1 The rise of a food market in European history

Carmen Sarasúa, Universitat Autónoma de Barcelona
Peter Scholliers, Free University of Brussels (VUB)

The history of contemporary Europe is the history of the effort of European peasants and farmers to produce enough food for themselves, and to provide the market. It is the history of technicians, scientists, and individual inventors who, together with the peasants, developed new tools, machines, seeds and breeds in order to produce more wheat and more meat, and to produce a better quality and taste. It is also the history of governments to put an end to starvation crises which fuelled the masses' opposition to the *Ancient Régime* across Europe in the second half of the 18th century, and to guarantee lower prices for food, so that workers could subsist with very poor wages.

Since the 18th century, the ever-growing European populations accounted for an increasing demand for food. Furthermore, an increasing percentage of this population was urban, dependent upon food markets, and of which the middle and higher classes, given their higher incomes and social aspirations, aimed at an increasingly diversified diet. To what extent did these massive changes in the *demand* for food transform its *supply*, i.e., agricultural productivity, techniques, and total output? They did transform it in the first place because of the central importance of agriculture in 18th-century economic thought and policies. Growing agricultural output meant the increase of the nation's wealth, to 'perpetuate wealth in the form of corn, drink, wood, livestock, raw materials for manufactured goods', as Quesnay wrote in his 1764 *Tableau Économique* (1972: i). The strategic importance of agricultural development for European governments explains the central role of agricultural *policies* and *institutions* that have regulated European agriculture in the last three centuries, developing a new revolutionary framework of property rights, and investing public money in water and transport infrastructures. The *political* importance of food was also apparent in the central role of agricultural price policies within economic policy. In the 18th and 19th centuries, when food shortages were common, European governments intervened to guarantee the supply of food at low prices for consumers and, at the same time, the profits of farmers (with protectionist policies). In the second half of the 20th century, with overproduction and increasing pressure from non-European producers, public intervention (EU agricultural policies) has consisted of subsidising agricultural prices in order to maintain farmers' profits.

To a large extent, the fact that European governments shifted from keeping low food prices to subsidising agricultural prices, reflects the success of the impressive ensemble of technological innovations known as the *agricultural revolution*. The pressures from the demand not only stimulated the rapid diffusion of new machines and tools, but what was more important, also the expansion of an international market for food. This in turn was possible because of the major transformation of the transatlantic transport system, achieved thanks to technological innovations such as steam power applied to ships, which allowed for a much cheaper and regular connection between the American highly productive fields and the European markets. The transport revolution meant cheaper food and an increasingly integrated international food market, for wheat in the first place, which was a powerful incentive to further adoption of technological innovations

by European farmers (a process, nevertheless, delayed or ignored thanks to the protectionist reaction of European agriculture).

In this sequence, changes in the demand for food appear as the origin of the transformation of European agricultural production, and particularly of the central role that technological innovations had in the increase of agricultural productivity. But this new, competitive, and capital-intensive agriculture had in turn major impacts on the demand for food, that is, on the Europeans' diet: cheaper and better food, with a more diversified diet, was possible for more people now, particularly in the 20th century. Thus, the impact of technological innovations on relative prices was a key factor of this transformation, with strong consequences on consumption and on the social redistribution of income.

To account for this story, this volume brings together three different research traditions: the historiography of agriculture, that of food, and that of retailing, and connects them to the history of technology. Although these fields have undergone distinct developments during the last decade, we strongly believe in their integration when it comes to the explanation of the history of food. Land tenure, soil characteristics, labour organisation, and climate or technical innovations affect directly the type, quality, significance, and quantity of the food. In turn, through consumers' preferences, snob effects, retailers' sales methods, and marketing, the retailers and the consumers have always influenced production. The history of food is, in fact, a perfect example of how the stories of production and consumption must be told together in order to explain the economic growth of the last three centuries. How the complex relationship between food production, distribution, and consumption did operate, and to what views and outcomes this has led and will lead, is a central concern of this volume.

I. The role of technology in the food chain

Such integral approach is common among food sociologists and food geographers. Particularly the notion of 'chains of provision' or 'food systems' has been applied (Fine and Leopold, 1991; Atkins and Bowler, 2001). So far, historians have hardly considered chains of food provision. One but crucial exception, though: Dutch historians have adapted the 'chain of food products' that includes primary production (agriculture), secondary production (agribusiness), distribution (transport, packaging, wholesale and retail), food preparing (shopping, cooking and serving), actual consumption (eating, conviviality, identification), and waste disposal. Each phase is mirrored by a temporal-spatial step, namely the farm, the factory, the market, the kitchen, the table and the garbage can (Van Otterloo, 2000; see also her chapter in this volume). Such approach has great merits with regard to the 20th century, when the so-called middle field is gaining weight (lobby organisations, marketing, household and cooking schools, food regulation by the state, medical counsellors et cetera). However, historians have directed their attention primarily to this middle field, and they neglected the whole chain of production, consumption and their relations.

True, historians have not waited for theoretical insights to develop some kind of integrated view. We may refer, for example, to the large literature on past hunger crises, where attention is paid to crop failure, price increases, failing wholesale and retail trade, private and public relief initiatives, nutritional information and cooking advice, shrivelling calorie intake, rising social inequality, emigration, and sharply growing mortality

(Rotberg and Rabb, 1985). There are of course other examples that advocate a direct link between food production, retailing and consumption (a connection that is not new in economics, that has traditionally analysed markets' supply and demand). But despite this strive for 'integral' consumption history, historians of agriculture, those of food retailing and food consumption seem to live in separate worlds with own journals, conferences, celebrities and bibliographical references. This is linked to different traditions and epistemological developments. Most agricultural historians have a background of economic history, devoting themselves to the study of employment, yield ratios, productivity and output, price developments, market structure, land tenure, technological innovation, labour and wages. Food historians have a very similar background when they study consumed quantities, price developments, institutions' diets, household spending on food, business histories, safety regulations and technological innovations. The 'culturalisation' of historiography, however, has taken many food historians away from the economics toward matters of taste, preference, sociability, representation, gender, identity, classifications, and other issues that became popular in the 1990s (Flandrin, 1999). Historians of retailing have largely followed the same path as food historians. Often, they started with the study of a big corporation (Wilson, 1970), or a spectacular innovation such as the department store (Miller, 1981). The cultural turn is presently shifting the attention to the significance and perception of shopping, fashion, gender, and especially to modernity. So, although the three approaches do have common grounds, they develop largely within own traditions and questions.

It takes a very broad outlook to tie together the land, the kitchen, the supermarket, medical counselling, agribusiness, the table, health concerns, and taste. Technology may be saluted as a common ground that brings together the *time-spaces* of the food chain. We use a functional definition of technology here, as 'the sum of the methods by which a social group provides themselves with the material objects of their civilization' (Long and Post, 2003: viii). Historians of technology have described a multistage process, from invention to information, diffusion, and final adoption, with many factors intervening in it: educational and credit institutions, firms, groups of interest et cetera. Choices made among competing techniques should be taken into account, as well as stories of failure and success.

Technology has been and is very present in the study of production, distribution and consumption of food. Agricultural historians have written extensively on innovations in work organisation, crop rotation, tools, fertilisation, machines, new seeds and breeds, in relation particularly to increasing productivity and output (van Zanden, 1991). Food and retailing historiography has focused on technological innovations transforming manufacturing and introduction of new produces, conservation, packaging, health, food distrust, and grocers' rationalisation and reorganisation (den Hartog, 1995). A definition of technology as inducing economic superiority (that can be traced back to Adam Smith and his description of a technologically superior capitalist division of labour) has been uncontested in economic and agricultural history for a long time. In this vision, technological superiority is defined as the method that costs less, with labour-saving technologies (with their massive implications on work organisation) as best indicators of economic efficiency. But technological innovations depend as much on economic and social institutions (that are in control of agricultural production).

We think that one of the major contributions of this volume is to show the strength of the critical approaches to the technological box used in the last decades in Western

agriculture and food industry. Interestingly, these criticisms do not stem from academic circles, but from consumers themselves. The critical reception (or direct refusal) of certain agriculture and food technologies shows the very active role of consumers in shaping and modelling technological production (Oldenziel et al, 2005). In fact, although not a new development, agriculture and food have become more of a battlefield in recent years, with heavy economic but also political interests at stake. And the fact that social scientists are being increasingly critical with the technological models adopted after World War II is only a reflection of consumers' growing discontent and a practical evidence that, in any given market, production cannot be understood without a deep comprehension of how consumption works.

II. Risk society, McDonaldization and other concerns about our food

The historical study of technology in relation to the food chain contributes to important, past and present-day societal issues. Two of them, food scares and hyper-rationalisation, have gained large attention in recent years and ought to be put in historical context.

Food scares form part of the recent concept of a society of risks, with fears, doubts, mistrust and uncertainties, which may be linked to neo-liberal, post-industrial developments (Beck, 1992). The role of technology is double, here. On the one hand, technology offers possibilities to control the whole chain of food provisioning more than ever, and to reassure consumers by boosting feelings of trust and security. Technological advancements have allowed the improvement of such control in the course of time. But on the other hand, the same technological innovations which have been the basis of the productivistic model of agricultural growth dominant in the 20th century have had side effects on the world's natural resources and supply of raw materials. Genetic manipulation of plants and animals has contributed highly to the already important distrust of food among an increasing number of people. They (we!) have clear feelings of *food alienation*, which may lead to a loss of identity, tormented social relations, growing anxiety and augmenting tensions, and to the search for food authenticity and food safety (Fischler, 2001). In this process, governments are expected to intervene, and this since far-remote times (Bruegel and Stanziani, 2004). Surely, a society of risk is of all times, and the relation between technology and food insecurity should thus be investigated in a long-term perspective.

Feelings of *food alienation* and food dangers lead to the second important phenomenon that links up with the first one: the so-called McDonaldization of social life, which is considered by sociologists as one of the three trends that affect present-day food consumption (together with social differentiation and self-rationalisation) (Germov and Williams, 1999, 6–8). At the *production* level, McDonaldization is a model of enduring rationalisation (Ritzer, 1996), fordism applied to the preparation of food. It refers to the ensemble of techniques that have transformed the food sector, seeking lower costs: most prominently the 'assembling line', but also standardisation of the product, exchangeability of components, and dequalification of the 'cooks', workers reduced to the repetition of a pre-fixed and limited number of movements. McDonaldization has transformed as well the *consumption* of food, implying a totally uniformed offer all over the world: same product, same taste, same process of preparation, same presentation.

Again, technology has played a central role with a double effect. The massive success of a globalised model of fast-food eating-places has been possible thanks to technical

innovations such as frozen foods, diffusion of standard types (in many cases genetically modified) of seeds and breeds (the same meat everywhere), industrial products such as ketchup or mayonnaise based on colouring and preserver chemical products, and transport and marketing innovations such as airlifting, packaging (take-away boxes) and retailing techniques. In this sense, technological developments appear as making possible new business opportunities and low cost food.

But on the other hand, McDonaldization involves invariable taste, form and quality of the food, atomisation of meal patterns, disruption of 'traditional' social life, ever-increasing distance between producer and consumer, et cetera. It replaces local products, tastes and traditional ways of preparing and consuming food. It ignores culinary culture of both cooks and eaters. The uniformed fast-food system has, thus, consequences that are undesirable for part of the population. The social and political struggle against these effects (and against the very technologies that have made this food system possible, like the demand for fresh, locally grown vs. frozen, imported foods, shows) has taken the form of a defence of 'traditional' or 'authentic' food. This reaction must not only be seen within the broader context of a defence (headed by France) of European food as an essential part of European culture, but also of European firms and markets. In making choices about their food, the new conscious consumers are also acting as protectionist barriers to the EU market as much as tariffs used to do. When José Bové and his farmer colleagues boycott a fast-food store, they are doing much more than advocating the return to the 'traditional' cheese, bread and wine diet.

III. Asking questions, seeking *integral* answers

The present volume is based on a workshop organised in Barcelona, March 2003, as part of the European Science Foundation funded project 'Tensions of Europe: Technology and the Making of 20th century Europe'.[1] Our main question to the participants was about the economic, social and cultural role of technology in the food chain, with special interest in tensions that came along with the technology. With *tensions* we meant, for example, the confrontation of different food models (fast food vs. 'slow' food), the distrust with regard to the massive use of chemical fertilisers, the struggle between producers and big retailers about the control over the food chain, or the debate with regard to the role of the state. We proposed to focus on six themes that fit into the broader theoretical concern of the ToE-project (i.e. linking and de-linking of infrastructures, circulation of knowledge, and circulation of artefacts):

1. Models of agricultural technological innovations: the ecological restriction
2. The technical formation of the agricultural labour force
3. The role of EC policies in technological innovations in agriculture
4. Industrial catering, fast food and their rejection
5. Hygiene and technological innovations in food preservation
6. Modern forms of food retailing

[1] We would like to thank all the people and institutions that supported the organisation of the colloquium (particularly Johan Schot and Ruth Oldenziel from the *Tensions of Europe-project*, ToE), and the Universitat Autónoma de Barcelona for hosting our meeting. More on the ToE-project may be found at http://www.histech.nl/tensions.

The workshop brought together historians, sociologists, natural scientists, economists, geographers and engineers. This mix turned out to be extremely fruitful. We wished to create for each chapter a close connection between the historiography of food production, food distribution and food consumption around the question of technology. It is far from evident to assemble experts on chemical fertilisers and experts on identity construction through food, or to convince them to consider the whole food system. Yet, we believe that we generally succeeded in doing so: thus, agricultural historians and economists considered the consumers' reactions and resistance, while food historians linked the consumers' hopes and practices to changes in production. We consider this 'integration' of different traditions to be an important contribution to the interpretation of the development of food systems. The volume includes case studies from most of Europe, overcoming the restrictive Anglo-Saxon monopoly of the food system literature (Germany, France, Great Britain, The Netherlands, and Switzerland, but also Spain and Greece).

A *first* outcome of the workshop was the electronic publication of six annotated bibliographies dealing with technology and dairy products (Barbara Orland), fertilisers, and in particular nitrogen (Vaclav Smil), industrial catering (Ulrike Thoms), environment and biological innovations (Josep Pujol), retailing (Isabelle Lescent-Giles), and agricultural education (Leen Van Molle).[2] A *second* outcome is the publication of the present volume.

IV. The long-term perspective: which technology, how much food?

It seems useful to put the chain of food provisioning in a broader historical perspective. For our purpose, this may start in the 18th century. In pre-industrial Europe, the large majority of Europeans ate what the fields produced around them. Their food system and diet depended to a large extent upon the natural conditions of the land, soil, rain and work, that is upon a physical environment little shaped yet by the hands of women and men. European landscapes were modified *and* transformed, as Sereni (1974) proved when he described the Tuscan territory. Mountains were broken into terraces and cultivated, irrigation systems were developed, and by the 18th century new non-European crops had been adopted. But with the exception of the wealthy people who could afford non-local foods, the population had a diet mostly based upon local production. Yet, the concept of *local* food was always changing. In Spain, American plants such as potatoes, tomatoes or corn were incorporated since the beginning of the 18th century, and by the mid-19th they were regarded as local crops. On the other hand, soil and climate conditions never allowed for the adoption of plants such as coffee, cocoa and spices, which kept being imported and regarded as exotic (in the sense of non-European, not of expensive) food until today (with the exception of sugar cane in parts of Andalucía and bananas in the Canary Islands).

If food consumption was a basic way of class differentiation, the central role of religion in shaping food demand should be remembered as well (for example, the expansion of pork meat as a statement on the condition of the non-Jew consumer). Massive consumption of fish (and an array of techniques to cure, salt, smoke, preserve, or keep it fresh) in

[2] http://www.histechnl/tensions/defaultOud.html (theme "Agriculture and Food", see "Publications", and then "Annotated Bibliographies").

Spain (today the second largest world consumer of fish, only after Japan) was also rooted in the fasting practices of Catholicism (Sarasúa, 2001).

The 18th-century agricultural revolution meant the development of capital-intensive agricultural techniques, which had rising yields as a consequence. Not only new tools and machines emerged, but also new organisational methods, property rights, practices, and ideas about the land. The incentive to develop, finance and adopt all these novelties, was the increasing population with a growing number of mouths to be fed, but also rising urban incomes. Middle classes and the rise of, what has been called, a consumer society, meant more abundantly supplied urban food markets, more money devoted to food (in absolute terms), and a more diversified diet.

This increasing demand for food put new pressure on agricultural production: even if external markets were increasingly able to supply European demand, local farmers wanted of course take advantage and make a profit of it. And so they responded to the rising demand for food. The farmers' strategy was increasing investments, capitalisation, adoption of new techniques, diversification of output, and increasing productivity. After two centuries of capitalist agriculture, as new techniques have developed (agricultural, but also transportation, refrigeration, storage, and transformation techniques), the relation between agriculture (production) and food (consumption) has completely changed. Technology has allowed agriculture to overcome physical restrictions, and thus now we can eat what it pleases us at any moment: cheap tomatoes and strawberries arrive to Central and Northern Europe every day around the year.

In the last decades, new functions of food (for example, food as a medicine) and changes in taste (Gavrilova in this volume) are replacing the plain, traditional ones (to merely satisfy a physical need, to perform a ritual as part of being a member of a social group). Thus, the ways we eat, as well as the very nature of our food, are changing. As a result of this deeply changing diet, the demand for food is changing too. And given the increasing international competition, this new demand is deeply conditioning agricultural practices and productive systems (non-refined bread and sugar, replacement of red by white meats, transformation of the greases market, et cetera). Of course, technological change in agriculture, entailing new uses and meanings of food, did not start in the 18th century, but it may be argued that changes then were that huge that the whole process became irreversible. Capital intensive technologies seem to have liberated agricultural production from physical restrictions. Agriculture *can* produce increasing amounts of any product at any time.

V. (Agricultural) policies, (ecological) costs, and (food) antagonisms

Which role did policies have? As we mentioned above, agricultural production has had a strategic importance for European governments and institutions since the 18th century. It has been the goal of (particularly EU) agricultural policies after World War II to increase productivity by achieving economies of scale (by favouring large-scale production and concentration) and capitalisation. By the 1980s, however, decades of heavy subsidies had led to a number of serious problems in the EU, such as overproduction, increasing need for tariff protection – and subsequently problems with agricultural producers in the so-called Third World –, increasing regional disparities, heavy reduction in the number of farms and agricultural jobs, and growing political discontent for sub-

sidies to the agricultural sector (which amounted to half the total EU expenditure). In an attempt to favour more productive units, subsidies have benefited more medium and large-scale units, and more developed regions. As a result, the costly and decades-long subsidies to the agricultural sector have actually *increased* economic differentiation among farmers and agricultural regions, and are being helpless in fighting the disappearance of agricultural activity.

These problems led to the 1992 reform of the EU agricultural policy, analysed in the chapters by Mattas and Loizou, and by Redclift and Goodman. The 1992 reform fostered a new model of 'rural development' to replace the old model of 'agricultural growth', a model that has been 'marketed' and presented to the public opinion as the solution to another problem not yet mentioned here: the damaged environment.

Focusing on the environmental problem, some of the chapters in the book put the question: at what cost? Very often, we understand costs in a very short-term way. A vision of long-term costs and externalities allows us to take into account the very high costs of producing while ignoring physical restrictions. In fact, failure or success in the adoption of a given technique also depends upon physical restrictions, as chapters by Pujol, Garrabou, and Navarro, López-Gálvez and Salazar show.

This is a crucial matter. To what extent recent changes in diet and food consumption are really induced and determined by the consumer? What has been the role of corporations in shaping the demand for food? We know that by using a given technological toolbox, food firms make choices that condition to a large extent agricultural production. Thoms shows in her chapter how the supply of potatoes was heavily conditioned by the technological choices made by canteens and other mass consumers. Furthermore, the rapidity with which agricultural producers are adapting themselves to these new developments (organically-grown agricultural production, et cetera) is explained by the fact that, in a context of increasing competition and 'open' markets, European producers are not competitive via prices. Ecologically produced, traceable, safe and controlled food is more expensive than food imports, and thus it is becoming the best possible strategy to compete in the EU market. Like in the case of the return to local food, the ever growing demand for quality and health controls has replaced (or better, reinforces) tariffs as 'protective' mechanisms.

The reaction against the type of standard mass-production that industrial food production entails, is another consequence of increasingly industrialised international food markets. This reaction, that may be labelled as 'slow food' in Van Otterloo's perspective, is taking two forms. One is the re-valuation of the 'traditional' way of producing food (i.e., non-industrial, home made food). This includes the opening of artisan-like shops to make cider, butter or jams 'the old way' (the use of pre-industrial technologies, including the restoration of old machines, tools and devices is an important mark), or the running of farms where hens are raised in open fields (vs. the chain-like industrial production). How food was produced 'traditionally' becomes the subject of a new narrative, as well as the target of food policies trying to preserve these 'traditions'. As Orland points out in her chapter, 'Discourses on *old* and *new* (...) can be read as a communication strategy which attempts to fill the gap between constant change in an industrialising world and the assumed character of unchanging and invariant peasants traditions'.

The second form of this reaction is the definition of locally produced food as quality food. This is entailing the return to old ('local') breeds and seeds, the development of narratives about the 'regional' or 'local' ways of cultivating the soil and breeding ani-

mals (in France, *le terroir*), as well as the reshaping of the industrial chains of distribution and marketing, well described in the chapter by Lescent-Gilles. *Authenticity* is the key word. 'Farmers markets', where farmers sell directly their production to the consumer, belong to this trend, which implies the return to seasonality and the rejection of exotic food. Finally, it seems obvious that one of the functions of these behaviours is to satisfy the need of wealthy consumers to distance themselves from mass consumers. Those who can pay more want to buy different products, and this is the new way to do it.

The 'national' definition of technologies has also much to do with the uneven results of their adoption. Every technology is inextricably linked with the place from which it has developed, and this is much truer for agricultural technologies, which aims at modifying the conditions of the soil, and the reproduction of plants and animals. The 19th-century agricultural technology developed mainly in England, the Netherlands, and Central Europe, and was rapidly marketed (in the form of new tools, machines, breeds or seeds) as the recipe for increasing yields. One century later, the results of the a-critical adoption of these new techniques are devastating in regions whose physical conditions differ greatly from the regions where these techniques were originally developed. Chapters by Navarro, López-Gálvez and Salazar on the one hand and Pujol on the other, show that the adoption of agricultural technologies developed in Northern European countries had a very negative impact on Mediterranean agriculture, where water scarcity and soil poverty demand a completely different technological set.

The questioning of intensive agricultural methods, high returns, high productivity, and industrialised technologies that have characterised the last two centuries, is taking different forms by Garrabou and Smil. The first is in favour of including the hidden costs of environmental destruction in the final balance of these productivistic models. Does it make sense to keep spending on technologies that have such a destructive impact on the environment? Should we abandon the tendency to ever increasing production? If Garrabou proposes to produce less (the abandon of intensive productive technologies), Smil proposes to eat less as the best way to lower the unnecessarily high demand for (and the waste of) food, and thus the non-sustainable pressure on the environment. In other words, to critically analyse consumers' habits and the political creation of *needs*.

VI. A further survey of the chapters...

It seems worthwhile to present very briefly each chapter separately, although some questions have already been raised. Each chapter shows very distinct points of interest, a specific approach or a particular conclusion, which will allow the emphasising of more questions.

Ramon Garrabou's "Conflict and environmental tension in the adoption of technological innovation in the agrarian sector" presents an overview of Europe's agricultural performance since 1800. He reminds of the rapid increase of agricultural productivity since the end of the 19th century, fuelled by technological change, stressing the different development between the Atlantic and the Mediterranean regions, and the growing tension caused by the ever-growing use of non-organic modes of agriculture. In terms of damage to the environment, Garrabou's view is quite pessimistic. He pleads to include fully the environment in the (historical) analysis of agricultural development, and to devote full attention to health, pollution, and destruction of traditional modes of

production. Vaclav Smil ("Nitrogen in modern European agriculture") picks up arguments developed by Garrabou, to fiercely denounce the ever-growing use of chemical fertilisers, particularly nitrogen that has great difficulties to get totally absorbed. He points at two far-reaching consequences: Europe's changing diet following the American model (particularly, the much too high caloric intake of the average European), and the environmental impact (on soil, water, air, wild life). Smil very explicitly connects agriculture to food, when suggesting that a possible solution for the high nitrogen use would include consumers who eat less, balancing our consumption of food with our real physical needs of food, and avoiding waste and excessive consumption. Such change would require social engineering.

In "Modernisation and the international food system: re-articulation and resistance?", Michael Redclift and David Goodman place agricultural technological development in the broader context of the transformations of agri-food systems in 20th-century Western Europe and the region's insertion in global commodity markets. The chapter starts from the transition to capital intensive agriculture in late 19th century, then it discusses European agricultural policies since 1945 (fixing prices, absorbing surpluses...), and the problems related to this capital intensive model, such as 'food scares', to arrive to Common Agricultural Policy reform ('a massive decoupling of farm support from production'), and the new paradigm of an alternative agriculture, including new uses of land. This change, they argue, involves consumers' more active (political) role. They introduce a new project of social engineering, the so-called *repeasantization* (a renewed central role for farmers) and the *quality turn* in agriculture and food, with increasing importance of alternative agro-food networks.

In "Environment conditions and biological innovations in European agrarian growth", Josep Pujol develops the striking differences between the Atlantic and the Mediterranean regions, stressing the divergent relative cost on the one hand, and environmental conditions on the other since about 1820. He emphasises the way in which technological innovations have been introduced in relation to the environment in both regions. These were developed in northern Europe under particular environmental conditions, and so their adoption in the South has led to unexpected negative consequences (too intensive use of scarce resources). María del Carmen Navarro, José López-Gálvez and José Salazar develop this North – South tension further by concentrating on the adoption of the greenhouse agricultural technology in Southern Spain ("Recent innovations in the horticultural production system in the Southeast of Spain"). Surely, productivity rose manifold, but at the cost of high technological investments and massive environmental damage (in terms of resources, water and soil pollution, and irreversible harm due to irrigation techniques). They stress the urgent need for environmentally aware agricultural policies to reverse this trend.

Leen Van Molle's "*Kulturkampf* in the countryside. Agricultural education, 1800–1940: a multifaceted offensive" describes the evolution of agricultural education and the spread of technological know-how in Central Europe. In most countries the outcome of agricultural education was paradoxical: on the one hand, a strong discourse on *authentic* rural values emerged around the notion of the *Heimat* (homeland), while on the other a market-oriented, modern and scientifically based mode of production was promoted. What made this paradox possible was the 'hidden agenda' of agricultural technical education: not only improving the methods of production, but also maintaining and reinforcing class and gender differences. Education was used as a political instru-

ment, and the transfer of technical knowledge was not neutral but aimed to maintaining the social, political and religious status quo.

In their chapter on "The role of EU policies in technological innovation in agriculture", Konstandinos Mattas and Efstratios Loizou identify six broad categories of technological innovation in agriculture (biotechnology, mechanical and electrical equipment, bio-energy and fossil fuels, environmentally friendly innovations, animal production innovations, and innovations in agro-industries). They discuss to what extent the price-support system characteristic of the UE Common Agricultural Policy induced farmers to adopt technical innovations. They conclude that CAP has led to new problems (pollution, soil mistreatment, water supply problems), which explains the ongoing reform of EU agricultural policy, not longer seeking an increase of productivity, but the supply of healthy food and sustained rural development.

These chapters, with an emphasis on the production side of the food system, address questions such as the measurement of the environmental costs, the chronology of innovation, the reaction of farmers to education, the role of mediators, and the responsibility of the state in education, the diffusion of technology and the environment. It appears that cultural elements need to be incorporated into the explanation of how agriculture has been conceived by rural workers, landowners, governments, lobbyists and consumers, and how, in turn, these cultural elements have influenced points of view, strategies and policies.

Anneke van Otterloo ("Fast food and slow food. The fastening food chain and recurrent countertrends in Europe and the Netherlands, 1890–1990") historically explores the initiatives countering the industrialisation and rationalisation of food production in Europe since the end of the 19th century. After describing fast food expansion, using as a case study the Netherlands, she analyses Slow Food (born in 1986 in Italy as a movement against fast food), and claims that 'the rise of the modern industrial food chain between 1890 and 1990 has been accompanied by recurrent manifestations of discontent and protest'. The documentation of this discontent allows her to point that the contemporary 'quality turn' described by Goodman and Redclift (in this volume) must be understood not so much as a novelty, but as 'part of a whole century of debates on food qualities'.

By focusing on mass consumption of food, Ulrike Thoms' chapter "Industrialising catering. Technological developments and its effects in the twentieth century", indirectly poses the question of defining who is the consumer of food: not only individuals or families but, as eating is increasingly done outside the homes, institutions (be these hospitals, schools, factories, other workplaces...). She looks at the cooking technology for 'the masses', considering the factors time, cost, scientific advice, endogenous elements (such as wars), the role of the state, and profit maximisation. Technical innovations, such as freezing and standardisation of the product, appear as preconditions for the increase in eating out. In turn, mass production of food implied the development of suitable (mass) cooking techniques and devices (friers, freezers), and the selection of a few varieties of each product (as the story of the potato shows). For Thoms, the most important innovations in food technology can be traced back to the specific demands of catering. Also, and importantly, the reciprocal influence between producers, scientists, the state and consumers is stressed, as well as the different evolution in East and West Germany.

Barbara Orland directly links cattle production and milk consumption to the construction of national identity ("Milky ways. Dairy, landscape and nation building until 1930"). She considers the case of Switzerland (especially between 1880–1930), investi-

gating the way the milk market operated, how the image of the Swiss nation was built and how and when new, sophisticated technology was applied. She explores the invention of a model (and an image, *in casu* the 'brown cow'), the way old modes of production changed under the influence of new techniques, market-oriented thinking and nation building.

Rayna Gavrilova's chapter "Changing tastes. The role of scientific and medical discoveries in changing the modern diet" explores the influence of scientific and nutritional knowledge on taste and eating. She defines taste as a social construct that influences choices, and gives a survey of the nutritional research. She then considers science's points of interest related to food (energetic value, composition, vitamins, and food-linked diseases as obesity). Finally, she investigates how this knowledge affected the people's minds as well as their everyday eating practice (with health concerns and food scares). Particularly, Gavrilova studies how the scientific and medical knowledge has been diffused by means of texts, education, and policy. Overall, four interrelated phenomena may explain the growing importance of scientific knowledge for the general public: the trust in rational knowledge, the importance of the individual person, the role of the state, and the power of the bourgeoisie and middle-classes.

Isabelle Lescent-Giles presents a chronology of modern, large-scale retailing in relation to product, format and business innovation ("The rise of supermarkets in twentieth-century Britain and France"). After an overview of the innovations in food retailing up to the 1920s (advertising, promotions, price strategies, et cetera), she focuses on 20th-century changes, and in particular on the coming of the supermarket in France and the U.K. She deals with product innovation (convenience and healthy foods), sales innovations (self-service, price scanning, differentiation with various trends that include slow food produces), and business innovation (centralisation, efficiency, internationalisation, diversification), which gave birth to a power struggle between the retailer and the manufacturer, won by the big retailers. Lescent-Giles' chapter stresses the technological innovations behind these business developments.

These chapters, which emphasise the demand side of the food system (distribution, manufacturing and catering), address the questions of the role of kitchen technology (e.g. microwave) in the transformation of meal patterns (and family life), the reversing links between retailing and agriculture / manufacturing, the role of technology and science in identity formation, and the conflicts in relation to technological development (water and soil pollution, food quality, global markets, North – South and East – West tensions).

VII. ...leads to new questions

Many blank spots need further attention, and among them the use of fertilisers throughout Europe, the diffusion of agricultural know-how or the image of agriculture and agricultural labour in past and present. As for food consumption, the agenda for future research would include the spread of fast-food restaurants, technical innovation on packaging, advertising, conservation techniques or consumer credit; and the changing relation between food consumption, work schedules and the now declining role of housewives as family cooks.

Yet, several conclusions may be drawn. The first one relates to a general observation: agriculture and food seem to offer a privileged way of looking at the contradictory

effects of technology in the twentieth century. The second is a paradox: the technological innovations responsible for the dramatic increase in agricultural production in 20th-century Europe are now widely rejected by individual consumers and by different social and political groups. The third conclusion refers to persisting (old, new and future) problems in European production, distribution, manufacturing and consumption of food with the widening of markets. There will be at least three main consequences of the 2004 EU enlargement to the East: food markets in the Western countries have to make room for the production of new members; subsidies for agriculture and livestock in the Western countries will be drastically reduced; and agriculture and food industries and distribution in the Eastern countries will have to adapt to the EU stricter health and environmental requirements. Proper insight in these developments and problems require an historical dimension.

Soil pollution is one of the most serious environmental problems in Europe. Contaminants deposited in the soil pollute ground waters through leaking, and vice versa, polluted waters affect soil quality. This has obvious consequences for agricultural production, food safety, public health and the perception of food by consumers. The most direct source of water and soil pollution is the chemical products used in excess on agricultural production and lost to the environment. Yet, these agents of pollution were years ago the very sources of productivity increase, both in the West and in the East (Ardillier-Carras, forthcoming).

We will highlight one example of how technological innovations welcomed in the 20th century for their positive impact on production and productivity have come to be rejected due to their negative side effects on public health and the environment. What Vaclav Smil terms 'the 20th century most important agricultural revolution' was the synthesis of ammonia, the simplest of all stable inorganic nitrogen compounds, in the years around the Great War. It replaced traditional sources of nitrogen fertilisers (organic, such as guano or manure, and inorganic, such as nitrates). Dutch agriculture was the most intensive pre-1940 user of nitrogen fertilisers, with applications averaging above 40 kg N/ha during the late 1930s, and reaching 50–60 kg N/ha in parts of the country (the average US rate was less than 3 kg N/ha). By the early 1980s the Dutch application averaged 250 kg N/ha and was the highest in the world. European usage of nitrogenous fertilisers remained above half of the world's total. It has gone from 1.8 Mt N in 1950, to 9.6 Mt N two decades later (in 1970), and it has peaked in 1988 at 15.98 Mt N. Europe's intensive fertilisation (even before ammonia) whose post-1950 costs were increasingly supported by rising agricultural subsidies, was reflected in a steady growth of average crop yields. By 1900 wheat harvests were around 2 t/ha in the UK, the Netherlands, Denmark and Germany. Due to other innovations, Dutch, English and French wheat yields rose from 4.3 t/ha during the early 1960s to 7.3 t/ha two decades later.

But unwanted side effects of intensive fertilisation appeared: 'The most acute problems with nitrogen leaking from excessively fertilised agro-ecosystems is the leaching of highly soluble nitrates into surface and ground waters' (Smil, this volume). In 1991 the Council of the European Communities issued its nitrate directive (91/676/EEC) requiring the member states to reduce the nitrate load from the agricultural sector to acceptable levels. This pullback lowered the average European applications to 99 kg N/ha by the year 2000, a nearly 20 percent from the 1988 peak (2057 g). Despite this reduction, 'The price Europe pays for its surplus of food thus goes beyond the staggering cost of

irrationally high agricultural subsidies and the health effects of changing diets. Environmental costs of excess food output are actually more worrisome as many of these impacts would persevere even if the subsidies were to be miraculously cut' (Smil, this volume).

Furthermore, there is a risk of over-production due to a fall in the demand for food. According to FAO's food balance sheets, Europe has by far the highest per capita food availability in the world. The EU mean was about 3,500 kcal/day in the year 2000, while actual daily food requirements are rarely above 2,000 kcal/person (a gap of 1,000 kcal/day). Food waste accounts for a large part of this gap which probably will lead to reduce food consumption (and thus, demand) in the near future. Changing diets and the continent's ageing population will further this tendency.

Not only does Europe have the highest per capita food availability, but the dominant model of protein consumption, based mainly on animal proteins, results extremely inefficient and costly. In the first half of the 20th century the 'climbing of the protein ladder' (Goodman and Redclift, this volume) was centered on cattle breeding: cows need to process massive amounts of pasture to produce every kg. of meat. The same process is today taking place with fish breeding in fish factories (after technological innovations have made it possible): to produce 1 kg of salmon, 4 kg of fish flour are needed. Fish flour is industrially produced using as raw material other less demanded (cheaper) types of fish, a process which incentives a systematic depredation of the seas. At the same time, consumption of vegetable proteins is falling dramatically.

The relation between agriculture and food is twofold, as stated above. Within the current system of the large agribusiness, agricultural production is dependant upon its conveniences and requirements, that have also changed cheap, standardised and industrially processed food in mass consumption, and has to a large extent dictate EU agricultural policies. This transformation has consigned agriculture to a subordinate role in modern food systems, while it shifted control from farmers to oligopolistic trans-national food industry conglomerates and retail multiples.

A more efficient use of technological innovations in the food chain implies, in the first place, a redefinition of *efficiency*: it is not about increasing yields and output at any cost or no matter how, but about sustainability and creating wealth without risking the environment or public health. Farmers must grow their crops without old chemical *friends* such as pesticides and fertilisers, and replace them with old traditional inputs such as manure. They must be very careful with, or completely avoid, their use of genetically modified seeds or breeds. They will be required, on the other hand, to produce under most strict hygienic and safety norms, recycling their packaging. Is a realistic option this return to traditional, labour intensive techniques, replacing the capital intensive, productivistic technological model that has been dominant for over two centuries? At least we know that for the first time in their history, current EU environmental and agricultural policies are in the process of convergence, which means that their goals are no longer in contradiction. This also means that institutions and firms involved in the production of technology will have to adapt to this new type of demand for technology, new legal and health requirements, a new vision of what the role of technology must be, a new place for technology in agricultural production, in the food industries, and in consumption in general.

VIII. Towards a new relationship between food and agriculture?

A redefinition of the functions of the agricultural sector is currently taking place in Europe and particularly debated in the European institutions. This has evolved from the exhaustion of the fifty-year old model of EU Common Agricultural Policy, and the new challenges from both the world food market and the European consumers' demands.

EU agriculture employs less than four percent of EU workers, but absorbs almost half the EU total budget. The reason for this dramatic unbalance is the old political decision by member states to subsidy a European agricultural sector, including a number of agricultural units of currently six millions (of which only one million would survive without subsidies). Heavy subsidies to agricultural production and exports have also led to other unsatisfactory unbalances. Within Europe, a double burden for the non-agricultural population arose, both in terms of how their taxes are being used and the prices they have to pay for their food. Outside Europe, the unfair competition with non-EU agricultural producers appears most particularly the non-industrialised, and thus the damaging consequences for food world markets.

There is also the question of who has benefited from this agricultural policy. Despite the general claims, the main beneficiaries have been by far the largest producers, particularly the multinational firms. Today, eighty percent of total beneficiaries of CAP subsidies receive around twenty percent of the money, whilst twenty percent of the beneficiaries receive the other eighty percent. This has led to serious social and regional inequalities in the distribution of the subsidies. According to the Commission (October 2002), half of all direct payments by CAP go to the largest beneficiaries in the more productive and competitive areas, such as the Paris basin, Low Saxony or East Anglia, most of which contain export-led, multinational firms.

Since 1 January 2005 the reformed CAP foresees the dis-entailment of subsidies from production: subsidies will be granted (and progressively reduced) to the agricultural unit, and no longer in connection with (as a percentage of) output. This is intended to end with overproduction and (what has been worst of all) with the fraud consisting in producing only to be granted the subsidy, no matter whether a demand existed for the product, and regardless any quality of environmental requirements.

Discussing overproduction does not mean that hunger and malnutrition are not a problem for Europeans anymore, given the growing numbers of poor people among the immigrant population, elder citizens – particularly women, and unemployed. Women and men collecting rejected meat or vegetables at night at the garbage cans, backdoors of supermarkets, are a common view in large cities, as people queuing at the entrance of private and public charity institutions for a simple, hot meal. Yet despite these new (or rather old) hungry poor, European agricultural policy is no longer concerned by food provision, but by increasingly sophisticated consumers' demands, such as quality and safety standards, traceability, protection of local denominations, environmental protection, and animal welfare.

These complex and new consumers' demands are shaping agricultural production in a wholly new way. Yet, this is not to say that the productive sector is in the hands of consumers. After a long century of innovations in organisation, marketing and distribution, and increasing vertical integration of firms in the food chain, favoured by CAP subsidies and policies, large agribusiness are able to market in their benefit every type of 'consumer demand', and increasing their profits through it. Not only that, but the

high standards of quality and safety required by EU food legislation are acting, in practice, as powerful trade barriers to imports from non EU (and non Western) agricultural producers (and as such, defended by EU multinational firms).

Yet, even if agribusiness is profiting by the new changes in demands of food, it is not the only one in doing so. The new tendencies in food consumption include a strong flavour of 'back to the local', a re-valorisation of the local, non-industrial cultivation and food production systems. Even if main suppliers of ecological and biologically produced food are large firms, a small segment of small scale producers coexists with them, mainly distributing through local fairs and markets, or through the farms themselves. Although their dimension is very modest, their existence is significant of a new taste for non-mass, industrialised, food production, and has also interesting political implications. The role played by cow breeding and milk production in the Swiss process of nation building (Orland, this volume) echoes the role played by agriculture and food in the new regionalisms and nationalisms growing within the EU. The construction (and then the defence) of local 'traditions' in soil cultivation, animal breeding, and food producing and cooking, explains some of the latest developments in food consumption.

Increasingly, the old functions of agriculture are being replaced by a new vision of the rural regions. This implies a vision about what the rural population should devote themselves to, i.e. to protect the environment and landscapes, to receive tourists (and sports lovers, hunters and fishermen), to keep alive the old productive activities, the cultural heritage. Europeans are surely happier to pay for these social goods than for overproduction of unwanted or too costly produced food items, only to be later destroyed to keep a convenient price level. What can be envisioned for the future is a much smaller part of the European soil devoted to agricultural and cattle production (and of this, most outside the intensively technological model today increasingly rejected), together with a large part devoted to alternative, non agricultural production. This evolution means that the close connection made at the beginning of this Introduction between agriculture and food may be less close in a few decades. Not only the old 'agricultural sector' will be less and less connected with food production, and increasingly centered in providing services or alternative – not for food – products (such as wood). Part of our food may have no relation with agriculture anymore! It may come from industries producing at their own laboratories. Is it too shocking for Europeans to imagine ourselves buying our vitamins, minerals and proteins in the parapharmacies, like Americans already do, instead of in our old markets in the form of oranges and milk? A perfectly balanced and perfectly safe diet for the European of the future? Let us simply say that this is, already, *technically* possible.

Bibliography

Ardillier-Carras, F. (forthcoming), 'La descolectivización de la agricultura en Armenia o las dificultades de la transición post soviética', *Historia Agraria*, 36.

Atkins, P. and Bowler, I. (2001) *Food in society: economy, culture, geography*, London.

Beck, U. (1992) *Risk society. Towards a new modernity*, London.

Bruegel, M. and Stanziani, A. (2004) 'Pour une histoire de la "sécurité alimentaire"', *Revue d'Histoire Moderne et Contmporaine*, 51, 3, pp. 7–16.

Fine, B. and Leopold, E. (1991) *The world of consumption*, London.

Fischler, C. (2001) *L'Homnivore. Le goût, la cuisine et le corps*, Paris.

Flandrin, J.-L. (1999) 'Préface', in J.-L. Flandrin and J. Cobbi (eds), *Tables d'hier, tables d'ailleurs. Histoire et ethnologie du repas*, Paris, pp. 17–36.

Germov, J. and Williams, L. (eds) (1999) *A sociology of food and nutrition. The social appetite*, Oxford.

Hartog, A. den (ed.) (1995) *Food technology, science and marketing. The European diet in the twentieth century*, East Linton.

Long, P.O. and Post, R.C. (2003) 'Series Introduction', in R.C. Post (ed), *Technology, transport and travel in American history. Historical perspectives on technology, society and culture*, Washington, pp. vii–ix.

Miller, M.B. (1981) *The Bon Marché: bourgeois culture and the department store 1869–1920*, London.

Oldenziel, R., Albert de la Bruhèze, A. and Wit, O. de (2005) 'Europe's mediation junction: technology and consumer society in the 20th Century', *History and Technology*, 21, 1, pp. 107–139.

Otterloo, A. van (2000) 'Voeding in verandering', in J.W. Schot, [et al.] (eds), *Techniek in Nederland in de twintigste eeuw*, Zutphen, pp. 237–247.

Ritzer, G. (1996[2]) *The McDonaldization of society*, New York.

Rotberg, R. and Rabb, T.K. (eds) (1985) *Hunger and history*, Cambridge.

Quesnay's *Tableau Économique* (1972), edited and translated by Kuczynski, M. and Meek, R.L, London.

Sarasúa, C. (2001) 'Upholding status: the diet of a noble family in early 19th-century La Mancha', in P. Scholliers (ed.), *Food, drink and identity. Cooking, eating and drinking in Europe since the Middle Ages*, Oxford, pp. 37–61.

Sereni, E. (1974) *Storia del paesaggio agrario italiano*, Milan.

Wilson, C. (1970) *The history of Unilever: a study in economic growth and social change*, London, 1970.

Zanden, J.L. van (1991) 'The first green revolution: the growth of production and productivity in European agriculture, 1870–1914', *Economic History Review*, 44, 2, pp. 215–239.