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BREAD

an interdisciplinary perspective

edited by
Cesare Manetti and Fabrizio Rufo

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In copertina: *Medieval baker* (Public domain).

Contents

Introduction

Bread contains human knowledge: from knowledge concerning fertility of the land to farming methods harvesting, and seed processing, not to mention the different possibilities of consumption of cereals and the different ways in which they are cooked.

In bread, we find all those components: the transformation of the natural landscape, technological and economic development which over the centuries have led to the building of a social organization, with a precise division and distribution of tasks and roles.

Saverio Manetti was the co-founder of the Academy of Georgofili, the first European agricultural academy and he presented the Botanical and Physical Fiorentine Imperial Society in 1764 a treatise on *Delle specie diverse di frumento e di pane siccome della panizzazione e di tutte quelle piante, e parti di esse singolarmente, che in occasione di carestia possono panizzarsi, o per alimento in altra maniera usato possono al pane supplire*, one of the best agronomy texts of the eighteenth century.

Saverio Manetti, by presenting this treatise, was reflecting on the needs of the biggest social crisis of the eighteenth century (1763-1766) and the fundamental problem concerning the nutrition of farmers and the urban supply.

The book thanks to google books can be read in all its entirety (You can web search on http://books.google.com), and appears in no way dated because, by describing the customs of different populations, it explains how to make bread with others flours, such as the ones obtained from legumes, in order to support subsistance.

It is significant that the UN chose 2016 as the international year of legumes, to ensure food security all over the world.

DELLE SPECIE DIVERSE
DI FRUMENTO E DI PANE
SICCOME
DELLA PANIZZAZIONE
e di tutte quelle Piante, e parti di esse singolarmente, che in occasione di Carestia possono panizzarsi, o per alimento in altra maniera usate possono al Pane supplire
MEMORIA
DEL DOTTOR SAVERIO MANETTI
LETTA DA ESSO IN VARIE ADUNANZE TENUTE DALL' IMPERIAL SOCIETA'
FISICO-BOTANICA FIORENTINA
nel caduto anno 1764.

..... labor omnia vincit
Improbus, & duris urgens in rebus egestas.
Virg. Georg. Lib. I.

Fig. 1. The title page of the first edition (1764): *Delle specie diverse di frumento e di pane siccome della panizzazione e di tutte quelle piante, e parti di esse singolarmente, che in occasione di carestia possono panizzarsi, o per alimento in altra maniera usato possono al pane supplire*, by Saverio Manetti.

In his book, Saverio Manetti, a medical doctor and naturalist, analyzed the issues with a scientific method which can now be defined as typical of the new "Nutraceutical" discipline.

The idea was that bread is directly connected with human subsistance and the properties of the ingredients used to make bread are connected with health.

However, the scientist immediately expanded his research to other fundamental aspects, which are still important today, in order to add value to bread and published an article dedicated to "pane composto, e praticato per lo più per tornagusto, e delizia".

In this book, some researchers from different departments of the Sapienza University of Rome and others from different research institutes of the Rome area present the first results of their work produced under a multidisciplinary project funded by the Sapienza University of Rome (Progetti multidisciplinari 2014). The convergence of archeology, anthropology, geography, history of science, economy and physico-chemical characterization makes it possible to valorize the product by ensuring the quality of the production. An approach of this kind is essential to highlight the link between products and territories, which has developed over the centuries and which has produced he specificity of bread.

The research proposals which aimed at enhancing the product will be the entire value chain: the soil, the climate, the choice of species to be cultivated, the practice cultivation, harvesting, handling, production, consumption and marketing with references to landscape, natural assets and cultural heritage.

The use of bread involves a complex interplay of geographical, economic, social and cultural rights. Man in this way not only builds a relationship with nature through his eating habits, but also defines himself and its social world. Through an economic, historical, geographical and anthropological survey, the importance of bread can be studied in all its meanings: nutritional, symbolic and cultural. The analysis of feeding behavior in a diachronic perspectiveand with a multidisciplinary approach expresses a multitude of the characteristics of man and of the human condition. In this sense, power is translated into a set of rules regarding the uses and customs that depend on social structure.

An accumulation of knowledge by archeologists is to be expected mainly in the following domains: an evaluation of systems of flour production, bread ingredients and baking. Archaeological cooking installations, such as ovens, and other instruments involved in production will be considered.

Specific analyses of raw materials (i.e. wheat and yeast), investigated by the methods of "molecular fingerprinting", also to define their origin (i.e., Autochthon yeasts), will find correspondence in the study of the various tools, processes and cultures that over the centuries have characterized production.

The molecular fingerprinting obtained by spectroscopic methods makes it possible to carry out a systemic characterization of products, which will be useful in defining origin and quality.

The properties of food are represented in the spectra in a way that can be decoded only through an integrated interpretation of the experimental data with the "stories" of the product.

The analysis of food with these methods is not limited to a simple description of the individual substances, but will include the identification of the chemico-physical correlation between the different components: the structure of the food matrix, the content of specific substances as a result of the chemical transformation of others.

The sensorial characteristics of the product, its quality and other properties such as, for example, shelf-life must be considered as emergent properties from the sum in "the Bread System".

1. Bread in Prehistory: looking for the path of an extraordinary invention

Francesca Balossi-Restelli, Cecilia Conati-Barbaro*, Cristina Lemorini* Lucia Mori*, Davide D'Errico***

1.1. Introduction

Domestication of cereals is the main markers of the rising of agriculture in Prehistory. The first testimonies of this groundbreaking change in the economical and social system of the prehistoric communities dates back to the beginning of the Prepottery Neolithic of the Near East, around 12000 BP.

Cereals exploitation implies the processing of seeds for the production of food. The production of flour from seeds by grinding is the best system for obtaining an high digestible and workable product. The production of flour is much older than the domestication of cereals and it dates back to the Upper Paleolithic[1]. When domestication started the "grinding technology" was applied to cereals for the preparation of various types of food including bread.

Direct traces of bread in prehistoric contexts are not easy to detect; however, it is possible to evaluate its presence on the basis of indirect data as objects and installations associated to bread production and consumption.

In this chapter we present a brief overview of the direct and indirect evidences of bread production in Prehistory through the discussion of the data coming from our researches in Prehistoric Near East and Europe.

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** PhD student, Faculty of Archaeology, Leiden University.
1 Revadin et al. 2010.

1.2. Bread in the Near East (*F. Balossi-Restelli, L. Mori*)

Bread in the Near East is today and was in the past the main staple food; it constitutes the major part of most people's diet and in Near Eastern ancient and modern languages the term for 'bread' is also used as generic name for food.[2] The Sumerian sign NÍG /GAR is used both in Sumerian and later Akkadian to indicate "bread" but also a more general term for "food/nourishment". Villagers today do not ask if guests want something to eat but if they want bread.

The first written sources in the history of the Near East (III millennium BCE) report that cereal production, consumption and re-distribution were at the base of the ancient Near Eastern economy and thus give us the perception of the importance of bread in ancient near eastern society.[3]

Recognising bread archaeologically is not easy as its ingredients and modes of production leave little traces. Bread is basically a dough of flour and water. Flour production is evidenced in the Near East since the earliest phases of the Epipalaeolithic. The use of wild cereals is attested at Ohalo, in the Jordan river valley, since 19000 BP and stone mortars appear around 15000 BP.[4] Mortars, querns, pestles, carbonized cereals and legumes (rye, barley, *triticum*, lentils) will then become abundant in the following Natufian period (12000-10000 BCE).[5] Ground stone – basalt – tools represent from now on the most recurrent and common artefacts in the archaeological record. We can thus hypothesise that bread was prepared in the Near East since the end of the Epipalaeolithic. Severe abrasion on the teeth of humans from the Neolithic site of Abu Hureyra furthermore suggests that such bread must have been rather gritty to chew.[6] Ancient texts confirm that, even later on, when grinding was surely able to reach different degrees of fineness of the flour, coarser (*tappinnum* – coarse-grained flour made of barley) or finer flours (*sasqûm* – fine grade flour mostly derived

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[2] C. Delaney, *The Seed and the Soil: Gender and Cosmology in a Turkish Village Society*, Los Angeles CA, 1991.

[3] M. Liverani, *Uruk la prima città*, "Il ciclo dell'orzo", Bari, 1998, in particular pp. 47-51.

[4] D. Nadel and I. Herskovitz, *New subsistence data and human remains from the earliest Levantine Epipaleolithic*, Current Anthropology 32, 1991, pp. 631-5.

[5] O. Bar-Yosef, *The Natufian culture in the Levant, threshold to the origins of agriculture*, Evolutionary Anthropology, vol. 6, 1998, pp. 159-177.

[6] A.M.T. Moore, *The inception of potting in western Asia and its impact on economy*, 1995, in W.K. Barnett and J.W. Hoopes *The Emergence of Pottery: Technology and Innovation in Ancient Societies*,. Washington DC, Smithsonian Institution Press, 1995, pp. 39-53.

from emmer) still existed. Simple saddle (mostly basalt) querns were used for grinding.

Ingredients and flavours could vary: at the Prepottery Neolithic site of Jerf el Ahmar, two charred "seed cakes" have been found, obtained by finely pounding some *Brassica* or *Sinapis* seeds.[7]

Epigraphic sources mentioning flour, bread and pastry, are abundant but at times difficult to translate as we do not know how to differentiate between the different types of breads or pastries; one has the impression that at times local names are used to describe specific breads, thus possibly not understood by everyone at that time too.

In Ur III documents (end of III millennium) bread was described either by size or type or shape, generally measured in litres, according to the quantity of cereal needed to make it. It is often not clear though whether a single loaf has been made out of the specific amount of flour or more; loaves weighing 600, 300, 200, 150 and 120 grams each have been reported for the pre-Sargonic Lagash.

Another important issue is that of yeast; whilst Natufian breads (12000-10000 BCE) were most probably unleavened, and were basically only a heated thick mixture of pounded cereal and water, we do not know whether the Neolithic ones were leavened or not.[8] Debates on the beginning of the use of yeasts in the Near East are still open; we know that they were surely used in beer production at the beginning of the III millennium BCE.[9] It has furthermore been demonstrated that Mesopotamian bread was leavened by adding flour of *Vicia ervilia* (bitter vetch) and *Cicer arientinum* (chick pea) to the bread flour, plants known and domesticated since the 9th millennium BCE. Data known today is thus non-conclusive, but we could thus say that leavened breads could potentially have been produced at least since the Neolithic period.

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7 G. Willcox, *Charred plant remains from a 10th millennium BP kitchen at Jerf el Ahmar*, Vegetation History and Archaeobotany, 11, 2002, pp. 55-60.

8 S.H. Katz, M. Voigt, *Bread and Beer: The Early Use of Cereals in the Human Diet*, Expedition, vol. 28/2, 1986, pp. 23-34.

9 R.H. Michel, P.E. McGovern et al, *Chemical Evidence for ancient beer*, Nature, 360, 1992, p. 24.

1.3. Evidences of ovens in the Neolithic of Italian Peninsula (*C. Conati-Barbaro*)

Structures specifically used for baking bread are quite rare in the Italian Neolithic. The most common evidence are the bases of small clay ovens most likely with domed vaults, found within villages (Olivento, Trasano, Ripa Tetta, Favella) or inside individual dwellings, according to a well known model of the Aegean area[10].

Completely different are the 23 underground ovens found at the ancient Neolithic site of Portonovo (AN), which date back to the first half of the VIII millennium BP cal. Since september 2011[11] five excavation campaigns have been undertaken by the Sapienza University of Rome over an area of about 600 m^2 (fig. 1). This site represents a unique evidence in Italy which can only be compared with Neolithic contexts of Central Europe, from Slovakia to France[12, 13].

Fig. 1.1. Three archaeological ovens from Portonovo.

[10] C. Conati Barbaro, *Fuoco per cuocere, fuoco per produrre: forni e fosse di combustione nel Neolitico italiano*, 2014, in *Amore per l'antico. Dal Tirreno all'Adriatico, dalla Preistoria al Medioevo ed oltre.* Studi di Antichità in onore di Giuliano de Marinis, a cura di Baldelli G., Lo Schiavo F., Scienze e Lettere Editore, pp. 367-378.

[11] C. Conati Barbaro, *Cooking, working and burying in Ancient Neolithic: the ovens of Portonovo (Marche, C. Italy),2013*, with contributions by Acquafredda P., Catalano P., Celant A., Di Giannantonio S., Lelli R., Muntoni I.M., Pallara M., Ruggero G., *Origini* XXXV, pp. 31-82.

[12] J. Petrasch, *Typologie und Funktion neolitischer Öfen in Mittel- und Südeuropa*, Acta Praehistorica et Archaeologica 18, 1986, pp. 33-83.

[13] D. Staššiková-Štukovkhá, *The Stone and Middle Age Ovens in Loess Sites of Slovakia. Influences on their Quality for Food Preparation*, Civilisations 49, 2002, pp. 259-269.

The ovens have circular bases, with diameters ranging from 1,50 to 2,00 m, an average height of 0,45 m, a single central opening and were originally excavated in the colluvial sediment and consolidated with fire.

So far it was not found any settlement connected to this site which could definitely be considered as a "specialized" production area.

Which function did these ovens have? Could they be ovens used to bake bread? Samples of oven's floors, walls, and vaults have been analyzed by means of Powder X-ray Diffraction (PXRD) analysis which places at 500° C. the maximum temperature reached, too low for pottery firing. Numerous charred barley caryopses were found inside four ovens, proving the hypothesis that the ovens were used for roasting cereals. Many ground stones were found close to the ovens, suggesting the production of flour and similar foods (fig. 2).

Fig. 1.2. An example of groundstone tools from Portonovo.

To test the real efficiency of the underground ovens for baking bread and cooking food we performed the experimental reconstruction of an oven of the same size and shape of the archaeological ones with the use of wood and bone tools (fig. 3a-b). The structure was dug in the same geological formation of the Neolithic ovens and consolidated by fire (fig. 3c). The oven was used for baking unleavened bread and roasting barley (fig. 3d). At the end of the experiment the roasted barley was ground with limestone groundstones (fig. 3e).

This experiment was essential to test the timing, methods, tools and difficulties in the realization of this type of oven the amount of fuel required for consolidation and for cooking food, the use of different temperatures for a variety of functions (eg. baking bread,

Fig. 1.3. Cooking in the experimental underground oven.

cereals roasting, etc.). In order, to reach the right temperature an oven must be heated for a prolonged time, particularly after a period of non-use. In the modern peasant societies it was a good practice to take advantage of the different range of temperatures reached by the traditional brick or stone ovens (from the highest to the lowest) for several food preparations (baking bread, roasting, stewing meat, cooking soups, etc.). Therefore, the ovens were lit in advance and kept in use for several days by many families. It is most certain that the Portonovo ovens were collective structures, because of their spatial location – all concentrated in a small area – and the energy investment required for their construction. The presence of three burials within two ovens in Portonovo underlines the strong symbolic value of these structures, which represented an important reference point for the local community.

1.4. Traces of cereals harvesting on archaeological chipped stone tools: an experimental update (*C. Lemorini, D. D'Errico*)

Domesticated cereals are the main markers of the rising of agriculture in Prehistory. Achaeobotanical remains are the principal testimony of cereals in an archeological context. Nevertheless, chipped stone tools used as lithic inserts of a sickle as well as groundstones are another important source of data for understanding what cereals were exploited and how they were exploited.

Direct evidences of the cutting of cereals with sickles and the processing of seeds with groundstones are testified by residues in various archaeological sites starting from Prepottery Neolithic[14] at least. Amorphous silica depositions, the phytolithes, and starches may better survive in the archaeological deposits than other types of residues and can give an accurate picture of the types of plants that were worked with.

Another indirect evidence of the processing of cereals with prehistoric lithic tools are use-wear[15]. In fact, the contact between the cutting edge of the tool and the stems of the cereals modifies the surface of the tool that becomes smooth and bright, developping the so-called glossy surface.

Glossy is quite easy to recognize. This type of use-wear is so developed that it can be easily perceived to the naked eye. With a stereomicroscope and a metallographic microscope and a reflected light system using magnifications up to 500X it is possible to verify if these traces are related to the cutting of cereals or other types of plants. However, it is more complicate to distinguish the glossy related to different types of cereals. Some scholars attempted to distinguish the glossy related to different cereals, in particular wild cereals vs. domesticated cereals, using quantitative analyses that gave encouraging results[16]. We are confident that an experimental program aimed at producing and studying replicas of traces related to the harvesting of various species of cereals may allow to identify the distinguishing characters of each type of cereal. Therefore, we carried out, during two summer seasons, a series of experiments of harvesting with replicas of prehistoric sickles at CRA-SCV (Unità di ricerca per la selezione dei cereali e la valorizzazione delle varietà vegetali) Center of Sant'Angelo Lodigiano (Lodi) (fig. 4a). Each replica was used for harvesting a single type of cereal for the same amount of time: 1h., 2h., 3h. The harvested cereals were: *Triticum Monococcum*, *Triticum Dicoccum* and *Hordeum Vulgare.*

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[14] G. Wilcox, D. Stordeur, *Large-scale cereal processing before domestication during the tenth millennium cal BC in northern Syria*, Antiquity 6, 2012, pp. 99-114.

[15] P.C. Anderson, *Neolithic tools used for stripping ears from hulled cereals: an update, XXXIIIe rencontres internationales d'archéologie et d'histoire d'Antibes*, Antibes, Éditions APDCA, 2013.

[16] A. van Gijn, A. Little, *Tools, use wear and experimentation: extracting plants from stone and bone*, 2016, in: K. Hary, L. Kubiak-Martens, eds., *Wild harvest. Plants in hominin and pre-agrarian human worlds*, pp. 135-154.

These experiments allowed to detect morphological traits useful for recognizing the traces related to specific cereals and to understand how much time is needed in order to develop these morphological traits (fig. 4b).

Moreover, the replicas of sickles were used as a reference collection for a preliminary evaluation of the archaeological traces observed on the flint chipped stone tools coming from the Calcolithic-EBA layers of the

Fig. 1.4. a) experimental sickle and cereals; **b)** glossy from experimental cutting of cereals with a flint tool; **c)** glossy observed on an archaeological flint tool interpreted as cereals cutting from Arslantepe (Turkey); **d)** use-wear observed on an archaeological obsidian tool interpreted as cutting of herbaceous plant from Catalhöyük (Turkey); **e)** use-wear from experimental cutting of cereals with an obsidian tool. (Photo **c** and **e** by *C. Lemorini*)

site of Arslantepe (East Anatolia, Turkey)[17]. The first observations are very promising and the interpretation of various chipped stone tools as sickles blades (fig. 4c) used for a very long time for the gathering of specific cereals highlights the developing of the agriculture and associated tool-kit in proto-urban contexts, as Arslantepe, in relation with the rising of élites that may control partially or in total vast farmlands.

As well, the experimental session at CRA-SCV Center was aimed to study the traces of cereals developed on chipped stone tools made of obsidian. We produced a reference collection for the interpretation of obsidian sickle blades at the Neolithic site of Catalhöyük (Central Anatolia, Turkey). Catalhöyük[18] is a key site for understanding the beginning and the developing of agriculture in the Near East and the deep social and cultural changes occurred during its flourishing. In this site the domestication of cereals is well testified by the very abundant archaeobotanical data[19]. With this picture in mind, it is quite obvious to expect to find a very high number of sickles at the site. Instead, the harvesting with sickle blades seems quite rare since few use-wear related to this activities were observed until now[20, 21] (fig. 4d). For verifying the datum, we carried out experiments of harvesting with replicas of sickles using obsidian as cutting edges. The experimental results confirmed this first impression (fig. 4e) suggesting that at Catalhöyük different types of harvesting techniques were probably carried out (hand harvesting, use of bone tools…) and the gathering by sickles was just one of various technical options.

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17 D. D'Errico, *Glossy Tools: Innovations in the method of Interpretation of Use-Wear Produced by Plant Processing, Procedings of the International conference on use-wear analysis*, Faro, Portugal, 10-11-12 October 2012, 2014, pp. 24-34.

18 I. Hodder, *Çatalhöyük: the leopard changes its spots. A summary of recent work,* Anatolian Studies 64, 2014, pp. 1-22.

19 I. Hodder, *Humans and Landscapes of Çatalhöyük Reports from the 2000–2008 Seasons* (Çatalhöyük Research Project Series, Volume 8), British Institute at Ankara BIAA Monograph n. 47, Cotsen Institute of Archaeology Press, Monumenta Archaeologica 30, ed. 2013.

20 C. Lemorini, D. D'Errico, *Catalhöyük Archive Reports 2014*, Chapter 22 Use-Wear Analysis of Chipped Stone Tools, pp. 205-207.

21 C. Lemorini, D. D'Errico, *Catalhöyük Archive Reports 2015*, Chapter 24, Use-Wear Analysis of Chipped Stone Tools from the Neolithic Phases of Çatalhöyük, pp. 263-265.

2. Bread as a Sign. The Ins and Outs of Bread. Cultural Anthropology's Contribution

*Valeria Trupiano**

Foreword (*Alberto Sobrero***)

The essay of the anthropologist Valeria Trupiano is a particularly refined and up-to-date reflection on bread-as-sign, looking at the meaning of bread not just and not only in the semiotics of nutrition but also within a much broader cultural semiotic framework, as a religious sign, as a community provider, as an index of malaise or well-being and, last but not least, as aesthetic material.

Bread ranks among the few elements that, on account of their usefulness and symbolic versatility, have for thousands of years formed the most basic grammar in the relationship between humankind and the environment. Indeed, as Trupiano notes, the more today's nutritional value of bread decreases, the more alive its symbolic richness becomes: the procedures for its production become differentiated, its shapes and forms multiply, its quality becomes connoted from a social point of view, and the traditions related to it are renewed. Bread-as-sign, sacred bread, ritual bread, social bread, community bread (*cum panis*, companion), bread for feast days and for every day have been the subject of exploration on the part of anthropologists (Marvin Harris, Marshall Sahlins), semioticians (Roland Barthes), historians (Ferdinand Braudel, Piero Camporesi, Massimo Montanari) and sociologists (Corrado Barberis). Alberto Cirese was the first in Italy to provide an anthropological framework for these studies, publishing in 1973 the results of an extensive research on Sardinian breads which he had launched together

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with his colleagues in the second half of the previous decade. It was this work that provided a reference point for discussion and further extension of the assumptions for many anthropologists more recently (Giulio Angioni, Cristina Papa, Vito Teti, Matthew Aria).

Trupiano falls into this disciplinary tradition, putting forward a systematic framework for these studies and a new set of hypotheses with the competence she acquired from previous work on the processes of community building and social memory[1], also in relationship with spread of practices and narratives on genetics across a wider audience[2].

2.1. Bread, Food, Culture

This paper explores the symbolic constituents associated with bread in the context of Italy in the belief that today this food is the object of a "thick", outreaching, diversified and contradictory symbolic investment marked by significant changes. There were two main reasons for backing up interest in this research perspective. The first is that the cultural facet of a commodity is pivotal in driving consumer choice and production; the other is that the study of bread's symbolic connotations is particularly well suited and useful for understanding the current cultural tendencies tied to food and eating in general, that are themselves valuable for shedding light on larger scenarios of contemporary cultural change. A little more about these two reasons, that are central to the choice of this line of enquiry. It is hardly news that the symbolic connotation of products is what underpins "consumer society" and that it is played out even in the ploys of competition over large-scale quantity and quality commodities, witness the aggressive policies of marketing. What is worthy of interest here is not so much or primarily the investigation of the explicit and/or functional use of imagery that marketing brings to bear in conditioning spending habits. We shall instead present

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1 V. Trupiano, "Gerarchie di memorie. Le narrazioni della strage nazifascista di civili a Crespino del Lamone, Fantino, Lozzole e Campergozzole" in (a cura di) Clemente P., Dei F., *Poetiche e politiche del ricordo. Memoria pubblica delle stragi nazifasciste in Toscana*, Carocci, Roma, 2005, pp. 213-239; V. Trupiano, *A sentirle sembran storielle. Luglio 1944: la memoria della strage di civili nell'area di Crespino del Lamone*, Pacini, Pisa, 2008.

2 V. Trupiano, *Gli usi della diversità genetica. DNA, parentele e politiche dell'appartenenza*, il Mulino, Bologna, 2013; V. Trupiano, *The Patrimonialization of DNA. An Italian Case Study: Genetic Park of Cilento and Vallo di Diano*. International Political Anthropology, vol. 5, n. 2, October 2012, pp. 135-156; V. Trupiano, *Geni, popolazioni e culture. Le ricerche genetiche tra scienza e politica*, CISU, Roma, 2009.

some symbolic markers that revolve around bread as a food that seem to be central today in configuring habits, experiences and worldviews. In some cases, these spur individuals to make choices that are outside of the more traditional market offers, or even in contrast to its rationale; not infrequently, they spark off trends that are spotted by the world of sales and 'appropriated' by the consumer market.

What makes bread a food particularly well suited for the study of cultural trends regarding food and society at large is the fact that in a Mediterranean context this food has been perceived as "the" food *par excellence*, another name for food. It is in the Mediterranean area that bread has been, and continues to be, fundamental to life, much as rice, maize, millet and tubers were elsewhere[3]: for much of history, when it was a daily strife for people to feed themselves, they looked to bread as their principal source of food, so much so that many would define traditional peasant civilization as the "civilization of bread"[4]. In this historical and geographic context, as Fernand Braudel[5] would express it, wheat is king. The central role of bread as food in the recent past, especially in the more poverty stricken areas, can be traced even in the pervasiveness of linguistic mention of cereals and bread, including the synecdochic figure of speech equating bread with food and with life[6, 7].

As we shall see, even if changes in material conditions led to bread no longer being fundamental to people's diet as in the past, it has maintained and indeed, in a seeming paradox, even increased its symbolic value the more its intake as a food declined. It has found a peculiar niche within the wider process of hyper-reflexivity with regard to contemporary food and eating habits, i.e. the pervasive and omnipresent discursive output, and not necessarily verbal at that, whereby food and eating in general and all that they entail (specific dishes, recipes, ingredients, procedures, people and personalities, and venues for the

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3 G. Angioni, *La cultura del pane nella Sardegna tradizionale*, in AA.VV. *Pani. Tradizione e prospettive della panificazione in Sardegna*, Nuoro, Ilisso, 2005, pp. 19-51.

4 V. Teti, *Il colore del cibo. Geografia, mito e realtà dell'alimentazione mediterranea*, Roma, Meltemi, 1999.

5 F. Braudel, *La Méditerranée et le monde méditerranéen à l'époque de Philippe II*, 3 vls., Paris, A. Colin, 1949; engl. transl., *The Mediterranean and the Mediterranean World in the Age of Philip II*, 2 vls., Oakland, University of California Press, 1996.

6 G. Angioni, *La cultura del pane nella Sardegna tradizionale*, op. cit.

7 G. Lupinu, *Il lessico del pane*, in AA.VV. *Pani. Tradizione e prospettive della panificazione in Sardegna*, Nuoro, Ilisso, 2005, pp. 343-356.

production and sale of food) are ubiquitous in both private and, more vehemently so, public and media-drivendiscourse.

Studies in humanities are well aware that food and eating styles are especially rich in cultural meaning; the eating or not of specific foods, how to eat, where and when to eat, the people with whom sharing a meal is possible, these are all imbued with "culture" and therefore vary from one cultural context to another. The influenceof food in the structuring of worldviews and life styles is equally well known[8] as is the fact that "food touches upon everything"[9], from the economy, to political strategy and policy, social inequality, gender issues, to family or community relations. Anthropological studies focusing on food and eating have consequently highlighted the broader social processes, all the way from the politico-economic to the symbolic[10]. What instead appears to be a peculiarity of this day and age is that the cultural traits related to food and its connection to other aspects of reality have become explicit objects of public reflection.

The concept inspiring this "discourse" is the nutshell delivered by the recurrent leitmotif "we are what we eat", that is the idea that food plays a central role in our existence, and first and foremost from a biological and nutritional point of view; but it doesn't stop there. As we venture into the main contemporary symbols linked to bread we shall see how, with varying levels of awareness on the part of those involved, the making, buying and consumption of bread, and of specific breads to the detriment of others, leads to a footing that is essentially about ethics, to practices and worldviews which project scenarios that are often critical of, and alternative to, the current social and economic model.

2.2. Bread as a Sign

Before introducing the symbology related to bread, it is useful to briefly cover the development that led cultural anthropology to insist upon looking at bread as a *sign*, from an avowedly symbolic stance, even before and beyond its nutrition-based scope. This is an important step on which to dwell because the change in perspective that the study

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[8] D.E. Sutton, *Food and The Senses,* Annual Review of Anthropology, n. 39, 2010, p. 215.

[9] C. Counihan, P. Van Esterik, *Food and Culture. A Reader*, Routledge, New York-London, 1997 (reissued 2008) p. 1.

[10] S.W. Minz, C.M. Du Bois, *The Anthropology of Food and Eating,* Annual Review of Anthropology, n. 32, 2002, pp. 99-119.

on bread led to also had a marked impact on anthropology in general at the national level, and it was from that moment on that it extended its scope with regard to food[11].

Bread had formed part of certain demological studies carried out during the late nineteenth century that generally took it into account cross-sectionally. The first broad systematic anthropological research to be carried out in Italy was during the second half of the 1960s by Alberto Cirese who, together with the research team coordinated by him, began a long and extensive research on the breads of Sardinia[12]. The specificity of this on-the-ground research was greatly influential in making bread emerge as a subject for study: Sardinia was the region where the domestic chore of bread-making had traditionally developed a much greater body of expression compared with other regions of Italy. The impassioned job of bread-making, be it for daily use or festive occasions, was exclusive to women[13] and gave rise to a rich and varied assortment of breads, the study of which initially favoured ceremonial exemplars. Aesthetically praiseworthy, these specialty breads gave life to what has been defined as "ephemeral plastic art"[14] a veritable artistic fabrication based on codified models (beings, things and forms taken from the real or imaginary world) expressed using procedures and know-how passed down through the family[15]. It is conceivable that the very variegated, detailed and fine expressive richness of Sardinian ceremonial breads was instrumental in pointing to the concept and importance of bread as a sign. Indeed, it is by way of their very multitude that these breads transpired as a distinctive product of Sardinian popular culture which, for each different location, presented a structured typology as regards variety and intricacy of shape,calendar dates, functions, and decorative styles, making this a veritable "cultural specialization" of the island[16]. Nearly all the days that fell outside of the normal calendar were marked by a special bread. The Lenten period, for instance,

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11 C. Papa (a cura di), *Introduzione* in Papa (a cura di) 1992a, 1992b, pp. 119-124.

12 A.M. Cirese, *Per lo studio dell'arte plastica effimera in Sardegna*, 1973, (reissued with integrations) in A.M. Cirese, *Oggetti, segni, musei*, Torino, Einaudi, 1977.

13 G. Murru Corriga, *I pani della tradizione*, in AA.VV. *Pani. Tradizione e prospettive della panificazione in Sardegna*, Nuoro, Ilisso, 2005, pp. 230-232.

14 A.M. Cirese, *Per lo studio dell'arte plastica effimera in Sardegna*, 1973, p. 7, op. cit.

15 A. Cusumano, *Il pane nelle feste popolari in Sicilia*, in Papa (a cura di) 1992a, 1992, pp. 139-146.

16 A.M. Cirese, *Il pane cibo e il pane segno*, in Papa (a cura di) 1992a, 1992, p. 29.

was all about loaves being shaped to look like a cross, a crown of thorns, a ladder, a fish or the *Lazzarèddu,* a small bread moulded to look like a human figure that sometimes came wrapped in bandages and placed in a shroud or in a coffin, to represent the miracle of the raising of Lazarus (fig. 2.1); there were breads for processional days such as the large loaves for the feast day of Saint Mark, that were round and stuffed with tiny pieces of dough modelled into flowers, leaves, fruits and birds, fit to fill any void (fig. 2.2); there were breads for weddings where a heart was the most commonly used symbol but could also extend to garlands, flowers, posies, motifs to do with the sun and the stars, nests, doves, ears of corn and wheat, or shoes; and then there were breads for children, such as those given to them as an Easter gift ranging in shape from a crown, to a branch with blossoms, to a chick, a hen or a dove, containing an egg in its shell (fig. 2.3)[17].

The study regarding the plastic lavishness of Sardinian breads went hand in hand with the development of a prospective study that for the first time prioritized the "value of the *sign*, whereby bread that normally ought only be 'good to eat' also becomes 'good for communicating', i.e. capable of conveying images or, more precisely, meanings that are different from the plain and basic meaning of it just being itself, i.e. bread for eating"[18]. Cirese put forward a framework that was useful for identifying and distinguishing links between two levels: with *bread-as-food* on one hand and *bread-as-word* on the other. That is, he placed the fabrile aspects of bread at one end, looking at the materiality of its ingredients and preparation, considering bread from the standpoint of a food that "is necessary and does not speak" both in normal everyday usage or on ceremonial occasions. At the other end, instead, we have the "symbolic facet" of bread that "speaks and is not necessary" from a nutritional point of view, and is there rather to be representative and to communicate: "from bread that *feeds* to bread that *speak*s"[19]. In an influential volume of interdisciplinary papers on this theme that came out twenty years after the groundwork of the research group led by Cirese, Cristina Papa annotated that the prospective change had "rendered significant and worthy of theoretical reflection and systematic research

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[17] E. Delitala, *La modellazione figurativa dei pani in Sardegna*, in Papa (a cura di) 1992a, 1992, pp. 131-138.

[18] A.M. Cirese, *Per lo studio dell'arte plastica effimera in Sardegna*, 1973, op. cit. p. 9.

[19] A.M. Cirese, *Pani di Sardegna,* in AA.VV. *Pani. Tradizione e prospettive della panificazione in Sardegna*, Nuoro, Ilisso, 2005, p. 7.

Fig. 2.1. Lenten Bread, representing the miracle of the resurrection of Lazarus (Delitala 1992, p. 132).

Fig. 2.3. Children Bread (Lecca 2005, p. 309).

Fig. 2.2. St. Mark's Bread (Contu 2005, p. 265).

an object that had hitherto seemed almost mute"[20]. Equally important were the implications for the overall development of the discipline of anthropology in a semiotic sense: "It was these very concepts which, reverberating off museographic considerations, prompted me to associate the 'objects' with the 'signs' […]"[21].

2.3. The Symbols of Bread

Bread, then, had become a subject of investigative study not just from the material standpoint of food but also from a "symbolic" stance. There flourished a series of studies to describe and analyse bread within the framework of broader systems of meaning, covering the multiplicity of itsvalue and significance, in everyday life just as during ceremonial occasions, in the material aspects relating to the techniques, knowledge and know-how, as well as the networks of social relationships used to produce it and consume it.

As proposed by Cirese, besides identifying the distinction between bread as a food and bread as a sign, it is furthermore useful to comprehend the reciprocal relationship that exists between these two. As anthropology began studying bread in this light, following on the "linguistic turn" paradigm interested in the semiotic study of reality, its argument was that the symbolic facet of bread did not reflect its alimentary importance and that, on the contrary, there was an uneven relationship between "the food conceptually thought of as fundamental and the fundamental thing in reality"[22]. In the course of history, bread had not always been the main source of food but even so it "remained the cornerstone food in conceptual terms"[23]. Upon ascertaining the abundance and vitality of those breads put on show and eaten by Sicilians during the principal feast days of their calendar, Cusumano went to the point of claiming that "whatever they had lost in economic and material terms, they definitely made up for in symbolic and ceremonial ones"[24]. Looking at the food-sign relationship, one must indeed take into account a significant factor relative to consumption habits in Italy.

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[20] C. Papa (a cura di), *Introduzione*, 1992b, op. cit., p. 10.

[21] A.M. Cirese, *Pani di Sardegna*, 2005, op. cit., p. 7.

[22] C. Papa (a cura di), *Introduzione*, 1992b, op. cit., p. 12.

[23] Ibidem.

[24] A. Cusumano, *Il pane nelle feste popolari in Sicilia*, 1992, op. cit., p. 139.

Starting in the 1950s, in parallel with the rise in income levels and the constant increase in the consumption of nearly all foods, the consumption of bread instead decreased; and this trend became even more marked during the 1970s when the consumption of meat and cheese increased, and that of vegetables, bread and pasta decreased.[25] Some even spoke of a veritable "demonization of bread that was spreading throughout the West" with felt cultural side effects: it would ring the death knell of the community, since bread is the result of cooperation between people and therefore emblematic of the human community, with the term "companion" derived from the Latin *cum panis* designating the reciprocity that binds those who share its nourishment.[26, 27] At the same time, as we shall see, it was the very desire for community building (along with other cultural aspects such as issues around ethics, the environment, and health and welfare trends) that wasto give rise to the (re)birth of the way bread is thought of, made and eaten today.

Taking into account the statistical downturn in bread consumption, the hypothesis put forward in this paper is in line with what was quoted above, namely thatthe semiotic realm relating to bread today is not just brimming with meaning as it did in the past but is, in many cases, even independent of or hegemonic over its "material" characteristics; in some cases it is inversely proportional to its economic and material importance and capable of holding sway over it.

We shall consequently focus on some of the major types and aspects that were looked into and appreciated or conversely avoided regarding bread which, though they may be material aspects, shall be taken into consideration for their symbolic value. We shall follow the thread of their rich sign production starting from the past leading up to the roles and meanings they take on in the contemporary context. Along an apparent continuity over time, and as we focus on the contemporary explicit desire for harking back to the past, there will paradoxically emerge significant distinctions betweenpast and present symbols. These contrasts and differences shed light on the meanings peculiar to bread today, and though bread may no longer be "founding and fleeting" as

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[25] E. Cialfa, *L'evoluzione del consumo del pane in Italia*, in Papa (a cura di) 1992a, 1992, pp. 185-192.

[26] M. Niola, *La parabola del pane da dio a demonio*, 2015b, La Repubblica, 8 luglio 2015.

[27] G. Murru Corriga, *I pani della tradizione*, op. cit.

was said for the modern era[28], it does "still allude to something other than itself"[29].

In particular, in today's society, bread seems to be caught in a crossfire: its symbolic articulations wind up between two opposing judgements. On the one hand, it is thwarted, drastically cut out from the diet for its rich carbohydrate content and, along with pasta and sugar-laden foods, accused of being a major contributor to weight gain and its consequent impact on looks and health. On the other hand, instead, it is chosen as a fundamental food, a cornerstone foodstuff to go back to in order to begin eating in a conscious, genuine, and healthy way, a way deemed both natural and cultural at the same time, with the most positive of meanings attributed to these terms.These are two opposing attitudes, tied to two different symbolic visions and, in some cases, they are experienced and expressed in an exclusive and all-embracing manner by groups and individuals. More often than not, these two visions interact with one another resulting in outcomes that are ramified, manifold and contradictory but which do in any case express broader cosmologies, and ethical political visions that target contemporary society. In the paragraphs that follow we shall see that the principal branches for this discourse are two, and that they are intertwined: one is the perspective interested in finding out what lies *inside* bread (the "ins of bread"), aspects that are mostly "invisible", prevalently made up of information and knowledge and concerned primarily with the health of the *individual;* the other perspective moves *around* bread (the "outs of bread"), hones in on what takes place when bread is made and shared, and is concerned most of all with "*community building*".

2.3.1. The Ins of Bread

If the modelling of loaves intended exclusively for festive or ceremonial occasions yielded a particularly rich seam for the symbolic line of enquiry, the modelling of bread was symbolic even when it came to normalweekday breads[30].The form of the bread (shape, thickness, size, etc.) clearly dealt with signs, bound as it was to the ingredients and

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[28] P. Camporesi, *Bread of Dreams: Food and Fantasy in Early Modern Europe*, Chicago, University of Chicago Press, 1989, (first It. edition, 1980).

[29] C. Papa (a cura di), *Introduzione*, 1992b, op. cit., p. 14.

[30] A.M. Cirese, *Il pane cibo e il pane segno*, 1992, op. cit., p. 29.

the methods for dough-mixing or baking, and it thus became a "visual indicator", one that sometimes referred to "ethnic styles"[31].

A bakers' estimate puts the number of Italian varieties of bread at no less than 1,500 with differences accounted for by the diversity and different combination of techniques, shapes and vocabulary.[32] "In Italy, there is a saying that there is a bread for every bell tower.[33] Breads are now no longer exclusive to the location of their making, and have spread all over the country, but still the shape of many of them immediately recalls the original place of provenance, along with their flavour and texture. The bread roll known as "michetta", made with plain white flour and hollow inside, is instantly associated with Milan, though not everyone would know that its name is derived from a characteristic Lombard bread called a "micca", that used to be baked in communal ovens by farmers of the Po Valley[34]; just as the bread roll known as "ciriola" is *the* bread of the Romans; with its thick doughy interior, it used to be the typical roll eaten by Roman manual labourers[35].

In seeking links between bread's role as food and bread's role as sign, Cirese honed in on an aspect that can prove to be particularly useful in the study of contemporary situations; he was able to draw out the symbolic pertinence not only from the outward shape, i.e. the visual facets, but also from "substance or matter" and all that it entailed, stating that "savour, fragrance, warmth, and texture all speak to our sense of taste, of smell, of sight, of touch (and sometimes even to our sense of hearing)"[36].

Indeed, it is by comparing the symbolic profile of the outer forms (that had come under scrutiny in the first demological research studies on bread on account of the cultural importance and richness that it had within certain popularcontexts) with all the other elements that go into the making of bread, that a significant trait seems to emerge regarding the cultural standing of bread today. Bread culture is less about forms these days and primarily about ingredients, followed by styles of preparation and baking. The focus moves from the outer to

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31 Ibidem.

32 C. Barberis, *Introduzione*, in Picchi (a cura di), 2000, p. 18.

33 E. Jerian, *Prefazione alla quinta edizione*, in Picchi (a cura di) 2000, p. 7.

34 G. Picchi (a cura di), *Atlante dei prodotti tipici. Il pane*, Roma, INSOR – Istituto Nazionale di Sociologia Rurale, Agra, 2000, p. 101.

35 Ivi, p. 225.

36 A.M. Cirese, *Il pane cibo e il pane segno*, 1992, op. cit., p. 32.

the inner, from the visible to the invisible; from what can be perceived by way of the senses, with the sense of sight first and foremost, to what is gleaned from sources of information. It transpires that one of the major parameters for classing bread is the kind of flour used, or sometimes the yeast: although based on material and sensory aspects, this is a parameter whose connotations are prevalently symbolic.

"As pointed out by the oncologist Franco Berrino of the National Institute of Cancer in Milan, 00-type flour is the 'poison' of our time, the cause of several diseases including celiac disease, diabetes, and obesity, and also forms a breeding ground for cancers"[37]. This declaration of war on the most refined of white flours is uttered by one of the most radical proponents of home-made bread, a veritable movement that has gone viral, as will be seen further on. Though not always expressed in quite so forceful a manner, it is true that thinking of "white flours" as being less desirable is now a common occurrence.

What comes to mind straight away is the different symbolic value assigned to bread in the course of history based on its colour. Following the food emergency of third-century Europe, wheat, which had been considered a high-end product for urban markets, was supplanted by those grains considered to be of lower quality but also more resistant and thus more reliable as a crop such as rye, primarily, but also barley, oats, emmer wheat, spelt, millet, panicum and sorghum. Wheat thus came to be grown in small quantities and became the preserve of the upper classes. A contradistinction between two kinds of product came into being, marked by social differences and defined by colour: bread made from wheat, white in colour, was for the rich and the nobility and took on the label of a luxury product, whereas bread made from rye or other kind of grain or cereal, that was dark or black in colour, became the food of peasants and serfs[38]. At all events, bread was in any case very scant, it was an "elusive bread" and thus made using a mixture of inferior grains, kept in poor storage conditions, or maybe even mixed with other toxic and narcotic vegetables that, according to Camporesi[39] would contribute to the formation of deviant models and delirious visions of the modern era. Bread became the main metaphor

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37 D. Chanaz, *Pane al pane*, in Spadaro, op. cit., p. 9.

38 M. Montanari, *La fame e l'abbondanza. Storia dell'alimentazione in Europa*, Laterza, Roma-Bari, 1993; engl. transl., *The Culture of Food*, Blackwell, Oxford (UK) – Cambridge (Mass.), 1994.

39 P. Camporesi, *Bread of Dreams: Food and Fantasy in Early Modern Europe*, 1989, op. cit.

for food, it activated two different cultural systems that found their focal point in bread whereby, in the words of the physician Giovanni Michele Savonarola, wehad: "bread of princes and grand masters" and "bread for dogs". "The tension between the castes is transformed into this metaphorical series of verses from which seeps the dreadful contempt of the eaters of white bread towards the eaters of dark bread or those who went without bread altogether"[40]. Even as late as the 1950s in all the southern regions of continental Italy, a difference in consumption and eating habits was still to be found, one that often reflected social differences with colour acting as the significant marker for the contrasts; the well-off classes were the "white bread eaters" whilst the working classes were the "black bread eaters"[41].

Today, the symbolic scene is overturned. Already forty years ago Roland Barthes noted how, in contemporary society, the transition from white bread to brown bread "corresponds to a change in social meanings: brown bread has paradoxically become a sign of refinement"[42]. Today white bread is not being coveted but "dark" bread, associated with "ancient grains", instead is. The commercial success of charcoal bread, whose healthfulness and legality have recently been called into question on account of the E153 colourant added to it, can be ascribed to the symbolic attributes of colour belonging to a confused social imaginary[43]. Underlying the market success of this "black bread" first of all is a health and wellness discourse which, as I shall argue, is often, as is in this case, tied to a rhetoric whereby the terms "traditional" and "typicality" coincide with "natural"; the "darker" the flours, i.e. typical and traditional, the more they are natural and therefore "good for you".

Gluten, the complex protein found in manycereals that is activated and swells when water is added to the flour, is a key factor in bread making, but it has also been pointed to as one of the main causes of white flour's negative impact on health on account of its role in celiac disease, the genetic autoimmune disorder wherein the ingestion of

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40 Ivi, p. 35.

41 V. Teti, *Il colore del cibo. Geografia, mito e realtà. dell'alimentazione mediterranea*, 1999, op. cit., p. 154.

42 R. Barthes 1961: engl. transl. *Toward a Psychosociology of Contemporary Food Consumption*, in Counihan, Van Esterik (eds.) 1997, pp. 34-35.

43 M. Bocci, *Il pane nero conquista l'Italia ma la ricetta divide i fornai*, La Repubblica, 12 novembre 2015.

gluten leads to damage in the small intestine. People suffering from this disorder naturally have to cut out all gluten-containing foods from their diet, including a good number of the commonest of cereals such as wheat, spelt, rye, kamut and barley. Media reports have noted a curious phenomenon that sees even people who are not afflicted by the disorder increasingly choosing to buy foods whose packaging sports an ear of wheat with a bar running through it to certify that that they are "gluten free". This sort of attitude has been branded as "irrational" by natural scientists and/or popularizers of science. Dario Bressanini, researcher and renowned science writer, for example, in his book with its telling title "Le bugie nel carrello"[44] ("Lies in the Supermarket Trolley", Translator's Note), debunks the myth of kamut, "the most successful of all the cereals"[45]. Market demand for kamut saw a steady increase as of 1992 and particularly so in Italy which became the largest market for Kamut, attracting half of global sales[46]. The myth that kamut was suitable for celiac suffers, in keeping with the perceived belief that ancient grains contained less gluten, had already been debunked a few years previously and Bressanini reconstructs the story of the kamut phenomenon demonstrating, consistently with the findings on kamut's gluten levels, that it was in no way an ancient grain and still less accidentally chanced upon in legendary fashion (just after the WWII, an American pilot supposedly found a handful of four thousand year-old kamut seeds in an ancient Egyptian tomb). The only credible hypothesis according to Bressanini is that kamut is a relatively modern selection of khorasan wheat, and the registered trademark of the American company Kamut International. The successful appeal of ancient grains lies, as Bressanini notes, in the conviction that they are "more natural" and (therefore, say I) endowed with interesting nutritional properties"[47].

Dismissing kamut's success, or that of any other food product lacking "scientific" backing, as being "irrational" will only get us so far, however. It is more interesting to start from notations regarding what is "lacking" in consumer knowledge in order to find out more about

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44 D. Bressanini, *Le bugie nel carrello. Le leggende e i trucchi del marketing sul cibo che compriamo*, Milano, Chiarelettere, 2013.

45 Ivi, p. 13.

46 Ibidem.

47 Ivi, p. 12.

what, instead, people do know, believe in and act upon where their food choices and consumption are concerned. This way, we can trace mindsets that are eminently symbolic, identity forming, political and ethical in nature, and hence "reasons" to all intents and purposes, that can have large-scale effects even though they differ from those that are eminently scientific.

Allergies and intolerances command a lot of attention and preoccupation these days, especially so where food is concerned. The upshot has been an increase in incidence and diagnosis (are these the two sides of the same coin?). When proof is lacking, and possible symptoms (poor digestion and a feeling of heaviness above all) are perceived, there is a tendency to impute the food for being poorly digestible and to prefer to avoid eating it. This widespread behaviour has to do with the "food tribalism" of affluent society, and namely the forming of groups whose members find and define their own identity on the basis of "saying no to food'' (no meat, no gluten, etc.): "We are what we do not eat"[48]. This is about a mechanism that falls within the broader and more generic paradigm developed by Fischler[49] to explain human eating behaviour, and more specifically the cultural role played by cuisines, and it highlights the contemporary exasperation in favour of one of the two extremes identified by Fischler.

The question "why is it that human beings, though omnivores, do not all eat everything, and each group will or will not eat certain and very specific foods?" was the starting point for some commanding anthropological research on food and eating behaviour, such as the now classic studies conducted by Marvin Harris[50] and Marshall Sahlins[51] that raised a debate exemplifying two opposite analytical stances. The former, a major exponent of "cultural materialism", puts down the reasons behind food practices (in particular food taboos) to factors of ecological and economic order: whatever food finds consensus within a given context is what will determine the cuisine of that group (such that what is "good to eat" is also "good to think upon"). The reasons identified by Sahlins invert the cause and effect relationship between these two poles, pinpointing the motivation on the symbolic

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48 M. Niola, *Homo dieteticus. Viaggio nelle tribù alimentari*, Bologna, Il Mulino, 2015a.

49 C. Fischler, *L'omnivore. Le goût, la cuisine et le corps,* Paris, Odile Jacob, 1990.

50 M. Harris, *Good to Eat: Riddles of Food and Culture*, New York, Simon & Schuster, 1985.

51 M. Sahlins, *Cultura, proteine, profitto*, Prometeo, n. 1, 1983, pp. 62-71.

plane. Thus: what is "good to think upon", i.e. whatever is culturally significant, is also "good to eat" and hence introduced into one's own cuisine.

Fischler[52] explains the "omnivore's paradox" by attempting to juxtapose both perspectives but giving special amplitude to the symbolic perspective. Human beings are free to eat (almost) everything but, at the same time, they are also obliged to do so. Indeed, they are unable to take in all the nutrients they need in order to survive from just one food source, the way a koala can by eating just bamboo. This condition has led humankind to develop two opposing and coexisting attitudes with regard to eating, *neophilia* and *neophobia*: one is about curiosity with regard to new foods, the other is about the wariness of ingesting unfamiliar foods,the fear of extending our body's boundaries, both material and symbolic, beyond the known through the opening to the outside represented by our mouth.

This latter attitude seems particularly developed in our society and is called "orthorexia", a burgeoning trend regarding dietary rules, food choices and everything related to food and nutrition in general. The term was first coined to label a pathology but is now also used to define our society as an "orthorectic society"[53], precisely because this attitude of hyper-reflexivity is centred around food and is clearly driven by the fear that this or that particular food might be "bad for you".

If all of this sheds some light, overall, on today's widespread attitude towards food in Western societies, it is also especially depictive of bread, which continues to be considered as "*the* food" par excellence. Moreover, though once again it is hardly news that food can be regarded as some kind of "medicine", bread has a special role to play today just as it did in the past.

It is fromso-called folk culture that the appreciation of the nutritional value of bread is derived: proverbs speak of it as a basic food, capable, in a poor diet, of ensuring one's primary sustenance – witness the Umbrian proverb that says "meat makes meat, wine makes blood, and bread keeps you going" *("carne fa carne, vinu fa sangue e pane mantiene"*). If the bread is made using top notch quality flour, proverbs then sanction bread's health-promoting power as in the Tuscan saying

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[52] C. Fischler, *L'omnivore. Le goût, la cuisine et le corps*, op. cit.

[53] G. Nicolosi, *Lost food. Comunicazione e cibo nella società ortoressica*, Catania, Editpress, 2007.

"bread made with good grain keeps the doctor away" (*"pane di bon grano tiene il medico lontano"*). Not only are the therapeutic practices of bread numerous (such as the widespread custom of feeding bread soup (*"pancotto"*) to mothers who have just given birth to stimulate milk production), many even retain a proper trait of magic. In the belief that it cannot be used for evil spells, bread can be turned into a home-made amulet (*"brevi"*), a crust of bread can be carried around in one's pocket, or else placed among a baby's swaddling to ward off the evil eye. Or, if a child has been possessed by a demon ("*bambini indemoniati*"), the thing to do is fling a bag of flour at it, or again, bread is used as a means of transferring an illness from a person to an animal, or even yet put to use as a spell to make someone fall in love with you if you mix it with some hair plucked either from the body or the head[54]. These were practices in line with the preventive guidelines of folk medicine, and in this respect not so far-removed from the widespread contemporary sensitivity towards food that, as mentioned, is often based on a precautionary ban against the eating of a given food. Take the issue of white bread and gluten, which is to be avoided at all costs because "the likelihood of developing celiac disease does indeed depend on a genetic predisposition, but it also depends on the intensity of the stimulus: the more cereals containing toxic fragments of gluten are consumed on a regular basis, the greater the chances are of the disease developing"[55].

It is in the act of evoking this kind of collective memory that typical and traditional foods are invoked in a wholly contemporary process that calls to mind an idealised past: "Products that are touted as typical reveal the need for alimentary balance, that might need to be invented or re-invented […]"[56]. Bearing this in mind, "yet typicality can become the prelude to new forms of awareness, it can reveal the need for establishing a link to the past, as well as a dissatisfaction with models that are perceived to be external or extraneous" (ibidem). Within this mindset, food that is typical and traditional is considered healthy in as much as it is presumed to be natural. This then is the implicit logic, often, underlying the syllogism:the more we go back in time, the less

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[54] P. Faltieri, *Pane di bon grano tiene il medico lontano. Pane e grano, lievito e farina nella medicina popolare dell'Italia centrale*, in Papa (a cura di) 1992a, 1992, pp. 147-154.

[55] D. Chanaz, *Pane al pane*, op. cit., p. 11.

[56] V. Teti, *Il colore del cibo. Geografia, mito e realtà dell'alimentazione mediterranea*, 1999, op. cit., p. 110.

food production and consumption practices were corrupted by the material and moral pollution of contemporary capitalist society. Food, today, is being vested with a new sacredness whose divinities are to be found in Nature, within an ideology that identifies Nature as the cornerstone of purity capable of bestowing such purity onto whoever feeds off her.

In popular religiosity, a continuous parallelism had been drawn between the life cycle of bread and the figure of Christ. At the root of bread's symbolic richness, in all its various ramifications and applications, there is the image of bread representing the body of Christ. From this derived that sacredness associated with bread that folk culture expressed via gestures of domestic micro-rituality, as well as via norms and prohibitions[57]. Thus bread was not to be thrown away or wasted even when it was plentiful. This taboo has lingered on, if only via people's attitude, even within an affluent society where bread does instead get thrown away on occasion, as has the tendency to use up any leftover or hard bread, at least in the recollection of numerous recipes from all the regions of Italy. This attitude of reverence for bread, which we shall eventually see re-emerge forcefully in practices that are exquisitely contemporary, can be traced back to pre-Christian cereal-growing societies for whom bread was a vital food, the symbol of what man could eke from the earth, the attentive gift bestowed by Nature, by the gods, by labour[58]. It is a mindset that coincides with the parallelism established among the vegetative cycle of wheat, the life cycle of bread and the cycle of human life, featuring rituals that used bread as the metaphor for the human being and for fertility. Cereals, and bread first and foremost, were the main stimulus for images that referred to the idea of death-resurrection or to the mystery of fermentation-pregnancy[59].

The impression, to conclude this first part, is that today food, and bread in particular, is shaping up as the cynosure of a new spiritual slant. The contemporary context, dominated by global capitalism, together with the contributing factor of an economic crisis that betrayed its promises, is not always able to satisfy the hunger for symbols and

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[57] P . Faltieri, *Pane di bon grano tiene il medico lontano. Pane e grano, lievito e farina nella medicina popolare dell'Italia centrale*, op. cit.

[58] Ibidem.

[59] G. Murru Corriga, *I pani della tradizione*, op. cit.

meaning that characterizes the existence of human beings. There are many instances where the need for a new cosmology emerges forcefully, with profound moral bearings that are thus rooted in Nature: bread, hitherto endowed with Christian values, now "returns" also to a pre-Christian symbolic envelopment, as the "metaphor for life"[60].

2.3.2. The Outs of Bread

Arising informally on the outskirts of both industrial and artisanal bread production, those individuals and groups making bread with sourdough are becoming more and more numerous as well as more influential on the public and economic scene. In a conscious and particularly intense way, even these cases stage important aspects of the process of searching for and inventing new ethical cosmologies that centre around bread.

We shall look at three cases that are emblematic: the choices made by the Interpan company of Terni between the late 1980s and early 1990s; the story of Davide Longoni, the contemporary cult baker from Milan; and the actions of sourdough "guilds". These subjects may differ considerably from one another – an industrial company, an artisanal producer, and self-production groups – but their work and ideologies revolve around the same object, sourdough. A comparison of their features brings to light common symbolic cores alongside certainpractical applications that, experienced as they are by these three subjects in an all-embracing way, as the cornerstone of their working life and in some cases even of their existence, increasingly and more popularly turn into a patrimony of shared experiences and representations.

An anthropological study was carried out between the late 1980s and early 1990s on "Tradition and Technological Innovation in Industrial Bread Making"[61] analysing the case of the Interpan company, which was one of the largest industrial bakeries in central Italy. The circumstance that is interesting to highlight here is the central role that continuity with tradition played in the company's policies and, within it, the function of sourdough. When it came to branding, marketing and

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[60] A. Buttitta, *Una metafora della vita*, in Papa (a cura di) 1992a, 1992, pp. 35-42.

[61] G. Angioni, C. Papa, *Tradizione e innovazione tecnologica nella panificazione industriale*, in Papa C. (a cura di) 1992a, *Il Pane. Antropologia e storia dell'alimentazione*, Perugia, Electa Editori Umbri, 1992, pp. 193-200.

communication strategies, the senior management at Interpan went to great lengths to present tradition in a way that would be perceived as authentic and locally connoted. But that was not all. The study also showed that the company image then acted as a unifier of the staff's perception of their company and of the work carried out both individually and collectively. As critical to their drive, along with other generally held indicators of tradition, the company showcased two details that were specific to local history, drawing them in a positive light, as synonymous with the product's genuineness and goodness, and these were the role of family-run businesses and the artisanal style of bread making. The company executives developed an image "that was indeed needed in order to vie with tough marketing demands but which to some extent also went even beyond them because it was based on a factor that was extra-ideological, traceable in the continuation of techniques and typology of artisanal bread-making, and even of homemade bread production, in as much as these were synonymous with genuineness and goodness"[62]. Thus their bread was produced using the latest technology but at the same time its mainstay was anchored in tradition.

The "mother", the mother sourdough, was the fundamental material element in this process – its role in activating fermentation is essential for making and determining the quality of bread – but, equally, it also carried metaphorical weight. The person making this sourdough is "an old lady, down to earth and clean, hailing from the Umbrian mountains where the air is good"[63] as she is defined by the company, an old lady who carries on making her own bread at home. In this context, the sourdough is the condition upon which good bread hinges but simultaneously a condition that goes beyond industry, an extra-industrial (and female) condition which, in the reading of the researchers of this case,the Interpan company "philosophy" rightly wished to maintain, even to the extent of reining in its industrial output within certain limits.

The autobiography of David Longoni tells a different story; even though at some level the use of sourdough is part and parcel of his desire to make bread the old fashioned way, "as in the past"[64], it entailed

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62 Ivi, p. 193.

63 Ivi, p, 195.

64 D. Longoni, *Il senso di Davide per la farina*, Milano, Ponte alle grazie, 2014, p. 9.

his having to experiment and innovate and to make "choices that are well rooted in the contemporary scene, that interpret the spirit of our times"[65]. Owner of his own bakery eponymously named Davide Longoni, he offers his demanding and discerning Milanese clientele an array of different breads but also a place to enjoy an aperitif with snacks, as well as bread-making courses, and his bread and his business have received many awards. The hallmark of his production is the natural yeast for his sourdough bread.

Let us take a brief glance at a passage from his recent autobiography in order to intercept the meeting point between the experience of a now successful baker and the wider cultural trend with which we are concerned, namely the peculiar symbolic richness of bread in the contemporary scene. Himself the son of a baker from Brianza, he says: "The bread of my family, like that of all of Italy, was an unassuming bread, the same as all the others, with no personality. My parents were pretty good as bakers go, but their products followed the beaten path,they did not carry within them any questions or variation, and knew no improvisation. The bread was made using industrial flours, produced by and sold at the global market, devoid of any link to the location of its origin, and using brewer's yeast. […] There wasn't much by way of variety, but enough to satisfy our customers, who in turn voiced no particular demands"[66]. He then describes the change in direction he undertook in his business, to which he returned after finishing a college degree, his motorcycle trips and his profession as war photographer, as a "choice" that he made, just like others of his generation, within the framework of an evolving consumer society that was becoming increasingly complex, and that saw public demand growing more sophisticated within a context of a drastic reduction in the number of going concerns in the bakery business: two out of three bakeries closed down in northern Italy between 1980 and 1990[67]. There developed a trend whereby, on the one hand, small artisanal bakeries turned towards industrial methods of production – "the use of brewer's yeast contributed considerably to streamlining the job of bread-making because it speeded up the fermentation time and made it easier to more

[65] Ibidem.

[66] Ivi, pp. 22-23.

[67] Ivi, p. 23.

accurately predict the overall production process"[68] – whilst on the other hand there was a rising interest in organically grown flours, Longoni goes on to say, with a few millers and bakers starting to pioneer their use. It is against this backdrop, from a story that is both personal and collective at the same time, that Davide Longoni's much sought-after bread comes forth: it is made with ancient grains, it is delivered in large sizes, and uses natural yeasts for its mother sourdough. He puts forwardan explanation for each of these choices: ancient grains, with their scents and flavours, evoke "thousands of years of history and the migrations of peoples"[69]; the use of sourdough, which he discovered in the early years of the millennium, represents the vindication of craft technique over large-scale industry represented by the latter's use of brewer's yeast, these being two worlds that Longoni intends to keep clearly distinct. The bread not only improves its quality – "it is much more fragrant and digestible, and it keeps for longer"[70] – it also exudes "a certain amount of elusiveness and the end result can never be altogether certain or predictable"[71]. He chooses, moreover, to bake his loaves in large sizes because, as he says forthrightly: "bread is a food to be shared with friends and company (the *cum panis*)" and "large loaves are there to be shared, they create a community"[72].

"Community building" is at the heart of the viral phenomenon called *"Confraternita della pasta madre"*[1] which began in Rome in 2009 and has grown to encompass about 400 families. Engaged in an endeavour defined by them as an "initiation", their aim to is to "enable anyone […] to regain the art of bread making"[73]. The keywords jump out in the very first lines of the project presentation written by its young (female) founder: "[…] I try to reconnect people to *nature* and to the *peasant* and *ecological* traditions linked to the home kitchen […] a process of *"re-colonizing" madie*[2] with *mothersourdough*, of re-acculturating families in the ways of bread-making *know-how*, of searching for *ancient grains*, and the engagement of *bakers*"[74]. Among the motivating

[68] Ivi, p. 26.

[69] Ivi, p. 8.

[70] Ibidem.

[71] Ibidem.

[72] Ivi, p. 7.

[73] D. Chanaz, *Pane al pane*, op. cit., p. 10.

[74] Ibidem.

factors behind this project, which is becoming more and more official, and is steaming ahead in parallel with a growing number of other similar ventures to be found in various locations all down the Italian Peninsula, such as initiatives, blogs, and publications, are the ever-present nutritional and health issues and the rhetoric of Nature and naturality. The fundamental features on which we would like to focus here lie in "community building" and the central and unique role assigned to sourdough. "They feel part of a new social network, and even though they may live in a big city they will gladly reach out to other bread makers to lend them the mother[3], as used to be the custom in small villages in the days of the hermit from Abruzzo"[75]. Those who take part in the bread-making course are given a piece of the sourdough owned by them, with much acclaim for the ancient lineage of its tercentenary strain. Accepting a piece of this ancient sourdough means becoming part of a community with family-like connotations, where people share the same "mother".

Central to the development of this kind of community is the practice of gifting and sharing, re-evoking the centrality of the charity of bread in times gone by, a practice that harks back to the "sacral efficacy" of bread[76]. Bound as we are to recall that, in many contexts and for a long period of time, food was generally thought of as a good that was hard to come by in the fabric of economic transaction, such that it was more of a good to donate or to exchange[77], we can see how bread now once again seems to beexpressing, in a particularly strong and clear fashion, a general principle relative to food. And so it follows that it is starting from the sharing of bread – or rather that small vital portion which by dint of a combination of work and passion will turn into bread, i.e. the sourdough – that a particular kind of community is formed, a community whose ethical and political connotations are blatantly, and not by chance, set against an urban environment.

The use of brewer's yeast is frowned upon because, starting from the 1950s when it took the place of the strains of sourdough in all the homes and bakeries of Italy,"sourdough was no longer cultivated and

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[75] D. Chanaz, *Pane al pane*, op. cit., p. 8.

[76] A. Alimenti, *Il pane nella ritualità popolare umbra*, in Papa C. (a cura di) 1992a, *Il Pane. Antropologia e storia dell'alimentazione*, Perugia, Electa Editori Umbri, 1992, pp. 155-162.

[77] M. Sahlins, *On the Sociology of Primitive Exchange*, 1965, in Id., *Stone Age Economics*, Chicago-New York, Aldine Atherton, 1972, pp. 185-275.

shared, but became something that had to be 'bought'"[78]. The approach and consumerist practices of a globalized capitalist market become the object of their criticism and "resistance", as do the social relations that ensue which are individualized, hedonistic and alienating, and reach their maximum expression in cities.

The intention to change one's personal lifestyle and disseminate it as much as possible so as to influence the market and society begins with opting for a certain kind of bread. "It is my opinion that self-production is self-educating, in that is it enables you to ask questions and seek answers. If you make your own bread, you also start questioning what kind of flour you are buying; then, little by little, you follow the supply chain, you enquire about small mills, you discover ancient grains, and seek out what is organic. From this point of view it is a sharp change in perspective," says the founder of the well-known blog *Comunità del Cibo Pasta Madre*[4, 79] who goes on to state: "Veering towards self-production can change the food and agriculture system: first and foremost because consumers become more informed and aware. The effect is that gradually many food companies begin rethinking the ingredients they use: and that is how, for example, hydrogenated fats began to disappear"[80].

Having shared both the sourdough and the know-how necessary for its survival and for bread-making, the project proceeded to pursue the supply chain: and the first cases of socially performing public ovens came into being.

2.4. Conclusion

The sharing of food and of knowledge and know-how, the coming together of people whose life centres around bread, and whose objective is to critique the economic, political, social and cultural distortions of consumerist societyin order to disseminate new existential and material prospects, these are all practices and ideas that are the result of the interfacing between the following two broad views: one is the trend that can be traced back to the "rural-folk revivalism"[81] of the late 1970s;

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78 D. Chanaz, *Pane al pane*, op. cit. p. 8.

79 R. Astolfi, *Il pane è un maestro di attesa*, 2014, in Spadaro, 2014, p. 23.

80 Ibidem.

81 T. Seppilli, *Consumo di pane nella società dei consumi*, 1992, in Papa C. (a cura di) 1992a, *Il Pane. Antropologia e storia dell'alimentazione*, Perugia, Electa Editori Umbri, pp. 201-206.

the other,the recent and increasingly widespread galaxy of so-called forms of social or solidarity economy[82, 83]. The critique of the "industrial model" – brandishing concepts such as "authenticity", "naturality", "rurality", "localism", "typicality" and "tradition" – in parallel with the "propensity to develop creative forms of production, exchange, consumption, citizenship, and conviviality built around innovative ambiances suitable for sharing and intimacy […]"[84] give rise to "environments that are highlighted by a living-together and doing-together as well as by a 'shared by us'"[85] where bread is re-connoted on the horizon of traditional typicality, re-evoking as good and fitting, and thus healthy, everything that comes down from the past.

These practices and outlooks cannot be dismissed as "irrational" or marginal, far from it, and it is important that these symbolic outpourings, even as they establish themselves against, at the margins of or even within the market, be examined in greater depth, and more so with a view to understanding if and how they will position themselves in the current neoliberal economic system.

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82 J.L. Laville, *L'economia solidale*, Torino, Bollati Boringhieri, 1998.

83 D. Graeber, *Debt: The First 5,000 Years*, Brooklyn (New York), Melville House, 2011.

84 M. Aria, *Condivisione*, in AM, n.34/36, 2013-14, p. 62.

85 Ibidem.

3. Food as an epistemic entity. The case of bread

Fabrizio Rufo, Lucia Maugeri***

Bread can be used in a number of different ways, and has considerable and varied cultural significance that has led to a vast range of visions of the world. Considering bread as an epistemic entity makes it possible to realize what Yhuda Elkana defines as "images of knowledge"[1]: a multidimensional reading of many phenomena and processes which "constitute the long lost bridges that effectively link the pure and simple social world (norms, values, ideologies) to the body of knowledge"[2]. Thanks to these intrinsic characteristics, bread carries us onto an interdisciplinary terrain, which breaks down the traditional divisions of knowledge connecting the living world and the environment through a process of contamination by which we can rediscover the profound significance behind the production and consumption of food.

It is difficult to establish which cereals were selected in prehistoric times. However, already in the Neolithic, the main problem regarded their conservation and later preparation. In fact, special terracotta containers were produced and a flat stone was used on which the precursor of unleavened bread was cooked[3]. In ancient Egypt, the Pharaoh was the lord of both wheat and the irrigation channels through which the Nile was controlled, which were so important for the success of the harvest. The Egyptians considered bread to be a symbol of discovery and object of research, whereas for the Jews, it represented the symbol

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1 Y. Elkana, *Antropologia della conoscenza*, Roma-Bari, Laterza, 1999, p. 25.

2 Ivi, pp. 29-30.

3 A. Marinoni, *Pane. Storia, tradizioni, ricette*, Milano, Acanthus, 1988, pp. 16-21.

of transcendency and the incarnation of the meaning of life, and it accompanied this population during their escape from Egypt[4].

In ancient Greece, this food played an important social role. In fact, civilized men were referred to as "bread eaters". Consider Odysseus for a moment described by Homer[5] in his meeting with the Cyclops. Furthermore, the goddess, Demeter, presided over the cult of bread, which from Sicily later arrived in Rome. Simple in their ways, the Romans were not worried about the ingredients or shape of their loaves, and the yeast, which had been long discovered, was rarely used. During the reign of Augustus[6], there were two important types of flour. The first, which was obtained from wheat, was used to make the bread of the patricians, while the second, which was lower in quality, was utilized to make the so-called "secondarius" loaf. Of extreme importance was the birth of the baker and the inclusion of such a role in Roman society, which led to the creation of organizations that rigidly controlled this trade.

In the Middle Ages, this product embodied the battle between the "real" religion and the others. In fact, it was the Christian scribes who emphasized the importance of bread compared to the foods of the other populations[7]. This era also saw the creation of the first mills, whose presence led to the net distinction between the work carried out by the miller and the baker. The regulation of the various trades started in the XIII century during the reign of Louis IX.

The year 1492 was significant given this was when the Americas were discovered. This led to the evaluation and later to the introduction of completely new and unknown products, such as corn, into Europe.

During the 18th century, following the birth and development of Enlightenment, many people in Europe began to reflect on the state on living conditions in their countries. This was particularly the case in France culminating in the Revolution (one of the causes being the serious lack of bread). When peace was restored, the problem regarding food shortages was resolved and, for the first time, the bread of

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4 *Ivi*, pp. 23-39.

5 Omero, *Odissea*, Torino, Einaudi, 2014.

6 A. Marinoni, *Pane. Storia, tradizioni, ricette*, op. cit., pp. 51-75.

7 M. Montanari, *Mangiare da cristiani: diete, digiuni, banchetti. Storie di una cultura*, Milano, Rizzoli, 2015.

Fig. 3.1. Medieval baker (Biblioteca Casanatese, public domain).

the nobility (white bread) became the bread of everybody. In the early 19th century, together with the introduction of the first fertilizers, new steam machinery was developed, which facilitated agricultural production.

Last century saw the birth of Corporations, and, in 1906, the first Congress of Bread Makers took place at the end of which the bakers founded the National Federation, leaving the Association of Roman Bakers with the job of organizing a statute to be distributed to their Italian colleagues[8].

One can therefore freely state that bread is the food of man and that it has accompanied man's evolution. In 1929, in the book "How

[8] A. Marinoni, *Pane. Storia, tradizioni, ricette,* op. cit., pp. 201-211.

Great Cities Are Fed" written by W.P. Hedden, the term "foodshed" was introduced. This term was recently reintroduced by Arthur Getz in his article "Urban Foodsheds" in "Permaculture Activist" published in 1991. The objective of this term is to indicate the geographical area that produces food for a given population and at the same time the stimulation of a strong sense of responsibility in the local people towards their environment. Therefore, this is why through the preparation, the distribution and consumption of this foodstuff, man is able to express himself and his culture within the society to which he belongs. The choice of bread itself is directly linked to the geographical, social and economic choice with which on the one hand man expresses his eating habits and on the other defines the position he holds within the community of his belonging.

Already in the 1960s, the writer, Murray Bookchin, commented on the interdependence of the relationship between individuals and society, and how the evolution of this concept was conditioned by materials coming from the environment itself and the collective ideals generated by living together[9]. Therefore, if one must consider the two environments to be closely interconnected, in order to re-establish a form of equity between the two parts, the development of society must be directed «in such a way that all members can realize themselves, developing a sense of identity and responsibility towards society and nature»[10]. Furthermore, in this context, as the French historian, Fernand Braudel, observed «eating and drinking are not only necessities, or social luxuries, but community games, relationships between man and society, between man and the material world, between man and the supernatural universe[11]».

Therefore, bread is subject to experience, the result of beliefs and cultural considerations, but it is also a consumer entity and as such can be subject to risks so linking it to the concept of safety. When there is a lack of knowledge, food can become unsafe. In fact, every day, public health officers must evaluate food risks and often the standards

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[9] M. Bookchin, *The Ecology of freedom: The Emergence and dissolution of Hierarchy*, Palo Alto Cheshire Books, 1982, p. 4.

[10] J. Clark, *Political Ecology. Introduction*, in Zimmerman et al., Environmental Philosophy. From Animal Rights To Radical Ecology, Prentice Hall, Upper Saddle River, 1998, pp. 345-363.

[11] F. Braudel, *Il Mediterraneo*, Milano, Bompiani, 1988 - ed. orig. 1987, p. 69.

required are defined by the Commission of the Codex Alimentarius[12], an international body founded in 1963 by the FAO and the OMS.

One aspect that is cause of concern regards, for example, the corn cultivated in Italy. As GM corn is not used, it is attacked by *piralide* larvae which provoke wounds through which toxic funguses of the *Fusarium* genera can enter and cause damage by releasing fumonisins, microtoxins which probably are the main cause of esophageal tumours and congenital malformations of the neural tube during gestation. In the last three years, 55% of Italian corn has been found to contain such high levels of toxic agents that it failed to meet the parameters established in the European recommendations 1126/2007. There is general consensus regarding the fact that Bt GM reduces the presence of fumonisins three to ten times more than non GM corn without having to use pesticides, which damage the environment. Furthermore, the use of the GM version would make it possible to produce safe corn and do away with two techniques that seriously damage the environment, namely the utilization of pesticides and the transformation of the corn hit by fumonisins into biofuels. This would help reduce crop losses and increase yields by approximately 20%. Paradoxically, the fact that organic corn production does not use chemical agents means it is particularly exposed to *piralide* larvae and therefore at higher risk[13].

The food and health sectors have become closely connected and this has created a number of problems such as the concept of trust. Risk and trust are strongly linked. Food consumption represents one of the supreme acts of trust: we cannot trust products that are offered us without any reasonable form of guarantee. While the "evaluation of risk" is generally a community activity, the "evaluation of trust" is an activity each one of us carries out according to personal experience, which influences our choices. However, trust in a product is never questioned until one considers personalized foodstuffs, for which the connection between the food and health sectors is absolute. Therefore, it is necessary to guarantee clarity not only regarding operative procedures, but also concerning the interpretation of moral norms and values[14].

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[12] http://www.fao.org/fao-who-codexalimentarius/en/

[13] R. Defez, *OGM, biodiversità e decisioni consapevoli*, Scienza e Società, n. 23/24, 2015, pp. 51-60.

[14] Mejiboom, L.B. Frank, *Trust, food and health. Questions of trust at the interface between food and health*, Journal of agricultural and environmental ethics, 2007, pp. 231-245.

The bread produced today is generally realized with refined white flour. Its consumption became consolidated in 1880 with the introduction of roller mills, and the use of powders in the bread making process started in 1838, while in 1850 the tartaric acid based powders and later the phosphate based powders started to appear on the market. Following the studies of Pasteur, complex yeasts were used. They were adopted in order to avoid the natural physical alteration of the flour[15] .

It is, therefore, important to consider the quality of a foodstuff such as bread due to the fact it is so widespread. Its value as food can change owing to the possible loss of germ oils, vitamins of group B (folic acid), minerals and bran fibre. The lack of such elements directly affects the metabolism which inevitably leads to a weakening of a person's natural defences. In fact, here, we must consider how the consumption of "daily bread", which today is more treated and therefore more "sophisticated" also due to the use of "refined" flours, has provoked an increase in food intolerance and the reappearance of a number of diseases (the use of refined cereals is closely linked to obesity, insulin resistance, diabetes, hypercolesterolemia, some forms of tumour, metabolic syndrome, …). Therefore, it is important to limit the use of these refined products "as much as possible"[16]. The French agronomist, Claude Aubert, observes: «bread, at first sight, seems to be one of the least unnatural products, given that it is principally made with flour, salt and water. Nevertheless, some additives are permitted: broad bean flour, ascorbic acid, malt extract, propionic acid and, in cases of filosity, lactic acid, phosphate, calcium acid, acetic acid, calcium acetate. These additives are few if one considers what can be found in the bread produced in America (which could become our bread of the future in the next ten or fifteen years) which contains: 50 kilos of enriched flour; 0.7-1.2 kilos of yeast; 0.5 kilos of soya; 1 kilo of salt; 1.5 kilos of sugar; 1-1.5 kilos of lard; 1 kilo of skimmed milk; 150 grammes of mono and diglyceride; 90-120 grammes of calcium propionate. The additives are: 0.0230% of starch; 0.0066% of benzoyl peroxide; 0.0030% of niacin; 0.0027% of iron; 0.0016% of tricalcium phosphate; 0.0011% of potassium bromate; 0.0004% of thiamine mononitrate; 0.0003% of ribo-

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15 M. Rotini, *Pane quotidiano. Storia, industria, ricette per l'autoproduzione*, Viterbo, Stampa alternativa/Nuovi equilibri, 2014, pp. 119-120.

16 W.C. Willet, M.J. Stampfer, *La nuova piramide alimentare*, Le Scienze n. 414, 2003, pp. 46-53.

flavin; 0.00006% of magnesium carbonate. French bread appears to be more natural but made with white flour which has lost a considerable part of the nutrients contained in wheat. Compared to a "complete" loaf (extraction at 98 per cent), a loaf that has been 75 per cent sieved (like most normal white bread) loses 50 per cent of its phosphorus, 60 per cent of calcium, 60 per cent of iron, 70 per cent of vitamin B1 and 67 per cent of vitamin B2, 87 per cent of vitamin B3 (PP). Also lost is the bran, which has finally been recognized as being important for the intestines. At the chemist's, at considerable cost, it is now possible to buy bran pills and crackers, despite the fact for fifty years most nutritionists sustained that bran was useless, even damaging. Having removed the bran and most of the protective elements (vitamins, trace elements) from the wheat grain, white bread is basically composed of starch and glutens which means it provides above all calories. The salt added to the flour is also refined and therefore lacking in magnesium and the trace elements contained in unrefined sea salt. The use of yeast, the quickening of the kneading process and reduction in cooking time, and the baking at higher temperatures gives bread the visual characteristics of today: white, light, insipid and uneatable the day after. Regarding packaged bread, a number of chemical products are added in order to improve conservation. For example, the contents of a so-called "country loaf" include: flour, milk serum, leavened wheat, salt, malt, yeast, E471, the emulsifier E322, the antioxidant E300, calcium propionate E282[17].»

At the beginning of the 19th century, the Authorities defined bread as a "product obtained from cooking dough composed of a mix of wheat flour, sourdough, alcohol yeasts, drinking water and salt"[18]. The bread thus obtained formed the basis of the Mediterranean diet and represented half of the food ration of farmers. Today science can confirm what we had in the past understood instinctively: 9/10 of the total of what is eaten daily should be a combination of proteins, fats and carbohydrates, while the remaining tenth should be basically fruit and vegetables[19].

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17 C. Aubert, *Un altro piatto: consigli pratici per un'alimentazione sana, semplice, gustosa ed economica*, Milano, Sperling & Kupfer, 1981, p. 240.

18 M. Rotini, *Pane quotidiano. Storia, industria, ricette per l'autoproduzione*, op. cit., p. 123.

19 *Ibidem.*

It is essential not to limit ourselves to defining what we eat. We must, in fact, also define how it is produced. Food is obviously also the result of a profound learning process, this acquired knowledge being then converted into action. We learn from others and we then make changes according to our own personal preferences.

In recent years, academic studies regarding the food sector talk of "foodways", indicating with this term the study of the production and consumption of food. The analyses of consumption and choices suggest that one reverts to wisdom and past traditions when dealing with the questions regarding dietary risk and consequential trust in what we eat.

Culture and knowledge act as a guide which can direct us in various situations and define the standards that we must follow[20].

Choosing a product instead of another (in this case between two types of bread) is often the result of a relationship between desire and the subconscious: we often feel the need for something while at the same time feeling a certain disgust. In this sense, the epistemological process is affected by psychological and physiological conditioning. The criteria involved in epistemological investigations, such as the concept of truth, can be applied to knowledge, but are unable to deal with sensations such as desire and need rather than disgust. When it comes to food, the role of the epistemic process, through which knowledge is developed starting from beliefs and evaluations, is in any case strongly contrasted by physiological notions and by subconscious motivations. From the traditional mind-body dichotomy derives the division between health and pleasure. When eating, one searches for metaphors that can bridge the gap between these two factors, leading to new forms of enjoyment through food which enhances a more responsible form of hedonism that in any case takes into consideration various individual sensations[21].

However, as already mentioned, bread is not simply a foodstuff. In fact, it represents a source and continual generator of culture. But this culturalization is also a complex process. «The many forms of bread, which indicate, through their countless variations, every day places and festive moments, both exceptions and the norm hand in hand,

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[20] M.L. Axelson, *The impact of culture on food-related behavior*, Annual review of nutrition, vol. 6, pp. 345-363.

[21] Van der Weele, cor, *Food metaphors and ethics: towards more attention for bodily experience*, Journal of agricultural and eviromental ethics, vol. 19, n. 3, 2006, pp. 313-324.

status, vital and temporal occasions and ethnic identity, shows that it, although not always and not everywhere and not for everybody, constitutes, more than any other type of food for a large area of the Mediterranean, one of the constant elements and is a form of identification which demonstrates a form of common cultural belonging[22]».

Fig. 3.2. Reaper grain (courtesy Archivio di Stato di Rieti).

Care is however paramount when considering such matters. As underlined by the Swiss semiologist and linguist, Ferdinand de Saussure, when contemplating symbols, the connection between meaning and significance is purely arbitrary[23], and given that culture is the mother of all symbols, it is constantly influenced by varying historical-geographical interpretations. In this sense, the case of black bread is a perfect example. In the period preceding the economic boom, the lower classes that had always desired bread made from soft wheat flour, were forced to comsume dark bread as their daily fare. However, at the end of the last century, this type of bread became a symbol of good eating and a symbol of social belonging.

«A thousand differing sensations, stemming from the same object, all concur because no single sentiment can represent an object. It can only indicate a certain conformity or relationship between the object in question and the organs or the mind. […] Beauty does not exist in the objects themselves but only in the head of the observer and every mind perceives beauty differently. A person can also perceive deformity where another sees beauty […][24]». Therefore, can we not even talk of objectivity when referring to gastronomy? There have been many

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[22] C. Papa (a cura di), *Antropologia e storia dell'alimentazione: il pane*, Perugia, Electa Editori Umbri, 1992, p. 14.

[23] F. de Saussure, *Cours de linguistique générale*, Roma-Bari, Laterza, 2009.

[24] D. Hume, *On the standard of tast*e, David Hume: essay moral, political and literary, Ed. Eugene Miller, Indianapolis: Liberty classics, 1985, p. 230.

philosophers apart from Hume who have tried examine the concept of taste, above all, in its most elementary form, as a sensorial ability for tasting food. Obviously, the description of the perceptive input that we receive is based on individual experience so it is therefore difficult to define global concepts[25].

If we consider the action of "speaking" as a sort of "social poetry", we must conceive it as the result of a form of communal action inside of which we try to identify a vision. When this happens, it is because the individuals involved in the attempt to reach this objective have had similar experiences. This idea was well evidenced in the work of the American philosopher, sociologist and psychologist, George Herbert Mead, when he insisted on the need to find a series of terms able to provoke in the other members of the community the same emotions which each one of us feels when experiencing something[26]. In this sense, the fact that food itself is an experience means it provokes emotions that need to be described, above all, because they can be conceived as a form of imprinting that can direct future community choices. Therefore, one must proceed by adopting a form of neo-Aristotelian approach, which could help us widen our knowledge involving us in the fruitful process of forming opinions that will lead to decision making and later consumption[27].

Therefore, food enriches us with symbolic values and as such becomes a vehicle of communication, through which it is possible to transmit a series of notions obtained, in more or less full awareness, from our daily behaviour. It is, above all, the passing on from generation to generation of this behaviour which makes it possible to enrich our knowledge and traditions and which have formed the foundations of our rituality, rites long forgotten that are returning to the fore today, above all, in the food production phase. A perfect example of this can be seen in the rediscovery of forms of leavening, which are no doubt slower and more complex, but which produce a higher quality product. There are many legends regarding the discovery of natural yeast.

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[25] M. Shaffer, *Taste gastronomic expertise, and objectivity*, in F. Allhoff e D. Monroe eds. *Philosophy and food: eat, drink, and be merry*, Blackwell publishing, Malden MA, 2007, pp. 73-87.

[26] G. H. Mead, *Mind, self and society*, 1934.

[27] Beekman, Volkert, *Feeling food: the rationality of perception*, Journal of agricultural and eviromental ethics, vol. 19, n. 3, 2006, pp. 301-312.

Leavening comes about through the actions of microorganisms, bacteria, which feed on the sugars and starch that can be found in dough so activating a process of fermentation. In the initial phases of the process, the yeast consumes the oxygen that can be found within the dough. When it is almost finished, the alcoholic fermentation initiates, which by acting on the simple sugars produces alcohol and carbon dioxide. This gas remains "imprisoned" in the dense network formed by glutens and as a result the dough begins to rise. At the same time, the enzymes trapped in the flour start to break the starch down into simple sugars, so becoming an important ally of the yeast in the leavening process. The rediscovery of sourdough makes other forms of fermentation possible, thanks to the presence of lactobacilli which can also ferment lactic acid. The main difference between leavening with sourdough and alcohol yeast lies in the large number of bacteria: in the former, there are both anaerobic bacteria in the form of Lactobacilli and Saccharomyces (the bacteria present in sourdough are very important in order to help our bodies function correctly because they are able to destroy the phytic acid present in flour so that the dough becomes more digestible and easier to conserve); brewer's yeast contains only Saccharomyces Cerevisiae[28].

Despite the fact the consumption of bread today is considerably lower than it was[29], independently from the way it is produced, it however remains the only type of food that can provoke a sense of privation when it is missing. The lack of bread has always been considered an index of famine and a factor that provokes wars. Even today there are no populations, more or less civilized, that do not have their own type of bread, whether it be unleavened bread or a shapeless loaf.

Every population has its own traditions in the kitchen, including the kind of bread it consumes.

The nomads of Afghanistan eat flat bread that is cooked on special stones that the itinerants carry with them. In Turkey, fasting is interrupted in the evening with the consumption of unleavened elongated flat bread. Flat bread is also traditional in many regions of Italy, above all in Liguria[30]. In North Africa, apart from unleavened flat bread, another type of unleavened bread is produced which is cooked on a decorated terracotta plate. In Mexico, the tortillas, made with the type of wheat

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[28] B. Rangoni, *Pasta Madre (ignoto il padre…)*, Modena, Damster Edizioni, 2013, pp. 9-10.

[29] http://www.coldiretti.it

[30] A. Marinoni, *Pane. Storia, tradizioni, ricette,* op. cit., p. 214.

which provoked the famous "revolt of the tortillas"[31], are the flat loaves for both the rich and the poor. They are used as a form of fork which can be used to carry food from the plate to the mouth. In Russia, people prefer rye bread, in the form of a braid and is considered as a symbol of life. The custom of sprinkling the top of bread with cumin seeds or other spices spread from Iran to Russia and later to Central Europe. This kind of bread is traditionally thought to bring good luck. There are also many Russian farmers that, in order to make their bread tastier, cook it in winter on a bed of maple or oak leaves[32].

In Germany, more than two hundred different sorts of bread are produced, with rye or wheat or mixed cereals, with yeast or through natural fermentation. In northern countries, ring-shaped rye bread was produced which were then thread onto a rope and hung from a wooden beam near a fireplace to guarantee its conservation. Also in Switzerland, many types of bread are produced which vary from canton to canton. The best known is from Bern, which is characterized by a great cut on the side, and is round in shape. In Paris, rye bread is still produced and served with oysters. The year 1510 seems to be the official date when the traditional form of bread took hold in France, namely the *baguette*, which is 70 centimetres long, 6 centimetres tall and weighs 250 grammes. Its name derives from the latin word, *baculum, even though its confirmation as a symbol of France did not take place until the 19th century.* In Brussels, Sunday bread, which is called *pistolet* , was longer and thinner compared to the French loaf. In Provence, and also in some areas of north Africa, some leavened loaves are cooked in special terracotta pottery. On the other hand, in China, Cambodia, Thailand and Vietnam rounded loaves are produced using wheat, sugar, fat, salt and yeast, which are placed in bamboo baskets and steam cooked. In Italy, every region, and every city has its own specific and characteristic bread[33]. Thanks to this wide and complex variety, Italian bread is considered an 'epistemic object' a position that was magnificently described in his studies on food in France by Roland Barthes:

> "Food serves not only as a "sign" for issues but is also linked to specific situations; and this, when all is said and done, means that it can emphasize rather than simply express a certain type of life style. Eating is

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31 F. Galletti, *Pappa mundi*, Milano, Guerini e Associati, 2015.

32 A. Marinoni, *Pane. Storia, tradizioni, ricette,* op. cit., p. 216.

33 Ivi pp. 219-225.

> a form of behaviour that develops its own ends replacing, uniting, generating other behaviours, and it is precisely this that makes it a "sign". But what are these other behaviours? Today, we could almost say that a 'polysemy' of food characterizes modern life; in the past, only festive occasions were "signed" by food in a way deemed positive. Nowadays, however, even the working life has its own specific food: light, energy foods are considered as a real "sign", and not as a simple indication of participation in modern life… today we can see an extraordinary expansion of situations associated with food, and this list is getting longer and longer. This adaptation usually takes place in the name of hygiene and improvements in the quality of life, but in reality, we must underline once again that food has a double value, being the basis of nutrition but also protocol and its value as a form of protocol becomes ever more important once the fundamental nutritional needs have been satisfied"[34].

This 'double value' that Barthes talks about can be seen in the traces that bread has left throughout the history of civilizations and which touches the lives of millions of people and countless resources in various production, economic, social, and political combinations that contribute to "making history". In this way, bread does not simply represent the concept behind the relationship between producer and consumer but goes further, having led to the development of fundamental meanings concerning work and the very nature of things.

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[34] R. Barthes, *Toward a Psychosociology of Contemporary Food Consumption, In Food and Culture*, edited by Carole Counihan and Penny Van Esterik, New York, 2008 (1975), pp. 28-35.

4. Geography of taste and taste of geography: the bread and pasta chain

*Armando Montanari**

Introduction

This section contributes to answering a very simple question that we might all ask ourselves when we're going to the doctor for any health issue: is it possible that bread and pasta could be so damaging for our health? For some symptoms, the doctor will recommend that we start by limiting our consumption of bread and pasta, or eliminating them all together. Cereals and their derivatives have been the basis for human civilisation since they first appeared many thousands of years ago. Given the thousands of years of history of our food consumption, it is natural to assume that our diet has so far been developed on the basis of that sort of wisdom stretching back thousands of years that is inherent in mankind's ability to think. So it is natural that bread, which has been the basis of our diet for millennia, should still occupy that position today. The fact now that it is bread that should be banned from our diet could cause serious mental confusion and psychological anxiety. Removing bread from our diet effectively means taking away mankind's ability to decide independently what to eat. If we're no longer able to decide for ourselves we're then forced to turn to a superior being, a clinical dietician, to find out what we should eat. In this situation, we will become anxious each time we eat pasta: thereis a fear that this food could be harmful for our health.

On many occasions, I have tried to prepare bread using ancient wheat species, to make the flour myself and prepare the bread using

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culture yeast. Then I compared this dark, solid, intensely flavoured bread, which fills the stomach, with the soft, white bread that I bought from my baker. The two breads, similar in definition, are very different when eaten. To echo the sentiments of Davis[1], the ancient recipe put me in a state of euphoria, as if I had been given a seat at the table of a Mesopotamian potentate several centuries before Christ. It nourished not only my stomach but also my soul.

In this work, we will look at the relationship between the production of wheat and its specific territory. We absolutely must identify methods of cultivation that are sustainable. This involves protecting the environment, safeguarding local culture and building the ability to develop sufficient income for the producer. In the first chapter, we will address the production of pasta and bread in the context of the globalisation of the food sector. Globalisation has certainly enabled a better price equilibrium and greater production efficiency, which makes it possible to feed the growing number of inhabitants on the planet. But globalisation of food production has its costs,which have an impact on the environment and on the health of consumers. The second chapter looks at the issue of diet as a consequence of the significantdegree of globalisation of production. Over recent decades, supply has become so large that it is easily able to determine demand. One consequence of this has been the rediscovery of national diets that in some cases have been recognised by UNESCO on its intangible cultural heritage list. This is the case with the Mediterranean diet. The third chapter takes a deeper look at the production strategiesused by local small and medium-sized enterprises compared to those of major multinationals, making reference above all to the production area. In the fourth chapter, the geography of taste, we analyse the quality production chain to identify the most significant characteristics of the link between production and its territory. The fifth chapter, the taste of geography, takes apart the production chain and looks at the individual components as part of the corresponding area. These territorial foundations therefore become the reference point for communicating the quality of the product in relation to the capacity of producers and the characteristics of the area. The sixth chapter provides an illustration of the geography of taste and the taste of geography for one specific area where new forms of production of wheat, bread and pasta are being trialled.

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1 W. Davis, *Wheat belly. Lose the wheat, lose the weight and find your path back to health*, New York, Rodale, 2011.

4.1. The globalisation of the food sector

Since the end of the Second World War, the food sector has followed the trend seen in other production sectors in terms of globalisation of production and processes and internationalisation of ownership. When we purchase a food product, we often do so by reference to prestigious brands that have long been the pride of 'made in Italy'. But expecting traditional quality production merely because the brand was once prestigious is not justifiable. Many brands have changed hands and, although they retain the same name, they now form part of production and distribution systems that are typical of a multinational. Burch, Rickson and Lawrence[2] distinguish between the phenomena of internationalisation, multinationalisation, transnationalisation and globalisation. In particular, according to Atkins and Bowler[3], Burch et al.[4] are examining the globalisation phase but believe that the current phase is still one of internationalisation. Indeed, the globalisation phase should be characterised by non-market forms of cooperation among companies. Atkins and Bowler[5] believe that the national limitations on the international trade in food products have been gradually reduced over recent years as a result of policies introduced by the World Trade Organisation (WTO). Oxfam International[6] has published the results of a study conducted on the ten largest groups in the world with daily turnover of around a billion US dollars that employ, directly or indirectly, millions of people. The activities of the BIG 10, Associated British Food - ABF (1), Coca-Cola (2), Danone (3), General Mills (4), Kellogg (5), Mars (6), Mondelez International - Kraft Foods (7), Nestlé (8), Pepsi Co (9) and Unilever (10), cover more than 90% of world food demand. In Italy, the BIG 10 are present in the form of the following brands: (1) Twinings, Ovomaltina, (2) Coca-Cola, Fanta, Sprite, Acqua Lilla, Acqua Sveva, Nestea, Powerade, (3) Activia, Vitasnella, Actimel, Mellin,

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2 D. Burch, R. Rickson and G. Lawrence, *Globalization and agri-food restructuring*, Aldershot, Avebury, 1996.

3 P. Atkins and I. Bowler, *Food in society. Economy, culture and geography*, London, Arnold, 2001.

4 D. Burch, R. Rickson and G. Lawrence, *Globalization and agri-food restructuring,* op.cit.

5 P. Atkins and I. Bowler, *Food in society. Economy, culture and geography,* op. cit.

6 Oxfan International, *Behind the brands. Food justice and the 'Big 10' food and beverage companies*, 2013, 106 Oxfam Briefing Paper (https://www.oxfam.org/sites/www.oxfam.org /files/bp166-behind-the-brands-260213-en.pdf).

Nutricia, (4) Haagen-Dazs, (5) Kellogg's, Pringles, (6) M&Ms, Milky Way, Snickers, Twix, Uncle Ben's, (7) Philadelphia, Sottilette, Oro Saiwa, Milka, Halls, Hag, Tuc, Fonzies, Splendid, Ritz, Cipster, Fattorie Osella, (8) Buitoni, Nescafé, Maggi, Smarties, Perugina, Motta Gelati, Antica Gelateria del Corso, Acqua Vera, Beltè, (9)Pepsi, Gatorade, Lipton IceTea, Tropicana, (10) Calvé, Algida, Ben&Jerry's, Knorr and Lipton. The food retailers sector is similarly concentrated in the hands of a small number of international companies, being dominated by the activities of the following TOP 5: (1) Wal-Mart, (2) Carrefour, (3) Metro Group, (4) Tesco, (5) Seven & I. We could argue that there is a difference between the globalisation of a technology product and that of agrifoods products. For automobiles and PCs, the production areas are limited to a small number of regions throughout the world. But the same cannot be said for food products, which are affected by climate, soil, environment and a whole raft of other aspects associated with the local area that cannot be overlooked. While it is not possible to completely standardise the growing environment, we have standardised methods of production, packaging and marketing. At the end of this process, even product quality, understood as the process of enhancing the specific characteristics of each product, and therefore the taste, fragrance and colour, is reduced to standardcharacteristics. Figure 4.1 illustrates the basic process a consumer goes through when choosing the food product that he or she intends to consume. Each consumer has his or her own personal conditioning including cultural background, disposable income, and social group. These elements dictate an individual's specific dietary habits and the fundamental aspects of behaviour. Each consumer also has emotional needs, cultural expectations or psychological problems that he or she seeks to satisfy through food, consumed in particular quantities or qualities. This is a reversal of the motto of Jean-Anthelme Brillat-Savarin[7], who wrote at the beginning of the 19th Century in his work '*The Physiology of Taste*' "tell me what you eat and I will tell you who you are". If we succeed in understanding an individual who consumes, we will also be able to anticipate that individual's dietary preferences. The multinationals are particularly active in this area, running their own vast research centres that study the market carefully. Using these tools, a company can anticipate trends in demand, also often influencing that demand.

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[7] J.A. Brillat-Savarin, *The physiology of taste*, London, Penguin Books, 1970.

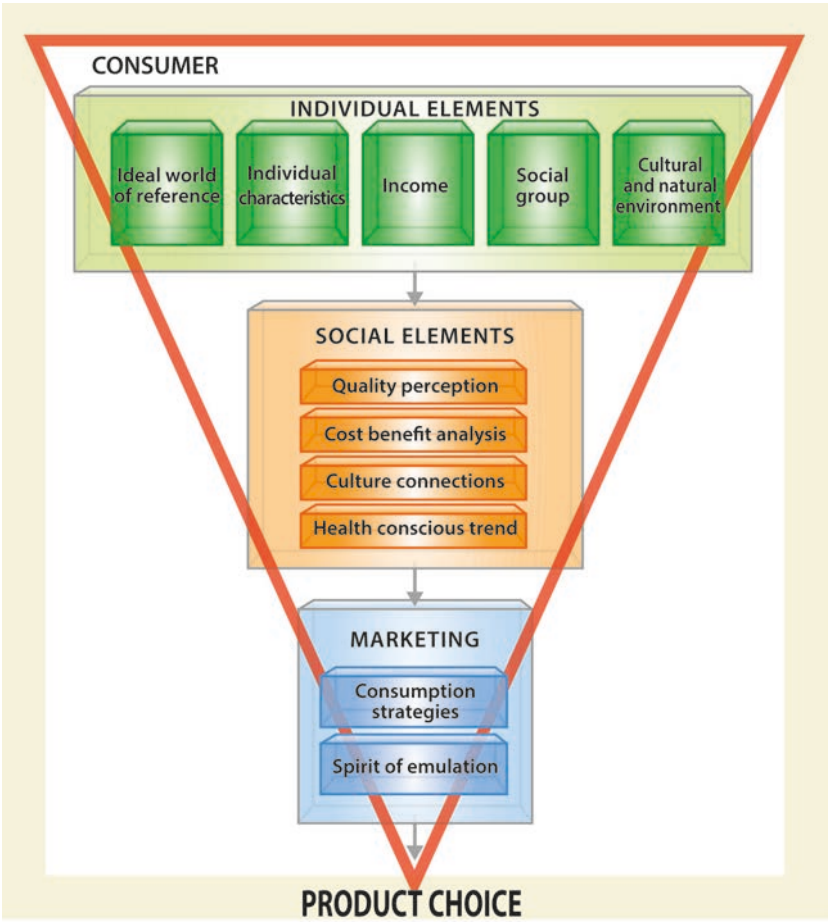

Fig. 4.1. Consumer and product choice.

In this particular sphere, a company must be very large or it will be swallowed up among the losers. At a secondary level, there is also the conditioning that each of us receives from the social environment in which we live. In each group, there is an internal dynamic that is affected by the conditioning originating from society as a whole. In post-modern society, the relationships between individuals are fluid: the health and well-being of the body assume primary importance in social relationships. There is certainly greater respect for the environment surrounding each individual, but good environmental management is perceived through the health of the body. Good diet is an integral part of an environment that is not polluted, or, at least, is polluted as little as possible. The individual, who has now been urbanised for

generations, has lost all contact with the ancient country wisdom that taught us how to decide which products were the best to eat. That individual is trying to rediscover the right modes of dietary behaviour by sharing his or her own experience, participating in social networks or more traditional associations for the purchase and consumption of food products. This also includes SMEs, which have limited capacity to investin advertising campaigns or to undertake detailed market surveys. Social networks can be more suitable for SMEs, which can use information from personal encounters to understand changes in demand and therefore adapt supply. But product selection also depends on the reach of marketing campaigns, which the major multinationals are ideally placed to afford. This assumes that the producer legitimately wants to understand the thinking and habits of consumers. But, in this phase, the situation is completely reversed, because the large companies have the capacity and all of the tools required to influence demand. In such a situation, the producer targets primarily the consumer's brain and only afterwards the individual's ability to distinguish the scents and flavours suggested. Advertising campaigns are often performed by actors, or other famous people, with whom the consumer is encouraged to identify and, therefore, to follow the dietary habits that the actor proposes, even if only in make-believe. The choice made by the consumer, as indicated in Figure 1, is represented by a downward-pointing triangle diagram, because, in theory, it would be correct for each person to be able to choose the food he or she consumes in relation to personal dietary habits and aspirations. In reality, food demand often becomes a driver for demand, given the vast capacity for media action, by means of large-scale marketing campaigns, on the part major multinationals.

The production chain for large companies is based on maximising profits and on their ability to offer competitive products on the market. These principles are priorities and sometimes fail to take into account the negative consequences that this behaviour can have on society and on production areas (fig. 4.2). To improve the efficiency of the individual product, a large quantity of chemical products are consumed as fertilisers, preservatives and additives. There is also a need for substantial quantities of energy, both for the various phases of production and for the transportation of the foodstuffs from one continent to another. To improve efficiency and increase competitiveness, and therefore profit, the chain develops over extremely vast

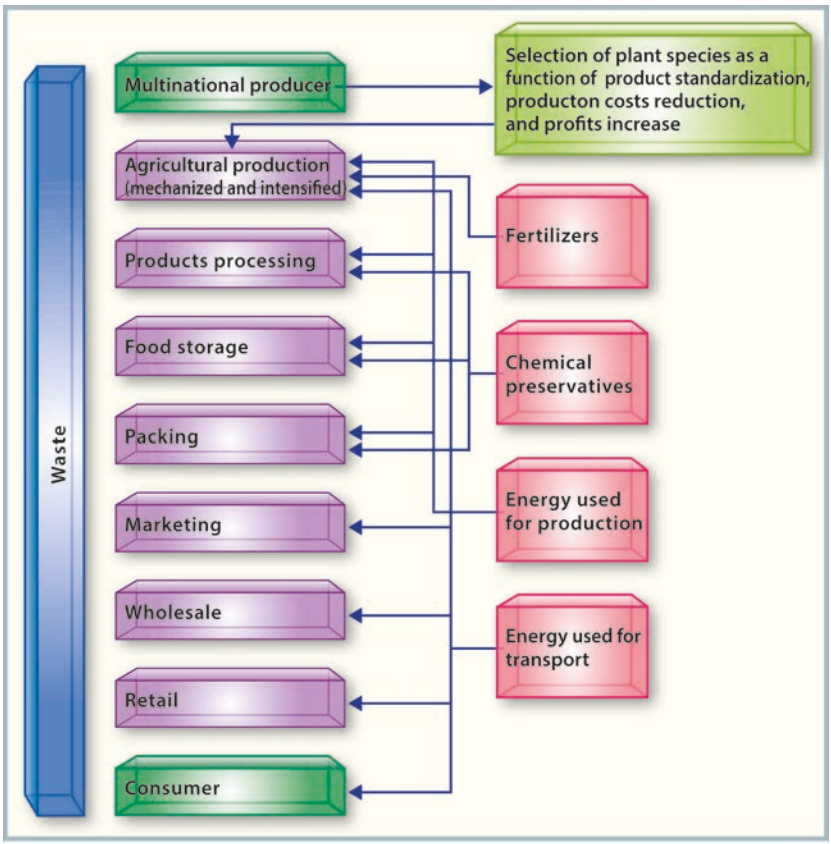

Fig. 4.2. Quantitative food chain.

areas, in the order of thousands of kilometres. An equally important factor is the production of large quantities of wastes and harmful emissions into the environment during all phases of the production chain. The bulk of the environmental costs are not internalised as part of the final cost of the product but, rather, left as a burden on society as a whole. The revenues from the sale of the food products therefore go to the multinational while the resulting environmental costs are borne by consumers through the charges paid to the local and national authorities.

Alongside the globalisation of management, we have also seen the internationalisation of the production chain, which is in fact intended to enable a rationalisation of costs and processes, and the chain has been fragmented into so many separate segments that production activities are performed in areas that are enormously distant from each

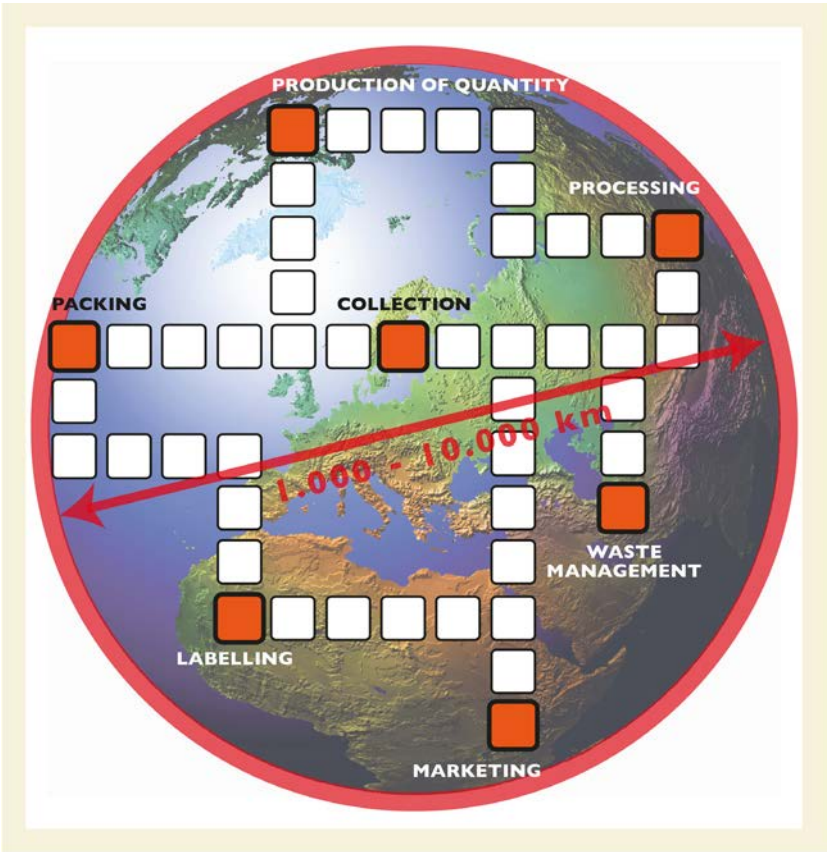

Fig. 4.3. The global dimension of the quantitative food chain.

other (fig. 4.3). The most striking example has been documented by the Wuppertal Institute[8], which calculated the route taken by a pot of strawberry yoghurt to the shelf of a supermarket ready for sale. The contents of that pot are each produced in a different location, like the pot itself, the alufoil lid, the label, and the cardboard packaging. When it is placed on the supermarket shelf, the pot has already travelled almost 10,000 kilometres. The study was performed to highlight the fact that, despite the huge distances travelled, the cost of that pot of yoghurt is still lessthan one euro. This shows that while transportation, and management of wastes, are fairly costly for the environment, and therefore for the community, they are not costly for the companies concerned.

[8] E.U.v. Weizsäcker, A.B. Lovins, L.H. Lovins, *Factor Four. Doubling Wealth - Halving Resource Use*, London, Earthscan, 1997.

4.2. The diet

Each day, more than 1.3 billion Coca-Cola products are sold worldwide. In 2005, McDonald's had almost 31,000 affiliated restaurants globally, with that figure increasing to 36,000 in 2015. When Americans think of McDonald's, they think of the 'dollar menu' and the very affordable offers for lunch of a hamburger and fries. In Europe, however, consumers began some time ago to consider the 'golden arches' as a 'manifesto for ill-treating the stomachs' of consumers, and not even at a reasonable price. In early 2016, a coalition of European consumers' rights organisations made a complaint to the European Commission, requesting an investigation into abuses by McDonald's in relation to its competitive power. Someone was surprised and asked: how could the fast-food giant famous for its 'happy meals' be responsible for serious damage to the health of consumers? The documentary 'Super Size Me' was highly successful throughout the world in 2004, and in it, the documentary maker, Morgan Spurlock, documented the deterioration in his health after he spent 30 days eating nothing but McDonald's, doing as little physical activity as possible, and every so often also eating from the famous McDonald's 'Super Size Me' menu. At the end of the experiment, his doctors documented a weight gain of 11 kg and a significant deterioration in his health compared to his status at the beginning of the experiment. Pollan[9] examines the story of the so-called diseases of the western world (cancer, cardiovascular disease, diabetes, obesity) and the direct role of poor diet in diseases of this kind.

To alleviate the many health problems caused by the globalisation of diet, Carlo Cannella, at the conclusion of the Third International Conference in Parma on 3 September 2009, organised by the International Interuniversity Centre for Mediterranean Food Culture (CIISCAM), Sapienza Rome University, presented the New Mediterranean Diet Pyramid (NMDP). The base of the NMDP is represented by foods of vegetable origin such as cereals, vegetables and fruit, which constitute the main meal, and then the other foods required to supplement that meal, distributed in decreasing quantities according to the recommended frequency of daily or weekly intake. In addition, using the experience gained from social sciences, the pyramid indicates

[9] M. Pollan, *In defense of food. An Eater's manifesto,* London References, Penguin Books, 2008.

Fig. 4.4. The new Italian Mediterranean Diet Pyramid.

base elements such as physical activity, conviviality when dining, and consumption of local products when they are in season. According to Donini[10], the Mediterranean Diet is a set of dietary traditions, artisanal knowledge and techniques, representations and landscapes, that the peoples living around the Mediterranean Sea recognise as an integral part of their cultural heritage.

These nutritional and behavioural requirements are clearly illustrated in a pyramid drawing that has become, in and of itself, a tool for dissemination of scientific information[11] using the principles of infographics (fig. 4.4). The food product to which reference is made in the NMDP is the result of a production chain that exists in the production area and is the conceptual representation of that area on the basis of

[10] L.M. Donini, *La nuova piramide alimentare mediterranea*, in: Donini L.M.: *La dieta mediterranea tra storia, cultura e scienza*, Roma, Atti della Accademia Lancisiana, 10a seduta scientifica, Accademia Lancisiana, 13.03.2012.

[11] A. Montanari ed., *Mitigating conflicts in coastal areas through science dissemination. Fostering dialogue between researchers and stakeholders*, Rome, Sapienza Università Editrice, ed. 2014.

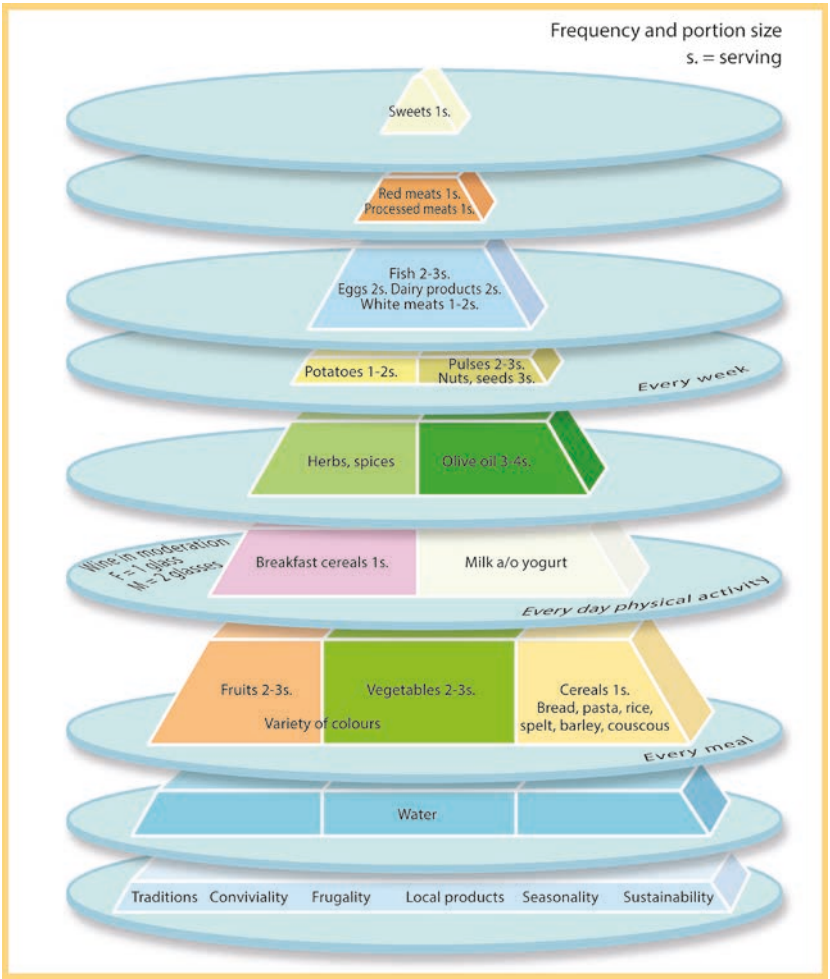

Fig. 4.5. The New Italian Mediterranean Diet Pyramid. Each food production activity is deeply rooted in its territory.

the associated natural and cultural resources. In Figure 4.5, the pyramid has been redesigned to indicate the need for each food production activity to be more deeply rooted in the specific local area. The logical model for this pyramid refers, for each food, to the product, the production processes, the consumers and the visitors in that area. The local area is the essential element of all foods that contribute to human diet and it is specifically from that local area that additional inputs derive for the structure of the dietary pyramid (fig. 4.6).

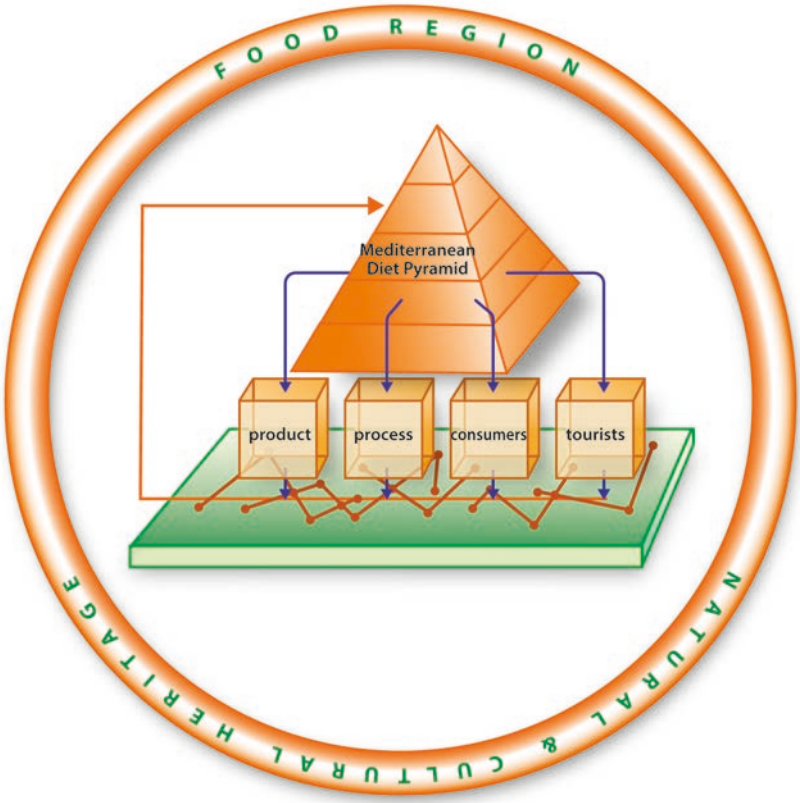

Fig. 4.6. The New Italian Mediterranean Diet Pyramid. The structure of the diet pyramid and the territory inputs.

4.3. Production in terms of company and local area

In its search for ever greater production efficiency and economic returns, the food sector has now expanded globally. If there are no longer limits to a specific area where food production takes place, then the role of 'area' becomes increasingly less important and tends to fade into an abstract concept that evokes theoretical emotions rather than creating a concrete reference to a specific landscape, soil, climate or culture. In a globalised economy, there are few obstacles to the mobility of financial flows,even in proportion to the number of people working. It is also true that production needs places where it can physically occur. The area therefore becomes a strategic component for production, even where it is globalised. In this case, however, the areas are not all of the same level but, rather, their level of strategic importance is organised in

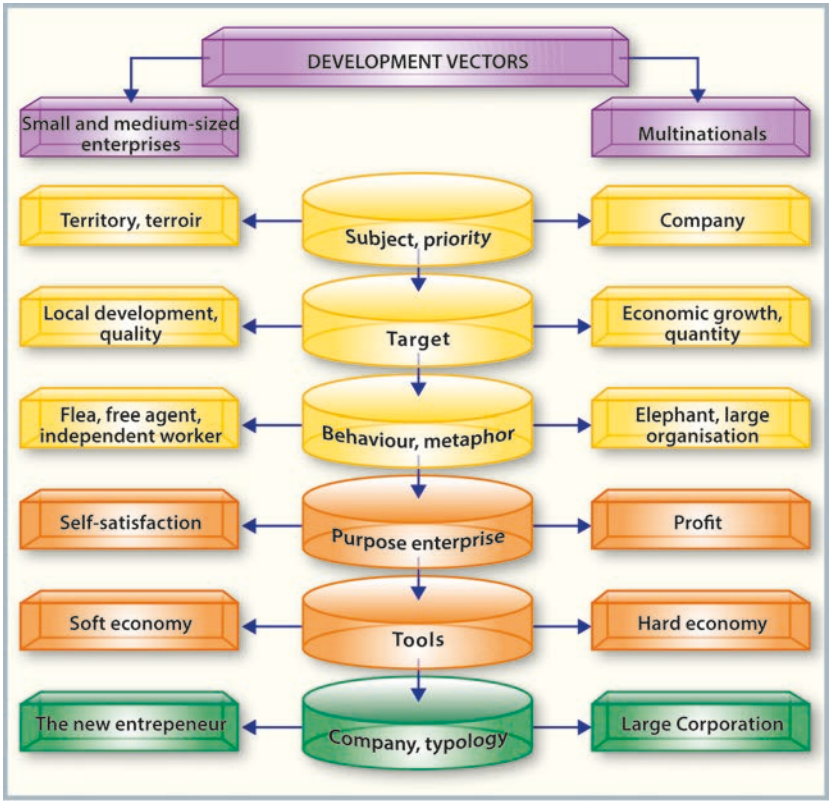

Fig. 4.7. Quality and quantity production: vectors.

terms of hierarchies of values. The acceleration of movements of people and exchanges of goods and information on a global scale is creating cultural uniformity in all expressions of human activity. In the past, food was as varied and rich as the natural biodiversity of the individual local areas. However, certain foods and drinks did experience, even in ancient times, distribution on a continental, firstly, and then intercontinental scale. In general, this happened very slowly, with certain exceptions. We then reached the point of acceleration and globalisation involving the participation, whether intentionally or not, whether willingly or otherwise, of the bulk of humankind. Despite this, local forms of production and consumption of foods and drinks are being reinforced at the same time, both for economic reasons and in order to rediscover a cultural identity. Figures 4.7 and 4.8 provide a summary representation of the difference between quality production, by local small and medium-sized enterprises, and quantity production,

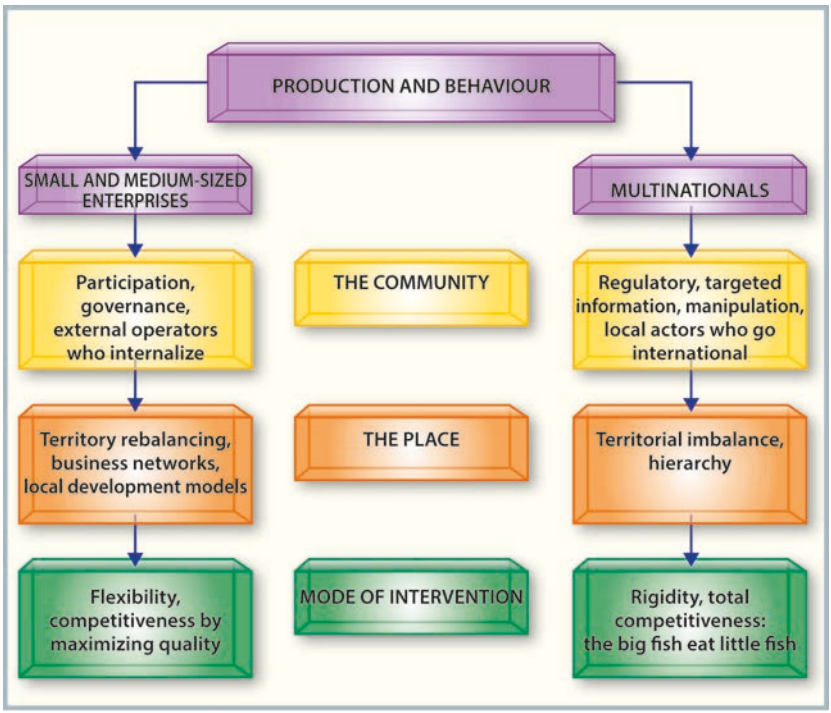

Fig. 4.8. Quality and quantity production: behaviours.

by multinationals. The elements taken into consideration have been divided into vectors (fig. 4.7) and behaviours (fig. 4.8) for development. The former category refers to the individuals, purpose, metaphor, objectives, tools and type of company. The company is then contrasted with the area, economic growth, local development, quantity, quality, the elephant, the flea, profit, self-satisfaction, production without area, the taste of geography, the hard economy,the soft economy, the manager, the enlightened entrepreneur, a maximalist capitalist, a reluctant capitalist. Some of these definitions require further thought. It certainly seems surprising that the term 'patron' is used in the field of production, because each investment requires profitability. However, there are some initial phases of action in which the recurring attitude is specifically that of a munificent protector of cultural resources. In his autobiographical work, Handy[12] describes the decision, on his 49th birthday, to resign from his position as a director of a huge multinational, 'going portfolio' and therefore gaining employment independence. Specifically

[12] C. Handy, *The elephant and the flea*, London, Arrow, 2002.

on the basis of his previous work, he was shown now to have become a reluctant capitalist. The drivers for development were presented as being community, place and style. On the basis of the principles of local development, the approach is based on the processes of partnership and governance. Since it is unrealistic to think that innovation can be introduced by people living in areas that have suffered lack of development, it is necessary to provide for the presence of operators who come from outside, whether totally external, external with partial interests in the area, or in fact external but from the area. The action is intended to re-establish the equilibrium in the area. In summary, there is a need to create a network of company systems (fig. 4.8) that reference the quality of the food product, the optimisation and promotion of natural and cultural resources, and innovation. According to the observations made by Estruch et al.[13], there is a correlation between dietary habits that follow the Mediterranean diet and a reduction in cardiovascular risks, which thus confirms the benefits of a varied diet, but one that is rich in fruit and vegetables, with foods produced locally and thus without the need for added preservatives.

4.4. Quality food products and geography of taste

Quality products are the result of a production chain that is rooted in the local area, in the sense that the quality does not exist without a reference area, and is the result of manual work, taste and the culture of the producer and, therefore, is necessarily a product available in a limited quantity, in relation to the size of the area, and with non-repeatable characteristics. In this case, the quality mark that has characteristics in common with those valid for an industrial product does not have any added value, because the quantity of product that can be sold is so limited that it is only the producer who is able to certify its quality for the consumer. The consumer usually needs to be encouraged to find an opportunity to go and visit the producer in order to learn about the processes, cultures and area. The system is therefore reversed, and we are dealing with two conflicting types of mobility. In the case of

[13] R. Estruch, E. Ros, J. Salas-Salvadó, M.I. Covas, D. Corella, F. Arós, E. Gómez-Gracia, V. Ruiz-Gutiérrez, M. Fiol, J. Lapetra, R.M. Lamuela-Raventos, L. Serra-Majem, X. Pintó, J. Basora, M.A. Muñoz, J.V. Sorlí, J.A. Martínez, M.A. Martínez-González, *Primary prevention of cardiovascular disease with a Mediterranean diet,* The New England Journal of Medicine, February 21, 2013, pp. 1-10.

industrial or quasi-industrial production, it is the product that travels, both during the production phase and lastly to reach the consumer. For artisanal products, everything is anchored in the local area and because this by definition cannot travel, it will be the consumer who will come and find the producer. In the industrial production chain, innovation is essentially technological, and potentially also relating to information and communication, while, for quality artisanal production, innovation is solely cultural, in the sense that attempts to reproduce the tradition of taste require an offer of added value in terms of culture, services and tourist supply.

Handy[14] proposes an analogy between the giant multinationals and the behaviour of elephants. These multinationals are now faced with four major challenges: a) how to keep growing but stay small and personalised; b) how to make creativity and efficiency compatible; c) how to prosper and maintain social acceptability; and d) how to reward both those bringing new ideas and those that own the business. Outside the world of the elephants, there are 'flea' producers. Fleas are independent operators, with small businesses, some operating alone and others as part of groups. The elephants need to use these annoying little creatures to introduce into their system the innovations and ideas necessary for their survival. It is not therefore true that only the strongest succeed in the globalised world, as often the most competitive and attractive win too. Referring specifically to the Italians, Handy recommends optimising their creative abilities, individual talent and taste, since it does not seem realistic to try to resuscitate the great industrial giants. According to Florida[15], the development of economies does not depend so much on physical and investment capital but, rather, on 'creative capital'. He considers that it is not possible to measure this form of capital on the basis of the qualification obtained, but that it should be measured according to the intrinsically human ability to produce new ideas, new technologies, new business models, new cultural forms and, in fact, new industries. Cianciullo and Realacci[16] have collected 25 stories of the 'Italy that is doing it right' and that have been defined as the soft economy an economy based on knowledge and innovation, identity, history, creativity, quality. An economy that is able

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14 C. Handy, *The elephant and the flea*, op. cit.

15 R. Florida, *The rise of the creative class revisited*, New York, Basic Books, 2014.

16 A. Cianciullo and E. Realacci, *Soft economy*, Milano, RCS Libri, 2005.

to combine social cohesion and competitiveness and to draw strength from the community and the local areas. Fine and Leopold[17] analyse the globalisation processes that have affected the agrifoods sector and have caused profound changes both to the rural environment and to the producer-consumer chain, which now favours the direct 'from farm to fork' process. To contrast these processes, counter-movements have been developing, based, according to Whatmore and Thorne[18], on an 'alternative geography of food', and these support the existence of new dietary cultures based on eating predominantly or exclusively local or regional food. In the Slow Food manifesto approved in 1989, we were encouraged to regain wisdom and liberate ourselves from the 'velocity' that is propelling us on the road to extinction[19]. According to Van Oers[20], food production can today be considered to have been divided in two. The major multinationals are able to respond to the growing need for fast food at low cost. This can be achieved only by producing large volumes of product at prices that are as low as possible. Research conducted does, however, show that there is growing demand for food that has been produced in a manner that respects the environment, uses sustainable methods, and contributes to the well-being of the consumer. To respond to this demand, Van Oers[21] is calling for a change in production methods and a new, innovative and 'slow' method of thinking about food.

The term 'taste' is used by Shortridge and Shortridge[22] in relation to 'place' to identify the diversity of dietary habits in the USA. The authors refer to geography in studying what is consumed in the various areas of the USA and the reasons for these specific habits, which have not only persisted in the time of globalisation but in fact appear to be growing rapidly in terms of both variety and demand. This is therefore the 'place' of these phenomena, which make it possible to better un-

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17 B. Fine and E. Leopold, *The world of consumption,* Londra, Routledge, 1994.

18 S. Whatmore and L. Thorne, *Nourishing Networks; alternative geographies of food*, in Goodman D. and Watts M.J. eds., *Globalising Food: agrarian questions and global restructuring,* Londra, Routledge, pp. 287-304, 1997.

19 C. Petrini, *Slow food: the case for taste (arts and traditions of the table: perspectives on culinary tourism),* New York, Columbia University Press, 2004.

20 P. Van Oers, *From 'mass & fast' to 'small & slow' - the development of ecogastronomic tourism*, International Journal of Management Cases, 2013, 15(4), pp. 133-140.

21 Ibidem.

22 B.G. Shortridge e J.R. Shortridge, *A taste of American place: a reader on regional and ethnic foods*, Rowman & Littlefield, Lanham, eds. 1998.

derstand the post-modern world. Obviously, not everyone thinks this way. Cresswell[23] reports various opinions on the issue, almost all of which agree on the existence of 'no places' in relation to the significant increase in human mobility that has followed the internationalisation of the economy. In a summary analysis, he identifies three levels of approach to the concept of place. There is a descriptive approach, a constructive approach and lastly a phenomenological (subjective) approach. This latter approach, which is typical more of humanist and neo-humanist geography and phenomenological philosophies, seeks to define the essence of human existence as it is created and constructed in a place. The conclusion is therefore that this approach, which refers to place rather than places, is the approach best suited to the concept of taste.

Shortridge and Shortridge[24] do not indicate what they mean by the term taste, which, however, after the title, is difficult to find in the almost three hundred pages of their volume. We can assume that they use this term to mean the integration between dietary habits and other aspects of cultural change that contribute to creating the profile of the communities living in a given place. In any case, Shortridge and Shortridge[25] lament the lack of available works in this field by researchers in the social and human sciences despite the publication of billions of words in cookbooks and articles dealing with food, which almost never apply an analytical, scientific approach. These are everyday goods, which intellectuals consider to be essentially trivial and commonplace, and they therefore say little about them, as they do for all other popular or vernacular cultural activities.

In Italian, the primary meaning of 'gusto', from the Latin *gŭstus*, refers to the sensory function that makes it possible to identify the flavour of foods. This is the definition credited to Dante Alighieri (1265-1321) in the infancy of the Italian language. Food is an essential factor in the economic, productive and cultural life of civil society. This is valid in all countries, both developed and developing, both where it is possible to have too much food and, sometimes, people die from obesity, and where there is a lack of food and, often, people die of

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[23] T. Cresswell, *Place, a short introduction*, Oxford Blackwell, 2004.

[24] B.G. Shortridge e J.R. Shortridge, *A taste of American place: a reader on regional and ethnic foods*, op. cit.

[25] Ibidem.

hunger. The art of eating, and the various forms of taste, are always able to reflect geographical identity. A strong identity, deeply felt by the community, full of cultural contamination and an expression of the richness and variety of the area. Food-related issues, and above all the relationships between food and environment, can therefore represent an important element for study and research for the discipline of geography. We must focus on the differences that exist in the various dietary habitsand know how to recognise them and respect them, and educate about taste, and not lose our guiding dietary roots. All of this can certainly help us and future generations to live better in a world full of contradictions. To respond to desires and tastes that are increasingly differentiated but also to confirm the characteristics, specificities, and richness of geography, there is only one key word in relation to food: 'quality'.

In this work, we're using taste more to mean the sensation that is caused by the flavour of foods, which can then evolve into the ability to identify a work of artand even a sensibility to what is beautiful. In Orlando Furioso (1858, 35/26), Ludovico Ariosto (1474-1533)[26] defines taste for the first time as a sensibility to what is beautiful. Unlike other living beings, humans do not eat merely out of biological necessity but also because of a desire for knowledge and, therefore, a desire to improve their own economic, social and cultural condition. We know that to satisfy this impulse to learn, humans are also prepared to travel and migrate.

So the differentiation of taste, as it was originally, and by definition this was diversified, not standardised and uniform, will remain only in products that are tied to the specific local area in all of the various phases of production, processing and preparation. An initial series of considerations addresses the natural, cultural, economic and social components of that invisible thread that links the various phases of food production, the way they are organised, and the prevention and control measures that must be introduced to reassure consumers and to create that scientific basis that enables sustainable development. The production chain for gastronomic products must be deeply rooted in the local area, and must therefore be tied to natural and cultural resources, constituting an element of its development. The geography of taste also provides considerable possibilities for analysis and study

[26] L. Ariosto, *Orlando Furioso*, London, Henry G. Bohm, 1858.

of culture, technical traditions, and the customs and traditions of the rural world. Living with diversity in the geography of taste is not just a wish and a life plan. The task of promoting the recovery of local traditions is important, because this is the only way we can appreciate the resources of others and, therefore, knowingly share processes to integrate diversity. This, in fact, contributes to the stability of the environmental, social and economic system and, therefore, is essential for sustainable development. 'Diversity' highlights and promotes the specific characteristics of each society. It thus helps the community of individuals to develop specifically because of the presence of elements that interact between cultures. 'Diversity' increases society's ability to perform creative activities, because creativity develops better in a society that is growing and thinks in terms of its own specific cultural characteristics and, therefore, does not depend on a dominant globalised culture. The geography of taste considers diversity applied to food consumers, contrasted with the homogenisation of those consumers, and the relationships that exist between food consumption and the environment, both cultural and natural.

This desire to see, read and understand constitutes a formidable tool of attraction for those wishing to verify, in concrete terms, in the local area, experiences and feelings that are spatially virtual. The actions of the Slow Food movement and the evidence from research studies conducted[27] make it possible to assert that the 'alternative geography of food' is not the same as the 'geography of taste', because the former considers above all a review of production processes, examined in spatial terms, on the basis of the need to protect consumers, an idea that also emerges from the work by Parrott et al..[28] In this case, the key element is the quality mark to which the consumer refers to guarantee the origin of the product. The geography of taste, however, refers to the cultural aspect of the production and consumption process in terms of its spatial reference. While the alternative geography of foods places the production cycle, and therefore the machine, at its

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[27] A. Castriota-Scanderberg, G.E. Hagberg, A. Cerasa, G. Committeri, G. Galati, F. Patria, S. Pitzalis, C. Caltagirone and R. Frackowiak, *The appreciation of wine by sommeliers: a functional magnetic resonance study of sensory integration,* NeuroImage, 2005, n. 25, pp. 570-578.

[28] N. Parrott, N. Wilson e J. Murdoch, *Spazializing Quality: regional protection and the alternative geography of food*, European Urban and Regional Studies, 9 (3), 2002, pp. 241-261.

centre, in the geography of taste, the central focus is humankind, as both producer and consumer. The increase in tourist flows over recent decades has enabled further development of the analysis of how tourism can affect food consumption and viceversa. On this issue, Mak et al.[29] consider food not only as sustenance but also as a fundamental means of establishing social, cultural and political relationships. Food also represents a symbolic element in meeting and experiencing other food cultures. In recent years, eating has been seen as a unique form of tourist activity, because it is able to gratify all five senses and, therefore, satisfy the emotive element of the tourist experience. Mason and Paggiaro[30] highlight the fact that it is important to offer tourists, by bringing together gastronomy and tourism, a holistic experience that includes sensorial, affective, cognitive, behavioural and social interaction. Native foods represent the place of origin and, along with landscape and local culture, are becoming a fundamental element in building the tourist experience. Montanari and Staniscia[31] have analysed the potential of supply in one Italian region to demonstrate that food and wine tourism can be a valid tool for re-establishing regional economic equilibrium. To measure the potential for integration between tourism and environmental protection, Clark and Chabrel[32] published the results of the international SPRITE project, illustrating a methodology that has enabled them to demonstrate coherently the methods for development of tourist practices in rural areas that benefit a local area and all stakeholders concerned in economic, social and cultural terms. To support this necessary integration, Montanari[33] (2009) suggests that there is a need to create regional centres, managed by university research centres, that can help to evaluate all of those variables that could have an adverse impact on the development of the area and the stakeholders concerned. These centres could help local producers to

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29 A.H.N. Mak, M. Lumbers and A. Eves, *Globalisation and food consumption in tourism*, Annals of Tourism Research, 39 (1), 2012, pp. 171-196.

30 M.C. Mason and A. Paggiaro, *Investigating the role of festivalscape in culinary tourism: the case of food and wine events*, Tourism management, 33, 2012, pp. 1329-1336.

31 A. Montanari and B. Staniscia, *Culinary Tourism as a Tool for Regional Re-equilibrium*, 17(10), 2009, pp. 1463-83.

32 G. Clark and M. Chabrel, *Measuring integrated rural tourism,* Tourism Geographies, 9(4), 2007, pp. 371-386.

33 A. Montanari, *Geography of taste and local development in Abruzzo (Italy). Project to establish a training and research centre for the promotion of enogastronomic culture and tourism*, Journal of heritage tourism, 4(2), 2009, pp. 91-103.

verify the management of their own food production, using methods and instruments that are often unavailable to them, because of their limited size.

It was on the occasion of the 29th Geographical Conference organised by the International Geographical Union (IGU), in Seoul, South Korea on 14-16 August 2000, that the term geography of taste was introduced for the first time, not without some embarrassment for the academic world[34]. At the IGU Conference in Seoul, Jean-Robert Pitte was asked to present, during the plenary session, a paper on food and the quality of food applied to the issue of diversity. According to Pitte[35], unlike other living beings, humans do not eat merely out of biological necessity but also because of a desire for knowledge and, therefore, a desire to improve their own economic, social and cultural condition. Human mobility can contribute to local development[36] and, therefore, to new forms of geography of taste. Food thus becomes diversified, and humans grow culturally, creating at the same time new stimuli for supply and, thus, developing new forms of mobility[37].

Figure 4.9 shows a model of quality food and wine products in which the producer and consumers are in fact part of a single chain because production adheres to the characteristics of the natural and cultural resources and, therefore, of the local area. Figure 4.2 above showed a food and wine products chain, with the example being the chain of meat and dairy products, based on quantity and therefore the efficiency and rationalisation of the system.

The industrial product chain involves a reference non-territory, significant mobility of resources and products, and a vast number of stakeholders, such as suppliers of fodder, chemical products, machinery and energy. In this case, food products must be processed on an industrial scale, using additives (to maintain their taste and colour) and preservatives, and lastly must be packaged. The chain then continues through

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34 A. Montanari ed., *Food and Environment geographies of taste.* Rome, Home of Geography, Publication Series, Vol. 2, SGI, ed. 2002.

35 J.-R. Pitte, *Geography of taste: between globalisation and local roots*, in Montanari ed. (a cura di), *Food and Environment. Geographies of taste,* Roma, Home of Geography Publication Series, Vol. 2, SGI, 2002, pp. 11- 28.

36 A. Montanari, *Human mobility, global change and local development*, BELGEO, Belgian Journal of Geography, 1-2, 2005, pp. 7-18.

37 D. Timothy, *Tourism and the Growth of Urban Ethnic Islands*, in hall c.m. e williams a.m. eds. (a cura di), *Tourism and Migration, New Relationships between Production and Consumption*, Dordrecht, Klewer, 2002, pp. 135-151.

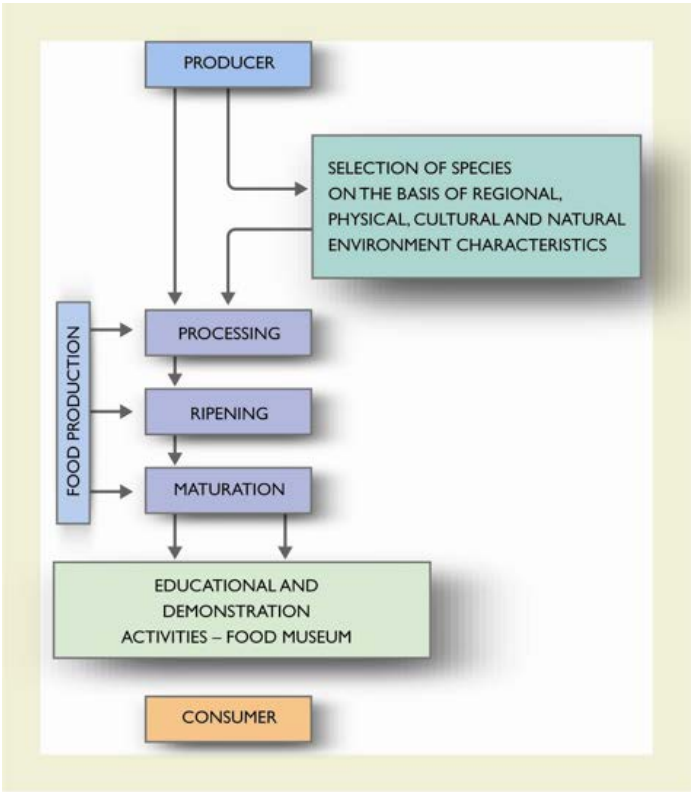

Fig. 4.9. Geography of taste: a totally integrated supply chain.

wholesalers and retailers, and of course the entities responsible for dealing with waste. Product and process certification is required for these types of production systems, and where possible a quality mark, which provides reassurance for the end consumer. This is primarily a product that, if there is no fraud, should not cause harm to health and could be introduced onto the market at a reasonable price given the corresponding standardsand the large quantities produced. The places where this chain is based are as numerous as the processing phases, all far apart from each other, and have no specific link to the reference production area. For example, fodder can be produced anywhere, can meet the required organoleptic characteristics at all times and, therefore, is not affected by climate, seasons and unforeseen events. There does not seem to be any basis for considering that a visit to this type of production chain might be attractive, and neither would this be easily achievable, given the distances to be travelled, and it is not therefore possible to propose tourism based on the agrifoods industry, at least in the terms

used in this volume. Giaccio et al.[38] have demonstrated that the isotopic variability of caseins extracted from cheeses made with sheep or cow milk from Abruzzo and Friuli makes it possible to distinguish the two types of cheese according to the area of origin and is not influenced by the production season. This confirms that there is not merely a cultural reference point or a subjective relationship of olfactory sensations between quality cheese and area of origin.

The routes and distances covered by the quality food and wine chain are particularly limited, and there are only a few requirements associated with the characteristics of the product that entail travel over distances of up to some tens of kilometres (fig. 4.10). In any case, this type of production chain clearly identifies a local reference area for all of its production activities, on the basis of which the quality of the associated products is verified and confirmed. Conversely, the routes and distances covered by quantity food and wine products are much larger, and can, as in the case of the strawberry yogurt described above, be as much as 10,000 kilometres (fig. 4.3). On this scale, it makes no sense to talk about a reference space because the individual stages of the chain are performed in 'non-places', since the product is guaranteed on the basis of a quality mark that refers more to the methods involved in a certified production process.

4.5. The taste of geography

If food and wine products offer an experience for all five senses, then the reference process cannot be food that satisfies a need for physical nourishment, but, rather, an artistic, figurative or musical entity. These products should not therefore be offered to a consumer's stomach but instead to that consumer's brain. In this regard, the choices made by an individual could even be antithetical, although completely valid, on the basis of the cultural and genetic conditioning drawn from the experience of individuals and generations. An individual's income can have an influence in terms of personal conditioning but certainly not directly. Quality food is the result of the interpretation of an area and does not necessarily always cost a lot more than a product resulting from an

[38] M. Giaccio, A. Del Signore, F. Di Giacomo, P. Bodoni e G. Versini, *Characterisation of cow and sheep cheeses in a regional scale by stable isotope ratios of casein (13C/12C, 15N,14N) and glycerol (18O/16O)*, Journal of Commodities Science, 42(IV), 2003, pp. 193-203.

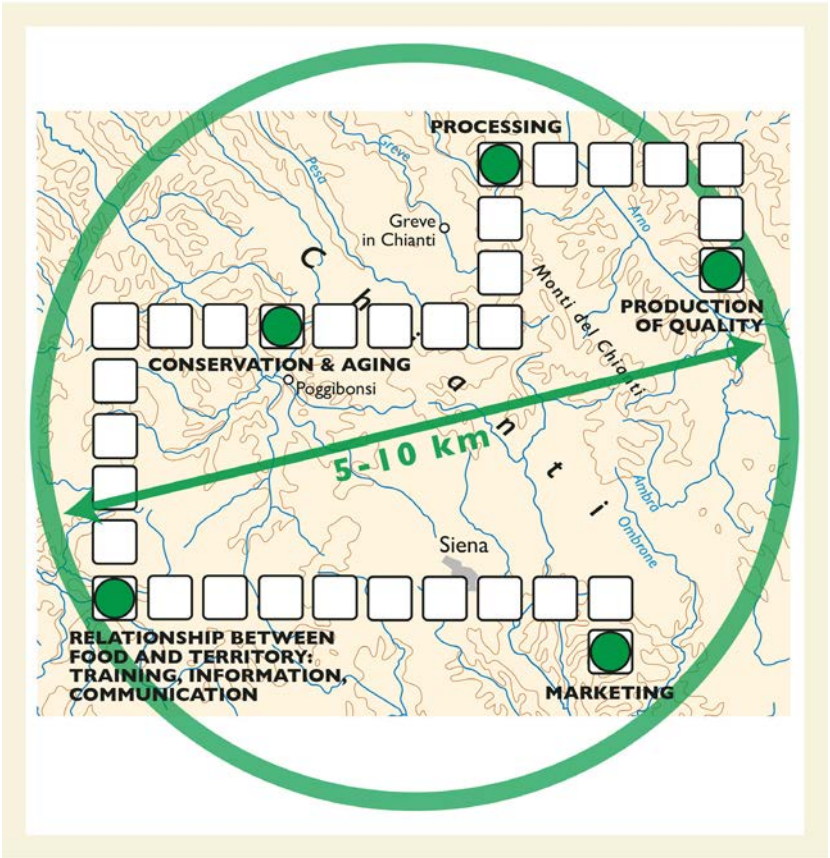

Fig. 4.10. The local dimension of the qualitative food chain.

industrial process. Income does, however, have an impact in the sense that a community that is essentially living in poverty inevitably eats to address the problem of physical survival. Only during a subsequent phase of development, in which well-being is spreading, is it possible to consider food as a tool for achieving a specific sensory ideal that forms part of a process of building a system of self-esteem. The individual is influenced by two other types of conditioning, deriving from the social group to which he or she belongs and determined by the environment in which he or she lives. Society as such is being affected a lot more than in the past by models of behaviour that are suggested by contemporary culture through the media, marketing activities and the emulative stimuli that these actions entail. The quality of food is a learning process that contemporary society, at least in part, has acquired over recent decades.

The initial supply by a few pioneers of taste was crucial in identifying niche demand that, although small, has been fundamental in driving the process, giving it as much mass as possible and therefore making it valuable in adjusting supply. The post-modern consumer is prudent, has developed an ethical consciousness and is therefore continuously motivated to check the cost of a product in relation to the benefits that it provides. This comparison can no longer be performed 'by weight'. A quality food product cannot be evaluated simply 'by weight' but, rather, on the basis of more complex considerations relating to artisanal processes, place of production, personality, manual skill and the ability of the producer, which can be found (and appreciated) in the taste of the food, in the positive relationship with the environment, and, finally, in the ability to evoke and reflect the area of origin. Indeed, the production area is a fundamental element of the product, and it cannot be purchased in a delicatessen – it can only be consumed on site. So the sale price for that cheese, bread, pasta, oil or wine also needs to include the costs of food and wine tourism, or, better, the price per kilo or per litre also needs to consider that this includes the production area. A given quality product will also be consumed in company with other people who are able to appreciate it, creating a culture of relationships that is self-regenerating. The consumption of quality products is certainly the consequence of the affirmation of a post-modern culture in welfare societies, but has also been fostered by the rejection of products and treatments subject to 'alchemy', which in some cases have deteriorated, causing serious consequences for the health of citizens. Over the last two decades, European society has regularly been plunged into food scares as a result of the serious health effects resulting from the use of widely available products such as wine, oil, beef and poultry meat that have been subject to food fraud, and it has not been possible to determine the consequences of these situations. Figure 4.11 shows a production chain for bread and pasta wheat. The chain exists within the production area, and is the conceptual representation of that area on the basis of the associated natural and cultural resources. This is therefore an illustration of a case of geography of taste. On this basis, the geography of quality bread represents, for the well-informed consumer, the object of his or her gaze. Even before visiting, the consumer is attracted by that area, and this defines the taste of geography. Figure 4.12 shows that the bread production chain is rooted in the area. The phases of production form part of the landscape and culture of the place, and are enriched by the charm and the poetry that make a visit

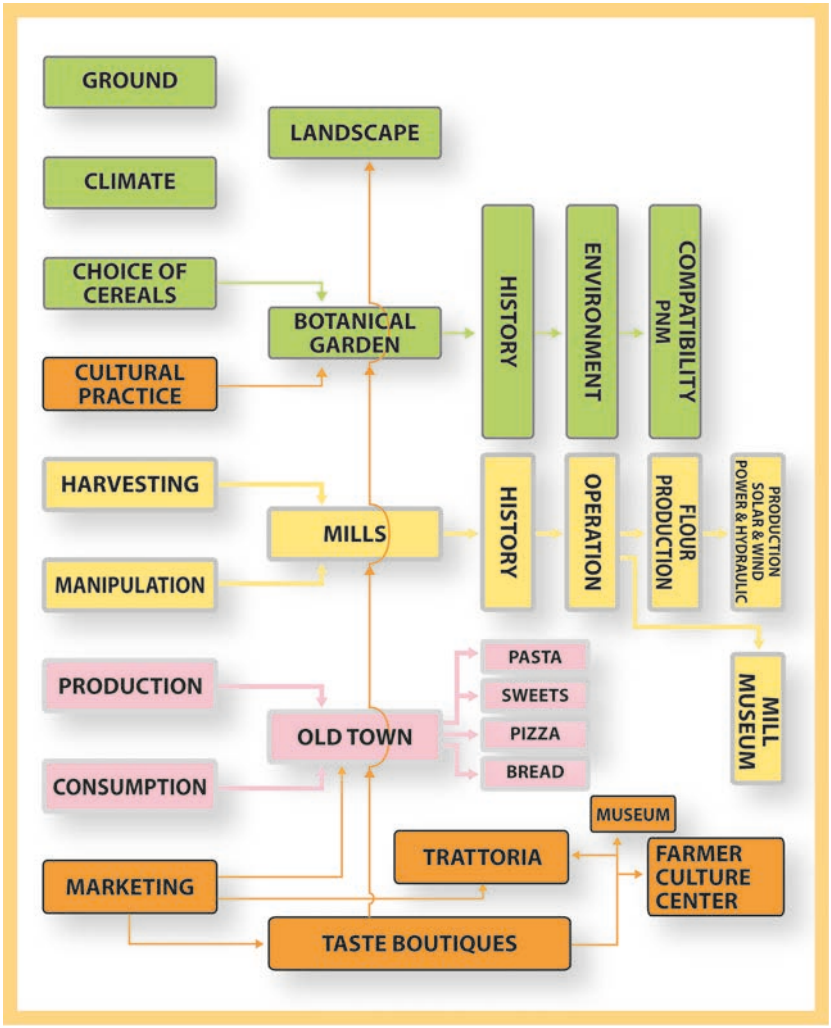

Fig. 4.11. Geography of taste: bread and pasta chain.

an unforgettable experience, because it is repeated mentally each time the consumer smells the fragrance or tastes the cheese from those places. The consumer verifies the quality, certifies the associated designation of origin and defines the associated ethical approach. In the Apennines, up to a few decades ago, the hills were planted mostly with cereals, ancient cereals such as spelt and barley at lower altitudes and solina at higher altitudes. Along the rivers and streams, there were water mills that operated until after the end of the Second World War. Now the mills are basically in ruins and many of the traditional species of cereals have been lost.

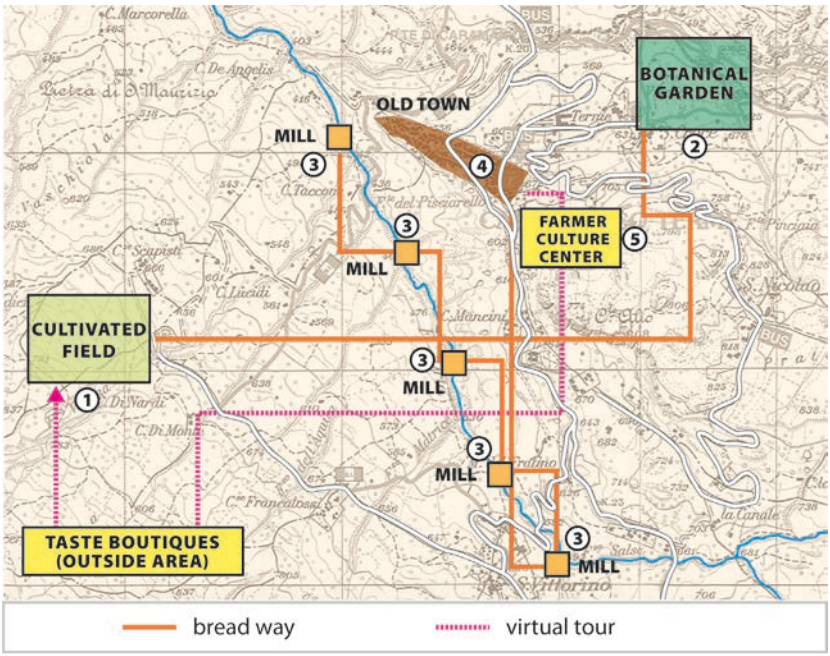

Fig. 4.12. Taste of geography: bread and pasta chain.

Cereals have always represented a fundamental element for human life, and their link to nature and the culture of human settlement is therefore significant. In the area of Caramanico Terme, in Majella National Park, a study conducted by Crivelli[39] identified the presence of more than ten mills along the Orte river. The production of quality cereals cannot be profitable nowadays unless the production chain is closed, with bread, biscuits and pasta being sold commercially rather than cereals. It is also essential to organise a tourist itinerary based around cereals and bread through the use of a product organised as described in Figure 4.11.

4.6. Recovery of hilly zones and support for quality cereal production. The case of Cilento

According to Matvejevic[40], the culture of bread production is tied to the transition of humans from nomads to growers, and then from hunters to shepherds, and then later to farmers. Planting and harvesting taught

[39] F. Crivelli, *Ambiente e sviluppo locale. L'ecoturismo come strumento d'integrazione dell'offerta*, Caramanico, Majambiente, 2007.

[40] P. Matvejevic, *Kruh naš (from our daily bread)*, Zagreb, Ambrozija, 2009.

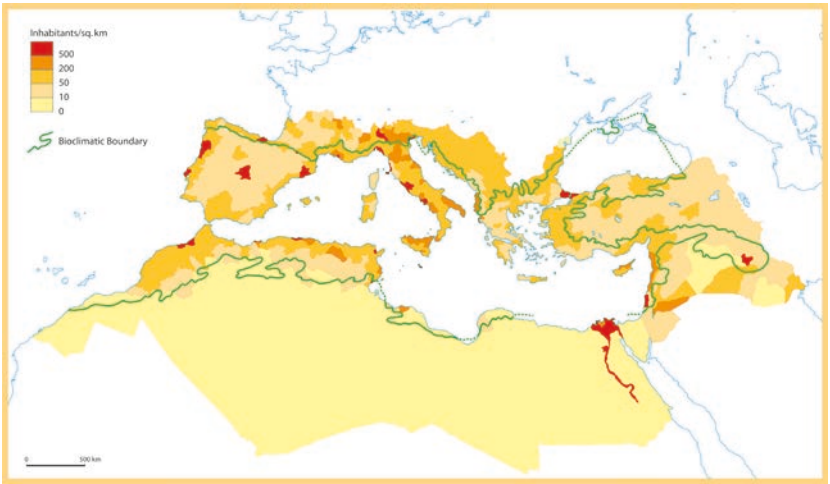

Fig. 4.13. The Mediterranean region: bioclimatic boundary.

people to divide their time into months, weeks and days. Furrows transformed the landscape into fields, which were covered with wheat. From Mesopotamia, travelling through the countries of the Mediterranean, bread, an instrument of culture, reached the tables of all the nations of the world. Figure 4.13 indicatesthe bioclimatic characteristics of the regions of the Mediterranean that have generated ideal conditions for the cultivation of cereals. On 28 August 1993 that Michael Wood wrote in The Independent that Saddam Hussein was destroying the life of the Marsh Arabs. The villages on the border between Iraq and Iran were being bombed, the lands poisoned and the wetlands drained, putting an end to the existence of a culture that had been there for more than 5000 years, a situation also described in a brief documentary by Wood entitled 'Saddam's killing fields'[41]. Cereals can no longer be grown in the lands of the Marsh Arabs,which have now become a desert. Although not a desert in physical terms, there are also other regions of the Mediterranean where cereals are no longer cultivated as they could be and the land has been abandoned by those who worked it for centuries. Figure 4.14 shows the structure of the land elevations of Italy, which is characteristic for all regions of the Mediterranean. The bulk of the country is covered by mountains and hills while the limited flat areas have been used over recent decades for the development of industrial areas, the construction of infrastructures and the growth of urban centres.

[41] http://www.liveleak.com/view?i=9fd_1215161177.

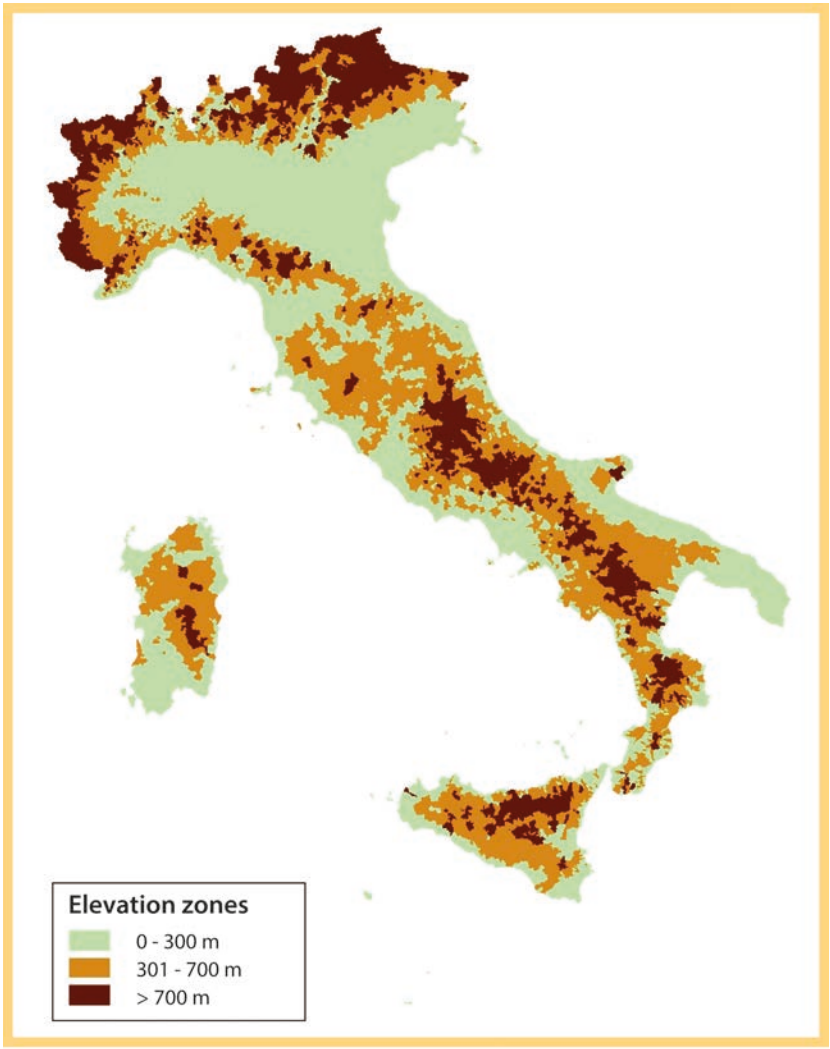

Fig. 4.14. Italy: altitude zones.

The cultivation of cereals has therefore been restricted to hilly areas where it has been possible to plant these crops where economic conditions have permitted. Indeed, the orographic structure of the majority of the country has not enabled the degree of mechanisation and intensification of agriculture possible on flat terrain. Ownership of arable land is highly fragmented and the owners have long been moving to urban areas within Italy or even abroad. These characteristics have meant that it is not possible to compete with the production levels achievable in the Great Plains of North America, which, also because of the globalisation

Fig. 4.15. Italy: national and regional parks and production areas for quality wine.

of markets, are able to be competitive in terms of production yields and reduced costs. The interior hill and mountain areas in Italy have met the key environmental prerequisites for the creation of numerous protected areas. Figure 4.15 shows the protected areas, national and regional parks, and production areas for quality wine. All of these areas represent protection, including in economic terms, of the landscape of Italy's hill zones. However, this major resource is not being used by regional governments to support quality agricultural production, despite the fact that national parks alone cover approximately 10% of Italian territory.

In the Abruzzo Region, often defined as the Parks Region because around one third of its surface area is covered by protected areas, a survey has been conducted among farmers to verify whether the protection of the area has positive repercussions on quality food production[42]. Many farmers believe that the national parks in Abruzzo still have not had a completely positive effect on the area. There is a widespread belief that the concept of national park is still a theoretical idea that is yet to be put into practice. Indeed, the concept of sustainable development should also provide, with the greatest emphasis possible, for the economic development of activities that are compatible with protection of the natural environment. This category should include agriculture and organic farming. The concept of protection of the natural environment should also include the agricultural production of the traditional species of a given area that do not conflict with the protection of biodiversity. On 25 March 2016, the day following Easter which is usually spent by Italian families on trips to the countryside, Coldiretti,a national and European farmers' organisation, organised a protest to denounce the fact that, in the last 20 years, Italy has lost 15% of its agricultural land, approximately 2.6 million hectares, as a result of urbanisation and, above all, because of the abandonment of agricultural holdings, including because of growing imports of food products from abroad.

One possible solution to this problem could be to support small businesses in making their production chains more efficient and supporting them through research, verification and monitoring activities, which could be performed by public research bodies. The case we are looking at here is a small business with its primary site in the municipality of Polla near the Cilento, Vallo di Diano and Alburni National Park, which is specialised in the production of Senatore Cappelli quality durham wheat and Timilia, or Tumminia, durham wheat. Senatore Cappelli is a durham wheat cultivar obtained in the early 20th century and derived from North African species. Timilia is a very ancient wheat typical of many regions within the Mediterranean. It is a variety that is naturally resistant to parasites that is easy to grow and does not require the use of chemical products during cultivation. The wheat and the flour derived from it are therefore naturally 100% organic. The practice used is characteristic of sustainable agriculture, based on crop rotation so as to

[42] A. Montanari, N. Costa e B. Staniscia, *Geografia del gusto. Scenari per l'Abruzzo*, Ortona, Menabò, 2008.

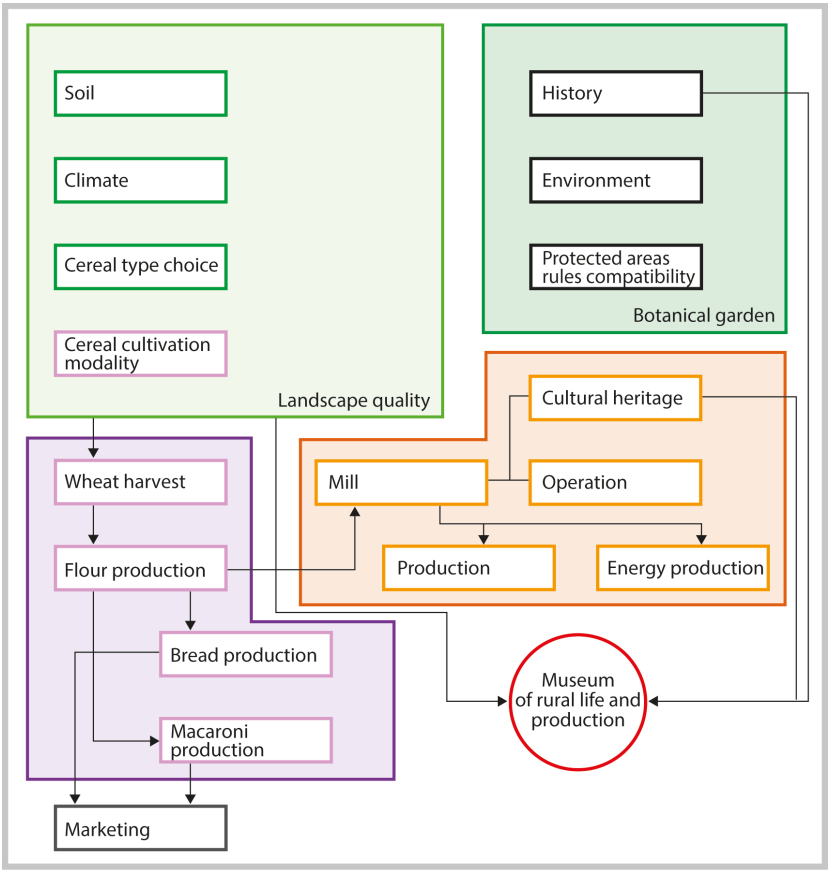

Fig. 4.16. Geography of taste: bread and pasta chain in Cilento region.

avoid the use of chemical fertilisers. The Geography of Taste (fig. 4.16) demonstrates the role of the farmer in the selection of the variety to be cultivated on the basis of the variables associated with soil, climate and cultivation methods in relation to the availability of water and the need to use chemical products. There is a reference to the history of the use of varieties in this particular area in relation to the prevailing climatic and environmental conditions and compatibility with management of the biodiversity of the protected area. These categories,which are present in the knowledge and culture of the people working in the area, should be formally defined in what Figure 4.16 refers to as the 'botanical garden', which serves as a documentation centre designed to provide information and news about production within that specific area and also as a repository for its cultural heritage. A third block of variables, however, refers more specifically to tangible and intangible cultural heritage, tied

more or less directly to agricultural production, plants, such as mills, and the production of energy, both now and in the past. A fourth group of elements is represented by the processing of cereals to ensure that they reach the consumer by the most direct route possible, by means of a single chain operated by a company or through networks of companies. For this purpose, marketing policies cannot be restricted to a single product or a phase of production, but, using ICT tools, should involve the entire local area and all production sites operating within that area.

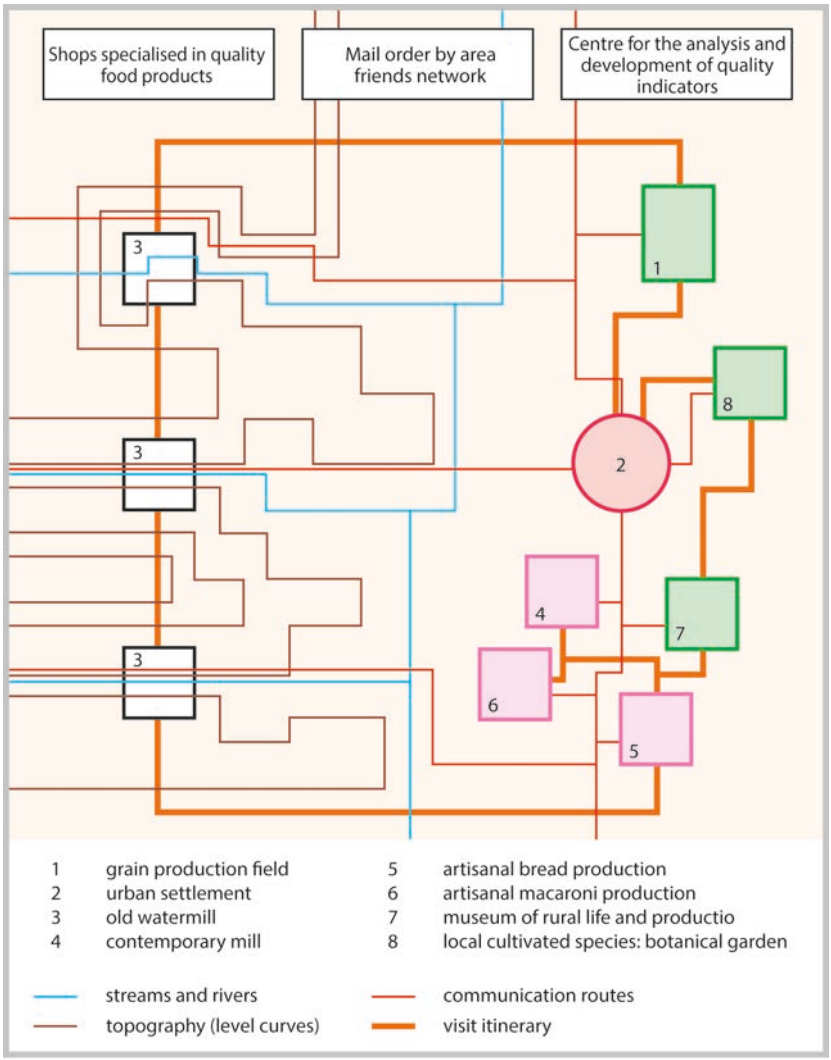

Fig. 4.17. Taste of Geography: bread and pasta chain in Cilento region.

Taste of Geography (fig. 4.17) identifies a process for controlling the quality of all components in the production chain that have already been included in the Geography of Taste. The linking metaphor for the elements in the chain represents a process for determining the quality of the product that includes the fields where the cereals are produced, the urban settlement to which they relate, the ancient and current mills where the cereals are processed, the artisanal production of the bread and pasta, and the places where the memory of the culture of the places and of the culture of the food varieties are stored. Local production should be sold predominantly in specialised shops or directly to the consumer using ICT tools. This production is also optimised by the presence of research centres operating outside the area and working with local producers to verify the quality of the product, the technologies used, and the innovations to be applied. The laboratories, including those with significant technological capacity and scientific value, are certainly available for quantity production but are not currently available for quality production.

4.7. Conclusions

Italian farmers are complaining about falling national agricultural production in favour of imported products. This has come to pass because of international competition selling products as 'made in Italy' where, in actual fact, they are not initially from Italy and it is only the final stages of the production chain that are really 'made in Italy'. Competition from multinationals has also been felt because of the fall in prices for products that do not have the same characteristics as quality products and that are produced locally. It is therefore becoming difficult to survive solely from agricultural production and people are abandoning the fields at an ever increasing rate. We must reverse this trend by ensuring that the added value associated with the local area, the landscape and the local culture is added to the sale price charged for quality agricultural products. These are goods that already exist in the countryside of Italian regions and that must once again be optimised and promoted as part of a process involving greater integration of the production chain in an attempt to offer consumers food products, local area, well-being, recreation and better quality of life, in one fell swoop. National and international tourism can contribute to recognising an economic price for the added value that the local area and the local culture can add to a quality food product.

Fig. 4.18. Marsh Arabs villages before their destructions.

Fig. 4.19. Senatore Cappelli wheat.

Fig. 4.20. Timilia wheat.

Fig. 4.21. Sant'Angelo a Fasanella, old mill.

Fig. 4.22. Sant'Angelo a Fasanella, old mill, horizontal wheel.

Fig. 4.23. Threshing.

Fig. 4.24. Senatore Cappelli wheat: a case of natural weed control.

Fig. 4.25. Thresher, XX Century.

5. Organizational managerial and economic aspects of the bread chain

Francesco Zecca, Mariarosaria Simeone***

5.1. The bread chain in Italy

Bread is a food of worldwide importance. Italy is a country where bread has a long cultural tradition and It can count on five kinds of bread recognized by the European Union: Coppia Ferrarese (I.G.P.), Pagnotta of Dittaino (D.O.P.), Pane Casareccio of Genzano (I.G.P.), Bread of Altamura (D.O.P.) – currently suspended – and Bread of Matera (I.G.P.).

The basic ingredients of bread are cereal flour, water, leavening agent, and salt.The chain of bread involves several phases, on global and local level, from input production to consumption of the product. The production process involves working processes that can take place in small-scale installations (artisan) or in large industrial installations. In addition to the difference of scale in terms of amount of raw materials and final products, the handicraft production systems normally differ from the industrial systems for technology and environmental impact[1, 2].

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** Department of Law, Economics, Management and Quantitatives Methods (DEMM), University of Sannio.

1 N. Espinoza-Orias, H Stichnothe and A. Azapagic, *The carbon footprint of bread*, Int J Life Cycle Assess, 2011, 16.4: 351-365.

2 K. Andersson, T. Ohlsson, *Life cycle assessment of bread produced on different scales*, Int J Life Cycle Assess, 1999, 4.1: 25-40.

5.1.1. Economic analysis of the bread production

The baking industry in Italy represents about 1% of the business of the country[3] (Istat 2016).

58% of businesses of the sector operate in the production of fresh bakery products and about 80% employ up to 5 employees. 41% of enterprises of the bakery operate in the regions of Southern Italy. The staff employed by the companies in the sector represents just over 1% of total employment in Italy. Among these, 60% works in businesses that produce fresh bakery products and companies operating in the regions of Southern Italy employ 31% of the industry's workers.

Italy produces and consumes about 3.2 million tons of bread each year, worth 8 billion. Of these, although 90 per cent is derived from production in bakeries and only 10 per cent is produced on an industrial scale. In terms of value, the industrial bread has a higher share of turnover of over one billion euro. Traditionally, Italians buy bread from local furnaces, packed with paper envelopes. Despite regional and local varieties, the general characteristics of this kind of bread are crispy crust and the relatively short duration.

There are more than 300 varieties of local bread in Italy and each region has a particular recipe and tradition, which varies according to the grain, the kind of flour, the baking, the shape and dimension of bread, together with the quantity of salt.

The industrial bread is normally a soft loaf, with duration of up to 40 days. It is sliced, packaged with plastic and sold principally in supermarkets, mainly used as a substitute (for example when there is no freshly baked bread) or when you have to eat outside home.

While the production of homemade bread is spread on Italian territory, industrial production is very concentrated (the top three companies occupy a total share of 37.4 per cent of the market and private labels represent the 13.5 per cent).

From the analysis of the demography of the bakery businesses it is noted that in Italy, in 2015 were born 348,015 new non-farm enterprises and 323 473 have ceased activities, the lowest result since 2006. The balance of enterprises newly born and ceased businesses is positive (+24,542) and this is the best result in the last five years.

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[3] Istat 2016 data: http://www.istat.it/it/

In Italy, four businesses bakery out of ten operate in the regions of Southern Italy and therefore is lower, than the average, the presence of operators in the northeast and central Italy.

Among the companies the bakery, about 80% have up to five employees. This is a share of almost ten points lower than that of the entire Italian business. Workers employed at the bakery sector represents about 1% of all workers. Of these, 87% are employed in manufacturing, 13% in the marketing of bread and similar. Moreover, going to look at the distribution of workers see that they are divided as follows:

- 60% employed in production companies of fresh bakery products;
- 15% employed in production companies of fresh pastry;
- 9% employed in retail businesses of bread;
- 8% employed in production companies of rusks, biscuits, and preserved pastry goods;
- 4% employed in companies for the grain processing, production of amides and starch products;
- 4% employed at the retail businesses of cakes and sweets.

5.2. The bread consumption in the Italian family

Due to the different elasticity of food expenditure with respect to the income – the necessary goods grow less than proportionally as income rises. The situation is different on the dynamics of property not strictly necessary, called "superior goods" that show greater responsiveness to the growth of the income, in fact, while some consumption (fish, beverages, fruits and vegetables) increase their relative importance in the families diet of other goods undergo a sizing as happens precisely for the bread, followed by cereals, milk, cheese and eggs.

In the discussion of consumption we have to also consider the differences resulting from the type of family and social status: the families with children eat more meat, while single people consume relatively more fruits and vegetables; young families spend more in the purchase of drinks and the food balance of working families affect more bread, cereals and meat. Also the habits and emerging lifestyles are important. In fact, the consumptions outside the home like in bars, restaurants and canteens grow, while the importance of lunch as the main meal diminishes and simultaneously the breakfast increases. To the highest social strata acquire importance the quality of products, production and distribution processes of food production and related

aspects of the individual reference values such as environmental protection, food security and territorial identity.

Moreover, according to what emerges from the ISTAT household consumption[4], the proportion of bread and cereals spending is higher in the South with percentages compared to the monthly average expenditure of 4.1, lower than in the centre and north that have a percentage equal to 3.2 and 2.9, respectively.

Based on the data from a research report commissioned by Assipan, the overall monthly average expenditure in 'bread and cereals' is a bit more than 73 Euros in the family, this leads to a turnover in one year amounted to about eight billion euros. However, the levels of consumption of bread and related products today marked a decline, marked primarily by a decrease in spending on "bread, breadsticks and crackers" (about 29 euro per family), the category with the largest contraction in the sector.

Moreover, taking into account the results of a survey commissioned by Assipan on a sample of 500 individuals, that is then extended to the universe, are the women (workers or housewives) with more than 45 years which are primarily active in family spending, in addition are the specialty stores those most visited by consumers to purchase bread.

The response to the question "In which types of stores do you usually go to buy bread (bread, buns, pizza, pizza bread)?" 69% of consumers say that they prefer specialty stores to buy bread, less than three on ten instead it seems to prefer the neighbourhood supermarkets. In general, although this practice is fairly homogenous, it seems to be predominantly male consumers, with age between 55 and 64 years, to prefer specialty stores such as ovens and bakeries.

In addition, 38% of consumers prefer to buy at the neighbourhood supermarket "products similar to bread". 32% prefers the big supermarkets or hypermarkets.

In general, although also in this case the phenomenon is rather uniform, consumers are predominantly female with age less than 34, and they prefer to buy in the neighbourhood supermarkets. Instead the men, often between the ages of 18 and 24 years and between 35 and 44 years buy bread and related products every day.

Looking at the analysis of the data emerging from the survey on household consumption, the following aspects are the ones that stand

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[4] I consumi delle famiglie, anno 2013, www.istat.it

out from the ISTAT survey method based on a sampling design to two selection stages, where the first stage units are municipalities and second-stage units are households and municipalities are stratified by region and demographic size.

The data have been released in July 2015, and the estimates from the new survey on household expenses have been spread. Since the survey was completely overhauled, these estimates cannot be directly compared with previous estimates in 2013.

Data on consumption of bread and cereals have been analyzed until 31 December 2014 (last available data from ISTAT).

The units of analysis are called family and have to be intended as single people up to 35 years old, single with 35-64 years old, childless couples with the contact person up to 35 years, childless couples with the contact person with 35-64 years, couples with no kids with reference person over 64 years old, couples with one child, couples with two children, couples with three or more children, single parents.

The results show the average monthly expenditure in euro. The consumption of bread and cereals are divided into four broad categories:

- Consumption of bread, bread sticks, crackers;
- Consumption of cookies;
- Pasta and rice consumption;
- Consumption of bakery and confectionery.

The analysis is carried out on the Italian regions. In one year, the average spending of bread is approximately eight billion euro. The daily consumption is decreasing over the years.

The overall monthly average expenditure on bread and cereals is a little more than 73 Euros per family. This is an average figure in decline compared with that data recorded in the previous 12 months.

In Figure 1, the provinces with a darker brown colour correspond to those with an average spending level higher in “bread and cereals” in relation to the total average expenditure of the same province, therefore, the highest level of average spending is the one related to the border regions in the north of Italy.

Fig. 5.1. Monthly spending for breads and cereals (Assipan 2016[5]).

The average monthly expenditure on "bread, breadsticks and crackers," is equal to about 29 euros per family. This is the category that does mark the strongest decrease (it is consuming less bread).

Also in Figure 2, the provinces with a darker brown colour correspond to those with an average spending level higher in "bread, bread sticks, crackers" in relation to the total average expenditure of the same province. Once again, the provinces with highest consumption are the ones of the north.

Of interest is the fact that in the South and in the centre south, the level of average spending for these products appears very low, like to indicate a lack of culture and tradition in the consumption of crackers and breadsticks.

[5] Assipan 2016, Diario Economico a cura di Format Research.

Fig. 5.2. Monthly expenditure on bread, breadsticks and crackers (Assipan, 2016[6]).

The monthly average expenditure on "cookies" is over 9 euro per family. Based on the mapping of biscuits consumption, shown in Figure 3, it seems to be a very high consumption in the north-west and in Abruzzo and Molise and in a to a lesser extent we find widespread in the southern regions. Much lower consumption is recorded in the regions of central and northern centre. Particularly low is the consumption of biscuits in Sicily and Sardinia.

[6] Assipan 2016, Diario Economico a cura di Format Research.

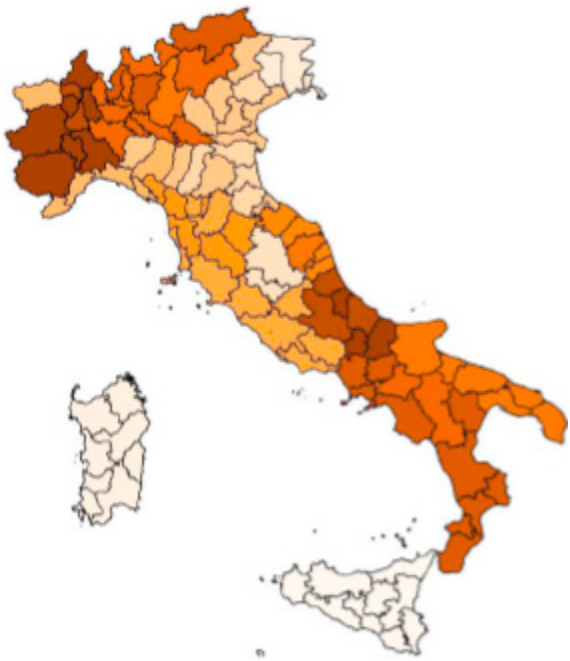

Fig. 5.3. Monthly expenditure on biscuits (Assipan 2016[7]).

The average monthly expenditure for pasta and rice is represented in Figure 4 and it appears to be distributed throughout Italy both in the South, in the centre and in the centre-north. It appears lower in regions where, from the previous figures it was possible to detect a greater expense in bread, especially those in the north on the Italian border, Sicily in a clear way and finally in Sardinia. Thus, it is clear the substitution effect between bread, pasta and rice, resulting from the different traditions in consumption.

[7] Assipan 2016, Diario Economico a cura di Format Research.

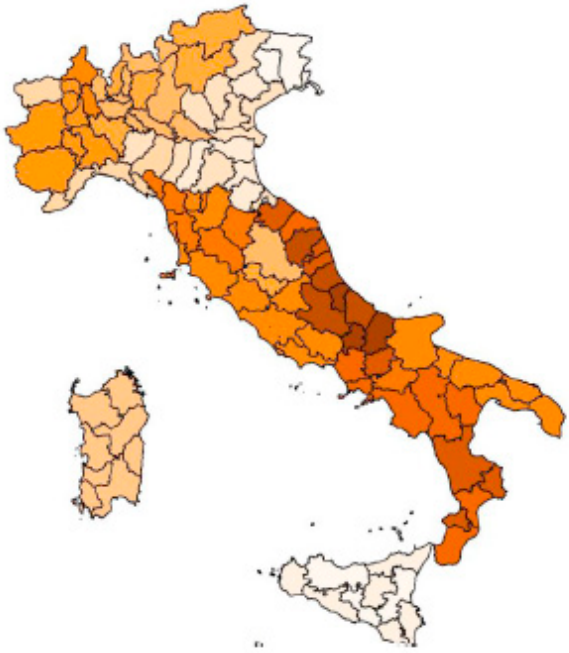

Fig. 5.4. The average monthly expenditure on pasta and rice is 15 euro (Assipan, 2016[8]).

Figure 5 allows us to highlight how the consumption of bakery and confectionery is different and probably alternative to biscuits. In fact, in this case it emerges an important consumption in the islands and in central and northern Italy. Moreover, the South who showed a high spending in the monthly consumption of biscuits. Also in this case the figure shows a substitution effect between pastry and cookies that seems tied to different regional traditions. The average monthly expenditure in pastries and sweets is of 12 euro.

[8] Assipan 2016, Diario Economico a cura di Format Research.

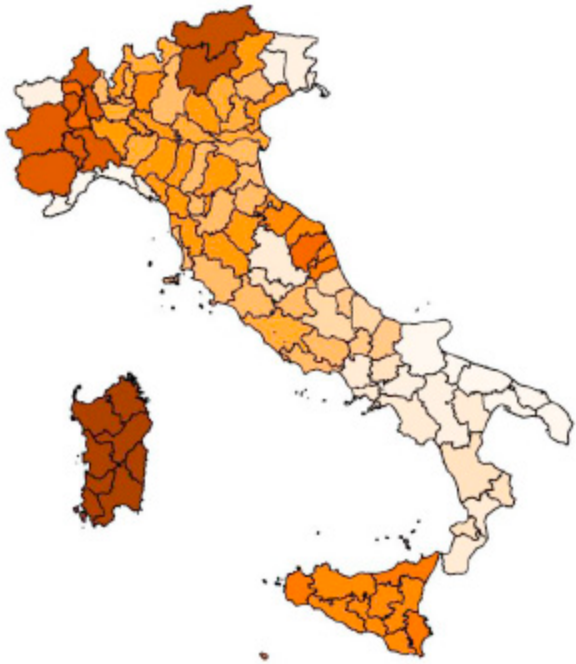

Fig. 5.5. Average Charge in pastries and sweets (Assipan, 2016[9]).

5.3. The consumer new instances and innovation in the breadsector: the case of charcoal in bread

From the analysis of a sample of 500 consumers, developed by Format research for Assipan, about 17% of consumers bought bread made of charcoal in the last two years.

Of these, 30% think that it contains beneficial substances for the organism, 15% of them prefer the taste than the traditional and more than half do not find differences with the conventional bread.

The lower the share of those who bought in the past products similar to charcoalbread (13%).

For four out of ten consumers, spending on bread made of charcoal does not exceed 1% of total spending of bread in a month 'type'. On average, 1.9% is attributable to spending on bread made of charcoal, for a turnover of around 200 million € per year.

[9] Assipan 2016, Diario Economico a cura di Format Research.

In general, the level of consumer information (buyers of products made of charcoal or not) about the effects of these products is low: two out of three does not know how to discuss the issues and as many as 77% are not aware of ' current ban for the production and sale of bread of charcoal.

The following graph inferred from the reply to the question: "Thinking only at the expense of 'bread', have you bought the last two years (2014-2015) bread made of charcoal?" It is clear that the greater spread in the consumption of coal-based bread, the total spending in bread made in the same territories, it occurs in the central regions such as Lazio, Umbria, Marche and finally in Sardegna.

Fig. 5.6. Consumption of charcoal bread (Assipan, 2016[10]).

To buy charcoal bread is mainly the consumer in the range from 25 to 34 years, while there are no significant gender differences in percentage terms. The data show the willingness of consumers to try new

[10] Assipan 2016, Diario Economico a cura di Format Research.

products as they are considered with beneficial effects even if, on the basis of the sample analyzed, 77% of consumers are not aware of the ban of production and ban of sale of bread made from charcoal.

The purchase of similar products in this bread is more prevalent in the region of central Italy and Puglia. Based on the sample of five respondents, it shows that 13% have purchased similar products in Italy.

Fig. 5.7. Mapping of similar charcoal products (Assipan, 2016[11]).

5.4. The sustainability attributes in the bread chain

The dimensions of sustainability refer to the social, economic, environmental and ethical context, and food safety.

Starting from the European study[12]. It has been considered 19 attributes to discuss the sustainability of the bread chain (Table 1). The chain of bread can be differentiated on the basis of four criteria resulting from

[11] Assipan 2016, Diario Economico a cura di Format Research.

[12] F. Galli, F. Bartolini, G. Brunori, L. Colombo, O. Gava, S. Grando, A. Marescotti, *Sustainability assessment of food supply chains: an application to local and global bread in Italy*, Agricultural and Food Economics, 2015, 3: 21.

the economic literature and which serve to distinguish between local and global chain. They are:

- the physical distance between production and consumption;
- the governance and organization of the chain, in particular the type of control on the chain practiced by local actors towards the global players;
- the resources, knowledge and technologies used for the production of flour and for the production of bread. Sometimes the ingredients and the complexity of the recipes discriminate between artisan breads and industrial bread;
- the way in which the actors of the bread industry create the product identity respect to the reference territory.

Table 5.1. Attributes for sustainability assessment (Source: Galli et al. 2015[13]).

Dimensions of sustainability	Attributes
Economic	Affordability
Environmental	Biodiversity
Social	Connection and labour relations
Social	Consumer behavior
Economic and environmental	Economic and ecological efficiency
Economic	Farmers income and value added received
Social and ethical	Food security
Economic and ethical	Governance/even distribution of power
Social	Information and Communication
Health	Nutrition
Economic	Profitability / competitiveness
Economic	Resilience and local development
Environmental	Resource use and pollution
Ethical	Responsibility
Health	Safety
Economic	Technological innovation
Social and ethical	Territoriality
Health	Traceability
Environmental and economic	Waste

5.4.1. Sustainable attributes in the bread supply chain and performance evaluation of the differences between the local and the global chain

Looking at the differences between global and local chain the main differences are on the basis of nineteen attributes[14]. In particular, the table above denotes a marked difference between local and global chain on the following attributes:

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[13] F. Galli, F. Bartolini, G. Brunori, L. Colombo, O. Gava, S. Grando, A. Marescotti, *Sustainability assessment of food supply chains: an application to local and global bread in Italy*, Agricultural and Food Economics, 2015, 3: 21.

[14] Ibidem.

- Accessibility for low-income families and in developing countries, especially considering that the bread produced in a global supply chain is very affordable, even in low-price supermarkets;
- Biodiversity is certainly present among the local producers and little considered in the global supply chain due to unstable supplies and technical characteristics;
- Connections: Local and regional supply chain are well integrated;
- Consumer behavior: the global supply chain and the local supply chain have very different consumer characteristics as shown by numerous studies on the consumer in the literature;
- Economic and ecological efficiency: the overall scale of production allows economies of scale also from an environmental point of view;
- Income for farmers and added value depend on the production cooperatives and on the assistance provided for by policies: local chains set the prices in relation to production costs while global chains are based on the prices on the global market;
- Food security as the increase in productivity and the reduction of food scarcity, can be reached in different ways on a local and global scale;
- Governance and distribution of power act from an ecological point of view and transparency in the chain: the local supply chain is very transparent and geared to the attention to the environment, the global supply chain has various strategies to increase transparency and collaborates with the producers of wheat to assess environmental risks;
- Information and communication and therefore the effects of information about the preferences of the consumer, the consumer perception on the quality of bread (organic vs. conventional), very intense information and communication in the global chain also for the problem of sustainability. The local chain is based on relationships of trust;
- Nutritional aspects of bread mainly concern the ingredients (flours, salt reduction), the production methods and the impact of the types of bread on the health and information on the label. The difference between global and local chain are mainly due to the fact that in the local development is related to communication strategies; in the global supply chain the focus is on the nutritional aspects and in particular on the processes and recipes for making bread;

- Profitability for transformers growers and sellers is related to the preparation of healthier food from vendors in terms of profitability. There is a tendency to the concentration in the production of raw materials and of the manufacturing process as a barrier to entry in the industry;
- Resilience and local development in which the critical aspects are the innovative response to the social and ecological risks and roles of cooperatives. The benefits relate to the production, resilience and biodiversity conservation. Local chains are focused on old varieties of wheat, organic farming and innovative food networks to differentiate and limit dependence on political support. The global chain research ways of integration with the grain producers to improve the resilience and to respond to social and ecological risks;
- Resource use and pollution, the environmental impact on the production of bread at different scales (industrial, craft and domestic) of different production methods and other parameters such as country of origin of the wheat, the production method, type of flour, type packaging and food waste. Studies on Life cicle assessment show that the use of resources and pollution are much lower for this sector, in particular by comparison based on energy emissions per kg tends to benefit a larger scale of production;
- Responsibility, social responsibility of producers and sellers, subsidies and social and political stability. Safety must be ensured in all the chains together with different constraints that depend on the context: while global chains provide an annual report on social responsibility, the local chain is monitored by a third party direct relations;
- Safety challenge in traditional foods. Food safety must be guaranteed in all the chains together with different obligations depending on the context;
- Technological innovation, genetic improvement of wheat, innovation in equipment for the production of flour and innovation related to the health, pleasure and ease of use: global chains have the resources to continuous innovation. Local chains are advanced in relation to the context and resources available;
- Territoriality, local adaptation of different varieties of wheat, willingness to pay for local and organic ingredients. The local bread reflects a close link with the territory and traditions;

- Traceability, the ethical aspects of traceability and communication to the consumer. Shift towards a higher quality and identity of the grain. The local chain is accessible and transparent. The global chain is directed to the growth of transparency and to a direct contact with the consumer;
- Food Waste identification to improve its shelf life. Both chains show a low level of wastage for different reasons. Both breads have a long shelf life: the local bread can be used in traditional recipes, the global bread has a duration of 40 days.

5.5. The prices of bread and competition with the bread of Eastern Europe

In Italy, the consumption of bread per capita per day is significantly changed if we take the years from 1861 to 2014[15]. After the unification of Italy, there was a consumption of 1.1 kg of bread a day, and about 120 years after switching to 230 g per day, to arrive in 2000 to 180 g and in 2014 to 90 g that is less than two slices (or two small rosettes) per person.

Total household spending for bread, breadsticks and crackers in Italy amounts to nearly 8 billion a year and, to be preferred according to Coldiretti, is the artisan bread that represents 88 per cent of the market with a steadily declining consumption while it is growing in recent years the question of substitutes of bread as crackers, bread sticks and special breads.

In recent years, consumer prices have been highly variable (from € 1.70 to 3.94 per kg in the south and northern Italy), depending on the type of bread, the quality and marketing channel used. Bread production experience with high-added value have spread[16] even in Italy, as indicated by the geographical indications and the proliferation of voluntary initiatives of high quality bread products.

The price of bread is also highly variable in Italy, according to a study conducted by Coldiretti, with prices doubling between Naples, where it costs 1.90 euro per kilo, Bologna where the price is 3.95 euro per kilo, 3.51 euro per kilo in Milan, 2.66 in Turin, 2.71 euro per kilo in Palermo, 2.48 in Rome and 2.83 in Bari. This study involved 138 stores, including

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[15] www.istat.it

[16] K.M. Hills, J.R. Goldberger, S.S. Jones, *Commercial bakers and the relocalization of wheat in western,* Washington State, Agr Hum Values, 2013, vol. 30, n. 3, pp. 365-378.

bakeries, supermarkets and hypermarkets in ten major cities: Bari, Bologna, Genoa, Florence, Milan, Naples, Padua, Palermo, Rome and Turin.

In recent years in Italy it has exploded the imports of baked goods from Eastern Europe, which in some cases is anexample of dumping and create market failure because sometimes it is unrecognizable compared to fresh bread and, as happens in cases of market failure, this could lead to consumer confusion, and exit from the market of quality bread due to the lower price that consumer are willing to pay. According to the data, we have gone from four million to eight million euro. This phenomenon explains the boom in production of bread freshly baked by the large retailers. They provide a frozen product, precooked and only gold in the place of distribution. In some regions we are developing quality symbols to make fresh bread recognizable with respect to these products that comes into direct competition being now present in all of a large retailer.

Looking at the label legislation, with the last Regulation (1179/2011) producers should refer to the place of bread production. In a market where even the chain of fresh bread is a global supply chain becomes a strategically important value to the national and local fresh product. In fact, the chain of bread in Italy uses the semi-finished product coming from Eastern Europe. This product competes with the Italian product, hardly recognizable except through the label. By understanding the differences, consumers can express its willingness to pay on the basis of the freshness and origin. In some Italian regions it has been created its own brand to make fresh local bread recognizable compared to the global pre-cooked and frozen bread.

In order to develop the existing marketing channels and promote enhancement in the supply chain it is necessary to develop strategies to be implemented through the development of certification systems. The origin of fresh bread, it may sometimes become difficult to be understood from consumers for objective factors and cognitive deficiencies. Therefore, in the absence of specific controls, the existing identification system is not entirely reliable, but leaves considerable margin for opportunistic behavior. The creation of bread recognition tools belonging to the local supply chain is important for the consolidation of relations of trust between producers and consumers and limit information asymmetries, which determine the inefficiency in the market[17].

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[17] G. Akerlof, *The market for Lemons: Qualitative Uncertainty and the Market Mechanism*, Quarterly Journal of Economics, 1970, p. 84.

Similarly, the companies belonging to the sector have the opportunity to differentiate themselves in the market, to guarantee the accuracy of the information and reduce transaction costs related to the choice of its suppliers and customers, thus reducing the internal costs of industrial organization.

5.6. The bread chain in Lazio

5.6.1. The industry of bakery in the Lazio region and the typical bread products

The bread of Genzano IGP, the Lariano bread, the Roman ciriola and the white pizza are just a few of the many varieties of bread of Lazio, region that has always been dedicated to the production of wheat. In the province of Rome there are eleven different types of breads, plus those of Sabina (unsalted or salted) or Tuscia. This vocation dates back to ancient times: in Rome of Augustus for example were active 400 ovens to produce bread.

The regional cereal sector vaunts one IGP (Bread Casareccio Genzano) but, at the same time,there are important many traditional productions that are not recognized by the typical trademarks.

The lack of DOP and IGP trademarks determinethe low number of companies (12 units) as emerges from the 6th – CGA – they are operating with this IGP trademark (0.1% of the structures engaged in grain farming). Organic productions involve 3% (499 units) of the regional grain producers, given that this also denotes a low propensity adoption of the biological specification.

In fact, although the Lazio boast in the various sectors typical quality products, in the bakery sector only it appears the homemade bread of Genzano IGP. In addition, the region boasts a rich tradition in the artisan bakery ranking among the Italian regions with the largest selection of "local bread," commonly referred to as homemade bread.

In the Lazio region there are 30 types of bread in the four macro-areas that are: in northern Lazio, in the province of Rome and Viterbo there arewhite breads, unsalted, often obtained from flour of durum wheat; in the area of Sabina (Rieti) and of the Simbruini (Subiaco, Canterano) there are dough not too refined with strong acidity, very similar to breads from Abruzzo, in the internal areas of the provinces of Latina and Frosinone we can find especially compact breads, made from unre-

fined flour and finally in the province of Rome, there is the prevalence of bread similar to the typical bread from the south like the Lariano bread.

Bread products are produced by small bakers, artisan companies that, unfortunately, in many cases are deemed to close the business in the absence of generational turnover and as the result of the migration from small towns.

According to the analysis of Menconi[18], the Lazio region has many varieties of bread. In Monteromano there is the production of "black bread", a kind of bread with crumb yellow, obtained from flour of durum wheat, used also in the area of the Tolfa mountains, with local bread with different kind between Canale Monterano and Allumiere where Tuscan influence has bring towards a bread free of salt. Genzano, however, it is recognized as the unique IGP Lazio bread that is aworked loaf with large bubbles, from the bitter crust and soft crumb.

Other bread that comes from a recent (50 years) craftsmanship is the bread of Lariano, obtained from semi-wholewheat. The oldest, however, are the origins of the bakery in Cori and Giulianello where, probably, came the first bakers who settled in Lariano. Breads similar to this type are produced even in Frosinone, where there are variants to "fennel".

In the province of Latina, we find light breads called ciabattone (Sezze), a kind of homemade high quality breads. Good bread is obtained from good flour and natural yeast. The quality of the flour used for bread making is an essential element to define the quality. Often it comes from imported flour – Italy imports 60% of its needs of wheat – and of poor quality that are drainedof the main essential nutrients, they are presented with the consistency of the "marble dust".

5.6.2. The cereal sector in Lazio region: agricultural production

The Lazio cereal production has been characterized by a gradual downscaling of production. Since the '80s, the cereals sector shows a tendency towards a reduction in terms of both company structures and areas of crops. The contraction has interested mainly the small structures and has determined an increase in the average area. In 2010, companies in the Lazio region in the cereal production amounted to 16,868 with an area under cultivation of about 103,189 hectares. In the years 2000-2010

[18] A. Menconi, *Il pane nel Lazio. Luoghi e cultura della filiera grano-farina-pane,* Regione Lazio, 2014.

the sector of cereals recorded a reduction of 57.3% in terms of company size (-22 657 companies) and approximately 28.8% of the area for the cultivation (-40 224 hectares). The average size farm in the area under cereals production amounted to 6.1 hectares, and it register a significant increase compared to the value in 2000 (3.6 hectares).

In particular, the data shows a concentration of companies in the areas of Viterbo and Frosinone and in the area of Frosinone, in 2010, It was recorded a reduction of 64% (-11 529 companies), compared to 2000. The value of regional cereal production is oriented mainly to the sale, 74.2% of the estimated production (Figure 1). The prevailing commercial channels refer to commercial intermediaries (29.5%) and to legal entities (24.4%). The part sold directly to processors appears low (8.6%) (Figure 8). Only 2.1% of companies is engaged in processing activities for self consumption.

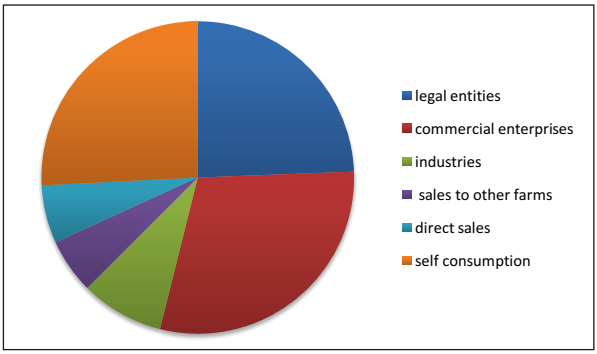

Fig. 5.8. Lazio Region Report (2015), elaboration on VI CGA.

5.6.3. The prevailing legal form Lazio inbakery sector

Looking at the data extracted from ISTAT database, we can see that the prevailing legal form in the

Lazio bakery chain is that of the individual entrepreneur as we can see from the Table 2. This legal form countsa number of 2,991 enterprises (Table 2). Numerically, we see that the second most common legal form in the sector is represented by the general partnership (1549 companies) followed by srl (1439 companies companies) and limited partnerships (486 companies). Among the corporations, are scarcely present the two typologies of legalcorporations (in the table SpA and SApA). Companies with small dimension compose the sector and that has a significant effect on the rate of innovation and on the enhancement of regional chain.

Table 5.2. Analysis by legal form in the bread Lazio chain (ISTAT: data extracted on 10th November 2015).

Legal Form	Individual enterpreneur, free lancer, self employed	SNC	SAS	Other partnership different from snc and sas	SPA and SAPA	SRL	Cooperative society	Other kind of company	Total
Ateco 2007									
Total firms	257186	23546	21960	3722	3323	106268	7160	2565	425730
grain processing	**12**	**13**	**4**	**..**	**2**	**18**	**..**	**..**	**49**
milling wheat	9	9	4	..	2	13	..	..	37
milling of other cereals	1	..	..	..	..	2	..	..	3
other seeds and grains processing	2	4	..	..	..	3	..	..	9
production of baked goods and starchy foods	**1092**	**544**	**171**	**1**	**5**	**491**	**28**	**1**	**2333**
production of bread, fresh bakery products	**783**	**435**	**136**	**1**	**2**	**421**	**21**	**..**	**1799**
production of fresh bakery products	585	364	103	1	2	334	18	..	1407
production of fresh pastries	198	71	33	..	..	87	3	..	392
production of rusks and biscuits, manufacture of preserved pastry goods	**43**	**16**	**10**	**..**	**1**	**28**	**3**	**1**	**102**
production of macaroni, noodles, couscous and similar farinaceous products	**266**	**93**	**25**	**..**	**2**	**42**	**4**	**..**	**432**
Total firms in the bread chain	**2991**	**1549**	**486**	**3**	**16**	**1439**	**77**	**2**	**6563**

5.6.4. The analysis of the perspectives for the Lazio breadsector

From the analysis of the economic literature, of the existing legislation, of the proposed new legislation under discussion and from the in depth interviews with the opinion leaders in the sector has been developed the SWOT Analysis of the bread industry in Lazio (Tab. 4).

The text under discussion from the Agriculture Committee has provided new necessities governing the production and sale of bread.

The liberalization of the sector took place with the Bersani law in 2006. It has in some ways facilitated the industry but It has caused also the increase of information asymmetries between producers and consumers. In fact, this law, profoundly changing the sector through the elimination of bakery licenses, resulted in a significant increase in the number of bread makers, that have changed the market organization. Moreover, the Bersani law, opening to the bakeries the opportunity to practice the sale of other fresh food products already made, has allowed manufacturers to offset the loss of revenue resulting from the elimination of licenses. In that way bakers are able to differentiate their offerings and its variety.

With regard to changes in the bread industry, further interesting changes arise from the Ministerial Decree (DM August 5, 2010), which approved a new table of goods which includes, among the activities that may be the subject of agricultural activities, the production of bakery products fresh, in Article 32, paragraph 2, letter c) of the TUIR (text of tax income). Therefore, after that Decree farmers can produce on-site bread. In this way it is born the short chain of the bread. The legislation, however, increasing the opportunities for the production of bread creates many areas for the illegal and unfair competition related to the lack of control that arises from Km0 situations. In these cases, in the absence of traceability we are faced with the risk of eating bread not controlled. This is leading trade associations to promote a number of initiatives aimed at a binding regulation that guarantees the consumer and the producers belonging to the legal circuit.

In fact, the text of this new law, still under discussion, will lead to the reduction of information asymmetries between production and consumption, limiting the spaces for those who still operate by exploiting legal gaps.

Infact, this law will regulate "provisions governing the production and sale of bread" in order to ensure consumers' right to information and to enhance the fresh bread.

In order to sum up the situation in the sector of bread, through a SWOT analysis have been examined the strengths, the weaknesses, the opportunities and the threats in the supply chain, elaborated in the light of the national legal framework and of the changes in progress and also the information obtained by opinion leaders. It has been so built a regional framework for the development of the bread chain (Table 3).

5.6.4.1. Analysis of the strengths

The first strength that emerges – from the tradition, the historical memory and the food uses in Lazio – is the promotion of quality production stimulated on one hand by intangible resources (presence of workers) and on the other hand by a sophisticated consumer demand.

The presence of typical breads is a result of this tradition, consolidated over time and that the emerging regulations will lead to greater protection of quality production ensuring transparency in the market and a new supply control. From the consumer point of view the new trends push to a growing demand for the short chain Italian bread.

5.6.4.2. Analysis of weaknesses

Through the interviews with opinion leaders it emerges a general lack of entrepreneurial initiatives to add value to the bread products. The problem of the regional sector remains tied to the inability of commercial enterprises to go towards global markets and to expand the production of scale. This result comes from the lack of ability to work with local institutions, from the lack of association, cooperation and also of a consortium.

An example of this phenomenon can be represented by the bread of Pastena, one of the territory with a strong tradition in bread production that boasts the presence of a school of bakery, a good agricultural production and wheat and that fails to promote their own product because of lack of association.

Last but not least, is the problem of the asymmetries between production and consumption that characterize this sector. The problem of bread, produced not packaged and then soldunpackaged is the lack

of labelling that makes it difficult to recognize fresh bread and bread quality than what comes from abroad instead. In addition, because of the elimination of the production licenses, there was a problem in acquiring margins by operators from quality productions, which would be recovered increasingly by the possibility to sale of other fresh productsintroduced by the Law 248 of 2006 (Article 4).

5.6.4.3. Analysis of the Threat

The current lack of development of quality production and the lack of transparency on the market, still present because of legal loopholes, may cause the phenomenon of Lemmon Market[19]. Certification and recognition of production and quality differences between different types of bread for sale becomes clear for the sustainability of the sector. Failing that, "The bad money drives out good" with serious damage to domestic producers.

There are forms of competition that most concern the industry. The first is given by the entry of frozen products from abroad that often can not be distinguished by fresh ones. The frozen bread market from abroad, widely used by large retailers is not always label ed and has very competitive prices compared to other types of bread present on the shelf.

The lower prices of the bread and the quality will not be recognized, since often the bread is not labelled, they could pose a threat to the development of quality productions with a loss of competitiveness resulting in the closure of retail outlets.

Furthermore, in addition to the illegal phenomena, the market seems less controlled also as a consequence of the new regulations that through the inclusion among the supplementary agricultural production also the short chain bread have caused problems linked to the lack of the production control that come from the surrounding countryside to the centres for which the production process is not traced. For that reason the Ministerial decree DM August 5, 2010, which approved a new table of goods which includes, among the activities that may considered from agricultural activities also the production of fresh bakery products, referred to in Article 32, paragraph 2, letter c) of the TUIR.

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[19] G. Akerlof, *The market for Lemons: Qualitative Uncertainty and the Market Mechanism*, op. cit.

The legislation having increased the opportunities for the production of bread creates many areas for the illegal and unfair competition related to the lack of control that arise from the zero kilometre situations. In these cases, in the absence of traceability we are faced with the risk of eating bread not controlled.

5.6.4.4. Analysis of Opportunity

The first opportunity for this sector is the ability to create good relations between the territory and institutions in order to bring out the quality products in a market which, although full of internal differences, is not transparent. They are in discussion some regulations to improve transparency in the sector, in particular the Draft Law (July 29, 2015) "Provisions on the production and sale of bread."Another legislative initiative of great importance is the inter-ministerial Decree for the fresh bread. This draft of decree that comes from the Minister of Economic Development, in consultation with the Minister of Agriculture, Food and Forestry and the Minister of Health is laying down the definition of Regulation about bakery names, fresh bread and bread with long durability.

The text of the draft Decree has been drawn up following the consultation with leading trade industrial and handicraft associations.

As emerged during the working groups that have guided the drafting of the text, It takes into account the need to adapt the facility mentioned in the law to make it flexible and ensuring the appropriate and correct consumer information.

Specifically, the proposal consists of six articles dealing with the following themes:

- Art. 1. Definition of bakery that is such only if it carries out the entire production cycle of the raw materials to the final cooking;
- Art. 2. The definition of "fresh bread" prepared according to a continuous process for which there is an interval of time exceeding 72 hours, from the start of production until the introduction of the product sold;
- Art. 3. It states that the bread of long durability can be offer for sale with an additional indication highlighting the state or conservation method and require exposure restriction in reserved sections;
- Art. 4. It invokes the application of the principle of mutual recognition;

- Art. 5. Provides for the disposal of stocks and for the temporary provision relating to covers or packaging with indications or sales descriptions that are not comply with the provisions of this Regulation;
- Art. 6. It has for the coming into force.

This proposal could reduce the phenomenon of market failure and thus to favour the correct information to consumers.

From the meetings made with the representatives of trade associations, it has emerged the growing attention to the protection of quality products in order to promote market expansion, through the export opportunities on the other markets.

The vision of the sector operators is to strategically enhance only the bread of Genzano (IGP) and the Larian bread representing the highlights of Lazio production.

Another development opportunities could affect the bread of Pastena that has a tradition, a good school of bakery, a good agricultural and wheat production and this, according to the experts, could be linked to a consortium that enables the reputation and the external communication.

Further opportunities are related to the expansion of the local consumer market and are related to the following factors:

- Promotion of typicality and quality characteristics;
- Promotion of the quality labels;
- Strong connection between the typology of bread and territory;
- Thematicevents organisation.

Finally, as this is an exploratory result in a marginal area of the bread market, from a market survey conducted by the trade association of bread makers, results showed as bread consumers from Lazio is very open to the innovations compared to the consumers from other Italian regions.

This figure emerged from the consumption of bread to charcoal, for which it has a high consumer attitude and willingness to buy by Lazio consumer. This could expose a high willingness to accept innovation in an industry that can try to innovate it to meet the new demands of the postmodern consumer.

Table 5.4. Swot Analysis: The bread chain in Lazio.

STRENGHT	WEAKNESSES
Presence of a tradition, culture and diffusion of the fresh bread *Sophisticated demand that stimulates the sensory quality and product innovation.* *Presence of typical and quality breads* • *Presence of the consortium of Lariano* • *Genzano Bread (Protected Geographical Indication)* **Emerging regulations to protect the production will bring to** – *New supply control* – *Ability to affect the price* – *Greater transparency in the market* – *Protection of quality production.*	**Lack of entrepreneurial initiatives for the development of the bread enhancement processes** • *Existence of a big share of small companies unable to go on global markets and to expand production scale;* • *Scarcity of institutional relations with local authorities;* • *Lack of a consortium thrust;* • *Lack of association, cooperation* *The bread of Pastena, a territory with a good bread tradition that boasts the presence of a school of bakery and a good agricultural and wheat production It is not able to stimulate associations for the promotion of this strategic sector.*
Good domestic demand for quality products • *Informed consumers are increasingly concerned about quality products, to productions with local wheat* • *Increasing attention to the short chain.*	**Asymmetric information between production and consumption** • *Difficulty recognizing the fresh bread and the bread quality due to poor labelling.* **Lower margins and diversification of bakeries** • *Difficulties in gaining profit margins by operators from quality productions that come increasingly from the possibility to sell other products introduced by Law 248 of 2006, art. 4.*

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OPPORTUNITIES	THREADS
Ability to create good relations with the institutions *The new law will improve transparency in the sector (Draft Law July 29, 2015), "Provisions relating to the production and sale of bread."* – *Increasing attention of industry associations for the protection of quality products.* – *Ability to export on other markets. Industry players consider strategic only the bread of Genzano (IGP) and the Larian bread representing the highlights of Lazio production.* – *Another development opportunities could affect the bread of Pastena that has a tradition, a good school of bakery, a good agricultural and wheat production and this, according to experts, could be linked to a consortium that enables the reputation and the external communication.* **Short chain, certification and enhancement** *Boost the production of local grain and supply chain quality certification (Chain Traceability) may make to acquire added value to the regional bread production, considering the increasing demand for food safety following recent scandals on whea***t** *containing aflatoxin imported from overseas markets.* **Market expansion of the local consumers** • Typical Promotion • Promotion of the quality mark • Identification product area **Event organization** *Diversification of key markets starting from the promotion of the area* **Lazio consumer and innovation** *The Lazio consumer emerges at the national level for the purchase of charcoal bread. This result points out the ability to experience the innovations in the industry and also the consumer willingness to pay for products with higher added value.*	*Lack of development of quality production "The bad money drives out the good one"* **Short chain and illegal bread** – *The short chain often corresponds to phenomena of illegal and of bread not controlled in both the manufacturing and the firing processes and as regards the grain used.* **Unlabelled foreign bread** *The frozen bread coming from abroad, widely used by large retailers is not always labelled and It has very competitive prices compared to other types of bread on the shelf. The lower prices of the bread and the quality will not be recognized, since it is often not labelled.* *Among different quality breads, when the quality is not recognizable by the consumers that can cause a loss of competitiveness resulting in the closure of retail outlets that do not remain competitive in the market.*

Sitography

Global and local food assessment. A multidimensional performance based approach.

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6. Chemistry, technology and nutritional profiles of wheat products

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6.1. Introduction

Cereal products are one of the most important staple foods for humans and have been so for thousands of years. Cereal-based foods are consumed worldwide with more than 2.3 billion tons of cereals produced annually[1]. They provide 30-60% of the daily energy, their contribution being highest in developing countries. The cereal grain cultivation has been associated with the development of civilization and now represents the base of world trade. As a matter of fact, even if various grains are consumed in the different parts of the world, cereal foods, in general, are an essential component of the diet across cultures[2]. The principal crops cultivated worldwide are wheat, corn and rice, and in temperate climates, such as Europe, barley, oats, and rye are cultivated as well. In Europe, the average annual consumption of cereal grains is 131 kg *procapite*, wheat making up the majority of it (108 kg/capita/year), whereas in Asia, about half of the annual cereal consumption is represented by rice. Corn is

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1 FAOSTAT, *Food and Agriculture Organization of the United Nations*, 2013, available from http://faostat.fao.org.

2 G.B. Panatta, *Cereali e patate,* Napoli, Italy, F. Fidanza & G. Liguori, (a cura di) Nutrizione Umana, Idelson, 1997, pp. 268-289.

important in particular in Central and South America, and sorghum and millets in Africa[3].

Cereal kernels are complex organs comprising mixtures of components which differ in their distribution between the various tissues and cell types, i.e. starchy endosperm, aleurone layer, embryo and outer layers. In fact cereals and cereal products are an important source of carbohydrates, proteins and fiber, as well as of significant amounts of micronutrients such as vitamins (E and B), sodium, magnesium and zinc. Cereal whole grains also contain significant amounts of "bioactive" compounds which are proved to provide health benefits to the consumers; as a consequence, in the last decades it is growing the interest on the phytochemical bioavailability[4] and on the synergistic effects between whole grains and fruits and vegetables[5] on health benefits. Nutritional guidelines suggest that carbohydrates should provide about half of the daily supply of energy, and cereal foods constitute the major source of dietary carbohydrates, which should be preferably derived from whole grain cereals. The concept that diets low in meat and high in cereals and legumes are beneficial for health is now widely accepted. As a matter of fact, epidemiological studies have shown the protective effect of whole grain consumption for the prevention of various chronic diseases (cardiovascular disease, type 2 diabetes) as well as of some gastrointestinal cancers and obesity[6].

6.1.1. Origin and evolution

Wheat (*Triticum* L., 1753) is a genus of Poaceae family (or "graminaceae") that,as many other grasses such as bermuda grass (Cynodondactylon), originally grew spontaneously in different geographic areas such as Fertile Crescent, Afghanistan, Turkey, India and Southern Europe. The numerous species cultivated today, whose ancestral strains originated in different areas, are an evidence of the different

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[3] A. Kuijsten, I. Arts, P. Van't Heer and P. Hollman, *The relative bioavailability of enterolignans in humans in enhanced by milling and crushing of flaxseed,* Journal Nutrition, 2005, 135, pp. 2812-2816.

[4] C. McKevitt, J. Redfern, F. Mold and C. Wolfe, *Qualitative studies of stroke: a systematic review*, Stroke, 2004, 35, pp.1499-1505.

[5] R. H. Liu, *Whole grain phytochemicals and health,* J. Cereal Sci, 2007, 46, pp. 207-219.

[6] R. Giacco, B. De Giulio, M. Vitale & R. Cozzolino, *Functional Foods: Can Food Technology Help in the Prevention and Treatment of Diabetes?*, Food and Nutrition Sciences, 4(8), 2013, p. 827.

geographical origins. The presence of such ancestral species are the starting point of the genetic improvement of several crop species that began with the domestication of the first wild plants (about 10,000 years ago). The domestication of such wild plants led to the passage of our ancestors hunter-gatherers to farmers and shepherds and then to the formation of the complex human society. The constant selection activities of the best plants carried out by farmers, especially for the yield improvement, resulted in a continuous and unconscious process of modification of genotypes until the revolutionary discovery of the independent segregation of traits formulated by Mendel. This discovery provided the scientific basis for the modern genetics and, therefore, the modern breeding as a science currently applied. However, the genetic selection performed on wheat before Mendel's researches originated from a quite complex populations (landraces), characterized by a variable portion of inter-crossings and the selective advantage of heterozygotes. Even though there are not clear evidences, it must be assumed that these new varieties, resulting from the natural breeding, were superior to their ancestors that were almost completely abandoned by the end of the nineteenth century in all most technologically advanced agricultural areas. However, due to their high rusticity, it is still possible to find these ancestral species cultivated in remote areas of temperate countries and to a greater extent in the tropical areas, despite they are slowly disappearing. In extreme summary, the origin of common (*T. aestivum*, hexaploid) and durum wheat (*T. turgidum* ssp *durum*, tetraploid), can be attributed to a series of crosses between wild emmer (*T. turgidum* ssp *dicoccum*, tetraploid) and diploid grasses of the genus *Aegilops*.

Modern agricultural models, based only on the economic sustainability of the crop itself, led farmers to an almost complete replacement of landraces with pure line varieties, the only type of cultivars currently used for wheat. Without doubt, the genetic uniformity of the new wheat varieties, led directly into a phenotypic uniformity, resulting beneficial for the applications of common agricultural and farming practices where the use of mechanization had been increasingly pushed.

Nowadays, the actual agricultural companies, use varieties characterized by high uniformity that allows the legal distinction of different cultivars in order to protect the rights of breeders as well as for responding to law requirements of distinctness, uniformity, stability and superior agronomic value. Moreover, uniformity is searched by breeders

also in pollinated species, such as corn and sorghum, for which uniformity is one of the reasons for the production of hybrid varieties.

The continuous cultivation of mono-varietal wheat led to a slow and inexorable genetic erosion process, whose effects are well known. Nowadays, the competent organs have implemented several actions in order to preserve also varieties which, despite presenting a low yield, achieve economic and environmental sustainability thanks to low agronomic inputs.

The actual goals of breeding, are no longer aimed only to increase yields, but also to reduce cultivation costs and impact on the environment. A further considerable aspect, correlated with rusticity of local ecotypes, is the resistance to pathogens that could also lead to a qualitative improvement of the grains from a hygienic point of view. All these aspects illustrated so far, which regards local varieties, lead to an accurate work of collection of interesting materials for the breeding programs and aim to a reduction of the extinction danger in order to preserve the genetic variability in the wheat populations through collecting the germplasm and its exploration. This latter aspect, was taken over the responsibility of different international organizations, such as FAO (Food and Agriculture Organization), which promoted the organization of international plant collection centres. The coordination of the protection of international plant genetic resources programs is managed by 'IPGRI (International Board for Plant Genetic Resources), established in 1974. Many countries also have national organizations or councils, such as CREA (Council for agricultural research and economics), who deal with cereals germplasm conservation facilities in particular local ecotypes.

6.1.1.1. Ancient wheats

The term "ancient wheats" includes various *Triticum* species that were cultivated in the phase of domestication and that are currently used only in some marginal areas. Examples are *T. monococcum*, whose cultivation is dated back approximately 10,000 years ago; *T. timopheevii* (originated from the cross between *T. monococcum* and *Ae. speltoides*) and *T. zhukovskyi* (originated from the cross between *T. monococcum* and *T. timopheevii*). These two last species are cultivated mainly in the Caucasian region. The slow but progressive abandonment of cultivation of these grains was due to the discovery of polyploidy species (obtained by spountaneous crossing), which prove to be more productive

than their parental. Today ancient wheats are regarded as a resource of inestimable value both from the genetic and from the nutritional point of view as a starting point for breeding and as a good source of bioactive compounds. In particular, in recent years, considerable interest has been shown towards einkorn wheat for the high digestibility of its gluten and for its peculiar nutritional value, i.e. high protein and carotenoids content along with high levels of iron, zinc and phosphorous.

6.1.2. Kernel composition

Grains, commonly referred to as 'cereals', are the edible seeds of plants belonging to the cereal grass family *Gramineae*[7]. The grass family includes about 10,000 species, and it encompasses tremendous morphological, physiological, ecological, and genetic diversity. The *Gramineae* family includes all the major cereals, such as wheat, corn and rice, and most of the minor cereals as well, such as rye, barley, oats, common millet, finger millet, teff, spelt, emmer, einkorn and khorasan wheat, these last being often referred as 'ancient' grains'[8]. Generally, the cereal kernel can be divided in three parts: bran (outer layers), endosperm and germ. In wheat the endosperm accounts for the majority of the wheat kernel or caryopsis (80-85%). The cells in the endosperm are specialized in the storage of starch (80%) and proteins (about 13%) that will function as source of energy for the embryo during germination[9]. The germ represents the smallest portion (2-3%) of the wheat grain and consists of the embryonic axis and scutellum. It contains lipids, small amounts of protein, minerals and bioactive compounds of lipophilic nature such as vitamin E, phytosterols and some phenols. The pericarp, the outermost fraction of the wheat kernel, comprising about 10-15% of the kernel weight, has the main physiological function of protecting the seed and consists of multiple layers[10]. From the inner layer to the exterior of the wheat kernel there could be found: the

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[7] E.A. Kellogg, *Relationships of cereal crops and other grasses*, Proceedings of the National Academy of Sciences of the United States of America PNAS, 1998, 95(5), pp. 2005-2010.

[8] J. Mercader, Y. Asmeron, T. Bennett, M. Raja, and A. Skinner, *Initial excavation and dating of Ngalue Cave- A middle stone age site along the Niassa Rift, Mozambique*, Journal Human Nutrition, 2009, 57, pp. 63-74.

[9] D.G. Lindsay. *Nutrition, hormetic stress and health*, Nutrition Research Reviews, 2005, 18, pp. 249-258.

[10] N.M. Anson, Y.M. Hemery, A. Bast, & G.R. Haenen, *Optimizing the bioactive potential of wheat bran by processing*, Food & Function, 2012, 3(4), pp. 362-375.

aleurone layer, the hyaline layer (nucellar epidermis), the testa or seed coat, the inner pericarp (cross and tube cells), and the outer pericarp.

The chemical composition of cereals may vary depending on the genotype and environmental growing conditions[11]. Generally, the fiber and protein content of wheat is higher than that of other cereals (except oats), while, on average, lower fat amount was reported (Table 1).

Table 1. Average composition of cereal grains (%)[12]

	Rice	Wheat	Maize	Sorghum	Barley	Oats	Rye
Moisture	12.0	12.5	13.8	11.0	11.1	8.3	11.0
Protein	7.5	12.3	8.9	11.0	8.2	14.2	12.1
Fat	1.9	1.8	3.9	3.3	1.0	7.4	1.7
Fiber	0.9	2.3	2.0	1.7	0.5	1.2	2.0
Ash	1.2	1.7	1.2	1.7	0.9	1.9	1.8

Grain-based foods are generally grouped into wholegrain or refined grain. In 1999 the Board of Directors of AACC approved and accepted the following definition of whole-grains:

> *"Whole-grains shall consist of the intact, ground, cracked or flaked caryopsis, whose principal anatomical components the starchy endosperm, germ, and bran are present in the same relative proportions as they exist in the intact caryopsis".*

Whole grains are low in fat, and are important sources of protein, fiber, vitamins (especially B and E group), minerals (magnesium, zinc) and many bioactive phytochemicals, such as arabinoxylans, alkylresorcinols, lignans, flavonoids, ferulic acid, and anthocyanins[13, 14].

Whole meal is produced by milling whole grains to a finer particle size. Whole meal is defined as:

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[11] Y. Hemery, V. Lullien-Pellerin, X. Rouau, C. Barron, J. Abecassis, M.F. Samson, P. Åman, W. Von Reding, C. Spoerndli, C. Barron, *Biochemical markers: efficient tools for the assessment of wheat grain tissue proportions in milling fractions*. Journal Cereal science 2009, 49, pp. 55-64.

[12] NIIR Board of Consultants & Engineers, *Wheat, Rice, Corn, Oat, Barley and Sorghum Processing Handbook (Cereal Food Technology),* Asia Pacific Business Press Inc., 2006.

[13] U. Schlemmer, W. Frolich, R. Prieto and F. Grases, *Phytate in foods and significance for humans: food sources, intake, processing, bioavailability, protective role and analysis*, Molecular nutrition & food research, 2009, 53.S2: S330-S375.

[14] K. Poutanen, *Past and future of cereal grains as food for health. Trends*, Food Science & Technology, 2012, vol. 25, n. 2, pp. 58-62.

"containing all the milled constituents of the grain in such proportions that it represents the typical ratio of those fractions occurring in the whole cereal."

Most cereal products are obtained by milling kernels after removing bran and germ, the two parts containing the most of bioactive components (vitamins, minerals, antioxidants, phytoestrogens and soluble and insoluble fiber)[15, 16]. Table 2 evidences the markedly different composition between refined and whole grain.

Table 2. Compositional differences between whole and refined wheat[17]

Component	Wholewheat	Refined wheat
Bran (%)	14	< 0.1
Germ (%)	2.5	< 0.1
Total fiber (%)	13	3
Insoluble fiber (%)	11.5	1.9
Soluble fiber (%)	1.1	1
Protein (%)	14	14
Starch (%)	70	84
Fat (%)	2.7	1.3
Minerals (%)		
Zinc (mg/g)	29	8
Iron(mg/g)	35	13
Selenium(mg/g)	0.06	0.02
Vitamins		
Vitamins B6 (mg/g)	7.5	1.4
Folic acid (mg/g)	0.57	0.11
Phenolic compound		
Ferulic acid (mg/g)	5	0.4
B tocotrienol	32.8	5.7
Phytate phosphorus	2.9	0.1

[15] J.L. Slavin, D. Jacobs, L. Marquart, K. Wiener, *The role of whole grain in disease prevention,* Journal of the American Dietetic Association, 2001, 101, 7, pp. 780-785.

[16] J. Jones, *Mining whole grains for functional components,* Food Science and Technology Bulletin, 2007, 4(7), pp. 67-86.

[17] J.L. Slavin, M.C. Martini, D.R. Jacobs & L. Marquart, *Plausible mechanisms for the protectiveness of whole grains*, The American journal of clinical nutrition, 1999, 70(3), pp. 459s-463s.

More recent evidences also indicate that cereals contain significant quantities of phytochemicals, such as antioxidants and phytoestrogens, which may significantly contribute to reported health benefits of whole grain consumption. In most cases, these beneficial compounds are concentrated in outer layers (bran) of the grain. In the last ten years, consumers are (re)discovering wholegrain based products, and food industries have substantially increased their efforts in producing cereal based foods reducing the removal of the bran in order to minimize losses of healthy constituents present in the intact grains.

Wholegrain foods may be nutritionally preferable overall because they furnish valuable nutrients and fiber to a balanced diet, however refined grain-based foods generally have a lower phytate content, which can improve mineral bioavailability. As it is well known, in fact, fiber and the associated substances have shown *in vitro* mineral binding; many reports indicated that the inhibition of mineral absorption could depend on the type of fiber used[18, 19]; in addition data confirmed that the mineral availability could be favored with a more balanced diet comprising all the food groups.

6.2. Wheat processing

6.2.1. Overview

After harvest the grains are shipped to the storage center where they are analyzed for the principal qualitative parameters (e.g. moisture, protein and gluten content, test weight etc). After commodity evaluation the grains passes through metal grate into a hopper that is large enough to accommodate a substantial quantity of grain. The metal grate prevents any large object from being introduced into subsequent handling and processing step. Grain is passed through a drum sieves as a part of pre-cleaning system for the removal of any rubble. The clean wheat kernel can be stored or directly used for milling process.

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[18] D. Bosscher, M. Van Caillie-Bertrand, R. Van Cauwenbergha, H. Deelstra, *Availabilities of calcium, iron, and zinc from dairy infant formulas is affected by soluble dietary fibers and modified starch fractions,* Nutrition, 2003, 19, 7, pp. 641-645.

[19] C. Frontela, G. Ros, C. Martínez, *Phytic acid content and "in vitro" iron, calcium and zinc bioavailability in bakery products: The effect of processing,* Journal of Cereal Science, 2011, 54, 1, pp. 173-179.

6.2.2. Milling

The milling process of cereal grains is known to induce compositional and nutritional changes in cereal products. In traditional technological transformation (based on roll mill machine), milling process is considered critical for the nutritional value of cereal flours, because of the unique bioactive compounds present in the outmost kernel layers which are removed. As well known, the objective of the traditional milling system for cereal grains as wheat, is the separation of the endosperm from the various outer layers and the elimination of the germ.

Trichopoulou and coauthors[20] reported nine main components in the definition of Mediterranean diet, among them it was recommended "high consumption of cereals, mainly unrefined cereals and bread"[21]. Pasta and bakery products are the traditional wheat-based products generally obtained from refined grains. Therefore innovative milling technologies have been developed to produce flours richer of the outer layers by ensuring, in the meanwhile, food safety requirements[22]. Nowadays, particular attention is focused on the impact of grain pretreatments and bran fractionation as well as to preprocessing prior to milling as degermination, debranning, histological fractionation; in this last case, different separation methods, such as size-classification, air-classification or electrostatic separation, can be combined to obtain efficient separation of the tissues.

6.2.2.1. Traditional milling process

The prime grinding method was the millstone characterized by a base or bedstone (stationary) and by a turning runner stone which actually does the grinding. The runner stone spins above the stationary bedstone creating the "scissoring" or grinding action of the stones. A runner stone is generally slightly concave, while the bedstone is slightly convex.The synergic action of bedstone and runner stone allows to obtain a whole flour with a different particle size in relation to milling time.

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[20] A. Trichopoulou, P. Lagiou, H. Kuper & D. Trichopoulos, *Cancer and Mediterranean dietary traditions,* Cancer Epidemiology Biomarkers & Prevention, 9(9), 2000, pp. 869-873.

[21] F. Saura-Calixto, J. Perez-Jimenez, I. Goni, *Contribution of cereals to dietary fiber and antioxidant intakes: toward more reliable methodology*, Journal of cereal science, 2009, 50, 2, pp. 291-294.

[22] J.A. Delcour, X. Rouau, C.M. Courtin, K. Poutanen, R. Ranieri, *Technologies for enhanced exploitation of the health-promoting potential of cereals*, Trends in Food Science & Technology, 2012, 25, 2, pp. 78-86.

Modern milling systems are based on different steps:

- the first step is the dampening and tempering which consist of water addition to ensure optimum preparation for the milling process and of the specific resting time that ensure the penetration of water into the bran layers and into the bordering zone between the bran and the endosperm. The water that penetrates below the bran layers into the endosperm creates tension within the kernel which allow a better separation between endosperm and bran;
- the second step is the grinding obtained by a roll mill machine that are characterized by a consecutive cast rolls that are equipped either with flutes or with a frosted surface. The rolls typically operatesat different speeds for creating a scratching effects rather than a pure pressing action. The result is particular important for durum wheat in order to increase the production of higher number of coarse particles (semolina) respect to the fine (flour), differently for common wheat where the fine fraction is the favorite one;
- the third step is the refinement obtained through a plansifter machine which is equipped with sieve stacks, to separate the mixture of ground products from roller mills into fraction of various size[23].

6.2.2.2. Innovative milling system

Innovative milling systems were developed in order to minimize losses of healthy constituents of grains during processing and to produce different type of fine finished whole mill products. Recently, the micronization process, usually applied in the pharmaceutical productions, was introduced as wheat milling process.

The micronizator is characterized by a rotor, that could operate at different peripheral speeds and carry out the function of crush the kernels, and a suction unit that aspirate the fine flour obtained in the rotor. This wheat ultrafine flour pass thought the suction unit and it is recovered, while the coarser fraction is subjected to rotor action until it becomes thin. The micronized products are represented by wholemeal flour presenting smaller (below the micron) particles size suitable for pasta or bread production.

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[23] G. Wolfgang, *Durum wheat milling. Chapter of book Durum Wheat: Chemistry and Technology*, Editors Sissons M.J., Abecassis J., Marchylo B., & Carcea, M.AACC International Press., 2012.

Usually, micronizators are coupled with an air classificator unit that allows to separate fractions in relation to specific tissues weight. In detail, it is possible to classify the different tissues and the relative bioactive or undesirable compounds content just by setting properly this instrument. The obtained fractions could be used to enrich the traditional semolina or flour in order to enhance the nutritional potential of pasta, bread etc. without neglecting the sensorial quality of the products.

6.2.3. Pasta

In Italy pasta is made only of durum wheat semolina, whereas in other countries a mixture of durum and common wheat is used. Pasta making consists of different steps starting from the addition of water to semolina and through mechanical action the dough is formed and modeled into the different pasta shapes (spaghetti, macaroni, etc) and ending with the dry thermal treatment to obtain the final product.

In the first step "semolina hydration" is essential to determine the water/semolina ratio to obtain a dough formation with good rheological characteristics. This ratio depends on semolina composition (protein, starch damage and fiber content) and in general the final moisture of the dough is adjusted to 28-30%. Semolina and water pass through a mixing-kneading process designed to produce homogeneously hydrated dough. After hydration and mixing, the wetted semolina particles enter the extrusion stage where pasta dough development largely occurs. Extrusion involves the operation of suitable designed screw inside a cylinder that transports the pasta dough along the screw, concurrently with increasing compression or pressure to stimulate dough development. Shaping of pasta involves transforming the dough into a specific form (spaghetti, macaroni etc.) along with the development of a continuous network of gluten protein, which surround the starch granules[24]. The drying of pasta consists of passing a current of hot or warm air oven on the fresh pasta products so that the thermo-hygrometric properties of the air progressively decreased product moisture content to a level acceptable for dry pasta storage. Different dry diagrams can be followed in relation to the raw material used and the

[24] C.M. Pollini, F. Panto, A. Nespoli, M. Sisson, J. Abecassis, *Chapter of book Manufacture of pasta products. Chapter of book Durum Wheat: Chemistry and Technology*, Editors Sissons M. J., Abecassis J., Marchylo B., & Carcea, M.AACC International Press., 2012.

industrial needs. Pasta is subject to the sensory judgment that is based on three textural characteristics: firmness, stickiness, and bulkiness. Stickiness is the material adhering to the surface of cooked pasta; bulkiness is the adhesion degree of pasta stands to each other; firmness represents the resistance of cooked pasta to chewing by teeth.

6.2.4. Bread

Common wheat flour is commonly used to prepare bread, however, durum wheat flour has a long history of use for traditional and local breads, especially in Southern Europe and in the near Middle East. The bread history started with the ancient Egyptians, who were known to produce flat breads with nearly every kind of meal. It is likely that leavened, or raised, bread was discovered accidentally when a wheat and water mixture was left in a warm place, causing the naturally occurring yeast to produce a puffed-up dough. It is also possible that a piece of leftover dough was mixed into a new batch, producing the same results [25].

Nowadays, the manufacturing process for bread making consists of different steps starting with the mixing of sifted flour at controlled temperature with water and a pre-measured amount of yeast. The mixing process produces an elastic dough, the characteristics of which are mainly due to gluten, whereas the growth of the yeast, the fermentation, produces gas bubbles, which leaven the dough. After the dough has fermented, it is loaded into a divider with rotating blades that cut the dough into pre-determined weights. A conveyer belt then moves the pieces of dough to a molding machine. The molding machine shapes the dough into balls and drops them onto a layered conveyer belt that is enclosed in a warm, humid cabinet called "prover" where the fermentation continues in the dough along with the gas production and the rise.

After, the fermented dough is cooked in the oven, where the temperature and speed are carefully calculated so that when the loaves emerge from the tunnel, they are completely baked and partially cooled.

Bread is subject to the sensorial judgment that is based on hardness, crispiness and cohesiveness.

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[25] D. Waines, *Cereals, bread and society: An essay on the staff of life in medieval Iraq*, Journal of the Economic and Social History of the Orient, 1987, pp. 255-285.

6.3. Nutritional Profile

As well known, cereals and, in particular, whole cereal products are also good sources of proteins of high biological value, carbohydrates, vitamins and minerals. In fact, consumption of cereal grains is an integral part of the recommended daily diet in many Western countries and the need to promote the consumption of whole grain has been recognized as one of the targets of nutritional education and of health promotion campaigns[26]. In addition the consumption of grain foods has a lower environmental impact on Earth, as reported in the Double Pyramid, developed by the Barilla Center for Food & Nutrition in 2010[27].

Already in 2005, US Dietary Guidelines included the recommendation to consume three or more once equivalents of whole grain products each day (about half of the recommended grain serves). Since 2007, revision of Canada's Food Guide it also recommended a daily consume of at least half of the grain products as whole grain. There has been a recent recommendation for four servings of wholegrain each day in Denmark. Since the specific US Public Health Nutrition Guidelines for wholegrain were introduced in 2005, there has been a 20% increase in wholegrain consumption amongst Americans between the 2005 and 2008. There is, however, no official Italian recommendation that quantifies the amount of wholegrain foods to be included in a healthy diet each day. As matter of fact, INRAN (now CREA-NUT) Nutritional Guide recommends to eat whole grain whenever it is possible. Finally, "Wholegrains Council" states "that a portion of food-based grains is such if it contains at least 16 grams of whole grain or whole grain flours"[28]. Recent researches have shown that the benefits of wholegrain are not simply associated with the high fiber content, but can be also related to the presence of other biologically active compounds and to synergistic effects between fiber and various micronutrients. Epidemiological studies in the US and Europe consistently report that consumption of wholegrain foods reduces overall disease

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[26] L.H. Kushi, K.A. Meyer and D.R. Jacobs, *Cereals, legumes, and chronic disease risk reduction: evidence from epidemiologic studies*, The American journal of clinical nutrition, 1999, 70, 3, pp. 451s-458s.

[27] L. Ruini, R. Ciati, C.A. Pratesi, L. Principato, M. Marino & S. Pignatelli, *Diete sostenibili: la doppia piramide del Barilla Center for Food and Nutrition*, 2010.

[28] P. Williams, *The Grains & Legumes Health Report*, http://www.healthgrain.org, 2010.

risk[29]. For example, the ARIC study in the US, which followed more than 15,000 individuals for 11 years, found that those consuming the highest amount of wholegrain (three serves a day) had a 23% reduction in mortality compared to those consuming an average of 0.1 serves a day[30]. According to the University of Wollongong's National Centre for Excellence in Functional Foods, eating 1-2 serves of wholegrain foods / day provides comparable disease risk reduction (in the order of 20-30% of total mortality, cardiovascular disease, diabetes, stroke and some cancers) to that observed for 5-6 serves of fruit and vegetables.

6.3.1. Proteins

Proteins are one of the macronutrients of cereal products, in particular, these represent about 12-14% of pasta dry weight and about 10% in bread. The principal proteins are albumins, globulins, prolamins and glutelins and they play a principal role in the determination of the nutritional and technological properties of wheat based foods[31]. However, even when protein adequacy is not a concern, wheat alone will not provide all the essential amino acids in the amount needed for proper growth and maintenance of good health. The amino acid profile of wheat reveals a most important deficient of lysine. Recently, to overcome this deficit the durum wheat flours are fortified[32].

6.3.2. Carbohydrates

Carbohydrates are an ideal source of energy for the body, because they can be converted more readily into glucose, the form of sugar that is transported and used by the body. There are two types of carbohydrates:

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[29] D. Jacobs, F.L. Anderson and R. Blomhoff, *Whole grain consumption is associated with a reduced risk of non cardiovascular, non cancer death attributed to inflammatory disease in the Iowa Women's Health Study*, American Journal of Clinical Nutrition, 2007, 85, pp. 1606-1614.

[30] P. Williams, *The Grains & Legumes Health Report,* op. cit.

[31] C. Grant, F. Cubadda, M. Carcea, N.E. Pogna, L. Gazza, *Vitamins, Minerals and Nutrient Value of Durum Wheat. Chapter of book Manufacture of pasta products. Chapter of book Durum Wheat: Chemistry and Technology*, Editors Sissons, M. J., Abecassis, J., Marchylo, B., & Carcea, M.AACC International Press., 2012.

[32] J.A. Wood, *Texture, processing and organoleptic properties of chickpea-fortified spaghetti with insights to the underlying mechanisms of traditional durum pasta quality*, Journal of Cereal Science, 49(1), 2009, pp. 128-133.

simple and complex. Simple carbohydrates are also known as sugars and are found in fruit and vegetables, whereas complex carbohydrates are often referred to as starch or starchy foods. The starch comprises two polymers of D-glucose, amylose that represent about 25% of granules and amylopectin that provides the partial crystallinity of starch, whereas amylose is completely amorphous. Total starch normally accounts for 65-75% of the dry weight of pasta or bread and only a part is present as indigestible form (resistant starch).

6.3.3. Lipids

Lipids is a source of essential fatty acids and they provide the mechanism for the absorption of fat soluble vitamins (Vitamins A, D, E, K). Fat is also a concentrated energy source, 1 gram of fat providing 37 kJ energy or 9 calories, which is over twice the amount of energy provided by carbohydrates or proteins. Wheat products (pasta and bread) usually are low in fat (1.5-2%), characterized by high amount of unsaturated fatty acids, which are able to lower elevated blood cholesterol levels, a risk factor in heart diseases. Among lipids, phytosterols and sphingolipids play an important role to reduce blood cholesterol amount and to control tumor outbreaks and in the maintenance of normal epithelia, respectively[33].

6.3.4. Bioactive compounds

More recent evidences also indicate that cereal whole grains contain high quantities of phytochemicals which may significantly contribute to the reported health benefits of whole grain consumption[34]. These compounds include: fiber, vitamins, minerals, polyphenols and carotenoids. Recent studies have identified many differences in the metabolic profiles of rats fed with whole or refined wheat grain. However, the components in wholegrain that are responsible for these effects on

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[33] A.B. Awad, H. Williams & C.S. Fink, *Effect of phytosterols on cholesterol metabolism and MAP kinase in MDA-MB-231 human breast cancer cells*, The Journal of nutritional biochemistry, 14(2), 2003, pp. 111-119.

[34] J.L. Ward, K. Poutanen, K. Gebruers, V. Piironen, A.M. Lampi, L. Nyström, A.A.M. Andersson, P. Åman, D. Boros, M. Rakszegi, Z. Bedő and P.R. Shewry, *The HEALTHGRAIN Cereal Diversity Screen: Concept, Results, and Prospects,* Journal agricultural and food chemistry, 2008, 56, pp. 9699-9709.

the protection of health and homeostasis and their mechanism(s) of action are still not fully understood. In fact, it is probable that several factors are involved and act additively or synergistically to achieve the favorable and advantageous effects[35].

6.3.4.1. Fiber

Fiber comprises mainly complex carbohydrates which are resistant to digestion and absorption in the small intestine although some of them could be, at least partly, used as substrates for micro-organisms in the large intestine[36, 37].

Belonging to the group of fibers are: arabinoxylans, glucans, resistant starch, cellulose, lignans, pectins, glucomannans, lignins, galactomannans, insoluble pentosans, hemicellulose, soluble pentosans, oligosaccharides, inulin, fructoligosaccharides. In relation to different water solubility and capacity to form viscous gels it is possible to classify the fiber in two main groups, i.e. water extractable and un-extractable or soluble and insoluble fiber to which different physiological effects have been ascribed in human[38]. The systemic and epidemiological impacts of these effects, however, are also associated with the presence of other compounds and not only with fiber [39, 40]. Fiber slows down the passage of food in the upper intestinal tract but increases the rate of transit in the large intestine. The overall transit time is 3 folds reduced with a fiber rich diet respect to low fiber diets. Usually, fibers are fermented and

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35 I. Bjorcka, E. Ostmana, M. Kristensenb, N.M. Ansonc, R.K. Priced, G.R.M.M. Haenenc, R. Havenaare, K.E.B. Knudsenf, A. Fridg, H. Mykkanenh, R.W. Welchd and G. Riccardi. *Cereal grains for nutrition and health benefits: Overview of results from in vitro, animal and human studies in the HEALTHGRAIN project*, Trends in Food Science & Technology, 2012, 25, pp. 87-100.

36 AACC, *Approved Methods of the American Association of Cereal Chemists*, American Association of Cereal Chemists, Saint Paul, MN, USA, 2001.

37 AACC, *Approved Methods of the American Association of Cereal Chemists*, American Association of Cereal Chemists, Saint Paul, MN, USA, 2003.

38 L. Saulnier, P. E. Sado, G. Branlard, G. Charmet, & F. Guillon, *Wheat arabinoxylans: exploiting variation in amount and composition to develop enhanced varieties,* Journal cereal science, 46(3), pp. 261-281.

39 T.S. Manning, G.R.Gibson. *Prebiotics*, Best Practice & Research Clinical Gastroenterology, 2004, 18, pp. 287-298.

40 M.A. Kabel, H.A. Schols, A.G.J. Voragen *Complex xylo-oligosaccharides identified from hydrothermally treated Eucalyptus wood and brewery's spent grain*, Carbohydrate Polymers, 2002, 50(2), pp. 191-200.

the main end products of fermentation are the short-chain fatty acids (SCFAs), butyric, propionic, and acetic acid and the gases, carbon dioxide, hydrogen, and methane[41]. Short-chain fatty acids enhance immune protection by promoting the production of T-helper cells, antibodies, leukocytes and cytokines, stimulate lymph mechanisms and stabilize blood glucose levels through their action on pancreatic insulin release. Whole grain flour contains range from 3 to 12% of fiber as reported by Slavin et al 1999, that are drastically reduced in refined flour and respectively in pasta and bread (about 3-5%).

6.3.4.2. Vitamins

Wheat whole grain flours contain significant amount of vitamins, the content of them being lower in refined flour and consequently in bread and pasta products (about less 50%). However, flour is a source of vitamin B (thiamin about 6.7 mg/kg), vitamin B2 (riboflavin about 1.1 mg/kg), vitamin B3 (niacin about 111 mg/g), vitamin B6(pyridoxine about 4.3 mg/g) vitamin E (tocopherols about 58 mg/kg and tocotrienols) and carotenes (about 8 mg/kg) some of which can act as vitamin A precursor[42]. Different nutritional roles are played by B group vitamins; in fact a correct metabolisms of carbohydrates, fat and protein are associate to these compounds. Several studies evidence an increase of neurodegeneration diseases, cancer, iron absorption reduction when low amount of B vitamins are present in the body.

Vitamin E presents different biological activity such as immune function, DNA repair, membranes stability and various metabolic process reducing cancer insurgence, risk of infections, neurodegeneration and cardiovascular disease.

6.3.4.3. Minerals

Cereal and cereal products are an important sources of trace microelements and represent their largest proportion of dietary intake in many

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41 J.W. Anderson and T.J. Hanna, *Whole grains and protection against coronary heart disease: what are the active components and mechanisms?*, American journal of clinical nutrition, 1999, 70, pp. 307-308.

42 G. Panfili, A. Fratianni & M. Irano, *Normal phase high-performance liquid chromatography method for the determination of tocopherols and tocotrienols in cereals*, Journal of Agricultural and Food Chemistry, 51(14), 2003, pp. 3940-3944.

countries. In fact, significant quantitative of magnesium, manganese, iron, zinc, copper and molybdenum, and a low dose of sodium, are found in whole grain flour[43].

The general function of minerals and trace elements is to be the constituents of skeletal structures such as bones, teeth and soft tissues and play a key role in the maintenance of osmotic pressure, and thus regulate the exchange of water and solutes within the body. In addition, minerals are essential for the transmission of nerve impulses and muscle contraction and play a vital role in the acid-base equilibrium of the body, regulating the pH of the blood and other body fluids. Many enzymes, vitamins, hormones and respiratory pigments, are formed by minerals or as cofactors in metabolism or as catalysts or as enzyme activators.

As previously reported for vitamins, an important reduction of them are observed in refined flour, pasta and bread because part of them are loss during the process.

6.3.4.4. Polyphenols

The phenolic compounds found in wheat grains are various but have the common features of the basically phenols, i.e. molecules containing an aromatic ring: phenolic acids, (such as ferulic acid, sinapic acid, p-coumaric acid, etc.) 5-n-alkylresorcinols, and vitamin E. Phenolic compounds display antioxidant activity by different multi-faceted antioxidant mechanisms. Their free radical scavenging activity is well documented. The biological effects of phenols along with their antioxidant capacity, are the high ability to stabilize biological membranes, antimutagenic, anticancer, antifungal and antibacterial properties; phenols also seem to inhibit the glycerol-3-phosphate dehydrogenase and thus prevent the accumulation of triglycerides in the adipocytes[44].

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[43] D.B.M. Ficco, C. Riefolo, G. Nicastro, V. De Simone, A.M. Di Gesu, R. Beleggia, C. Platani, L. Cattivelli & P. De Vita, *Phytate and mineral elements concentration in a collection of Italian durum wheat cultivars*, Field Crops Research, 111(3), 2009, pp. 235-242.

[44] L.W. Morton, R.A.A. Caccetta, I.B. Puddey & K.D. Croft, *Chemistry and biological effects of dietary phenolic compounds: relevance to cardiovascular disease*, Clinical and Experimental Pharmacology and Physiology, 27(3), 2000, pp. 152-159.

6.3.4.5. Carotenoids

Carotenoids are plant pigments which can vary from red orange to yellow color and are responsible for the different pasta or bread colorations, in particular in durum wheat products. The most commonly found carotenoids of wheat are lutein, zeaxanthin, b-cripthoxanthin, bcarotene and a carotene[45]. They present an important antioxidant activity reacting with free radicals to form less reactive free radical products; furthermore, they have a provitamin A activity. Carotenoid amount ranges from 4 ppm to 9 ppm in durum wheat.

6.3.5. Anti-nutrient and gluten intolerances

Among saponins and lectins, phytic acid are considered the major anti-nutrients found in wheat.

In cereal kernel, phytic acid is found predominantly (about 80% of it) in the bran. The negative effects of phytic acid is the ability to bind some essential minerals such as iron, zinc, calcium and magnesium in the digestive tract and inhibit their absorption by the body.This is significant when it is considered that most of whole grain and high-fiber food products include all the phytic acid, while processed or refined grains have it removed entirely. In addition, also fiber is considered as anti-nutrient because it may act by binding lipids, carbohydrates, minerals etc. reducing the body absorption[46].

Celiac Disease (CD) is an inflammatory disorder with autoimmune features and a primary manifestation in the small intestine. The disease is triggered upon ingestion of wheatgluten or similar proteins found in barley and rye. Gluten is a complex mixture of proteins called prolamins, comprising glutenins and gliadins, which contain a relatively high concentration of glutamine and proline aminoacid residues within their primary structures, settling on several gluten-derived domains with high resistance to degradation by human gastrointestinal proteases[47]. Indeed, none of the major human gastrointestinal proteases, such

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[45] K.K. Adom, M.E. Sorrells, R.H. Liu, *Phytochemical profiles and antioxidantactivity of wheat varieties*, Journal of Agricultural and Food Chemistry 51, 2003, pp. 7825 e 7834.

[46] C. Frontela, G. Ros, C. Martínez, *Phytic acid content and "in vitro" iron, calcium and zinc bioavailability in bakery products: The effect of processing*, op. cit.

[47] L.M. Sollid, *Coeliac disease: dissecting a complex inflammatory disorder. Nature Reviews Immunology*, 2(9), 2002, pp. 647-655.

as pepsin,trypsin, chymotrypsin and brush-border membrane enzymes of the small intestine contain the necessary proteolytic capabilities to effectively cleave certain immunogenic gluten peptides, because of a lack of post-proline cleavage-site specificity[48, 49].

In the past few years, forms of gluten sensitivity other than celiac disease have been gaining the attention of physicians. Some patient-shave reported the appearance of intestinal (bloating, diarrhea) and extra-intestinal (headache, fatigue/irritability, foggy mind) symptoms shortly after the ingestion of gluten in the absence of any serologic celiac disease marker or intestinal mucosaldamage but with a variable presence of antigliadin antibodies (AGA) and the disappearance of such symptoms on a gluten-free diet (GFD). This condition has been defined as nonceliac gluten sensitivity[50]. To date, a strictly gluten-free diet represents the only medical treatment for celiac disease patients. However, compliance to the gluten free diet is difficult and affects the quality of life of patients because, besides economic and social factors, it involves the consumption of poorly palatable andscarce technological-aptitude bakery products. This is the reason why alternative approaches to the GFD are actively sought, which include the search for and the development of new cereals with less amount of prolamins or poor structured gluten with no or low immunogenic content[51, 52]. Extensive research is currently aimed at discovering and breeding wheat cultivars that are potentially tolerated by most celiac patients, while conserving reasonablebaking aptitude. Diploid *Triticum monococcum*, einkorn wheat, species is among the most promising suitable candidates, because of a reduced number of stimulatory epitopesof T-cell

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48 G. Picariello, G. Mamone, C. Nitride, F. Addeo, P. Ferranti, *Integrated platforms to study food-protein digestion and derived functional and active peptides*, Trends in Analytical Chemistry, 52, 2013, pp. 120-134.

49 L. Shan, Ø Molberg, I. Parrot, F. Hausch et al., *Structural basis for gluten intolerance in celiac sprue*, Science, 297, 2002, pp. 2275-2279.

50 C. Bucci, F. Zingone, I. Russo, I. Morra, R. Tortora, N. Pogna, G. Scalia, P. Iovino & C. Ciacci, *Gliadin does not induce mucosal inflammation or basophil activation in patients with nonceliac gluten sensitivity*, Clinical Gastroenterology and Hepatology, 11(10), 2013, pp. 1294-1299.

51 L. Spaenij-Dekking, Y. Kooy-Winkelaar, P. Van Veelen, J.W. Drijfhout et al., *Natural variation in toxicity of wheat: potential for selection of nontoxic varieties for celiac diseasepatients*. Gastroenterology, *129*, 2005, pp. 797-806.

52 I. Comino, M. de Lourdes Moreno, A. Real, A. Rodríguez-Herrera, F. Barro & C. Sousa, *The gluten-free diet: testing alternative cereals tolerated by celiac patients*. Nutrients, 5(10), 2013, pp. 4250-4268.

lines and of the lack of a D-genome encoding the principal immunodominant fragments[53, 54]. Despite of his poor-quality gluten, coupled with a very high protein content, einkorn wheat has turned out to be a very good raw material for the production of high quality pasta and other bakery products.

6.4. New methods for Celiac Disease (CD) diagnosis and diet personalization

Current diagnostic procedure is based on serological tests for detection of anti-tissue transglutaminase (anti-tTG) and anti-endomysial (anti-EmA) antibodies and afterwards the histological examination of at least one biopsy. Recent studies have demonstrated that the identification of antibodies to deamidated gliadin peptides (gliadin is the alcohol soluble fraction of gluten) can be applied, as novel biomarkers, for the diagnosis of CD and for monitoring the adherence of CD patients to a gluten-free diet (GFD). The detection of these biomarkers showed significantly higher specificity and reproducibility than the anti-tTG and anti-EmA, respectively, therefore their recognition has becoming fundamental for CD patients. Detection of these antibodies is usually performed by enzyme-linked immunosorbent assay (ELISA)-based screening tests, which require bulky and expensive equipment, therefore can be performed only at special laboratory facilities. Electrochemical immunosensors and tapered optical fiber biosensor devices have been developed for the detection of both anti-gliadin and anti-tTG antibodies, as a valuable alternative to classical ELISA tests. However, there are no reports that describe devices for the simultaneous detection of multiple antibodies against deamidated gliadin peptides (GPs).

The advent of miniaturized array technology has enabled parallel and multiple comparative measurements of different samples combining high sensitivity, low sample consumption, high-throughput and rapidity of the analysis.

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[53] O. Vincentini, F. Maialetti, L. Gazza, M. Silano et al., *Environmental factors of celiac disease: cytotoxicity of hulledwheat species Triticum monococcum, T. turgidum ssp. Dicoccum and T. aestivum ssp. spelta*, J. Gastroenterol, Hepatol, 22, 2007, pp. 1816-1822.

[54] C. Gianfrani, M. Maglio, V. Rotondi Aufiero, A. Camarca et al., *Immunogenicity of monococcum wheat in celiac patients*, American journal of clinical nutrition, 96, 2012, pp. 1339-1345.

Sapienza University researchers[55, 56] developed an ELISA-on-chip device for the simultaneous detection of multiple CD antibodies against GPs. In this system, recognition, detection and read out elements are all performed in a single glass substrate without external, bulky and expensive equipment. This aim has been achieved by combining and optimizing surface chemistry with microelectronic processes on the two opposite sides of a glass substrate.

By this kind of device, it will be possible obtain not only a diagnosis but also a real profile of the response of single patient to different cereal products and so quantitative data for personalized diet.

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[55] D. Caputo, G. de Cesare, R. Scipinotti, N. Stasio, F. Costantini, C. Manetti, A. Nascetti, *On-Chip Diagnosis of Celiac Disease by an Amorphous Silicon Chemiluminescence Detector*, Sensors and Microsystems, (268), 2013, pp. 183-187.

[56] F. Costantini, A. Nascetti, R. Scipinotti, F. Domenici, S. Sennato, L. Gazza, F. Bordi, N. Pogna, C. Manetti, D. Caputo, G. de Cesare, *On-chip detection of multiple serum antibodies against epitopes of celiac disease by an array of amorphous silicon sensors*, RSC Advances, (4), 2014, pp. 2073-2080.

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Cesare Manetti, Professor of *Physical Chemistry*, President of Agrobiotechnology and Food Science & Technology Courses at Sapienza University of Rome.

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