clear statement of the market opportunity is highlighted. Together with these market potentialities, also some of the future trends described in the "Exploring Opportunities" chapter support and highlight the business opportunities in the market.

The signals that may consolidate the market potential of the concept are the future trends of the organic market and CSA models (together with the young farmers' movement), the growth of the healthy lifestyle market as well as of the fresh food e-commerce, and the constant new ways of engaging Chinese consumers.

MEICAI 美菜网



Meicai is a Chinese startup, whose aim is to provide a better connection between farmers and restaurants. Founded by LIU ChuanJun (刘传军), the platform is building an industry chain from the farmers to the businesses.

Indeed, by collecting the orders from the restaurants, the service brings the needs of various species of agriculture products to the farmers and organizes them in order to optimize their work and production plans. Therefore, Meicai helps the farmers to produce needed agriculture products based on market demands and supports both the parties in the management of the orders and their delivery.

Although the service benefits from the use of technology, which allows the collection of many data, it does not yet offer the chance to see which farm or region your produce is coming from or whether your order is organic or not. During the field research with chefs and restaurant managers, there were also noted issues with the quality of the products, not always constant.

<https://www.meicai.cn>

GOMA GREENS



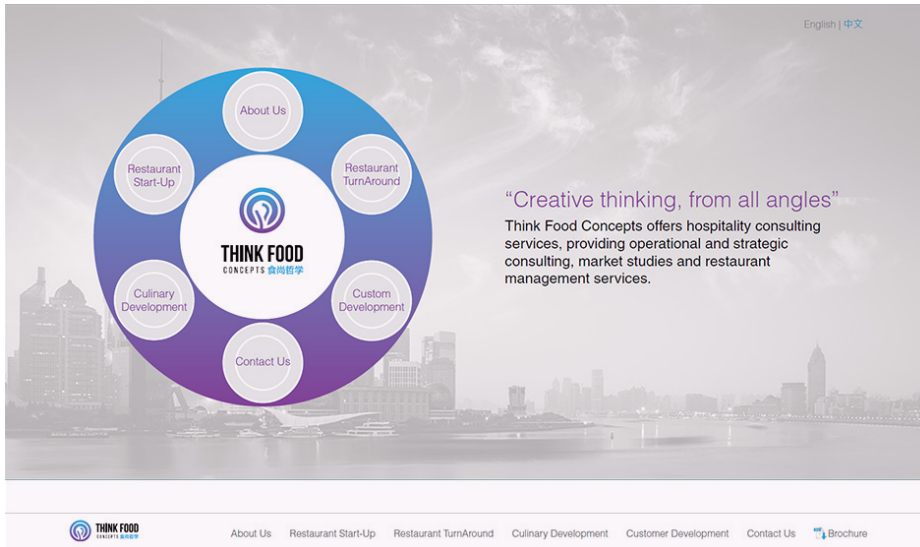
Goma Greens is a B2C service which provides a veggie box, together with healthy recipes, to its members, on a weekly basis. The startup, founded by the Denmark Christina Freddie in 2016, aims to offer a healthy platform for people to get some inspiration on how to cook veggies, and how easy it is to adopt a healthier lifestyle. Through WeChat, indeed, the community box-subscribers can share pictures, tips, and recipes on how to use the veggies of their boxes.

Goma Greens gathers mostly-local farmers (even if not all comes from Shanghai), some of them with the organic certification, some others without, and finally, even some who are using a tiny quantity of chemicals (but within the levels allowed in the EU). They do regularly sample tests on their products to verify their level of pesticides.

Considering the founder's origin, and the communication style, the service mainly addresses foreigners who move to Shanghai to live and work.

<http://gomagreens.com>

THINK FOOD CONCEPTS

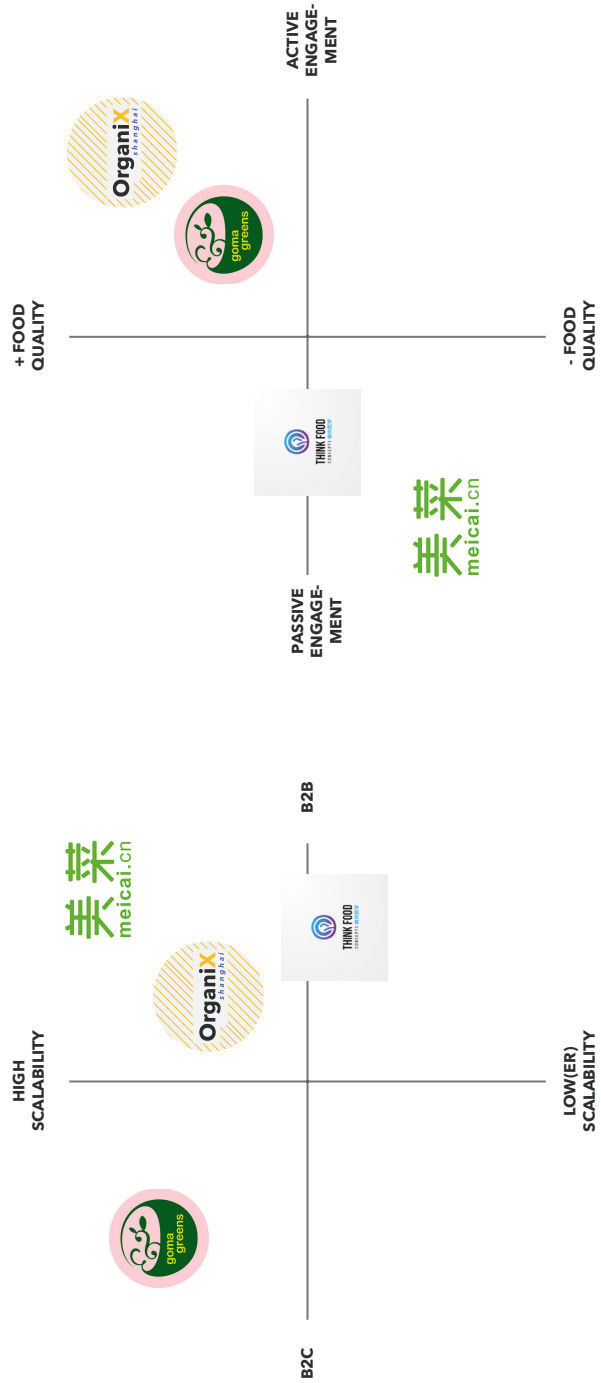


Think Food Concepts is a provider of hospitality consulting services, which provides operational and strategic consulting, market studies and restaurant management services to the hospitality industry. In particular, the agency, based in Macau and Shanghai, is specialized in new restaurant openings. Indeed, their professionals support the entrepreneurs in multiple aspects of their new venture, from the restaurant concept, the business model, to the supply, and to the interior design. Their aim is to offer a seamless service from the beginning to the public opening.

Even if Think Food Concepts is growing its market share, its contribution is still mainly targeted to the style and perceptive features of the new restaurant business, overshadowing their potential strategic thinking, and attention to the network of suppliers.

<http://www.thinkfoodconcepts.com>

Fig.149 Positioning maps.



As it is possible to see, it has been decided to compare the concept with the other 3 market players according to 2 couples of values. In the first map, the two comparative values are the typology of business (B2B/B2C) and their level of scalability.

Hence, Meicai and Goma Greens show a slightly higher level of scalability, which is due to the easier possibility of highly expanding their business operations with limited efforts. Indeed, they can both scale up by simply adding new farmers in their network, considering that their requirements for joining in are quite restrained.

If Think Food Concepts can scale up only by increasing its marketing activities (finding new customers and delivering their services to each of them), Shanghai OrganiX scalability is higher due to the same reason of the previous two players. However, compared to them, Shanghai OrganiX focuses more on the quality of the supply and the quality of the producers possibly joining the network. Therefore, its scalability results slightly lower than Meicai and Goma Greens.

In the second map, the two comparative values are the attention to the community (in particular to the creation or involvement of a community) and the focus on the quality of the food. In this case, Meicai does not perform very well since it purely a business sale platform (and there is not any community activation), and, as described above, it does not constantly offer the same quality of products. Being a consultancy service focused more on the restaurant concept and interior design, Think Food Concepts presents a similar positioning.

Goma Greens and Shanghai OrganiX, on the contrary, shows a higher level of community involvement and surely a higher focus on food quality.

Eventually, Shanghai OrganiX may be less scalable than other kinds of business models but it provides a higher quality of the service, of the food, and of the human relationships and involvement.

Hence, in order to accelerate the scalability of the model, it will be fundamental to continuously looking for good producers and start since the beginning to instruct new farmers and recruit them.

5.8 ABOUT BUSINESS

A very important aspect of an accelerator is its business model. In order to better highlight the value that Shanghai OrganiX delivers to each one of its two main targets, it has been decided to develop two different lean canvases. Also, since the partnerships are core elements of the accelerator business, also two business canvases were developed as well (the former as a tool to reflect and consolidate the business idea; the latter as a tool to more completely show the more mature business idea). Here only the two business canvas will be presented.

The first canvas targets entrepreneurs who are willing (or going) to open a new restaurant, and, in particular as early adopters, the ones planning to launch a middle size, mid to high-end single restaurant (not a chain), focusing on quality and healthy food. The identification of the kind of business is expressed by using the categorization used on a well-known review platform: TripAdvisor. The “\$” is not only used to express the cost of the food but it also helps to figure other characteristics out, as the interiors, the food quality, the location, the professionalism of the staff, etc. The reason why this early adopter was chosen is that setting up a new restaurant is one of the biggest challenge in the overall business management, the best time to intervene, and the most successful one (rather than intervening once already running). To face the problems of poor food differentiation and business management within the restaurant industry, and yet to possibly hit the market (together with considering the sustainable mission), intervening during the new restaurant concept definition is the right time.

Finally, the kind of restaurant (expressed with “\$” symbols) is due to the slightly higher cost of the food compared to the conventional one, to the more preparation needed for the staff, and to exploit the current market standards.

The second canvas targets beyond organic farmers, and, in particular as early adopters, the small local independent beyond organic ones. The reason why this early adopter was chosen is that they represent a sustainable and healthy food production system, which reflects the typical Chinese one (made of small and scattered but numerous farms), and because they are more quality and principles driven rather than merely profit-driven. Moreover, these farms do not have enough resources and expertise to effectively market their products and easily build commercial relationships. They want to be independent (receiving government money would influence their farming) but they struggle with profitability.

Fig.150 Business canvas entrepreneurs.

<p>KEY PARTNERS</p> <ul style="list-style-type: none"> - network's service platform: Urban Rural Bridge - restaurant staff's training: Kabxin Cooking - soil tests: Above Farm - advertising and delivery: Meituan - Dianping 	<p>KEY ACTIVITIES</p> <ul style="list-style-type: none"> - build the partnerships - search, test & select the producers - provide training to restaurants - design the restaurant communication - set up & support activities - market new entrepreneurs - controlling farms' soil condition - instruct & recruit new producers 	<p>UNIQUE VALUE PROPOSITION</p> <ul style="list-style-type: none"> - healthy food business acceleration program, providing access to a quality and exclusive suppliers' network, and to a complete ongoing business activities support 	<p>CUSTOMER RELATIONSHIPS</p> <ul style="list-style-type: none"> - constant support during and after any new business launch - co-creation sessions to create additional ad hoc activities in restaurants 	<p>CUSTOMER SEGMENT</p> <ul style="list-style-type: none"> - new restaurant owners (\$\$ - \$\$\$ to \$\$\$\$ Restaurant, according to TripAdv.) - not informed but concerned and informed consumers (restaurant targets) 	
<p>KEY RESOURCES</p> <ul style="list-style-type: none"> - proprietary expertise (the team) - partnerships - Network of suppliers 				<p>CHANNELS</p> <ul style="list-style-type: none"> - restaurant trade fairs - restaurant trade magazines (on- and off-line) - Direct Email Marketing (DEM) - proprietary website 	<p>EARLY ADOPTERS</p> <ul style="list-style-type: none"> - middle size, mid to high-end (\$\$ - \$\$\$ Restaurant, according to TripAdv.) new restaurant owners focusing on quality and health - informed and concerned urban consumers (restaurant targets)
<p>COST STRUCTURE</p> <ul style="list-style-type: none"> - key activities (consulting, training, communication design, farmers instructions) - key resources (human resources) - channels (business development and marketing costs) - customer relationships (dedicated personal assistance, IT support, co-creation activities) 				<p>REVENUE STREAMS</p> <ul style="list-style-type: none"> - initial restaurants subscription - restaurants' shares - subscription to the Network (for already existing restaurants) 	

Fig.151 Business canvas farms.

<p>KEY PARTNERS</p> <ul style="list-style-type: none"> - network's service platform: Urban Rural Bridge - restaurant staffs training: Kaixin Cooking - soil tests: Above Farm - advertising and delivery: Meituan- Dianping 	<p>KEY ACTIVITIES</p> <ul style="list-style-type: none"> - build the partnerships - search, test and select the producers - provide training to restaurants - design the restaurant communication - set up & support activities - market new entrepreneurs - controlling farms' soil condition - instruct & recruit new producers 	<p>UNIQUE VALUE PROPOSITION</p> <ul style="list-style-type: none"> - a crops and harvests management tool, giving access to a trusted network of business clients through which more easily marketing their products and reaching urban consumers 	<p>CUSTOMER RELATIONSHIPS</p> <ul style="list-style-type: none"> - constant support to farmers for the set up of the service platform and visits to their farms 	<p>CUSTOMER SEGMENT</p> <ul style="list-style-type: none"> - beyond organic farms
<p>KEY RESOURCES</p> <ul style="list-style-type: none"> - proprietary expertise (the team) - partnerships - Network of suppliers 				<p>EARLY ADOPTERS</p> <ul style="list-style-type: none"> - small local independent beyond organic farm
<p>COST STRUCTURE</p> <ul style="list-style-type: none"> - key activities (consulting, training, communication design, farmers instructions) - key resources (human resources) - channels (business development and marketing costs) - customer relationships (dedicated personal assistance, IT support, co-creation activities) 				<p>REVENUE STREAMS</p> <ul style="list-style-type: none"> - farmers subscription - farms' visits support and set up

KEY ACTIVITIES

In order to make the accelerator running, a series of activities are required. First of all, building the partnerships and commercial relationships is of first importance. In order, they are Urban Rural Bridge (for the network platform), Kaixin Cooking (for the training), Above Farm (for the soil tests), Meituan-Dianping (for the advertising and delivery) (see section 6.4 for more details).

As the second step, it is needed to search, test and select the farms which are already producing good and healthy food, so that to add them in the Network. At the same time, to increase the number of future good producers able to join the Network, it is fundamental to start informing and instructing new farmers about sustainable farming methods and their market opportunity. This activity needs to be done at the beginning since the minimum amount of time for the soil to recover from conventional agriculture to a sustainable one is of 3 years. Subsequently, the marketing to reach entrepreneurs (clients) will start, and, there will be a chance to conduct a test with the first client(s). Finally, once running, the key activities will consist of delivering the services to the restaurants that join the acceleration program (with the backend activities continuing to be carried out as well).

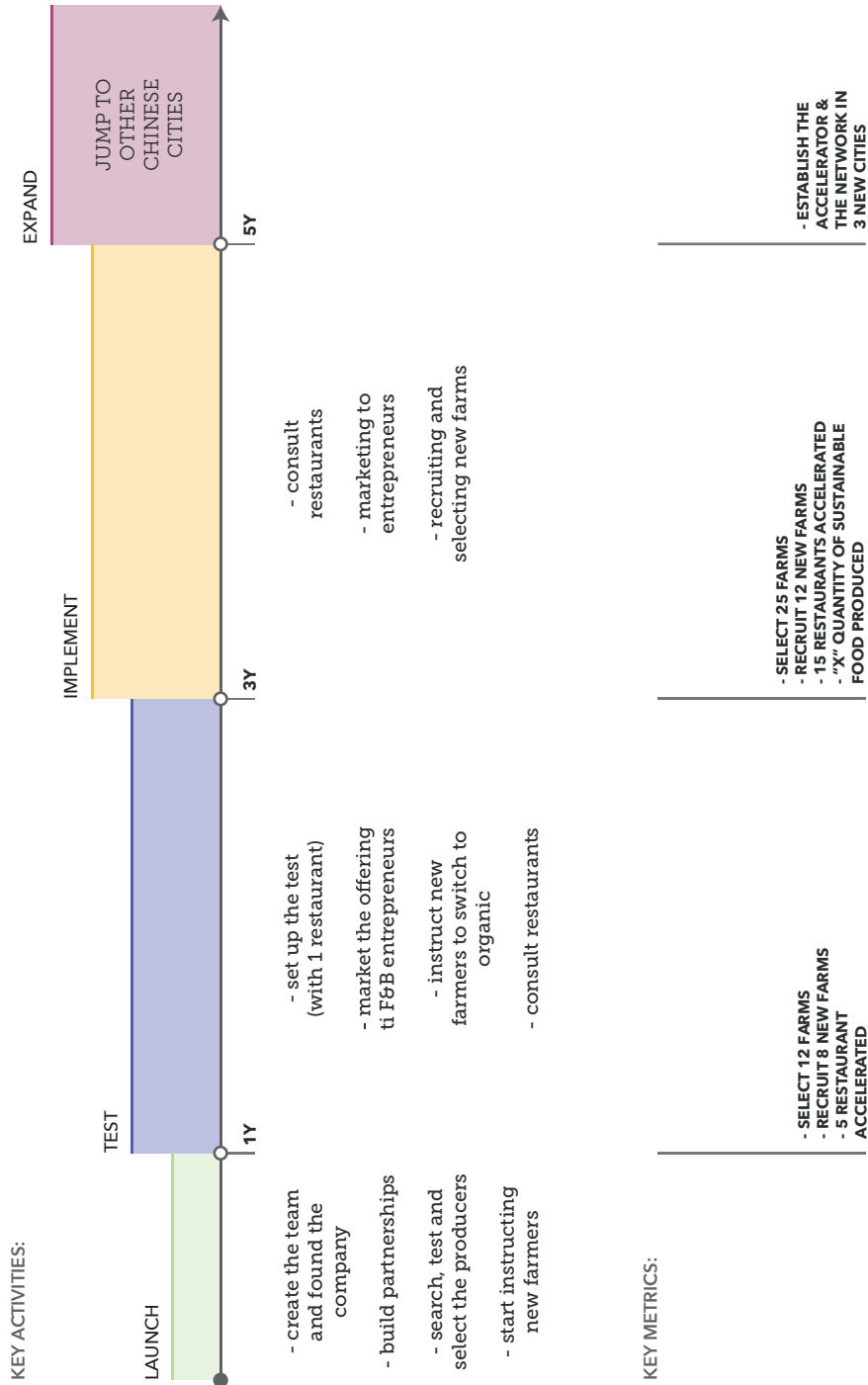
KEY METRICS

In order to measure the success of Shanghai OrganiX, key metrics, based on 4 different steps in ten years, were highlighted. Surely, they go hand in hand with the backend and key activities, needed to develop the accelerator (the complete plan is visible in the roadmap below). Within the first year, the goal is to build all the partnerships and select 6 farms. Within 3 years the goal is to reach 12 farms to add in the Network, to have recruited 8 new farms to start farming sustainably and to have accelerated at least 5 restaurants. In the following years, the goals simply increase in their number, until the last, long term objective, representing the objective within 10 years. At that time, indeed, the aim is to replicate and implement the same system in other 2 Chinese tier1 cities.

CHANNELS

Another important element of the business strategy is the way through which communicating and reaching the targets. As regards the entrepreneurs, it has been decided not to focus on Chinese Social media, rather to focus on specialized, off and online magazines, and to be physically present to the sector trade fairs. In addition, Direct Email Marketing (DEM) and the proprietary website will be used as digital presence and touchpoints. As regards the farmers, instead, the communication will be mainly offline and based on visits to the farms (so that to meet and talk with the producers, and to observe their operations), and on direct participation to farmers' events, like fairs and talks. In both cases, personal relationships are predominant over the digital ones and more valuable.

Fig.152 Roadmap with key activities and objectives over time.



REVENUE STREAMS

Being a restaurant accelerator imposes diverse and articulated revenue streams. Both short and long term earnings are needed to guarantee the day to day operations and the business success over time, not only for the accelerator itself but also for the clients. The pricing strategy is, therefore, based on all these aspects, in particular, on the restaurants' financials and liquidity.

Considering that a restaurant in Shanghai has to face multiple opening costs (see below for details) and investments, it has been decided to ask for an initial participation subscription (a fixed cost) and shares of the business. Indeed, in this way, the restaurant is surely encouraged to join the acceleration program since it does not need to spend other big quantity of money, and it is reassured of the serious involvement of the accelerator. Within 3 years, before the average industry return on investment time (4 years, see costs for details), restaurants will be given the option to buy their shares back and only pay for the subscription to the Network, or to share the revenues of their operations. As a matter of facts, it has been briefly calculated/hypothesized that, by benefiting from all the services offered by Shanghai OrganiX, a restaurant will pay back the initial investments quicker than other average restaurants in the industry.

The subscription to the Network is also what allows other revenues to come in. In this case, other restaurants not accelerated by Shanghai OrganiX can have the possibility to join the Network of suppliers by subscribing to it (if they meet the accelerator requirements).

In the accelerator perspective, this revenue model ensures a first quantity of money, used to cover some operational costs, and to cash-in in the upcoming 2-3 years. It also pushes the overall organization and partners to be deeply engaged and carefully participate in each restaurant's operations, ensuring trust and quality of the services. Even if the majority of the revenues come from entrepreneurs, also the farmers provide some earnings. As for restaurants, however, the pricing strategy is based on their financial situation. In order to keep the producers independent and not to burden the costs of the food, they will be only asked to subscribe to the Network, with flexible subscription plans. This will allow them to stay in business and to maximize the use of the Network. On a second level of intervention, another source of revenue will come from the support and set up of the visits to their farms (which possibly bring them new commercial relationships, i.e. subscribing to their CSA). In the first phases of the accelerator operations, however, the business strategy related to them will be slightly different. It will be the usual intermediation fee per order which allows them not to invest a (bigger) quantity of money, when the Network may be still small, with not many clients. After this initial period and once the Network will be both populated by a good number of business clients and farmers, they will pay the subscription mentioned above.

COST STRUCTURE

Setting up such a system and business involves different costs. In order to manage this complexity and to keep it simpler, it has been decided not to go into numbers, rather to break the cost structure down into blocks, and evaluate their weight (compared to the total). Moreover, to better understand them, a description and resume of each are provided, together with a clear highlight of the avoided costs. Finally, a description related to the restaurants business is provided as well, aiming to depict their usual financial situation (and to better understand the reasons behind the revenues strategy).

Starting from the costs of the accelerator, the “key activities” is surely the voice which involves more costs. As a matter of facts, considering that the technology to make the Network work is given by one of the partners, the backend activities of selecting the farms, recruiting new ones, and marketing, together with the front end activities of consulting, supporting the training, designing the communication and its touchpoint, and setting up the restaurants and farms’ activities, represent the main costs.

On a second level, there are the costs related to human resources, i.e. the team, and the management of the partnerships. In order to offer quality services to the clients, the professional profiles required are consultants to advise the clients and set up a profitable business model; user experience/graphic designers, together with a software developer, to design the communication and to develop its touchpoint; an agronomist to scout and assess the good farms; a business developer to expand the business; a service designer to design the processes and link all the aforementioned professionals and partners together.

On a third level, instead, there are the costs associated with the channels of the accelerator, such as the business development and the marketing activities. These, as described in the section above, consist of the fairs stands, advertising on specialized magazines, the DEM, and the preliminary visits to the farms.

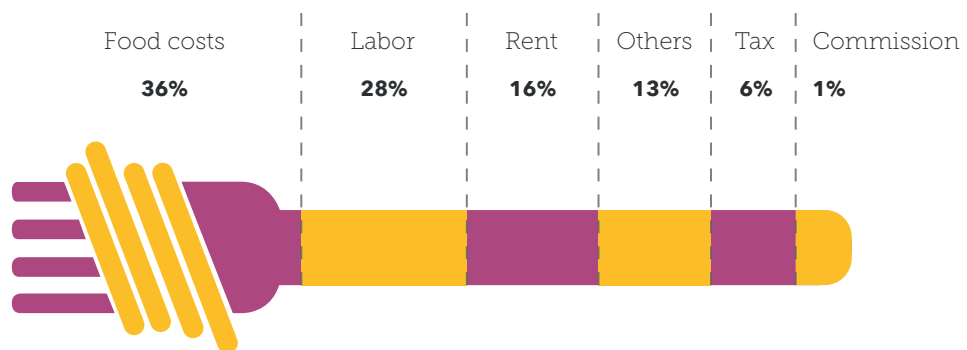
Finally, there are costs related to the relationships with the customers. Indeed, considering the participation in the clients’ shares, the kind of support offered is personalized. Besides, it involves co-creative sessions where to set up new activities able to attract customers to the restaurant. On the farms’ side, instead, the support is personalized as well but it mainly involves the use of the platform and the support and set up of new activities to be carried on the farm.

In order to understand the desirability and feasibility of Shanghai OrganiX offerings, from a business perspective, it is useful to go into the details of the average restaurant business in Shanghai. First of all, it has to be noted that, even in this case, calculating precise data is surely not easy since there are many factors to be considered. The following analysis is therefore based on an existing and comprehensive study of

restaurants' costs, made in Shanghai in 2015 (see the Appendix).

The study presents the costs of running such a business, divided into 6 categories, to which a percentage is assigned. Food cost usually represents the majority of the restaurant expenses, varying between 25% to 40% of total revenue. Labor accounts for about 25% of total revenue, a percentage cheaper than in the Western countries. Rent usually represents around 15% of total revenue, much higher than in many Western cities. Tax accounts for the 6%, legal management costs (commissions) for the 1%, and the remaining quantity is due to extra, various expenses (hygiene control, new business cards, paper towels, etc). When calculating the profits, also the initial investment has to be considered. Usually, according to the study, the average time to return on the investment for successful restaurants is 4 years circa.

Fig.153 Cost structure of a foreign restaurant in Shanghai. Adapted from smartshanghai.com.



The image above shows the costs of a particular restaurant, analyzed by the study. It is a foreign restaurant with a profit margin of 6%, which, after 4 years of operations, has now paid the initial investment off.

Differently from this case, the restaurants accelerated by Shanghai OrganiX will have lesser food costs because of the kind of cuisine (Chinese) and the use of food locally produced (and not imported). Also, the cost represented by the rent will be more easily amortized by the use of the restaurant space, during the least popular time of the day, for the restaurants' activities (like the cooking classes). Therefore, considering the intensive effort to engage with customers by different means, the quality of the food, and the differentiation in the market, the return on investment of Shanghai OrganiX's restaurants is expected to be quicker (around 3 years).

5.9 PROTOTYPING

In order to verify the potential of the concept, different prototyping sessions and user tests were carried out. Indeed, since there was not the possibility to test the overall service, it has been decided to conduct 3 different activities separately, testing 3 different service components.

The first activity that was carried out was a test of the platform, targeting the farmers. The aim of this user test was not to verify the use of the service platform of one of Shanghai OrganiX's partners (UR Bridge), rather, to test its acceptance and to start a discussion about some specific aspects. Since the UR Bridge app was still not publicly available, it has been decided to design a low fidelity prototype.

In facts, the app was realized by sketching on paper its different screenshots (taking inspiration from the partners' app but shaping it according to the author's needs), and animating and linking them together. The critical points needed to be tested were the overall use/acceptance by the farmer, the pricing of joining the Network, the validity of the information needed to better manage the harvests, the possibility to combine together different farmers' produces, and the level of importance of the app functions (and if there was anything missing).

The app was tested with one farmer, in a deep session, and with one restaurant manager, digitally. Indeed, to better simulate the use of the platform and to also get feedback from the restaurant side, it has been decided to test it as well. Unfortunately, there was not the possibility to carry an in-depth test session and that is the reason why it has opted for a digital test (which the technology allowed to do, fortunately). The results of these two tests were really useful to better define some elements of the concept (the accelerator). In particular, thanks to them, the pricing strategy was defined, together with the actual organization and execution of the activities. These sessions were ultimately also useful to discuss the general conceptual idea.

The second activity that was carried out was an actual prototyping of a subcategory of one of the restaurant offerings, i.e. the arrangement of a farm visit. In this case, the aim was to verify the interest of urban consumers (the ones selected as targets) into one of the activities offered by the restaurants (which join the acceleration program). The visit to the farm also allowed to verify the feasibility, ease, and management of organizing different activities there, and the success of the kind of event.

Therefore, being the author already part of one Community Supported Agriculture in Shanghai, together with the farmers and other community members a one full

day visit was organized. The organization of such an event was aimed to make new people try and experience the CSA model, and get to know its farmers and members. Hence, a series of activities was decided together with the farmers, based on the period of the year, the resources needed and the interests of the members. They were: a tour of the farms, a picking veggies session followed by a cleaning session and a cooking class.

Fig.154 Prototyping the network offering with the farmer and the restaurant manager (07/07/19, Shanghai).

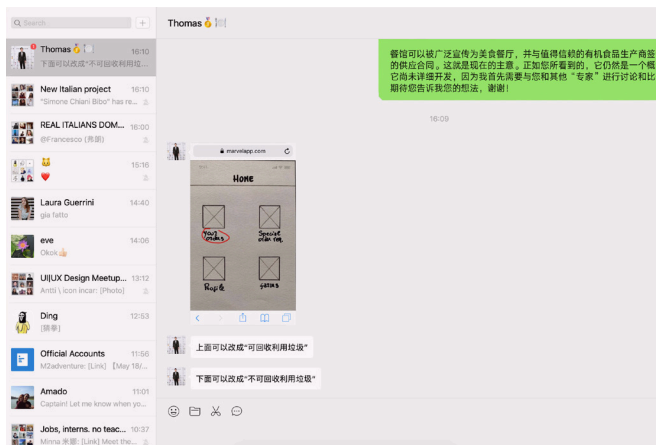
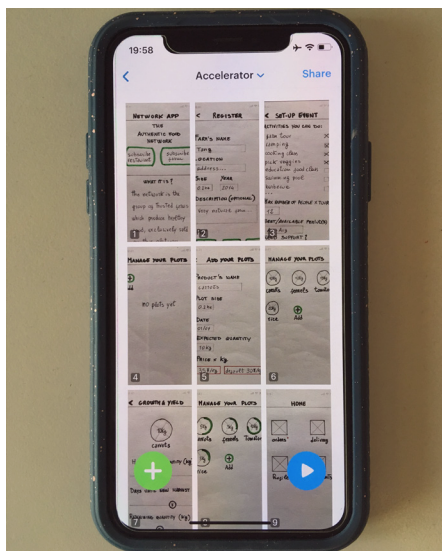


Fig.155 Prototyping the farm visit and its activities (08/07/19, Shanghai).

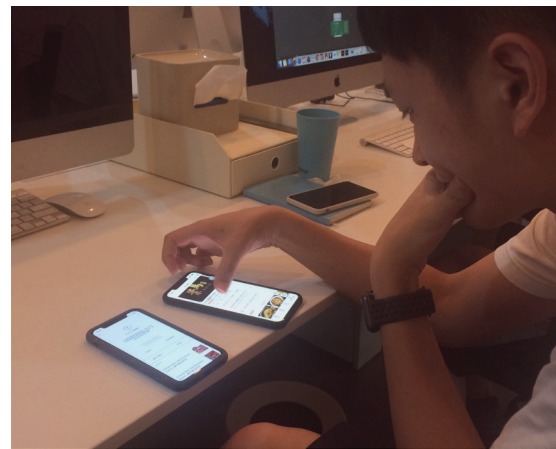


The day at the farm was very nice, with a chill and friendly environment, and the activities were all carried out (with ups and downs, of course). This prototyping session was particularly useful because it revealed the skills level of the farmers when interacting with the public, their strengths (plants knowledge, teaching skills, partially the communication) and weaknesses (managing a big group, getting enough resources/materials for everyone to conduct the activities). It also showed the level of interests of the participants, who all followed carefully and enthusiastically the activities of the day. This prototyping session was, again, also a way to discuss the concept of the accelerator and to bet feedbacks. Probably the best result of this activity was that, one of the person that the author invited to the event eventually, after some weeks, decided to join the CSA (giving proof of the visits as a potential way to make new commercial -and not- relationships arise).

Finally, the last activity was a test of the main communication touchpoint, through which the customers can interact with the accelerated restaurants. In order to verify whether a WeChat official account was the right touchpoint, its usability and which information were needed to be displayed, two in-depth user tests were conducted. Hence, a high fidelity prototype was designed, simulating a fictitious restaurant's WeChat official account (as if the restaurant was already been accelerated).

The account was realized by digitally designing its different screenshots (taking inspiration from an existing account but shaping it according to the author's needs), and linking them together. The critical points needed to be tested were the first encounter and how to go from that to WeChat, the user scenario (when, where and how to use it), and the level of importance of the displayed information (and if anything was missing). The reason why a high fidelity prototype was designed was to better simulate a real-life situation where the users could be more familiar with. The prototype was tested with two urban consumers, one informed and concerned about healthy food, the second not-informed but concerned (see chapter 4 for details). The result of this test was partially satisfying. Indeed, using a high fidelity prototyping helps people to better imagine themselves in a real-life situation. This was really useful especially to better understand the users' scenario and the way they can pass from the first encounter (Dianping) to the WeChat official account. It was also helpful to determine whether the account was missing important information or not. On the other hand, however, their attention focused too much on the details of the visuals, about which they expressed their thoughts. Nevertheless, this test session contributed to define the user flow and its triggers, as well as to refine some sections of the account.

Fig.156 Prototyping the restaurants' touchpoint (24/07/19 , Shanghai).



5.10 SUSTAINABLE ASSESSMENT

In order to evaluate more accurately the environmental and socio-ethical improvements that the system innovations will produce once implemented, a concept assessment has been drawn, together with a comparison to the current system. To visualize it, the SDO toolkit radar was used.

The radar in the image shows the assessment of the system as if the author's concept would be in place. For each priority, a letter is assigned, according to its impact. The letters are N=No; L=low; M=Medium; H=High. Also, the darker areas represent the assessment of the current system (without my solution).

As it is possible to notice from the radar on the left, the implementation of the concept will positively impact the most the "toxicity reduction" of the system, but it will not influence the transportation (reduction), nor the resources (reduction).

On the right side, instead, the priorities which are mostly influenced are "empower/valorize local resources" and "enable responsible/sustainable consumption", whereas "favor/integrate the weak and marginalized" was not influenced.

The underlined priorities in the radars are the most important (defined during the research). Coherently, they score a high result (except for the "system life optimization" which scored medium), especially because they were the drivers of the concept generation.

By looking at the comparison between the current system's assessment and the new one (as if my concept would take place), it is clear where the project focused on, and how the concept increases the system. Surely, the concept does not impact all the priorities, leaving some of them untouched and open to future and further intervention.



Fig.157 Sustainable assessment.

6 CONCLUSIONS

6.1

RESEARCH CONCLUSIONS

The research about food, conducted through the lens of sustainability, shows the complexity of the food system and how a holistic approach to the topic is needed, not only to address the right problem but also to find its answer and develop a practical solution for intervention.

The research has demonstrated that the current food chain does not represent a long term solution for the provisioning of food for the future, because of its unsustainability due to the huge quantity of energy and resources required and to the losses happening along the chain. This is, ultimately, the price to pay for a context of food abundance, at least in the industrialized countries.

Also, food waste has resulted to be the most tangible proof of the inefficiency of the system, as it is a symbol of an overproduction compared to the functional unit of feeding a certain number of people. As a matter of facts, however, it only represents the tip of the iceberg: in its life cycle assessment, food waste accumulates together the impacts of the previous steps, but it is not the most impactful step (nor its treatment). Rather, the most impactful step is the food production, as it relies on the massive use of chemicals substances, derived from fossil fuels energies.

During the analysis of the alternative production methods, organic has been discussed as a promising sustainable practice. However, it has been claimed that, while surely better for the environment than conventional agriculture, the dispute between organic and conventional farming is based on wrong assumptions: nor conventional nor organic have been defined as truly sustainable agriculture if they are based on an industrial model.

Rather, the valid alternative seems to be in those farming techniques which are closer to the principles that generated the organic movement at first. These techniques, commonly referred to as beyond organic, place the health of the soil at the first place, relying on a much more balanced system of inputs and outputs following the natural cycles, and, thus, they are based on a different economy model (not a mass one). Beyond organic has therefore been recognized as the most promising sustainable alternative to the current food production system.

However, there are uncertainties about the possibility of this farming technique to be implemented at a large scale, due to its complexity (compared to conventional agriculture) and the average time needed to turn conventional cultivation to that.

Further research in this direction should be done, with the particular aim to understand if the trade-off between the time needed to implement the beyond organic production and its effects is truly feasible and worthy.

Also, by going more in-depth with the agricultural production itself, studies should be done to understand if the impacts caused by breeding animals, like cows (which beyond organic agriculture includes), is lesser than the avoided impacts due to the overall beyond organic farming system, especially considering its promising principle of soils conservation, opposed to soil degradation as in today's agriculture. Finally, the role that small beyond organic farms could play in Shanghai is important. However, additional researches and estimations need to be done to understand if these alternative production models could effectively guide the transition towards a cleaner food production, and if they will ever find a governmental endorsement.

6.2 PROJECT'S REFLECTIONS AND IMPLEMENTATIONS

As regards the project solution, there are surely aspects that may be improved, and that deserve a mention.

First of all, as well as for the academic research, the language definitely represented a barrier. Indeed, the project was developed taking into considerations the available and accessible resources, including people and places. Although the concept was tested, more participants would have generated a richer outcome, based on quantity and not only on quality. The language also definitely influenced the development of the business part, in particular with the difficulty of getting into detailed numbers. In order to further implement the project solution, a more accurate elaboration of the business part would be needed.

Secondly, the concept is aimed to integrate with the existing economic and social tissues of today's China, in particular, Shanghai. Therefore, some important/hot issues of the Western countries were not treated in the development of this thesis, as the privacy one. In China, this is not an important issue, surely not more important than others. Chinese people are way more used than Westerners to share their data with the public authorities and with 3rd parties, as long as they do not represent a threat, especially through their smartphone (which they greatly use).

Hence, privacy issues were not taken into considerations as “problems” but they were simply treated as they are in China nowadays.

Finally, the conceptual outcome of the project mainly aims to serve as inspiration for other entrepreneurs and (in the future) the Chinese government for the actuation of sustainable and profitable initiatives. In more general terms, it shows what could be a doable path to follow to be able to feed the increasing number of Chinese (and world’s) people, while conserving and protecting the environment. Business, human needs, and environmental sustainability altogether.

6.3 PERSONAL CONCLUSIONS

During the development of this thesis project, I had the chance to learn many new things and to meet interesting and knowledgeable people. I consider myself satisfied with the work done, especially taking into consideration the obvious obstacle of being in such a foreign country, with cultural habits, language, and beliefs very different from mine.

Being in China, indeed, naturally forced me to adapt the design methodologies and processes, learned at the university, to the local context. It has been difficult but surely interesting getting to know the Chinese mindset and attitude, as well as their creative thinking, and how to possibly merge my Western design approach with theirs.

As regards the main topic of this project, i.e. sustainability, I decided to focus on that exactly because it was a topic only superficially faced and never taken as a starting point or core of any project previously designed. My personal aim was to go beyond the surface of this complex subject and to start understanding why, even if so necessary, few of my colleagues (as well as design practitioners) place it on a second or third level of importance. There is surely not a simple answer to it. However, I came to the conclusion that it is not as practiced as I think it should be because of its complexity, and the current low resources (in particular money) it is usually linked to. Again, this second point may bring to a whole new discussion about our economic model. However, this is out of the scope of this thesis project.

7

REFERENCES

7.1

BIBLIOGRAPHY

A AFA. (2014). Asian Farmers' Association for Sustainable Rural Development. (2014). Asian Farmers and IYFF: What is it for us during the International Year of Family Farming, 6(1). Quezon City, Philippines.

Andersen, M., and Tukker, A. (2006). Workshop of the Sustainable Consumption Research Exchange (SCORE!) Network. Copenhagen, Denmark.

B Bai, J., Wahl, T. I., Lohmar, B. T., Huang, J. (2010). Food away from home in Beijing: Effects of wealth, time and "free" meals. *China Economic Review* 21, 432-441.

Baidu. (2019). The wholesale market. Retrieved from: <https://baike.baidu.com/item/农产品批发市场>

Barton, D., Chen, Y., and Jin, A. (2013). Mapping China's middle class. Retrieved from <https://www.mckinsey.com/industries/retail/our-insights/mapping-chinas-middle-class>

Bevilacqua, M., Braglia, M., Carmignani, G., and Zammori, F. A. (2007). Life Cycle Assessment of Pasta Production in Italy. *Journal of Food Quality*, 30(6), 932–952. <https://doi.org/10.1111/j.1745-4557.2007.00170.x>

C (China Briefing, 2019). Paul, V., and Förster, M. (2019). China's Health Foods Market: What Makes it Attractive for Foreign Investors. Retrieved from: <https://www.china-briefing.com/news/chinas-health-foods-market-makes-attractive-foreign-investors/>

Chinese Food/Cuisine: Culture, Ingredients, Regional Flavors. (2019). Retrieved from <https://www.chinahighlights.com/travelguide/chinese-food/>

China Sustainable Development Report 2019. (2019). Retrieved from <https://dashboards.sdgindex.org/#/CHN>

Cornell University (2018). Retrieved from: http://events.cornell.edu/event/sustainable_local_food_system_in_shanghai_prc

Davis, B., Lockwood, A., and Stone, S. (1998). Food and Beverage Management. 3rd edition. Butterworth-Heinemann. Oxford, US.

D

(DG Environment, 2018). Annual Activity Report. Directorate-General for Agriculture and Rural Development. (2018). European Commission.

Du, S., Mroz, T. A., Zhai, F., and Popkin, B. M. (2004). Rapid income growth adversely affects diet quality in China— particularly for the poor! *Social Sci. Med.* 59, 1505-1515.

Euromonitor. (2017). Retrieved from: <https://blog.euromonitor.com/2017/10/new-insights-fresh-food.html>

E

European Commission, and FUSIONS. (2016). Estimates of European food waste levels. Swedish Environmental Research Institute. Stockholm, SE.

European Commission, Joint Research Centre. (2010). Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment. Luxembourg. Publications Office of the European Union.

Eurostat Farm Survey. (2016). Retrieved from: <https://ec.europa.eu/eurostat/documents/2995521/9028470/5-28062018-AP-EN.pdf/8d97f49b-81c0-4f87-bdde-03fe8c3b8ec2>

FAO. (2016). FAOSTAT. Rome: Food and Agriculture Organisation of the United Nations. Retrieved from: faostat.fao.org/site/655/default.aspx.

F

FAO. (2014). OECD/Food and Agriculture Organization of the United Nations. (2014). OECD-FAO Agricultural Outlook 2014, OECD Publishing. http://dx.doi.org/10.1787/agr_outlook-2014-en

(Fao, 2014). Tubiello, F.N., Salvatore, M., Córdor Golec, R.D., Ferrara, A., Rossi, S., Biancalani, R., Federici, S., Jacobs, H., and Flammmini, A. (2014). Agriculture, Forestry and Other Land Use Emissions by Sources and Removals by Sinks. FAO.

FAO. (2013). Food wastage footprint: Impacts on natural resources: summary report. Rome, FAO.

FAO. (2011). Energy-smart food for people and climate. Rome, Italy.

(FAO, 2011). FAO. 2011. The state of the world's land and water resources for food and agriculture (SOLAW) – Managing systems at risk. Food and Agriculture Organization of the United Nations, Rome and Earthscan, London.

(FAO, 2019). International Fund for Agricultural Development, UNICEF, World Food Programme, and World Health Organization. (2019). The state of food security and nutrition in the world: Safeguarding against economic slowdowns and downturns. Rome, FAO.

FAOSTAT. (2019). Rome: Food and Agriculture Organisation of the United Nations. Retrieved from: <http://www.fao.org/faostat/en/#data/EL/visualize>

FAOSTAT. (2013). Rome: Food and Agriculture Organisation of the United Nations. Retrieved from: <http://faostat.fao.org/site/291/default.aspx>

Feedback: Feeding People, Backing the Planet. (2019). Retrieved from: <https://feedbackglobal.org/>

Ferne, E. (2016). Alternative Food Networks. Department of Geography, Trinity College Dublin. Dublin, Ireland.

Fieldhouse, P. (1995). Social functions of food. Food and Nutrition: Customs and culture, 78–105. https://doi.org/10.1007/978-1-4899-3256-3_4

Food is much more than what is on our plates. (2018). Retrieved from Food and Agriculture Organization of the United Nations (FAO): <http://www.fao.org/fao-stories/article/en/c/1157986/>

Food Safety. (2019). Retrieved from Food and Agriculture Organization of the United Nations (FAO): <http://www.fao.org/food-safety/en/>

Food Sustainability Index. (2017). BCFN foundation. Retrieved from: <http://foodsustainability.eiu.com>

Foteinis, S., and Chatzisyneon, E. (2016). Life cycle assessment of organic versus conventional agriculture. A case study of lettuce cultivation in Greece. *Journal of Cleaner Production*, 112, 2462–2471. <https://doi.org/10.1016/j.jclepro.2015.09.075>

Gale, F., and Huang, K. (2007). Demand for Food Quantity and Quality in China. Economic research report. United States. Dept. of Agriculture. Economic Research Service, No. 32. **G**

Garrone, P., Melacini, M., and Perego, A. (2015). Dar da mangiare agli affamati: le eccedenze alimentari come opportunità. Politecnico di Milano. Executive summary. Fondazione per la Sussidiarietà e Politecnico di Milano in collaborazione con Nielsen Italia. Edizioni Guerini e Associati. Milan, Italy.

Ge, K., Chen, C. Shen, T. and Zhang, S. (1991). Food consumption and nutritional status in China. *Food, Nutrition and Agriculture*, 1(2/3), 54–61. Retrieved from <http://www.fao.org/3/U8050t/u8050t03.htm>

Goedkoop, M., Halen, M., Riele, H., and Rommens, H. (1999). Product Service Systems, Ecological and Economic Basics. Amersfoort, The Netherlands.

Goodman, D., DuPuis, M., and Goodman, M. (2011). *Alternative food networks: Knowledge, practice and politics*. Routledge. New York, US.

Gustavsson, J., Cederberg, C., & Sonesson, U. (2011). Global food losses and food waste: Extent, causes and prevention ; study conducted for the International Congress Save Food! at Interpack 2011. Düsseldorf, Germany. Rome: Fao.

Hu, X., Zhang, M., Yu, J., and Zhang G. (2012). Food waste management in China: status, problems and solutions. *Acta Ecologica Sinica*, 32(14), 4575–4584. **H**

Huang, E. (2017). One kind of food absolutely dominates China's restaurant industry. Retrieved from: <https://qz.com/982226/chinas-favorite-food-is-hot-pot-the-country-spent-half-a-trillion-dollars-eating-out-last-year/>

I IFOAM. (2019). Retrieved from: <https://www.ifoam.bio/en/organic-landmarks/principles-organic-agriculture>

International Institute for Industrial Environmental Economics (IIIEE). (2009). *The Future is distributed: a vision of sustainable economies*. Lund: IIIEE.

IPCC. (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva, Switzerland.

J Johansson, A., Kisch, P., and Mirata, M. (2005). Distributed Economies. A new engine for innovation. *Journal of Cleaner Production*, 13, 971-979.

JRC. (2006). European Commission and Joint Research Centre. (2006). *Environmental Impact of Products (EIPRO): Analysis of the life cycle environmental impacts related to the final consumption of the EU-25*. Institute for Prospective Technological Studies (Technical Report EUR 22284 EN).

Junguo, L., Lundqvist, J., Weinberg, J. and Gustafsson, J. (2013). Food losses and waste in China and their implication for water and land. *Environmental Science and Technology*, 47(18) 10137-10144.

K Kan, K., and Chen, W. (2019). How e-commerce is reshaping organic farming in China. China's small-scale organic farmers are selling their produce online but face competition from e-commerce giants. Retrieved from: <https://dialogochino.net/22106-how-e-commerce-is-reshaping-organic-farming-in-china/>

Kearney, J. (2010). Food consumption trends and drivers. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 365(1554), 2793–2807. <https://doi.org/10.1098/rstb.2010.0149>

Kjærnes, U., Harvey, M., and Warde, A. (2007). *Trust in Food: A Comparative and Institutional Analysis*. London: Palgrave Macmillan.

Kniss, A.R., Savage, S.D., and Jabbour, R. (2016). Commercial Crop Yields Reveal Strengths and Weaknesses for Organic Agriculture in the United States. *PLOS ONE*. <https://doi.org/10.1371/journal.pone.0161673>

Kurmu, M., Moel, H., Porkka, M., Siebert, S., Varis, O., and Ward, P.J. (2012). Lost food, wasted resources: Global food supply chain losses and their impacts on freshwater, cropland, and fertiliser use. *Science of the Total Environment*, 438, 477-489.

Lam, H. M., Remais, J., Fung, M. C., Xu, L., and Sun, S. S. M. (2013). Food supply and food safety issues in China. *The Lancet*, 381(9882), 2044–2053. [https://doi.org/10.1016/S0140-6736\(13\)60776-X](https://doi.org/10.1016/S0140-6736(13)60776-X)

LeNSlab Polimi. (2017). The lensin research hypothesis: System Design for Sustainability for all. The design of S.PSS applied to DE: a win-win offer model for a sustainable development for all. Politecnico di Milano. Milan, Italy.

Li, J. J., and Su, C. T. (2007). How face influences consumption: A comparative study of American and Chinese consumers. *International Journal of Market Research*, 49(2), 237-256.

Li, L. T., Yin, L. J., and Saito, M. (2004). Function of Traditional Foods and Food Culture in China. *The Japan International Research Center for Agricultural Sciences (JIRCAS)*, 38(4), 213-220.

Liu, G. (2014). Food Losses and Food Waste in China: A First Estimate. *OECD Food, Agriculture and Fisheries Papers*, No. 66. OECD Publishing, Paris. <http://dx.doi.org/10.1787/5jz5sq5173lq-en>

Liu, G. (2013). Food losses and food waste in China: a first estimate. Preparatory study. *OECD Food, Agriculture and Fisheries Papers*.

Liwei, G., Shengkui, C., Xiaochang, C., Dan, Z., Xiaojie, L., Qi, Q., and Yao, L. (2013). An Overview of the Resources and Environmental Issues from Wasted Food in Urban Catering Across China. *Journal of Resources and Ecology*, 4(4), 337–343.

Ma, G. (2015). Food, eating behavior, and culture in Chinese society. *Journal of Ethnic Foods*, 2(4), 195-199. <https://doi.org/10.1016/j.jef.2015.11.004>

Martinengo, M. C. (2015). The importance of food in the individualized society. *GeoProgress Journal*, 2(1).

L

M

(McKinsey, 2016). Zipser, D., Chen, Y., Gong, F. (2016). *Consumer & Retail Practice. The Modernization of the Chinese Consumer*. McKinsey&Company.

McMillan, T. (2018). How China Plans to Feed 1.4 Billion Growing Appetites. Retrieved from: <https://www.nationalgeographic.com/magazine/2018/02/feeding-china-growing-appetite-food-industry-agriculture/>

Meier, M. S., Stoessel, F., Jungbluth, N., Juraske, R., Schader, C., and Stolze, M. (2015). Environmental impacts of organic and conventional agricultural products – Are the differences captured by life cycle assessment? *Journal of Environmental Management*, 149, 193-208. <https://doi.org/10.1016/j.jenvman.2014.10.006>

(Meituan-Dianping, 2018). Meituan Dianping Crunch time in 2019. (2019). Retrieved from: <http://n.sinaimg.cn/finance/20b4c54d/20190319/MeiTuanYanBao.pdf>

Merriam Webster. (2019). Definition of FOOD. Retrieved August 12, 2019, from <https://www.merriam-webster.com/dictionary/food>

Meyer-Höfer, M., Tijerino, A. M. J., and Spiller, A. (2015). Sustainable food consumption in China and India. *Transformation of Global Agri-Food Systems: Trends, Driving Forces, and Implications for Developing Countries*, No. 60. Georg August University. Göttingen, Germany.

Minister of agriculture (2013). Retrieved from: http://sd.ifeng.com/zt/sdjtnj/djtnj/detail_2013_06/21/919015_0.shtml

Mintel. (2019). *Global food and drink trends 2019*.

Mogensen, L., Hermansen, J. E., Halberg, N., and Dalgaard, R. (2009). *Life Cycle Assessment across the Food Supply Chain. Sustainability in the Food Industry*. IFT Press. Wiley-Blackwell, 5, 115-144.

P

Parfitt, J., Barthel, M., and Macnaughton, S. (2010). Food waste within food supply chains: quantification and potential for change to 2050. *Journal of Philosophical Transactions of the Royal Society B*, 365, 3065-3081.

Parry, A., James, K., and LeRoux, S. (2015). *Strategies to achieve economic and environmental gains by reducing food waste*. WRAP, Banbury, UK.

Pollan, M. (2006). *The Omnivore's Dilemma: A Natural History of Four Meals*. Penguin Press. New York, US.

Popkin, B. M. (2006). Technology, transport, globalization and the nutrition transition food policy. *Food Policy* 31, 554-569. <https://doi:10.1016/j.foodpol.2006.02.008>

Primo Piano. (2017). Spreco alimentare a un anno dalla legge. Retrieved from: <https://www.italiaatavola.net/alimenti/tendenze-e-mercato/2017/9/12/spreco-alimentar-e-anno-legge-miliardi-euro-pil/51874/>

PwC. (2016). *Managing Upstream Risks in China's Food Supply Chain*. Pricewaterhouse Coopers, China.

Qi, X. (2017). Face: A Chinese Concept in a Global Sociology. *Journal of Sociology* 47(3), 279-295. <http://DOI: 10.1177/1440783311407692>

Q

Ritchie, H., Roser, M. (2017). CO₂ and Greenhouse Gas Emissions. Retrieved from: <https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions>

R

Roy, P., Nei, D., Orikasa, T., Xu, Q., Okadome H., Nakamura, N., and Shiina, T. (2009). A review of life cycle assessment (LCA) on some food products. *Journal of Food Engineering*, 90(1), 1-10.

(SAN, 2017). Rainforest Alliance. (2017). *Sustainable Agriculture Standard for farms and producer groups involved in crop and cattle production*. Version 1.2.

S

Service design network. (2019). About service design. Retrieved from <https://www.service-design-network.org/about-service-design>

Shanghai Agriculture. (2017). Retrieved from: http://en.nyncw.sh.gov.cn/nw_en/index.html

Sheng, Y., & Song, L. (2019). Agricultural production and food consumption in China: A long-term projection. *China Economic Review*, 53, 15-29. <https://doi.org/10.1016/j.chieco.2018.08.006>

Shetty, P., (2002). Nutrition transition in India. *Public Health Nutrition*, 5, 175-182. <http://doi:10.1079/PHN2001291>

Shi, Z., Wen, L., Huang, Z., & Ye, J. (2011). An empirical study on face need effects on advertising of luxury. *Innovative Marketing*, 7(3).

Shimokawa, S. (2015). Sustainable meat consumption in China. *Journal of Integrative Agriculture*, 14(6), 1023-1032. [https://doi.org/10.1016/S2095-3119\(14\)60986-2](https://doi.org/10.1016/S2095-3119(14)60986-2)

Stickdorn, M., Lawrence, A., Horness, M., & Schneider, J. (2018). *This is service design doing*. Canada: O'Reilly Media.

Skunca, D., Tomasevic, I., Nastasijevic, I., Tomovic, V., & Djekic, I. (2018). Life cycle assessment of the chicken meat chain. *Journal of Cleaner Production*, 184, 440-450. <https://doi.org/10.1016/j.jclepro.2018.02.274>

Statistical Yearbook Shanghai. (2018). Retrieved from: <http://www.stats-sh.gov.cn/tjnj/zgsh/nj2011.html>

Sun, X. (2016). Chinese food distribution and retail outlets. Exporting food to China. The Australian Centre for Sustainable Business and Development (ACSBD). University of Southern Queensland. Queensland, Australia.

T

Tai, J., Zhang, W., Che, Y., and Feng., D. (2011). Municipal solid waste source-separated collection in China: a comparative analysis. *Waste Management*, 31(8), 1673-1682.

The Free Dictionary of the English Language. (2016). Food Service. Retrieved from: <https://www.thefreedictionary.com/food+service>

The History of China: Dynasty/Era Summary, Timeline. (2019). Retrieved from: <https://www.chinahighlights.com/travelguide/culture/china-history.htm>

The Rodale Institute. (2019). The 30 year report. Retrieved from: <https://rodaleinstitute.org/wp-content/uploads/fst-30-year-report.pdf>

The Sustainable Development Agenda. (2019). Retrieved from: https://www.unssc.org/sites/unssc.org/files/2030_agenda_for_sustainable_development_kcsd_primer_en.pdf

Tickell, J. (2017). *Kiss the Ground: How the Food You Eat Can Reverse Climate Change, Heal Your Body & Ultimately Save Our World*. Enliven Atria Books. New York, US.

Tischner, U., Sto, E., Kjaernes, U., Tukker, A. (2010). *System Innovation for Sustainability III. Case studies in sustainable consumption and production, food and agriculture*. UK: Greenleaf publishing.

Tomić, M. (2018). Food and the Sustainable Development Goals. Retrieved from: <http://socisdg.com/en/blog/food-and-the-sustainable-development-goals/>

(UN, 2012). Giovannucci, D., Scherr, S., Nierenberg, D., Hebebrand, C., Shapiro, J. Milder, J., and Wheeler, K. (2012). *Food and Agriculture: the future of sustainability. A strategic input to the Sustainable Development in the 21st Century (SD21) project*. New York: United Nations Department of Economic and Social Affairs, Division for Sustainable Development.

(UNDP, 2019) About China | UNDP in China. (2019). Retrieved from: <http://www.cn.undp.org/content/china/en/home/about-us/about-china.html>

UNDP, Goal 2: Zero hunger. (2019). Retrieved from: <https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-2-zero-hunger.html>

UNDP, Goal 12: Responsible production and consumption. (2019). Retrieved from: <https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-12-responsible-consumption-and-production.html>

United Nations Department of Economic and Social Affairs. (2019). *World Population Prospects 2019: Highlights (ST/ESA/SER.A/423)*.

(UNEP, 2002). Manzini, E. Vezzoli, C. (2002). *PRODUCT-SERVICE SYSTEMS and sustainability*. Interdepartmental Research Centre Innovation for the Environmental Sustainability (CIR.IS). INDACO, Politecnico di Milano. Milan, Italy.

(USDA, 2018). *Food Service Industry Sector Overview, China*. (2017). Gain report. USDA, Foreign Agricultural Service.

Vezzoli, C., Ceschin, F., Osanjo, L., M'Rithaa, M. K., Moalosi, R., Nakazibwe, V., and Diehl, J. C. (2018). *Designing Sustainable Energies for All: Sustainable Product-Service System Design Applied to Distributed Renewable Energy*. Switzerland: Springer. <https://doi.org/10.1007/978-3-319-70223-0>

U

R

Vezzoli, C., Kohtala, C., Srinivasan, A., Xin, L., Fusakul, M., Sateesh D., and Diehl, J.C. (2014). *Product-Service System Design for Sustainability*. London: Greenleaf Publishing Inc.

Vezzoli, C., and Manzini, E. (2008). *Design for environmental sustainability*. London: Springer.

Y Yin, S., Wu, L., and Chen, M. (2010). Consumers' purchase intention of organic food in China. *Journal of the science, food and agriculture*. <https://doi.org/10.1002/jsfa.3936>

W Wang, Y., Wang, L., Xue, H., and Qu, W. (2016). A Review of the Growth of the Fast Food Industry in China and Its Potential Impact on Obesity. *International Journal of Environmental Research and Public Health*, 13(11). <https://doi.org/10.3390/ijerph1311112>

Warwick Institute for Employment Research. (2010). Restaurant industry. Retrieved from: <https://warwick.ac.uk/fac/soc/ier/ngrf/lmifuturetrends/sectorscovered/hospitality/sectorinfo/subsectors/restaurant/>

(WFP, 2019). Zero Hunger. (2019). Retrieved from <https://www.wfp.org/zero-hunger>

WHO. (2019). Obesity and overweight. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>

(WHO, 1997). Codex Alimentarius Commission. *Codex Alimentarius food hygiene basic texts*, 1st edition. (1997). Rome: World Health Organization and Food and Agriculture Organization of the United Nations.

Wiedmann, T. O., Schandl, H., Lenzen, M., Moran, D., Suh, S., West, J., and Kanemoto, K. (2015). The material footprint of nations. *Proceedings of the National Academy of Sciences of the United States of America*, 112(20), 6271-6276. <https://doi.org/10.1073/pnas.1220362110>

Willer, H., and Lernoud, J. (2019). *The World of Organic Agriculture. Statistics and Emerging Trends 2019*. Research Institute of Organic Agriculture (FiBL), Frick, and IFOAM Organics International. Bonn, Germany.

World Business Council for Sustainable Development (WBCSD). (2015). SUSTAINABLE LIFESTYLES REPORT, CHINA. Beijing, China.

World Urbanization Prospects 2018 Highlights. (2018). United Nations Department of Economic and Social Affairs.

WRAP. (2011). New estimates for household food and drink waste in the UK. Retrieved from: <http://www.wrap.org.uk/content/new-estimates-household-food-and-drink-waste-uk>

Xue, H., Wu, Y., Wang, X., & Wang, Y. (2016). Time Trends in Fast Food Consumption and Its Association with Obesity among Children in China. PLOS ONE, 11(3). <https://doi.org/10.1371/journal.pone.0151141>

X

Zhai, F., Wang, H., Du, S., He, Y., Wang, Z., Ge, K. and Popkin, B. M. (2009). Prospective study on nutrition transition in China. Nutrition Review, 67(1), S56-S61.

Z

Zheng, C. (2011). Serious food waste found in the catering sector in China. Retrieved from: www.chinadaily.com.cn/hqgj/jryw/2011-03-08/content_1957714.html

Zhang, J., Mauzerall, D. L., Zhu, T., Liang, S., Ezzati, M., Remais, J.V. (2010). Environmental health in China: progress towards clean air and safe water. 375: 1110-19.

Zhang, Q. F., and Pan, Z. (2013). The Transformation of Urban Vegetable Retail in China: Wet Markets, Supermarkets, and Informal Markets in Shanghai. Journal of Contemporary Asia, 43(3), 497-518.

Zhang, J., and Zhang, C., (2018). SUSTAINABILITY INSIGHTS: SHANGHAI'S FOOD WASTE MANAGEMENT. Collective Responsibility. Shanghai, China.

Zhou, W. (2013). Food Waste and Recycling in China: A Growing Trend? Retrieved from: <http://www.worldwatch.org/food-waste-and-recycling-china-growing-trend-1>

Zhou, Z., Weiming, T., Wang, J., Liu, H., and Cao, L. (2012). Food consumption trends in China. Australian Government Department of Agriculture, Fisheries and Forestry.

7.2 LIST OF FIGURES

Contents

<i>Fig.1 Literature research areas.</i>	21
<i>Fig.2 The process.</i>	26
<i>Fig.3 Maslow's pyramid of needs (Maslow, 1943).</i>	33
<i>Fig.4 The disparity between abundance and scarcity, adapted from FAO, 2019.</i>	36
<i>Fig.5 Increasing urban demographic concentration (500px.com/Denys Nevozhai).</i>	38
<i>Fig.6 Undernourished people's trend (FAO, 2019).</i>	39
<i>Fig.7 Moderate and severe insecurity (FAO, 2019).</i>	41
<i>Fig.8 The dimensions of sustainability for a sustainable development.</i>	43
<i>Fig.9 The sustainable development model of The Sustainable Development Agenda, adapted from un.org, 2019.</i>	44
<i>Fig.10 The 17 Sustainable Development Goals, adapted from un.org, 2019.</i>	45
<i>Fig.11 Urban/rural China population over time, adapted from China Statistical Yearbook, 2018.</i>	48
<i>Fig.12 Countries and territories with 2050 urban population exceeding 100'000, adapted from unicef.org, 2012.</i>	49
<i>Fig.13 Current average lifestyle material footprint of food and nutrition as a % of the total individual lifestyle footprint (average Chinese) including the hotspots driving the footprint today and projected to 2020-30. A future sustainable lifestyle target level of material intensity for food consumption is also suggested. WBCSD, 2015.</i>	52
<i>Fig.14 Health-related issues in today's China (China Sustainable Development Report 2019).</i>	54
1	54
2	54
<i>Fig.15 Market signals for better food, like fresh and organic (500px.com, Luis Vasconcelos).</i>	56
<i>Fig.16 China flavors divided per region (ChinaHighlights.com).</i>	58
<i>Fig.17 Chinese traditional food for the New Year (500px.com, Thy Le).</i>	62
<i>Fig.18 Chinese agriculture (500px.com, Sirisak Baokaew).</i>	65
<i>Fig.19 Food production increase, by category. Adapted from FAOSTAT, 2013.</i>	67
<i>Fig.20 Environment and water pollution in China (flickr.com, Bert van Dijk).</i>	69
<i>Fig.21 Dead pigs floating in Huangpu river (Chinasmack.com, Fauna).</i>	73

<i>Fig.26</i> Food waste highlights.	87
<i>Fig.27</i> (Skunca et al., 2018).	90
<i>Fig.28</i> Relative contributions to GWP from processes involved in the subsystems 1-5 (Skunca et al., 2018).	91
<i>Fig.29</i> Contribution to the environmental load for each impact category (Bevilacqua et al., 2007).	92
<i>Fig.30</i> Shares of energy consumed along the life cycle of pasta (Bevilacqua et al., 2007).	92
<i>Fig.31</i> Greenhouse gas emissions by gas, in the world. Adapted from Ritchie & Roser, 2017.	94
<i>Fig.32</i> Global warming potential of greenhouse gases over 100-year timescale (GWP_{100}). Adapted from Ritchie & Roser, 2017.	95
<i>Fig.33</i> The most impactful sectors to GHG emissions. Adapted from IPCC, 2014.	95
<i>Fig.34</i> Global shares of GHG emissions along the food supply chain. Adapted from FAO, 2011.	97
<i>Fig.35</i> Indication of global, shares of end-use energy demands throughout the food supplytotal final energy for the sector. Adapted from FAO, 2011 .	97
<i>Fig.36</i> Food wastage volumes, at world level by phase of the food supply chain. Adapted from FAO food wastage footprint, 2013.	98
<i>Fig.37</i> Contribution of each phase of the food supply chain to food wastage and carbon footprint. Adapted from FAO food wastage footprint, 2013.	99
<i>Fig.38</i> Carbon footprint by phase of the food supply chain with respective contribution of embedded life-cycle phases. Adapted from FAO food wastage footprint, 2013.	100
<i>Fig.39</i> Carbon footprint by phase of the food supply chain with respective contribution of embedded life-cycle phases. Adapted from FAO food wastage footprint, 2013.	102
<i>Fig.40</i> Comparison of USDA commercial seed varieties sold in the U.S. in 1903 with those in the U.S. National Seed Storage Laboratory in 1983. About 93% of the varieties had gone extinct (UN, 2012).	107
<i>Fig.41</i> The paradigm shift from centralized to distributed locally-based systems (LeNSin, 2018).	113
<i>Fig.42</i> Example of alternative production/distribution models (dialogochino.net, 2019).	116
<i>Fig.43</i> The five principles for a sustainable agriculture (SAN, 2017).	117
<i>Fig.44</i> The organic labels of different countries/continents (different sources).	120
<i>Fig.45</i> Comparison of organic vs. conventional lettuce cultivation per unit of area (ha) and per product unit (ton), using (A) IPCC 2013 and (B) ReCiPe impact assessment methods. Adapted from Foteinis & Chatzisyneon, 2016.	123
<i>Fig.46</i> The potential contribution to global warming, kg CO ₂ -equivalents per Functional Unit, with a time horizon of 100 years. Adapted from Cederberg & Mattsson, 2000.	125
<i>Fig.47</i> The soil health conditions of different farming techniques. Organic, no-tilled soil is compact: it better absorbs and retains water (The Rodale Institute, 2019).	127
<i>Fig.48</i> The Farming System Trial results (The Rodale Institute, 2019).	129

8

APPENDIX

A) Chinese Consumers

1) General Info (5)

- Nationality
- Gender
- Age range
- Kind of job/occupation
- Monthly income range

2) Routine / Behavior (7)

In order to simplify my research, I divided the categories of Chinese place where it is possible to eat in: Fànguǎn, Cānguǎn, Fàndiàn corresponding to low-, mid- and high-end restaurant. (show pictures).

- In which kind of place do you usually eat with others and you share the dishes? (Western, Fànguǎn, Cānguǎn, Fàndiàn + others)?
- In which kind of situation do you usually eat with others and you share the dishes? (lunch break at work, business meeting, romantic dinner, celebration with friends, celebration with family + other)
- When does it usually take place? Choose the two most frequent time frames (weekdays lunch, weekdays dinner, weekend lunch, weekend dinner)
- Usually, how many are you or how many were you the last time you ate there? (number)
- Now, imagine to be there. Last time, were you the invitee or the inviter?
- How many dishes do you all order? (between x and x)
- What are the criteria in choosing the dishes (traditional food order, hunger, show respect for the commensals, curiosity towards new dishes, price, health, other)? (multiple choice)
- Would something change if you are together with only Chinese people or together with international ones (Yes, everything, Yes, we would go to another kind of restaurant, No, not that much, No, it never happens to eat with International)?

3) Waste (6)

We all know that very often, in one of those situations when we eat altogether with other people, we cannot finish all the food on the table.

- How often does it happen to you to leave some food on the table or in your plate at the end of that kind of meal? (Never, we always finish everything; rarely, we tried to eat and finish everything; it frequently happens to leave something on the table; always, we always leave something on the table)
- Do you remember how much food was not finished or was left on the table at the end of that meal? (half, 1/3,
- Which kind of food was mainly left on the table? (cold dishes, meat, fish, noodles, dumplings, rice, vegetables, desserts + other)
- Does the quantity of food, left at the table or in your plate, vary according to: (companionships, kind of place I am eating in, kind of meal (lunch, dinner), kind of situation (lunch break at work, business meeting, romantic dinner, celebration with friends, celebration with family), none of the above + other?)
- Could you please specify it better? (open)
- In which occasion do you think there is the biggest quantity of food left on the table or in your plate at the end of the meal and why? (open)
- How many times do you ask for the doggy bag (bag with the remaining food of the meal) and you bring it home? (multiple choice: I didn't know it, never, sometimes, very often).
- Which kind of food would you bring back home? (cold dishes, meat, fish, noodles, dumplings, rice, vegetables, desserts + other)

4) Touchpoints in the restaurant (3)

Finally, three quick questions about the facilities inside the place.

- Is the physical menù inside the restaurant the only way for you to get to know the food offering? (Yes, I know the offering only when I look at the menù; No, there is also: ...)
- From the menù, do you know how big the dishes are? (Yes; No, every place has its own quantities, + other)
- Do you ask the waiter information about the food (such as quality, origin, cooking processes or suggestions to choose the dishes)? (sometimes, very rarely, never)?

B) International Consumers

1) General Info:

- Nationality, Age, Gender, Status (single, married with..., engaged no sons,...) LOGIC
- Job, monthly income (range)
- How much time have you been living in China (range)?
- Do you speak Chinese?

2) Routine / Behavior

- Which category of "restaurant" do you usually hang out at (Chinese, International, Fast Food)?
- In this category, according to which criteria do you choose the restaurant (reviews, distance, price, kind of food, quality/health of food, appearance, others)? (multiple choice)
- How many times per week do you eat in a restaurant (no Fast Food)?
- In which occasion/situation do you eat outside? (lunch break at work, elegant dinner, celebrations, family time, gathering with friends, everyday)
- Do you usually eat outside (alone, friend, partner, in group)?

LOGIC

- Talking specifically about Chinese restaurants, when you go there, are you with other Chinese?
- In that situation, do you share your dishes or everyone takes its own?
- Do you already know the quantity of food of every dish that is going to arrive
- Is there any other criteria in choosing the dishes (hunger, impress the commensals, try new dishes, price, health, other)? (multiple choice).
- Would something change if you are together with only Internationals people or together with Chinese ones (Yes, everything, Yes, we would go to another restaurant, No, not that much, No, it never actually happen)? (multiple choice)

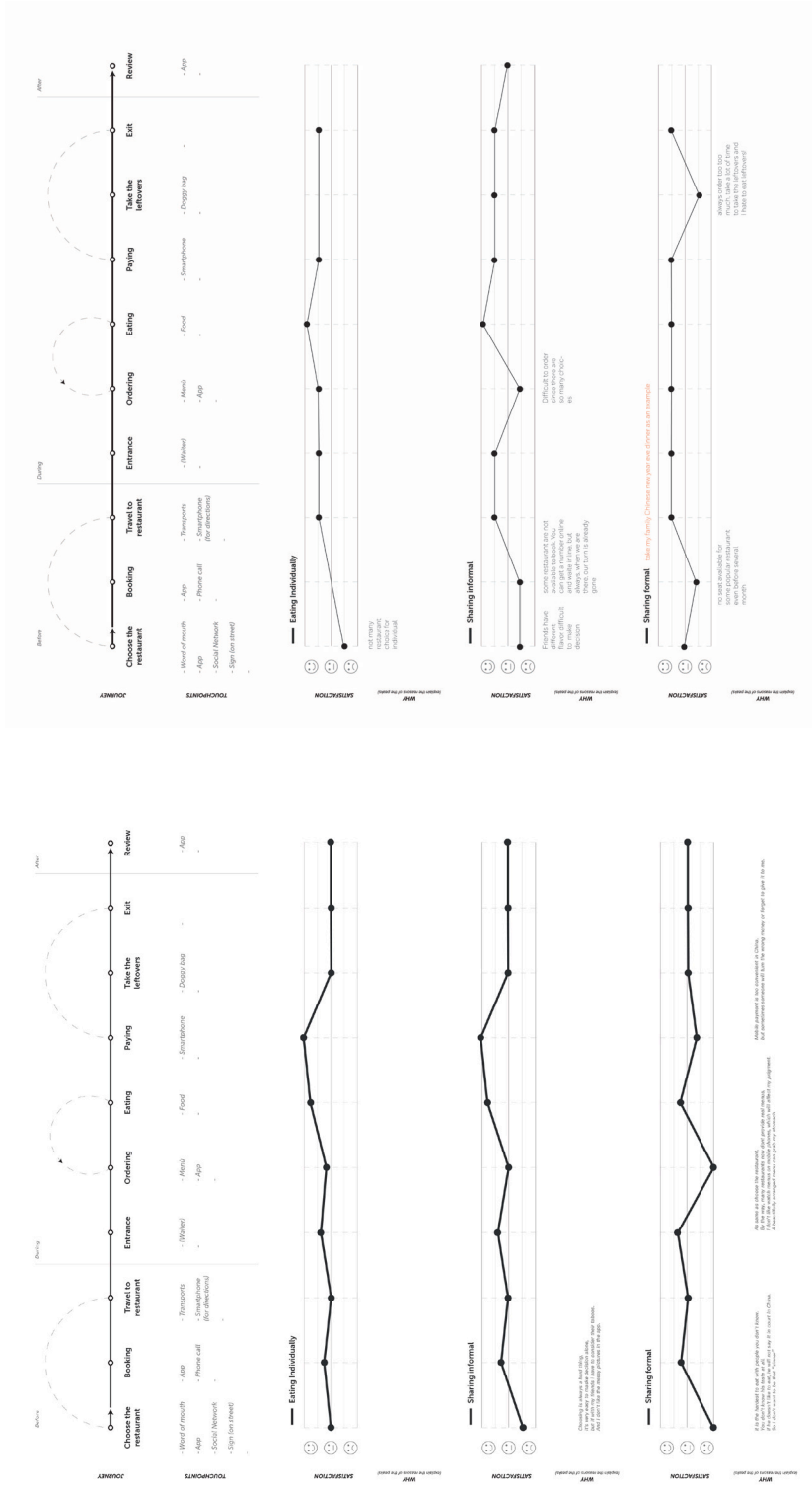
3) Waste

- How many times does it happen to you to leave some food on the table or in your plate at the end of the meal?
- Does the quantity of food, left at the table or in your plate, vary according to (companionships, kind of restaurant, kind of meal (breakfast, lunch, dinner), kind of situation (lunch break at work, elegant dinner, celebrations, family time, gathering with friends, everyday)?
- How many times do you ask for the doggy bag (bag with the remaining food of the meal) and you bring it home?
- Do you know that the food, left at the table or in your plate, gets wasted (yes and I am worried about it, Yes but ok, No, No but who cares)?

4) Touchpoint in the restaurant

- Is the menù inside the restaurant the only way for you to get to know the food offering / to order the food? (multiple choice)
- Talking specifically about Chinese restaurants, what are the pro and cons of the menù (open question).
- In general, do you ask the help of the waiter to decide which dishes to order (sometimes, very rarely, never, others)? (multiple choice)
- Have you ever ask the waiter about the quality of the food?

Customer journey maps.



Community Supported Agriculture - What I like?

What this kind of community should provide you in order to motivate you to take part in it?
(Which ones are stronger for you? Add also yours!)

How much is likely to happen in
the upcoming future: ___ /100%

Some options:

1. Visit the farm
2. Picking the veggies by myself
3. Camping in the farm overnight
4. Purchasing related products (jam, sauces, pickles...)
5. Cooking classes
6. Products informations (nutrients, harvest techniques, seasons)
7. Occasional informal meeting with the members
8. Arrange dinners in restaurants with the products of the farm
9. Meeting with other CSA communities
10. ...
11. ...
12. ...
13. ...
14. ...
15. ...

What I am eating? Information of my food!

What are the information that you want to know about your food and its ingredients? (Select the 4 best. Add also yours!)



1. _____

Why? _____

2. _____

Why? _____

3. _____

Why? _____

4. _____

Why? _____

Some options:

- Ingredients
- Origin of the ingredients
- Nutritional intake (calories, vitamins, fats...)
- Production (how the ingredients were grown)
- Expiring date
- Farmer's name (who grown the ingredients)

- Chef's name (who cook it)
- Environmental impact / resources used to produce it
- Is it a seasonal product?
- Other restaurant which use the same ingredients
- ...
- ...

Restaurant cost sheet (smartshanghai.com)

Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	RMB
Revenue	612.00	832.00	978.00	817.00	956.00	994.00	570.00	636.00	750.00	515.00	456.00	503.00	559,980.00	0%
Cost	488.95	190,120.35	242,309.61	264,100.88	219,584.64	199,519.10	175,259.87	167,044.00	171,791.98	191,019.79	220,153.65	168,074.82	2,428,501.68	36%
Cost/Revenue	37.10%	42.89%	34.27%	37.36%	34.67%	34.23%	33.88%	33.88%	35.82%	37.42%	33.03%	33.28%	35.50%	
Excise tax	29,589.85	35,346.90	35,346.90	35,346.90	35,346.90	35,346.90	35,346.90	35,346.90	35,346.90	35,346.90	35,346.90	35,346.90	341,990.40	5%
Education tax	2,076.66	2,474.42	2,474.42	2,474.42	2,474.42	2,474.42	2,474.42	2,474.42	2,474.42	2,474.42	2,474.42	2,474.42	23,939.96	0%
Local education tax	887.43	664.98	1,060.47	1,060.23	950.55	780.34	739.55	739.55	713.39	768.68	1,000.00	757.55	6,859.99	0%
Local education tax	591.62	443.32	706.98	706.82	633.36	582.94	520.23	493.03	479.53	510.45	666.67	505.03	4,752.52	0%
Local education tax	295.81	221.66	353.49	353.41	316.64	294.47	260.11	246.52	239.77	252.23	333.34	252.52	3,420.00	0%
Local education tax	33,426.37	25,047.69	39,944.24	39,938.17	35,785.04	32,936.27	29,392.82	27,856.31	27,093.56	28,840.49	37,666.97	28,534.36	386,459.31	6%
Income tax	388,700.68	228,135.96	424,724.13	402,780.95	377,994.26	350,479.63	315,583.31	298,133.69	280,646.46	290,590.72	408,821.38	306,423.82	4,025,027.00	58%
Income tax	88,352.00	88,352.00	88,352.00	88,352.00	88,352.00	88,352.00	88,352.00	88,352.00	88,352.00	88,352.00	88,352.00	88,352.00	1,084,572.00	16%
Income tax	24,200.00	24,200.00	24,200.00	24,200.00	24,200.00	24,200.00	24,200.00	24,200.00	24,200.00	24,200.00	24,200.00	24,200.00	29,040.00	0%
Income tax	6,141.18	546.70	12,485.88	7,669.20	8,511.04	97.40	18,734.04	532.80	20,261.26	7,806.46	7,431.16	7,431.16	90,203.12	1%
Income tax	6,746.25	4,394.46	7,335.20	8,386.82	6,934.38	7,039.82	5,909.36	4,705.74	6,074.36	5,664.32	7,204.82	6,202.89	76,532.22	1%
Income tax	18,536.00	1,008.70	18,225.20	18,225.20	18,225.20	18,225.20	18,225.20	18,225.20	18,225.20	18,225.20	18,225.20	18,225.20	184,000.00	1%
Income tax	1,495.00	844.20	1,185.00	1,708.00	685.00	947.00	575.00	94.00	17,500.00	4,200.00	8,000.00	5,890.00	117,952.00	0%
Income tax	5,702.00	2,240.00	3,164.00	16,933.00	3,330.00	376.00	1,030.00	1,030.00	860.00	1,610.00	3,500.00	3,500.00	31,203.00	0%
Income tax	2,750.00	840.00	5,650.00	16,933.00	3,330.00	376.00	1,030.00	1,030.00	860.00	1,610.00	3,500.00	3,500.00	31,243.00	0%
Income tax	8,660.56	8,788.74	8,788.74	9,003.20	9,039.60	9,039.60	9,039.60	9,039.60	9,515.39	9,515.39	9,515.39	9,515.39	98,270.72	0%
Income tax	322,945.99	286,026.20	317,338.12	346,109.92	297,438.82	287,906.52	305,160.30	276,635.64	298,162.51	282,529.07	265,423.45	286,473.25	3,333,880.53	52%
Income tax	800.00		300.00		800.00				3,400.00				9,900.00	0%
Income tax	1,700.00		500.00		9,800.00				17,200.00				8,200.00	0%
Income tax	2,500.00		1,605.00		319.30				208.00				18,100.00	0%
Income tax	103.10	202.60	734.40	394.44	394.44	394.44	394.44	394.44	394.44	394.44	394.44	394.44	4,454.70	0%
Income tax	103.10	202.60	734.40	394.44	394.44	394.44	394.44	394.44	394.44	394.44	394.44	394.44	4,454.70	0%
Income tax	103.10	202.60	734.40	394.44	394.44	394.44	394.44	394.44	394.44	394.44	394.44	394.44	4,454.70	0%
Income tax	13,156.99	-40,074.84	107,018.77	56,351.73	70,023.04	61,737.32	2,951.75	22,084.48	-34,538.81	4,398.65	143,110.93	20,939.16	427,176.17	0%
NET PROFIT/LOSS	2%	-9%	15%	8%	11%	11%	1%	-6%	-7%	1%	2%	-4%	6%	



ACKNOWLEDGMENTS

Many people, professionals and professors helped me in the writing of this thesis document.

First of all, I sincerely thank my Italian and Chinese tutors, respectively professor Carlo Vezzoli and professor Zhu Xiaocun (朱小村), for their support, guidance and precious feedbacks over the course of the project.

A second thanks surely goes to all the teaching staff of Politecnico di Milano for the knowledge dispensed, and for having shared with me their point of view related to the design practice.

A similar thanks goes to the administrative staff of Politecnico for the support and, especially, for the patience demonstrated.

Furthermore, I thank my fellow master candidates for the time spent together designing, inspiring each other, and eventually having a drink altogether at the end of the day.

A special thanks goes also to all my Chinese friends who helped me a lot during the field research, without which I could not probably have done it (physically and psychologically). In particular: Zidi Bai, Xiao Ding, Li Yanfei, Rui Tang....

Finally, I thank my family and my close friends for the uncompromisable support that has been always given to me.
