

# The production of food: from quantity to quality

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The present paper presents a non-technical overview of contemporary developments in food supply, as seen from the standpoint of economic adjustment. The historical concerns over availability and price of food have now passed in the UK, and agriculture is no longer dominantly driven by the supply-side forces of new farming technology and the stimulus of support policies. As a now demand-driven sector of the economy, it is the developing diversity of consumer food preferences that will increasingly determine the adjustment path of agricultural production. Those demands seek distinctive elements of food value, many of which are entirely created and delivered by industries beyond the farm gate. However, many of the quality characteristics of food that consumers increasingly seek are associated explicitly with what takes place on farms and how crop and livestock husbandry is conducted. In responding to these demand preferences many farmers will shift from being merely raw material producers to becoming genuine producers of food, or capturing more of the final value of the products consumed. As a result a dual structure within farming will develop, with a 'quality agriculture' becoming increasingly differentiated from a 'commodity agriculture' as two distinct strategies for farm business survival.

**Food production: Food demand: Economic forces: Consumer preferences:  
Agricultural change**

## The historical background

The supply of food, in terms of both its availability and its predictability over time, has been the primary concern for all human societies. The early hunter-gatherers gradually moved to shifting (slash and burn) agriculture to gain more control over their food supply. This system developed into settled agriculture, with domesticated livestock and selection of crop plants, as the population grew and man learnt more about managing the biology of food production. Through the centuries, with expanded clearance and cultivation of land, the adoption of animal power, enclosure of fields, the selective breeding of crops and livestock, the management of soil fertility by rotations, the development of mechanical power, the progressive growth of farming underpinned by the science of fertilisers, agro-chemicals, animal nutrition and disease control, to the present era of genetic modification, cloning and electronic control, all have been driven by a persistent search for a capacity to produce more food, with greater dependability from year to year and with less human effort. It is unclear (and in the end does not matter) whether all this evolution was driven by rising population or whether it was the dynamic that allowed

population growth. The result is that farming around the world has for generations pursued a consistent path of rising productivity of its key resources (land, plants and animals), driven by technological developments in the capacity to produce and by farmers' search for new means and methods of production.

The major effect of this evolution in a historical perspective is that it permits human societies to shift from an essentially agrarian economy, where the dominant economic activity is food production, to an industrial and thence to a modern service economy. In the process the proportion of the nation's resources devoted to agriculture progressively declines, even though agriculture's output expands in absolute terms, as land (not greatly), labour and capital increasingly concentrate in other areas of economic activity. The extent of this evolution is seen by comparing the situation in poor countries with those in rich ('developed') economies today. In Bangladesh half the population are engaged in agriculture, which constitutes one-third of all economic output (World Bank, 1999); in the UK, farming occupies less than 2% of the working population and contributes about 1.5% of the economy's output (Ministry of Agriculture, Fisheries and Food, 1999a).

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The policy towards agriculture in the UK has been conditioned by major economic and political forces, not least of which have been military conflicts and their aftermath. The 'agricultural revolution' had major effects during the 17th, 18th and 19th centuries, assisting Britain to become a major industrial and world trading power. The Napoleonic wars led to explicit encouragement, via price supports and export taxes, for expanded home production of food. After the First World War there was an expansion of newly-created small farm holdings, the settlement of returning soldiers on the land, and later the introduction of price supports to maintain output during the depression years. The onset of the Second World War saw the country producing <40 % of its food needs, and the desperate shortages during the war led to the political commitment to an expanded domestic agriculture. The famous 1947 Agriculture Act (UK Parliament, 1947) offered 'stable prices and guaranteed markets' for British farmers, with a raft of grants and subsidies for output expansion, productivity increase and the adoption of new technology. The Common Agricultural Policy, developed in 1962 by the original six member states of the (then) European Common Market, espoused the same expansionary principles and support framework, but just a different method of achieving it. When UK joined the EEC in 1973, therefore, it simply changed step from one type of agricultural support policy to another, but continued its drive towards higher and higher levels of production.

By the 1990s, therefore, British agriculture had experienced >50 years of being driven consistently by supply-side forces to expand its output. An accelerating stream of new production technology, in the form of developments in mechanisation, fertilisers, pesticides, herbicides, medicines, animal feeds, housing, crop and animal husbandry, and management systems have been pushed at farmers from the industries supplying agricultural inputs, from the advisory services and from the agricultural research sector. Added to this background, a policy framework of protected markets and high support prices for all the major commodities, supplemented by grants and financial incentives for investment, had provided an economic environment of comparative security and predictability for the bulk of the agricultural industry. (There were some significant omissions from this support framework, notably horticulture, pig and poultry sectors.) Not surprisingly, therefore, UK farmers have presumed their role was to produce more food more efficiently, because that is what all the economic and political signals have been indicating for years. That is what they did, with government commendation and apparent public approval, even as it became obvious that 'surpluses' of many agricultural commodities were beginning to accumulate, needing large export subsidies to dispose of them in the lower-priced world market. It became evident that a new situation had been reached, and new thinking about agriculture's role in the 21st century was required.

### The contemporary framework

Although the trend has been evident to agricultural economists for years, to government and the public it

appears as though we have recently crossed an important threshold. The supply-side drivers of agricultural growth, which have determined the pattern of agricultural change for decades, are now being greatly moderated. New agricultural technology is no longer being urged on farmers and the incentives to pursue yet greater productivity growth are less obvious. Public sector and industrial research budgets to develop new technologies are far more selective and focused. The attitudes of the general public towards agriculture, largely ill-informed it has to be said, but influential nonetheless, have grown increasingly negative. Much of this negativity has been given fresh impetus by the major epidemic of food and mouth disease in 2001, which suddenly brought modern farming into the awareness of every household, but it is a development that has been gaining ground for some time. The perception of 'intensive' farming (which really means high physical output per hectare or per animal), from being viewed as the commendable hallmark of the progressive farmer-businessman has now become increasingly negative. The concerns about animal welfare, environmental pollution and loss of countryside features have become a dominant image of modern farming. The disastrous episode of bovine spongiform encephalopathy during the 1990s, along with sporadic food scares over *Salmonella* and *Escherichia coli*, and crowned by the high-profile debate over the benefits and dangers of genetic-modification technology, have now almost obliterated the warm glow created by 40 years of steady agricultural improvement, to such an extent that 'new technology' is viewed almost as a danger, and a reversion to more 'traditional' (i.e. inefficient?) farming methods seems to be advocated.

Added to this change in public attitudes, the expansionary encouragement provided by government support policy is being adjusted markedly. The 'reform of the Common Agricultural Policy', a battle cry for many years, is now starting to pursue a clear direction. The policy has always consumed 50–60 % of the whole budget of the European Community (now EU); not only was this policy becoming unacceptably expensive, but prospective enlargement of the EU to include the mostly agricultural economies of six new member states from Eastern Europe makes continuation in its present form now financially prohibitive. In addition, continuing international negotiations among the major trading nations to reduce farm support, allow freer trade in agricultural products and move towards the general globalisation of world commodity markets represents an important dismantling of the manipulated price and policy incentives that had previously encouraged UK and European output expansion.

As a result of these developments, which have gained pace in about the last 5 years, the situation facing British agriculture has changed radically. It is no longer being pushed by irresistible technological innovations and deliberate economic incentives to expand. Its supply-side drivers are being replaced by economic signals (and public declarations) from the demand side of the food system. In effect, we are witnessing the emergence of a demand-driven agriculture, where the pressures shaping what is produced on farms and how it is produced are determined quite explicitly by what food consumers (or, more accurately,

food retailers) indicate they want. In the past farms typically produced simply a generic food raw material (milk, wheat, sugarbeet, finished cattle etc.) which someone took away at the farm gate and turned into the totally different product that the consumer recognises as 'food'. The modern developments in the food chain meant that the links between farmer and final consumer became increasingly tenuous, and most farmers had little idea (and certainly no connection with) what happened to their products once they were sold. Understandably, they were not directly demand responsive, reacting simply to the fact that whatever they produced would be taken up by the (supported) markets, and encouraged by the principle that the cheaper they could produce it the higher their incomes would be. Now, however, we have reached a new situation, where the specific influence of food demand and its changing nature will reach right back to the farm gate and provide farmers with a much more complex set of economic signals to guide their productive activity.

### **The determinants of food demand**

There is a well-established framework for explaining the demand for food and the way it changes over time. These demand patterns will manifest themselves increasingly in the future, as farming adapts to its new economic environment where market forces are less distorted by government intervention.

From an economic analysis standpoint, food demand is determined by three key influences: food prices; household incomes; consumer preferences. (In addition, social, cultural, historical and personal factors, plus experience, awareness and a variety of individual or collective perceptions also fine tune the specific nature of food demand; for present purposes these are all subsumed under the heading of 'preferences'.)

#### *Food prices*

Apart from unusual circumstances, it is invariably the case for every product we buy that the level of demand is inversely proportional to its price, and food products are no exception. The interesting aspect is how responsive this relationship is, i.e. to what extent does demand increase (decrease) relative to a fall (rise) in price. This factor is captured in economic analysis in a variable called the 'price elasticity of demand', measured as the percentage change in demand in response to a given percentage change in price. For food products collectively this variable has a very low value, indicative that food demand changes very little in response to changes in the overall level of food prices. (For individual food products the responsiveness to price changes is often quite high, because consumers can to some extent substitute one (cheaper) product for one whose price has risen. However, as there are no substitutes for food as a whole, these substitution possibilities are virtually non-existent when considering the overall food price index.)

For agriculture this situation means, therefore, that there is no great expansion in demand for its output, even if increased production efficiency allows products to be supplied substantially more cheaply. Hence, the long-term

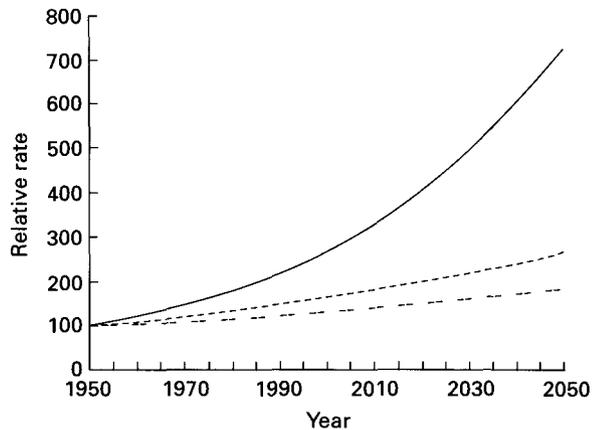
fall in the real price of food experienced over recent decades has not created a comparable growth in demand, and, more importantly, any further success in producing commodities at even lower cost will not generate great benefits to farmers (consumers will simply purchase about the same quantity of food and pocket the benefits themselves in terms of the lower price).

#### *Household incomes*

For most commodities the demand will increase as incomes rise, but again it is the responsiveness of this demand change that is of interest. Another elasticity variable, 'the income elasticity of demand' measures the extent to which the quantity purchased of (or expenditure on) a commodity rises with a given percentage rise in income. For many of the consumer goods of an affluent society (personal transport, holidays, entertainment, household electronics) this elasticity value is quite high ( $> 1$ ). For food as a whole, however, it is low, in the order of 0.2 (Ministry of Agriculture, Fisheries and Food, 1996b); i.e. a 10% rise in average incomes will result in only a 2% rise in average expenditures on food. The net effect of this situation is that the food sector grows at only about one-fifth the rate of the overall economy, and so constitutes a progressively declining share of economic output and consumer expenditure. The evidence for this decline is shown clearly by the fact that in the 1950s retail food purchases represented about 30% of the average household budget; today that percentage has fallen to about 10 (Ministry of Agriculture, Fisheries and Food, 1999b). The message for agriculture is that an increasingly affluent society does not offer encouraging economic growth prospects. Indeed, the decline in economic importance of the food sector relative to the rest of the economy is even greater for agriculture, since the expenditure increases that consumers do demonstrate tend to be for the processing, convenience, packaging and other 'retail' elements of food purchases, offering very little demand growth for the basic agricultural raw materials that go into food production. The manner in which food and agriculture fall behind the general growth in the economy is represented schematically in Fig. 1, which shows the comparative growth paths with an annual 2% rate of economic growth in the total economy.

#### *Consumer preferences*

The general presumption in economic activity is that consumer preferences are for more of anything that provides benefit. However, this is not the case in relation to food, because the demand for increased consumption in a society only continues until everyone is basically adequately fed. After that point, the nature of food demand changes from wanting quantitatively more to wanting food that is qualitatively different. That stage has been reached in the UK (and Europe). For the first time in our history we now live in a society that is food sufficient and food secure. This situation is relatively recent in a historical sense, and for many individuals it is still something that is not accepted as a dependable fact. However, the functional consequence of decades of agricultural productivity growth, an efficient



**Fig. 1.** Relative rates of growth of income, food demand and agriculture. (—), Income growth at 2%/year; (---), growth in food demand (income elasticity 0.2); (- - -), growth in demand for agricultural products.

supply system and 'cheap' food, coupled with affluence and economic power as a trading nation, is that to all intents and purposes we now presume that concerns over adequate food availability are completely a thing of the past. The progress towards this position, where in the experience of most of the population food shortage has changed from the inconvenient to the inconsequential, is charted in Table 1.

The general public in Britain no longer worries about 'will there be enough food?' or 'will we be able to afford to eat?'; those are the questions that concerned their grandparents, and which remain a burden for two to three billion people in the poorer nations of the world. Food availability is, not unreasonably, taken for granted, and under these circumstances consumer preferences and attitudes towards food change radically. The average consumer no longer has a demand for more food and, despite frequently-quoted generalisations to the contrary, is not actually concerned to have cheaper food. What they want is different distinctive food products. From an economic point of view food has passed from being 'a necessity' to becoming a typical consumer good, and as such it is its qualitative nature, not just its availability and price, that has become the major interest in terms of demand preferences. (This transition is not true for those on very low incomes. However, markets respond to economic demand, not need, and in a market-driven economy those with little purchasing power unfortunately exert little economic influence.) This modern type of consumer preference is already bringing changes in the way agriculture undertakes crop and livestock production, and the business activities that take place on farms.

#### Economic value in the food chain

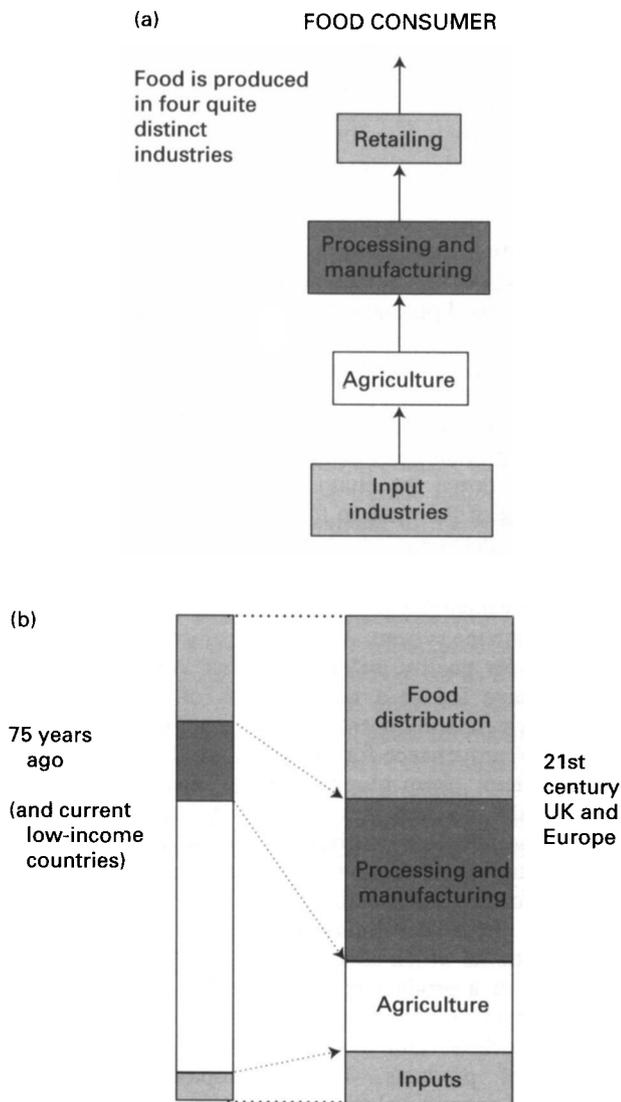
Agriculture and food production are often spoken about as though they are synonymous, with the presumption that 'farmers produce our food'. However, a little thought shows this presumption to be grossly simplistic and as obviously incorrect as suggesting that timber growers produce furniture or the steel industry produces cars. The food production system consists of four distinct industries—economic sectors (Fig. 2(a)). First, there is the input supply

**Table 1.** UK food supply news

Famine in Ireland	1845
Food supplies running low; Britain 6 weeks from surrender	1942
Hopes of food rationing to end soon	1952
Shortage of milk in some north west towns due to foot and mouth disease epidemic	1967
Potato harvest poor this year; chips likely to cost more	1976
Small fresh turkeys more scarce this Christmas	1988
Local Sainsbury store ran out of granary bread last Friday evening	2001

industry, producing farm machinery, agro-chemicals and fertilisers, fuels, animal feed, plastic bags, financial services etc., and all the diversity of inputs upon which modern agriculture is totally dependent. The agricultural sector then produces food raw materials which are transformed by the processing and manufacturing industry into the sort of commodity we might start to recognise as 'food products'. However, as consumers we do not encounter these products until they have been portioned, packaged, branded, distributed to countless outlets and presented on shelves in the retail store, or on plates and polystyrene packs in restaurants and fast-food emporia. The link between food consumers and farmers, as stated earlier, is clear in conceptual economic terms, but extremely remote in practice. Increasingly, with concentration throughout the food supply system and the emergence of five dominant supermarket chains, it is the retailer (not the household) who is the effective 'consumer', since the retailer determines what the individual food shopper has available to choose, and determines also what demand signals it sends back down the chain to food manufacturers and farmers. Given this extended but integrated structure of the food supply chain, and the separate but crucial role of each of the four main actors, it is interesting to ask why, in pursuing objectives of food security and stability, governments have focused on encouraging efficiency gains and supporting economic activity exclusively in the agricultural production segment!

Indeed, as can be seen from Fig. 2(b), the economic contribution of agriculture is far from being the dominant one in the creation of food value. In an earlier era, and in poor countries now, when agriculture largely produced its own inputs, food processing was minimal or largely done in the home, and when 'retailing' was little more than selling on a market stall, it is true that agriculture was the dominant contributor in food supply. However, in the modern economy, for every £100 of food value consumed the farming sector can claim to have supplied no more than £25 worth, and £8 of that value was provided by the input industries. In a modern affluent society the growth in food demand that does take place is manifested in increased expenditures on the preparation, convenience and food values created by the post-farm food industries, and particularly by the catering sector. Basic crop and animal production at farm level has little to contribute to (or gain from) this pattern of demand growth.



**Fig. 2.** (a) The economic structure of food supply and (b) the relative shares of value added in food supply. (From McInerney, 1999.)

### Economic characteristics of 'food quality'

With effectively no demand for additional agricultural output from the adequately-fed food-secure (and increasingly fussy) population of the UK and Northern Europe, where is agriculture to go? More mouths to feed creates new food demand, but population growth is low in these countries. Rising *per capita* incomes, as already discussed, don't offer much in the way of stimulus for expanding output of agricultural products. Producing for export onto world markets could supply the expanding food demand of other countries experiencing economic growth, but they have their own agricultural production capability to develop, and anyway the UK is not likely to develop into a major competitive exporter of agricultural commodities, for a number of reasons. Yet agricultural productivity growth will continue; it is driven by science and the technology development industries outside agriculture, not by food

demand, and there will always be incentives for it to be adopted by farmers seeking a competitive advantage in shaving their unit costs of production. However, in the face of static demand for further agricultural output, increasing productive efficiency will simply manifest itself in the release of farm resources for other uses (which is itself a major economic benefit to a society seeking an array of alternative goods and services from the countryside, but all that is separate from changing food demands).

Food having largely moved from being a 'necessity' (for which consumers make an initial allocation from their expenditure budgets) to becoming a typical consumer good which competes with other goods for discretionary expenditures, the analysis of food demand needs to be viewed within a different framework. Growth in demand will relate not to the quantity of physical products consumed, but increasingly for the 'food services' that are embodied in the products purchased. These 'food services' can be identified under a number of headings.

### Value components

These components include the values added to the basic agricultural raw material to create a more-preferred food item, and include processing, packaging, convenience, pre-preparation, ready-to-eat foods, fast food and meals eaten outside the home. Some of these value elements have long been a component of the modern consumer's perception of what a 'food product' is, while others are experiencing increasing contemporary growth in an affluent and lifestyle-oriented society. It is now the case that over one-quarter of all food expenditure nationally goes to the catering (or, more properly, the food service) sector of the economy, and this proportion is growing. For most of us this consumption pattern is markedly different from that of our parents, let alone our grandparents. It represents a distinctive change in the culture of food consumption, but has virtually no economic impact on the primary producer of agricultural products.

### Technical characteristics

Increasing publicity given to food-safety issues, plus a wider understanding of what may go into food production, has brought many consumers to consider the constituents of the food they purchase: what additives, preservatives, residues or other 'dangerous' components they may have; their sugar or salt content; their extent of 'processing' (not easily assessed); their bacterial or other safety risks; whether they contain genetically-modified material etc.

### Background characteristics

An increasingly important quality attribute of food products is seen to be simply their provenance, rather than anything definably technical or economically embodied in their production. The environmental acceptability of the farming system and the animal-welfare standards applied in production are gaining increasing attention. Even issues such as geographical origin are gaining importance, with

consumers showing preferences for locally-produced or regionally-branded foods, for products which are purchased in farmers' markets, are burdened with few 'food miles', or come under fair trade arrangements from poor countries.

These preferences are a long way from food as some generic commodity derived from crops and livestock produced on places called farms. Many of these demand distinctions are ill-informed, based on perceptions, presumption and image rather than defensible technical or scientific data. However, in the workings of a demand-driven economy such 'failings' do not particularly matter; an economic system is supposed to satisfy the demands of the individuals who make up the society, not to respond only if those demands are in some sense 'correct'. As consumers we are all ill-informed in absolute terms; but as long as we feel we have got the desired value for our money, and our consumption does not have obvious negative effects on others, the overall objective would appear to have been achieved.

It is also obvious that the food values listed earlier are not uniformly recognised and accepted by all. In fact, it is probably mainly amongst the more-educated higher-income and enquiring consumers that the demand for what we have defined as the quality, technical and background characteristics of food is growing most strongly. What some call 'junk' food will still be considered by a substantial proportion as tasty, good value and a highly satisfactory eating experience which fully satisfies their consumer preferences. This fact emphasises the point that we should not refer generically to 'the consumer' or 'consumers' as though they represent a uniform group of preferences and purchasing decisions. There exists a diversity of consumers, and hence only a great (and increasing) diversity of food products is consistent with the developing pattern of food demand in societies such as the UK.

### **Implications for the food system**

As with all consumer goods (whether cars, household durables, clothing, or whatever) increasing income leads to greater demand for the convenience and service elements embodied in the product. In the case of food the post-farm value elements in the food system will be the primary focus for growth. The processing, food manufacturing and product delivery sectors will be drawn to expand their share of final food value, with the food service ('catering') sector showing particular growth in the future. At the other end of the food system, the agricultural inputs sector will continue to deliver new technology into farming, albeit more slowly than in the past, and hence increase further the economic share it contributes to agricultural output. In the middle of this evolutionary process the agricultural sector will find that, although its production of raw materials remains the core of food supply, its share of the economic value of final consumption will be squeezed and continue to represent a declining proportion.

These changes have distinct implications for both food products and for agriculture, in each case representing a continuation of adjustments that have been evident for some time.

### *Food products*

From an economic standpoint food products have increasingly become brands, not simply generic commodities. Differentiation, diversity and distinction will increase, with conventional labels like 'bread' or 'cheese' embracing (as they have already) an expanding array of differentiated items. Innovation and creation will continue, with novel products and variations on existing ones being developed to meet or initiate new nuances of consumer demand. The typical supermarket already carries over 20 000 product lines, not all food products, but nevertheless indicating how complex the concept of 'food' has become.

From the standpoint of the overall food supply chain the concentration of market power at the 'consumer end' (in the form of the major retailers) will continue, and will lead to vertical integration and more rigid supply contract arrangements back down the chain through to the farmer. The development of the modern food system has destroyed any direct links between farm producer and household food consumer, and, as the dominant economic influence, the retailers now have the key role in articulating demands back down through the system. Added to this factor, the increased concerns over quality, safety and other attributes of food products have led to a rapid growth of farm assurance schemes which aim to establish traceability and provide evidence of provenance for individual products through the supply system; 'from plough to plate' and 'from farm to fork', as the catchphrases have it. Whatever else they provide, the need for certification, validation, information and labelling is self-evident if consumer preferences are to be both informed and satisfied.

Beyond these developments, the nature of modern demand patterns which attach value to the locality of origin and image of a product is leading to the development of accessory retail outlets for food, such as farm shops and farmers' markets, and to the specific local or regional branding of products. This development provides a particular economic value to consumers, resulting simply from where they purchased their food or where it was produced. All these kinds of developments show clearly that consumers are increasingly seeking satisfaction or economic benefit through gaining food products of higher value, rather than of lower cost.

### *Implications for agriculture*

As well as seeing a slow decline in the proportion it contributes to the value of food consumption, the agricultural sector is starting to experience a number of structural adjustments as a result of the 21st century food demand patterns. Although much of the post-farm-gate value added has to be created by the downstream food sectors, some of it can only derive from what takes place in agriculture. Demand for economic values created explicitly by the farm-level origins of products can only be satisfied by adjustments in what farm businesses do. This is the case for on-farm processing (farmhouse cheese, ice cream), on-farm killing and curing of livestock. There are many other ways whereby new food demands draw consumers closer down towards agriculture, and so satisfy the preference for

specific farm connections of products. These approaches include: farm shops; pick-your-own; individual branding and marketing of products; the attachment of interestingly bucolic labels; the identification of products from specific production systems (such as organic, free range, welfare friendly, rare breed livestock); a whole range of other speciality lines and minority products for so-called 'niche markets'.

In responding to these kinds of demand signals that derive from varied consumer preferences, many farmers will move towards becoming genuine food producers, as opposed to simply food raw material producers. Thus, there will be the gradual creation and growth of a distinct sub-sector within farming, which is becoming referred to as a 'quality agriculture'. In many cases it is small-scale farms with particular locational advantages, or simply entrepreneurial initiative of their operators, who will pursue this development path. Those farms that have not the inclination or advantage to respond to the new consumer-oriented demands (which will only ever represent a sub-set of the overall market) will find their economic survival rests in the extent to which they can successfully pursue the traditional route of agricultural progress, producing standard undifferentiated outputs at lowest cost for sale on the mass market in competition with other, often overseas, suppliers. This more uniform sub-sector of farm production is being styled as a 'commodity agriculture'. Although the linkages between farming and food consumption are nowadays quite remote, the developing differentiation of consumer demands for food can be seen as itself initiating quite

distinct adjustments in the nature of farm business activity and the structure of the agricultural sector.

The creation of a 'dual agriculture' in the UK is occurring for a variety of other economic and political reasons, and the harsh truth is that many farm units will not find a sustainable future in either of the two types of production. That farming processes should be refined and driven explicitly by what the ultimate consumers want, rather than by historic and simplistic presumptions about the need to expand output (or, worse, the presumptions and preferences of the farming community about what their role should be) is not, however, simply the outcome of a new political or economic outlook on agriculture. It is entirely consistent with one of the earliest canons of economics, declared 250 years ago by the founding father of the subject. 'The object of economic activity' said Adam Smith, 'is not production; it is consumption.' At last the food supply system is getting the message.

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