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CHARACTERISTICS OF THE AGRICULTURAL SECTOR OF THE 21ST CENTURY¹

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The objective of this paper is to identify some of the salient characteristics of agriculture in the new millennium. The driving force behind economic change is technology and information, and information and knowledge will replace land, labour and capital as the sources of wealth in agriculture. The resultant cognitive-technical complex in farm production will lead to the true industrialisation of farming and thus placing the traditional family farmer at a distinct disadvantage. Technology developments combined with inverse population growth and ageing population, will not only negate Malthusian visions, but also lead to downward pressure on farm commodity prices, and thus increase the adoption rates of new technology. However, in reaction to the increasingly complex nature of modern society a demand is developing for terroir-based products. This range of products may not only significantly change some characteristics of agriculture, but also provide a new set of opportunities for farmers. Agricultural policy and development strategies should also be reconsidered in the light of this new environment.

1. INTRODUCTION

The theme of the annual conference of AEASA is 'South African agriculture into the new millennium'. But what will the characteristics of the agricultural sector be in this new millennium? An informed answer to this question should depend on the expected characteristics of the sector. In this paper, however, we argue that it is as important to understand the expected characteristics of our main competitors in the global agricultural market, and of the markets to which we export. Thus, the focus of the paper will be on the future 'size and shape' of the agricultural sector in the industrialised countries.

The agricultural sector is not isolated from the rest of the economy, thus it follows that a good point of departure will be to define that economy. The nature of the coming information economy is discussed in Section 2 below. As

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it is also clear that the agricultural sector reacts to changes in the market place, the third section will focus on some of the factors that are expected to shape the future demand for agricultural products. The fourth section will briefly focus on some supply side issues before, in the final section, an attempt is made to integrate the preceding parts into a design of agricultural sector characteristics.

2. DEFINING THE INFORMATION ECONOMY

A scan of the literature reveals that different scientific disciplines have different names for the 'new' economy that is developing in the 21st century. However, although developing from different doctrines, there is considerable common ground among these approaches. There is, for example, general agreement that the driving forces of change revolve around technology and information, and that these are rendering fundamental change at the core of society. Information and knowledge, as key variables, are replacing land, labour and capital as the very fountainhead of the creation of wealth (see Spies, 1999).

This is not the first time in history that fundamental change has had such a radical impact on society, and thus also on the agricultural sector. While the industrial revolution resulted in a 'progression' from an agrarian to an industrial order (see for instance Kirsten, 1999 for a description of the progression from agrarian to industrial from an input perspective), which in turn resulted in a complete change to the fabric of society, this did not imply that the production of agricultural goods was terminated. To the contrary, agriculture has grown in absolute size in all these countries, while the agrarian sector generally has increased in political importance. It follows that one can expect that the information revolution will not eliminate the need for agricultural and industrial production, and that the information economy will have a large impact on these sectors. These changes will impact on the agricultural sector largely through their impact on the demand for, and supply of agricultural products.

3. SOME FACTORS SHAPING DEMAND

The consumers of farm produce are human beings with a basic but limited need (utility) for farm products. The result is the well known relatively price inelastic aggregate demand for farm products, and the sensitivity of that demand to changes in the number and composition of the population. With the world population reaching the symbolically important 6 billion mark in 1999, agriculture has become accustomed to an expanding market. However,

a slackening of this growth is becoming apparent with the world population expected to stabilise at 9,7 billion people by the next century with an actual decline of ± 100 million expected in the population of Europe by 2050 (UN, 1999). In the industrial countries this translates into an ageing population, often associated with yearnings to the 'good' of the 'good old days'. Cochrane's treadmill hypothesis predicts that this check in, and actual inversion of the movement to the right of the aggregate demand function for farm produce will add downward pressure on farm commodity prices.

The existence of the global village or the so-called Coca-Colonisation of the world is also expected to have a profound effect on consumer demand. The erosion of the nation-state, the soft borders that have resulted from economic globalisation and the perceived homogenisation of culture, it is argued, will lead to an identity vacuum for many individuals. Nationalism, as a cultural commune in people's minds and a collective memory through the sharing of history, is (one of) the cultural reactions against this global integration (Castells, 1997).

Another such reaction is agrarian fundamentalism of which the tenets can be found in the perception that:

- (a) Farming is the basic industry upon which all others depend;
- (b) Farm life is good and natural as opposed to city life;
- (c) Farmers should be economically independent;
- (d) Farmers work hard to demonstrate their virtue;
- (e) Family farms are indissolubly linked with democracy (Beus & Dunlap, 1994).

These can be translated into the following positive externalities:

- (a) Existence value (preserve family farming and values because they are there).
- (b) Use value (interacting with farm people and enjoying the rural countryside).
- (c) Option value (to enjoy the countryside and the option of buying a farm).

- (d) Demonstration value (rural values act as yardstick) (Drury & Tweeten, 1997).

But is agrarian fundamentalism still relevant in an information society? Offutt *et al* (1998) argue from an American perspective, that the uniqueness of farmers is little more than a myth created to serve the political economy needs of farmers. In Europe, consumer's trust in the farm sector has been severely tested during the past decade by well-known incidents such as the discovery of salmonella and dioxins in eggs and poultry, BSE in cattle, hormones in beef, and antibiotics in pork (De Tavernier, 2000). The elements of such food-safety scares are:

- (a) Universality of the hazard
- (b) Some form of actual and perceived novelty
- (c) Plausibility of the potential hazard; and
- (d) Uncertainty regarding the magnitude of risk involved (North, 2000).

It is interesting to note that the GMO issue seems also to contain all these elements.

It follows that because of such food-safety scares, a demand is developing for products that are not universal, not novel and that carry no (perceived) risks because the product has been produced in a traditional way. Or, as Bessière (1998:22-23) theorises, modern-day agrarian fundamentalism is a reaction against complexity. However, De Tavernier (2000) maintains that unsubstantiated generic claims such as 'grandma's recipe', 'natural', 'genuine', 'original' or 'pure' will have no value if they are not normatively evaluated. The normative evaluation, in turn, must be carried out by a reliable and objective institution according to a procedure understood and trusted by consumers. To be successful, such substantiation should not add to the complexity of the modern world, but should rather simplify the complexity.

In this context food is not only an aggregation of nutrients for human survival, but also:

- (a) a symbol (some foodstuffs are the basis of fantasy and the focus or "elixir" of symbolic virtues – the blood of the prey for hunters; bread, wine in the Christian tradition);
- (b) a sign of communion (intimacy) and companionship (food shared and eaten with others is a fundamental social link);

- (c) a marker of class (Champagne, caviar, well matured wine etc. are distinctive markers of lifestyle);
- (d) An emblem (food as a 'banner' beneath which people find their identity; i.e. during Ramadaan).

It follows that food also has psycho-sensorial and symbolic characteristics. For a farm product to be a 'traditional' product, it must be closely associated with a distinct *terroir* and thus recreate the link between the farmer and the producer. The term '*terroir*' refers to a specific area with an outspoken geographic, cultural, historical and knowledge identity (Bessière, 1998).

In the same vein Ray (1998) talks about a 'cultural economy' in which space (and products) are becoming differentiated and imbued with symbolism. Products could include ethno or cultural tourism, regional agri-food products, regional cuisine and traditional crafts. It is necessary to capture the territory and culture in the products before the *terrior* can be sold outside the community. More difficult is selling the *terrior* internally due to devalued local culture and traditions that are often seen as an obstacle to development. As soon as a product with the *terrior* as identity is established, the identity of the product feeds back into and enhances the *terrior* and creates the opportunity for additional products. Thus, it can be argued that culinary heritage strengthens agrarian fundamentalism as vector with subsequent economic and political implications.

4. SOME FACTORS SHAPING SUPPLY

In section 2 it was proposed that technological change and information (or knowledge) would be the main driving forces behind the economy of an information society. The same argument could be maintained for agriculture. Three main areas of change affect technological artefacts:

- (a) Enabling technology (vector from human controlled to expert systems);
- (b) Size range and complexity of artefacts (artefacts benefiting from smaller size become smaller and those benefiting from larger size become bigger);
- (c) Performance increases (measured as either/or efficiency, capacity, density or accuracy) (Spies, 1998).

In agricultural technology these areas range from the machinery (i.e. precision farming) to the crops and animals used in the production process (i.e. biotechnology).

The implications of these technological changes on agriculture can be evaluated with crop production as an example. The current *de facto* concentration of germ plasm in seven life science companies limits producer choice in input acquisition. Exacerbating the situation is the global trend toward diminishing public funding for basic research, thus the need for contract research. Many research institutions become, for all practical purposes, subsidiaries of these life science companies (Harl, 2000). The competitive structure of modern agriculture leads to an intermediate demand for standardised, just-in-time farm produce. In this context intermediate demand means the demand for a farm product of that has not yet reached its final form as required by consumers. For instance, the demand for wheat will be intermediate while the demand for bread will be final. As a result of the intellectual property rights imbedded in farm inputs combined with the specific nature of intermediate demand, contractual arrangements are replacing the traditional market place for farm produce. The result is that competition between vertically integrated supply chains will probably replace competition between individual firms in the near future. Boehlje and Doering (2000) describe the main characteristics of industrialised or fordist agriculture as:

- (a) the adoption of manufacturing processes in agricultural production and processing;
- (b) a food supply chain approach to production and distribution;
- (c) negotiated co-ordination replacing market co-ordination;
- (d) a more important role for information, knowledge and other soft assets; and
- (e) increasing market power consolidation at all levels.

At the farm level, economies of scale were traditionally seen as a balancing act between the advantages gained through technical efficiency on the one hand and command and control management problems on the other hand. In this paradigm the family farm (with the majority of labour being supplied by the farm family) is seen as the most efficient equilibrium (see for instance Binswanger, 1994:166). However, in creating a cognitive-technical complex the

change in technological artefacts has the effect of reducing the command and control problem almost at an exponential pace. Cognitive-technical complexes are the result of knowledge-based artefacts and artificial intelligence technology in an informatised society. In addition, the capital and knowledge requirements and the complexity of some artefacts puts a significant number of traditional family farms at a distinct disadvantage compared to the company (fordist) farmer or the family farmer integrated in a supply chain. The range of skills necessary for fordist farming exacerbates this situation.

It follows that now, at the dawn of the information economy, true internationalised fordist farm production is possible for the first time in history. Within the context of Cochrane's treadmill, this represents a giant leap of the aggregate agricultural supply function to the right with associated expected downward pressure on the prices of undifferentiated farm products.

5. CHARACTERISTICS OF AN INFORMATION SOCIETY AGRICULTURAL SECTOR

From the discussion so far it is apparent that the supply of farm produce is acquiring clear (fordist) industrial characteristics while, at the same time, demand for agricultural produce in some regions clearly has many of the characteristics of other goods common to an information society. As farm production is demand driven, however, it follows that the truly industrial phase of agriculture may be of shorter duration than has been the case in any other sector of the economy.

A number of the characteristics of the agricultural sector in the information era may not differ significantly from those that characterise agriculture in the industrial era, as described by Bonnen and Schweikhardt (1998) (see Table 1). The number of 'inferior goods' (with fordist characteristics) with a negative income elasticity of demand may increase, leading to a wider range in the income elasticities of demand for farm products. Following this argument one would expect consumers to be less price sensitive for farm produce with information society characteristics over the short run. However, due to finite food consumption capacity and expanding consumers choice in the allocation of scarce resources, the longer run price elasticity of demand would probably remain unchanged.

Table 1: Some characteristics of agrarian sectors in a continuum from developing to information society economies

Agrarian or farm sector economic characteristics	Low income 'developing' economies	High income 'developed' economies	Information societies
Income elasticity of demand	0,8 – 0,9	0,1 – 0,2	-0,1 to 0,3
Price elasticity of demand (SR)	-0,4	-0,3	-0,2
Price elasticity of demand (LR)	-1,0	-1,0	-1,0
Price elasticity of supply (SR)	0,1 – 0,2	0,1	0,3 – 0,4
Price elasticity of supply (LR)	0,4 – 1,2	0,8 – 1,0	1,0
% of population rural	80 – 90 %	2 – 25%	10 – 25%
% of Labour force in farming	30 – 90% (69%)	1 – 13%	2 – 15%
% farm sector income of GDP	20 – 50% (38%)	1 – 8%	1 – 5%
% of farm inputs purchased	0 – 20%	50 – 85%	70 – 90%
Labour and total productivity	Low	High	Higher
Capital/total land in farms ratio	Low	High (\$1 020/ Ac)	Lower
Capital/total labour force ratio	Low	High (\$333 177/p)	Higher
Number of farms	Many	Declines by >°; <30% commercial	More
Size of farms	Very Small	Av. Size inc. 10x or >	More small, av. increase

Source: Adapted from Bonnen and Schweikhardt (1998)

The nature of demand in an information society may lead to some interesting phenomena. The potential role of food in the verification of identity may lead to the reinforcement of the demand for *terroir*-based products. These products include not only identity-verified foods, but also interrelated products such as agri-tourism, rural crafts and lifestyle farms. It follows that, in some cases in

the developed countries, the rural population as a percentage of the total may actually increase as counter-urbanisation gains momentum and negative population growth rates are maintained. Counter-urbanisation is not to be confused with city-centre decay, but represents an actual relocation of people, in search of quality of life, to the countryside when professions can be sustained with the aid of communication technology. Although this may lead to an erosion in the rural-urban income gap, it may not result in an increased agricultural contribution to GDP.

Counter-urbanisation could also lead to an increase in the demand for lifestyle farms, thus resulting in more smaller sized (hobby) farms. However, not all farm products will be *terroir*-based, but the majority will be from fordist farming. All factors show that the latter (fordist) activities will be increasingly multi-sectoral and multi-national, leading to the conclusion that the actual or virtual size of such farm units will increase. Increased information efficiency will lead to a more elastic short run supply function, leading to higher levels of productivity and more inputs being bought off-farm.

An interesting case is capital. Although individual technological artefacts will probably imply a higher initial outlay of capital, the performance of these artefacts will result in a lower capital outlay per production unit. Accommodation of this trend will result in either the ascendancy of the larger farming enterprise, or the establishment of dedicated farm cultivation enterprises. The net result will, however, be a lower capital to total land ratio but a higher capital to labour force ratio.

6. CONCLUSION: THE VESTIGES OF A STRATEGY

South African agriculture is currently in the unenviable position that certain sections of the sector share many of the characteristics of a developing economy while the commercial farming sector shares many of the features a developed economy, and is also changing in the same way. It follows that decision-makers can either chart a traditional agricultural development route, or that they can develop a strategy that will catapult domestic agriculture into the information society. As a distinction between industrialised (fordist) and non-industrialised farm products is a characteristic of information society agriculture, such a strategy should *inter alia* make provision for:

- Meeting the demand for non-industrialised farm produce through the development and implementation of an internationally recognised enabling framework for *terroir*-based farm products. Part of this leg should be research on defining *terroir*-based products, agri-tourism and demand

and supply of non-industrialised farm produce. South Africa's developing agriculture, with its wealth of traditional knowledge, may especially benefit.

- Understanding the dynamics and social costs and benefits of supply chains in order to develop appropriate support services (research, extension, and training) to farmers, especially family farmers.
- Special support measures for marginalised commodity farmers caught outside supply chains or in non-industrialised agriculture.
- A reconsideration of policy frameworks to ensure that policies are appropriate for an environment where local and international trade will more and more be within vertically integrated chains rather than between organisations. Issues should include trade, intellectual property rights of especially (partially) publicly funded research results, farmer support and farmer support services.

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