

Food for Thought The Future of Agribusiness

Global Research Report by Capgemini Consulting



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Executive Summary

The agribusiness sector has seen impressive growth in recent years and most companies in the sector have performed well. Most interviewees in our recent survey believe this trend will continue.

In 2005, when major players were constructing their strategic plans, it was envisaged that the crop protection segment would decrease in importance as growth in seeds businesses escalated. In reality, crop protection products have enjoyed a very good run in terms of sales and profitability in the intervening four years. The factors driving this have included increased crop prices and increased demand from countries in emerging geographies such as Eastern Europe, Latin America and Asia Pacific. The comparative success of the crop protection segment has forced agribusiness companies to reflect on their strategies and future business model.

They do so against a background of growing demand and potentially constrained supply. It is well documented that demand for food, feed and fuel crops will continue to grow, with acknowledged drivers including the increasing population; rising incomes leading to an increase in demand for food generally and in particular for more resource-intensive foods such as meats; and more demand for crop-based energy. Less well documented is the growing demand for biomass for industrial use, from which biorefineries will produce not only energy and fuel but also plastics and chemicals analogous with those traditionally obtained from petroleum based resources.

Although expansion of the market is a cause of justifiable optimism on the part of agribusiness companies, generic manufacturers – not currently regarded as a threat by most of our respondents – are a rapidly growing source of competition.

While demand is growing, there is also a squeeze on the supply side. Expansion in arable land will not be able to match population growth, so that there will be a significant decline in the amount of arable land per capita. Another constraint is the limited availability of water, particularly in developing countries. These factors mean that farmers need to find new ways – both practices and technologies – to increase their yields.

While this situation presents important opportunities for agribusiness, companies need to adopt a responsible stance and avoid being seen as exploiting the situation. Action to address the demand-supply gap is required from all stakeholder groups: political decision-makers, retailers and consumers, as well as agribusiness and growers.

The industry will be tackling these challenges within a business environment that is becoming increasingly complex. In addition to the traditional complexity drivers of the weather and prevailing economic conditions, other sources of complexity will include the variable stringency of legislation in different countries, changing and possibly divergent public perception of GMOs and agrichemicals, the need for product differentiation between an expanding set of markets, and the inevitable shift from product- to service-based offerings.

These complexities will require increased organizational flexibility, in the form of traits like greater process adaptability, a better understanding of future capability requirements and the agility to adapt to global, regional and local needs.

To succeed in this environment, organizations will need to make sure they have the capabilities that enable flexibility. Among the necessary capabilities highlighted in this report are a robust strategic planning process that anticipates and allows for multiple outcomes in key dimensions of change. Another vital capability is accelerated execution both of the responses to these trends and of broader transformational activities.

Our findings suggest that the companies that fare best in the next three to five years will be those most able to adapt to their increasingly complex environment and to capitalize on continued growth in established and emerging markets.

1. Introduction

Why this study now?

The twin issues of rising demand for food and competition for land, water and other resources have attracted considerable attention over the last two to three years, and are likely to continue doing so. This situation creates significant opportunities for agribusiness companies, but at the same time they must not be seen to be exploiting the misfortunes of others. (Here there are lessons to be learned from the pharmaceutical sector, which has recently been taking steps to demonstrate social responsibility to stave off accusations of profiting unduly from the H1N1 outbreak.)

Capgemini has been serving the biggest names in this sector for over a decade and traditionally produces a major global thought leadership report into life sciences annually, usually looking across the industry as a whole.¹ From our conversations with senior executives across the agribusiness sector, we have noticed some consistent themes in the issues that they are facing. By far the greatest of these is the growing complexity posed by an increasing number of international markets, coupled with the increasing specificity (and in some cases divergence) of needs at a local level.

It is in response to these themes that we have decided to produce our first specialist report on this sector. We have set out to investigate both the current debate about food supply and natural resource usage and, more importantly from agribusiness's point of view, the implications of some surrounding trends on the future of the industry.

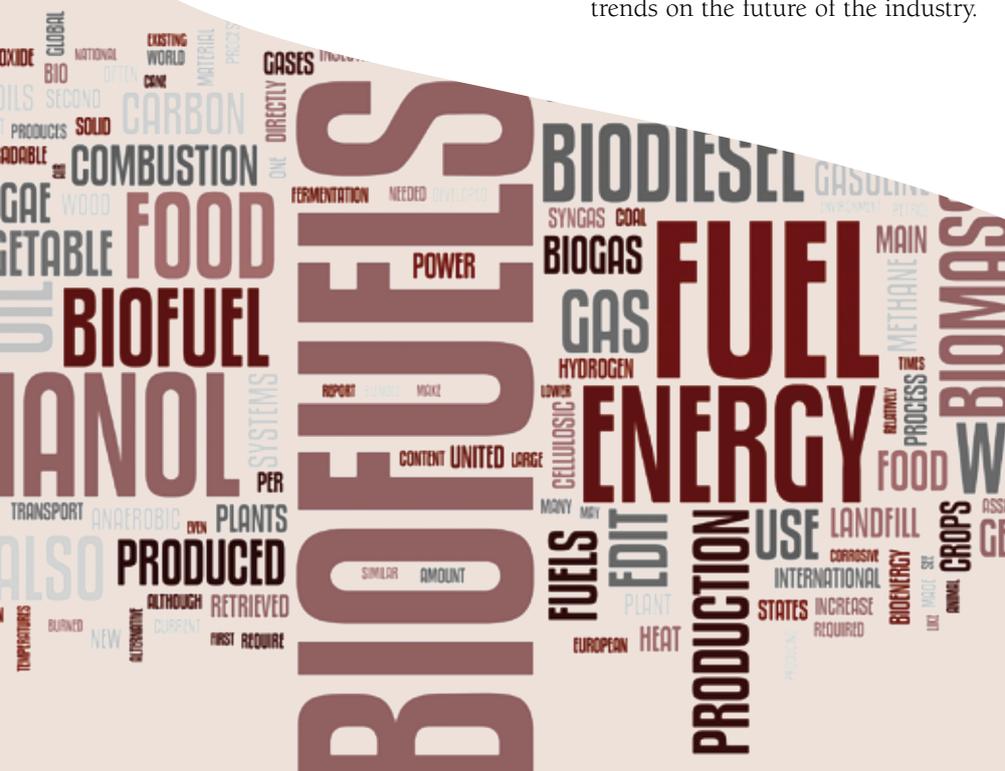
Scope of study

The agricultural industry spans a wide variety of businesses relating to or supporting the cultivation of plants, animal husbandry, forestry, fisheries and agriculture. This study focuses on the provision of inputs to the cultivation of plants. These include on the one hand agrichemicals for the protection of crops against pests and disease, and on the other hand seeds, which may be conventional, hybrid (that is, produced by artificially cross-breeding compatible types of plants) or genetically modified. These chemicals and seeds are relevant not only to farming but also to wider applications in gardening, forestry and the maintenance of public spaces such as parks, airports and railway verges.

Approach

Three main research methods have informed this study. We have conducted interviews with executives from across the industry to help shape the thinking and define the areas to focus on. Desk research from our global strategic research group has provided hard data which largely substantiates what we have been hearing from the industry. Finally, our global network of 50+ experts has helped us to interpret our findings and to formulate some ideas about what the industry should be doing now.

Source: EU-AgriNet European portal under European Commission accessed 9th October 2009; "Who Owns Nature? Corporate Power and the Final Frontier in the Commodification of Life" – ETC Group, November 2008



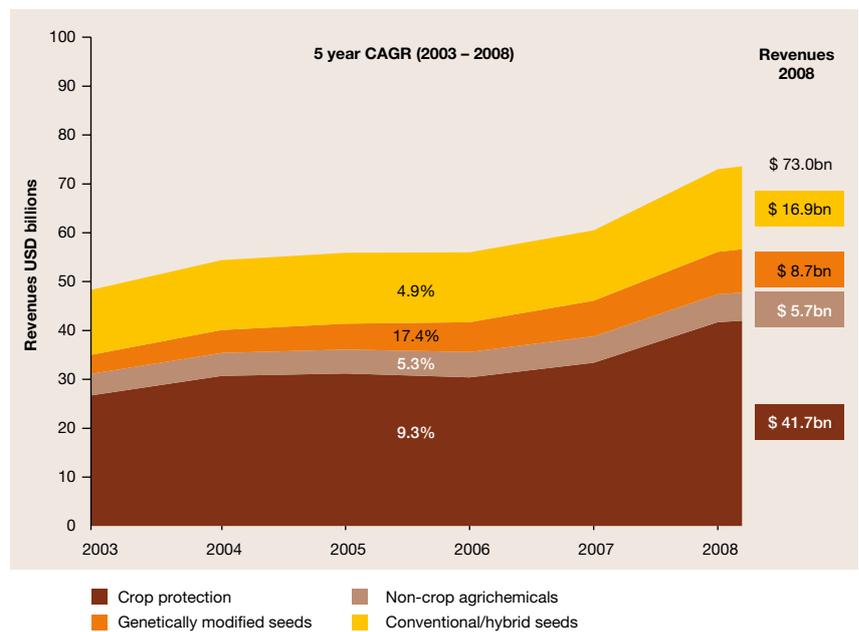
¹ Pharmaceuticals, biotechnology, medical devices and agribusiness

2 Background: Market Growth that Looks Set to Continue

Growth in all sub-segments

The agribusiness sector has seen impressive growth in recent years, with current revenues in excess of \$70bn. All four sub-segments – crop protection, non-crop agrichemicals, conventional and hybrid seeds and GM seeds – have grown in the past five years. As Figure 1 shows, GM seeds constitute the fastest-growing sub-segment, while crop protection is the largest; as we shall see, it looks likely to remain so for the foreseeable future. Rising demand for food together with increases in grain prices and in the area planted have contributed to the overall upward trend.

Figure 1. Past growth of the four sub-segments



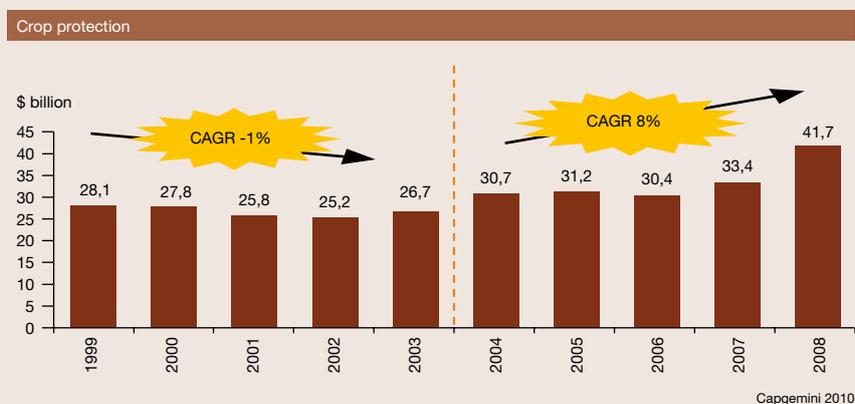
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All four sub-segments have shown positive growth in the last five years and should continue to do so

Agrichemicals: crop protection

After a lean period, the crop protection industry has shown a revival in growth in the past five years. An increase in food prices since 2005 has translated to higher farm incomes and this in turn has led to an increase in demand for agrichemicals. Another contributor to growth was the EU's decision to suspend set-aside, which has meant a bigger planted area in Europe. Further afield, the relatively stable economic situation in Latin America also helped, while the Asian market benefited from expansion of developing agriculture-based economies, notably China and India.

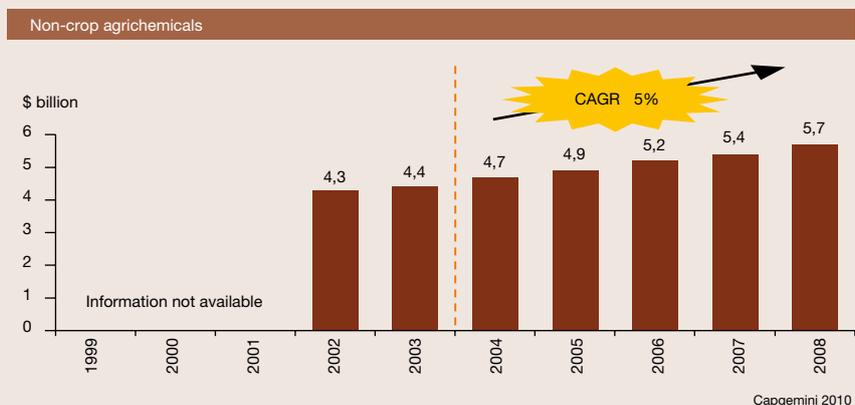
Figure 2. Past growth: crop protection



Agrichemicals: non-crop

The non-crop agrichemicals industry was virtually non-existent in the 1990s but worth over \$5bn in 2008. Its growth has been assisted by an improved level of awareness together with better availability of information on the internet and from conventional media. Increasingly, individuals are spending part of their disposable income on pesticides, primarily for the home. Home and garden usage now accounts for 50% of the total market, the rest being used in the leisure sector (for example by golf courses and "stately homes"). This split is important because the different customer types require separate distributors and in some cases different sales models.

Figure 3. Past growth: non-crop agrichemicals

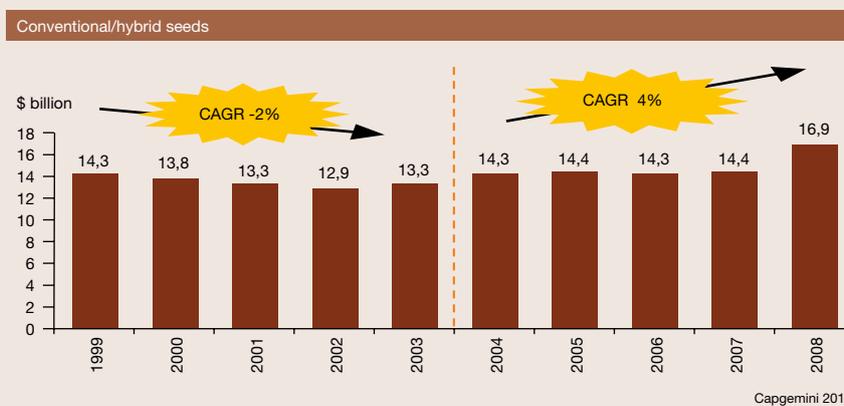


All four sub-segments have shown positive growth in the last five years (cont'd)

Seeds: conventional and hybrid

The market for conventional and hybrid seed has shown fluctuating growth patterns, almost certainly because of the advent of GM seeds, which offer advantages such as better resilience to shifting weather conditions. However, the anti-GMO stance of most European countries means that there is continuing demand for conventional and hybrid products, with associated opportunities for agribusiness companies. High-growth areas within this segment include vegetable seeds, which offer comparatively high margins.

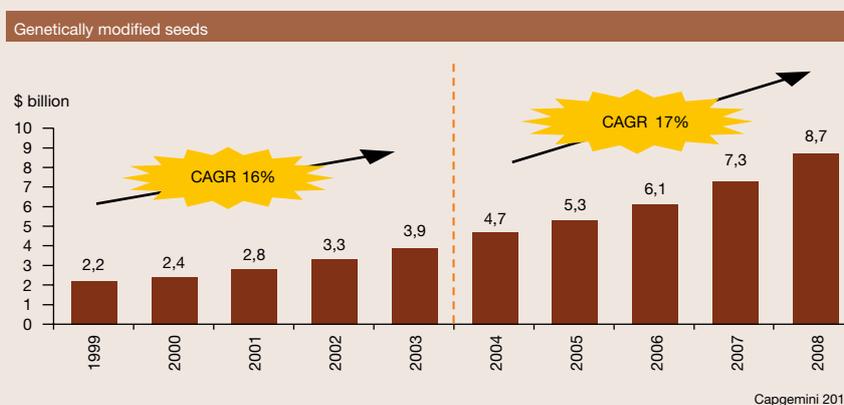
Figure 4. Past growth: conventional and hybrid seeds



Seeds: genetically modified

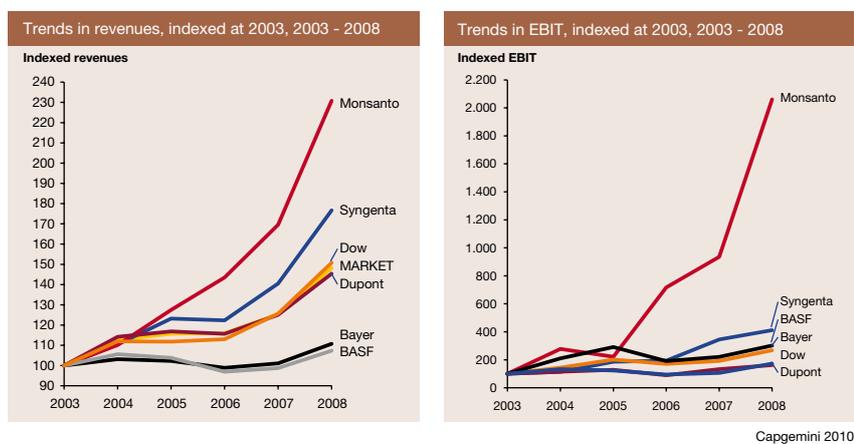
For the past ten years the GM seeds market has achieved double-digit growth, led by the U.S. and U.S.-affiliated countries where attitudes are more favorable than in Europe. Globally, GM crop acreage has increased consistently by 14% over the last five years to reach 309 million acres (approximately 3% of total agricultural land). In 2008, the number of countries planting biotech crops increased to 25 (up from 18 in 2003). A key factor contributing to the rise of GM seeds was an increase in the adoption of “stacked trait”² varieties of maize, and to a lesser extent cotton.

Figure 5. Past growth: GM seeds



² Stacked trait varieties are those with more than one gene from other organisms, and hence more than one GM trait

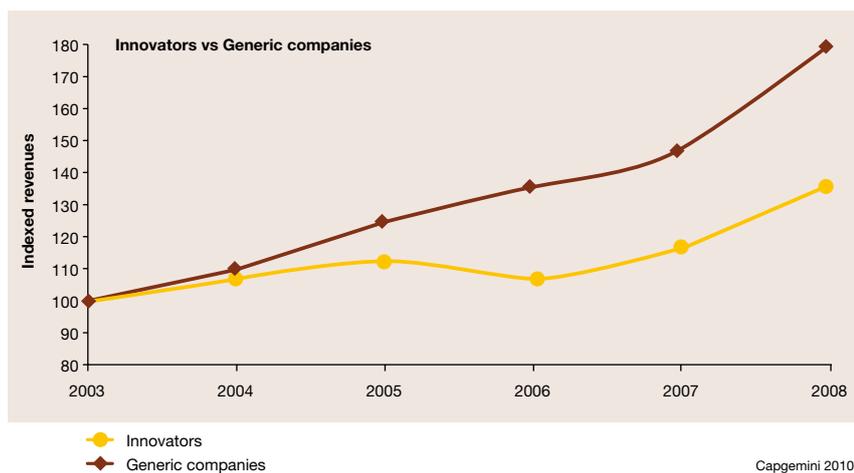
Figure 6. Recent trends in revenue and operating profit for a group of leading companies



The upward trend in these four sub-sectors means that most of the big companies in the sector have performed well in recent years, as shown in Figure 6. It can be seen that Monsanto and Syngenta have both shown a steep upward trend in terms of revenue, while Monsanto has blazed a trail in terms of profitability.

While our survey respondents did not generally see generics as a major issue, it should be noted that generic companies were growing twice as fast as innovators over the 2003-08 period (12% vs 6% CAGR), as shown in Figure 7. The observed revenue growth in the market as a whole may be hiding an emerging threat from generic providers who are gaining overall market share.

Figure 7. Comparing revenue trends for innovators and generic companies



Sources for this section: *The Global Agrochemical and Seed Market, Industry Prospects, Presentation at CPDA Annual Conference – Phillips McDougall, July 2008; Facts and figures – The status of global agriculture – CropLife International, 2009; “Seize the opportunity” – Rod Parker, AGROW magazine, August 2008 Issue; Informative Meeting – Vilmorin, 07 October 2009; US Agriculture Industry Trends – Makhteshim AGAN of North America, May 2009; Citigroup Global Market Report on Crop Science- 14 January 2009; company annual reports, 2004-2008*

With some caveats, growth can be expected to continue

This track record has left the industry feeling bullish. In our survey, the majority of respondents believed their organizations would somewhat outperform the market in the next three to five years (Figure 8). While in practice not everyone can outperform, there are many good reasons for general optimism about the sector, the biggest of which is growth from emerging markets and, more generally, continued growth of demand for food. The critical factors determining a company's success relative to the rest of the market, in the eyes of our respondents, included the strength of an individual company's R&D pipeline, its agility compared with the competition (a point that informs much of the latter portion of this

report) and the relative strength or weakness of its product portfolio.

These responses are underpinned by a shared expectation that the market will continue to grow. As shown in Figure 9, future growth is anticipated in all sub-segments, albeit at a reduced rate compared with the last five years. The reduction is partly due to the fact that some of the recent growth arises from high prices from 2008 onwards – prices which experts believe are not sustainable over the longer term. This is particularly true in the case of GM seeds, where most growth in planted acreage is expected to come from emerging markets, which are price-sensitive. To meet their growth targets in these price-sensitive markets, companies are employing pricing models that

can flex to accommodate market differences – a requirement that adds to the complexity of both market entry and subsequent growth.

Sources: The Global Agrochemical and Seed Market, Industry Prospects, Presentation at CPDA Annual Conference – Phillips McDougall, July 2008; Facts and figures – The status of global agriculture – CropLife International, 2009; Informative Meeting – Vilmorin, 07 October 2009; US Agriculture Industry Trends – Makhteshim AGAN of North America, May 2009; Citigroup Global Market Report on Crop Science – 14 January 2009

Figure 8. Respondents' expectations of how their company will perform in the next 3-5 years

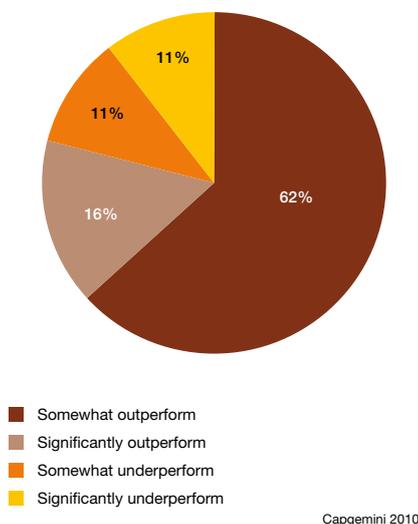
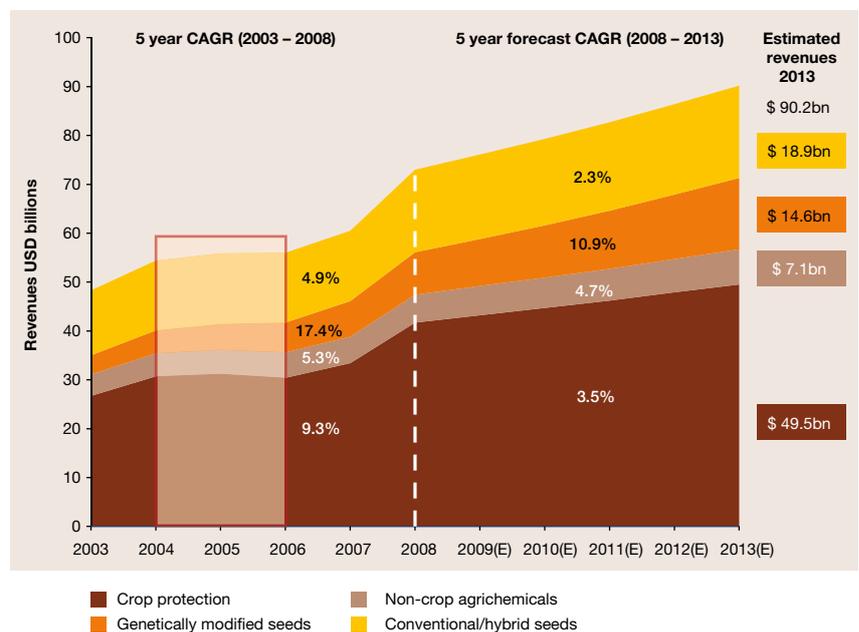


Figure 9. Past and projected growth of the four sub-segments





Re-evaluating the business model

In 2005, when the major players were constructing their strategic plans, it was envisaged that the relative importance of the crop protection sub-segment – the largest of the four, then and now – would decrease, particularly compared with GM seeds. Looking at the figures and trends for the period between 2004 and 2006 in Figure 9 (page 11), it is easy to see why they would have taken this view.

At this time, the companies expected to have to adjust their business models to reflect the changing relative importance of the different sub-segments. Contrary to expectations, however, crop protection products have enjoyed a very good run (in terms of sales and profitability) in the intervening four years. There seem to be two main reasons for this success: increased crop prices and new demand from emerging markets. We look at these in more detail below.

Increased crop prices

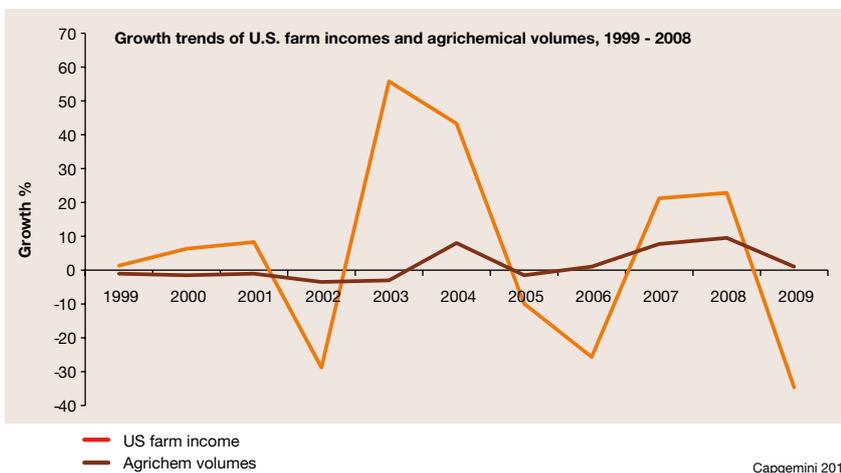
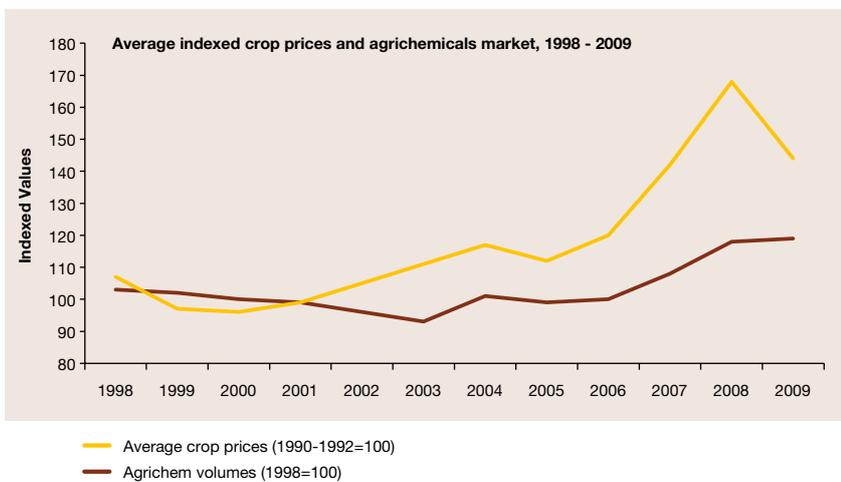
Demand for crop chemicals appears to be related to the volume of grain produced and its average selling price. Higher crop prices encourage higher planted acreage as farmers try to maximize their revenue potential, which in turn leads to greater demand for agrichemicals.

This pattern is also partly due to the fact that higher grain prices and/or volumes result in higher farm income and more disposable income to purchase inputs like fertilizers and agrichemicals, an explanation that is to some extent borne out by Figure 10.

This relationship may offer an opportunity for agribusiness companies to add a service component to their offerings. When crop prices are lower there is potential to support farmers to help them maximize their income through the correct usage of chemicals. This could help farmers to minimize the input costs of agrichemicals by ensuring that products are used correctly (for example, only at the most appropriate times). Opportunities such as this call for some creativity on behalf of the chemical producers but also offer the chance to build deeper relationships with growers which in turn may help insulate them from both branded and generic competition.

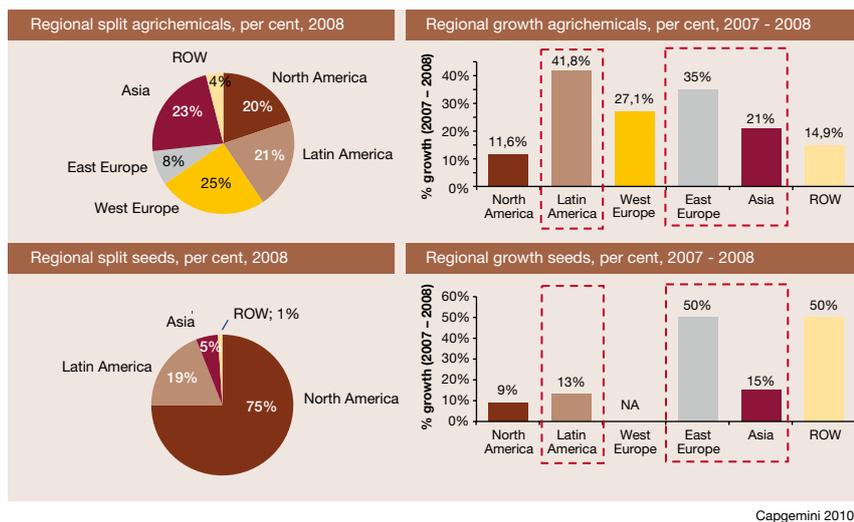
Sources for this section: USDA.gov, accessed 02 December 2009; Citigroup Global Market Report on Crop Science - 14 January 2009; Syngenta analyst report – Deutsche Bank, 01 July 2009

Figure 10. Trends in average indexed crop prices and farm incomes compared with agrichemical volumes



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Figure 11. Comparing growth patterns in regional demand for seeds and agrichemicals



Demand from emerging markets

The second factor in the recent success of crop protection products is increased demand from emerging geographies such as Eastern Europe, Latin America and Asia Pacific. Figure 11 shows that markets like these are relatively small at present but are growing rapidly. While Western Europe shows healthy short-term growth for agrichemicals, it is in the developing markets that the next phase of growth is expected to occur.

Source: Citigroup Global Market Report on Crop Science – 14 January 2009

Implications for agribusiness

Against expectations, then, the crop protection sub-sector is continuing to grow. There are a couple of caveats: firstly, its 2008 growth is partly due to low food stocks, and secondly, in future EU regulations on pesticides³ may negatively impact it. Nonetheless, the continued importance of this sub-sector has forced agrichemical companies to re-think their business plans and models. We asked participants in our survey to say which they thought was the more likely outcome in five key areas; the results are summarized in Figure 12 and discussed below.

Figure 12. Respondents predict the business models of the future.

Driver	Scenario 1		Scenario 2
Combination of seeds and crop protection	The seed and crop protection business will stay separate		Integrated solutions model for seed and crop protection
Branding	Establishment of strong and global market brands even in front of the end consumer	★	Different brands in different markets —no branding in front of the end consumer
Role of acquisition vs. collaboration	New products and capabilities will be acquired by dominant players — primarily in-house development and marketing — usually a single IP owner	★	Network of issue-specific collaborations to increase and foster an “ecosystem” of development and marketing —IP owner consortium
Global vs. local	Globally diversified markets and customer base. Strong regional/local stewardship in marketing and sales approaches as well as logistics	★	Globally harmonized market approaches with only minor, specific elements being adapted locally to serve market needs
Established vs. emerging markets	Clear split between established and emerging markets: highly innovative products and hybrid seeds for established markets — more conventional products for emerging markets	★	Equal split of innovation between established and emerging markets

Source : Primary Interviews

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³ For example, since September 2008, the EU has required agrichemical manufacturers to provide studies on expected maximum residue levels (MRLs) for pesticides as part of the product registration process; if the MRL of a pesticide at normal use is found to be above its MRL threshold (usually 0.01 mg/Kg), its use is banned on that specific crop. The EU legislators have also proposed new regulations on crop protection products which could lead to bans on many active substances based on hazard measurements of the ingredients.

The responses to the five questions can be summarized by the three axes shown in Figure 13: namely the degree to which products are globally harmonised versus locally tailored, the extent to which seeds and chemical products are offered as separate or integrated solutions, and the nature of the R&D model (that is, whether it is acquisitive versus collaborative).

Combination of seeds and crop protection

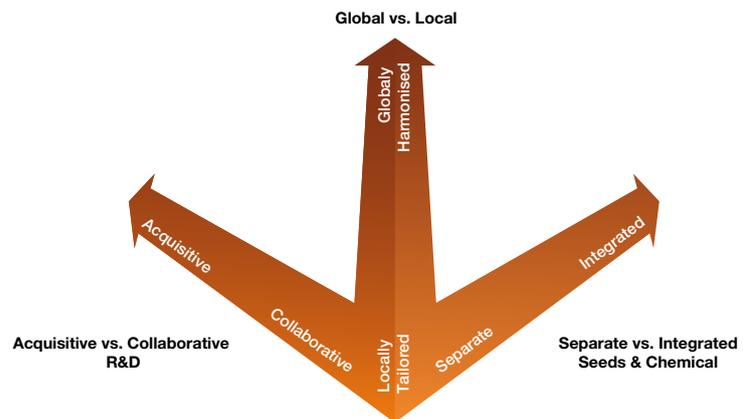
There was a considerable degree of consensus that the companies producing both chemical and seed products will increasingly move towards integrated solutions (i.e. bundling seed and crop protection products together). There is also motivation to include value-added service elements, either to add to or to protect current revenue streams.

Global versus local

Most respondents recognized the need to offer diverse products between geographies, rather than to be harmonized with only minor local adaptations. This trend will be an important driver of complexity in the business model as it requires strong regional and local stewardship of the marketing and sales approaches, as well as of productions and global logistics. “We need to manage the complexity of our offerings if we are to serve highly fragmented, differentiated market segments,” commented one respondent.

Branding is another area where respondents were mostly in agreement. Instead of offering different brands in different markets, they expected to establish strong, global market brands. They also expected to increase the positioning of these brands in front of the end consumer.

Figure 13. Three major axes for future business models



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Acquisition versus collaboration

Although there was not such a strong consensus here, most respondents expected that new products and capabilities would be acquired by dominant players, rather than through collaborative “ecosystems”. Development and marketing would primarily be in-house and IP would normally be owned by a specific company rather than a consortium.

Most respondents also suggested that the majority of innovation would be focused on established markets, and that emerging markets would be offered a more conventional product set.

3 Mounting Pressure on the World's Resources

Why resource constraints matter to the industry

As we saw in the previous chapter, there is reason to expect continued growth in demand for agribusiness products in the coming years, not least in the area of crop protection. This growth will arise mainly from increasing demand for the products of the sector's major customers – farmers.

In this chapter, we will discuss the demand for these products in three well-established areas: food, feed and biofuels. In addition we will discuss a less familiar source of demand: the industrial use of biomass in refineries, to replace fossil fuels as input to the production of energy, plastics, chemicals and the like.

We will then look at the resource constraints that could limit farmers' ability to meet these demands, and their implications. Agribusiness needs to be concerned with these issues for two main reasons: firstly the need to show a responsible attitude to the market, and secondly



the commercial consideration that constraints on farmers' efforts to satisfy demand could also limit their demand for chemicals and seeds.

Looking more closely at the need for responsibility, if farmers' ability to meet demand is constrained by resource shortages, for example of land and water, there is an obvious knock-on effect in terms of food security and related issues. The industry therefore needs to adopt a responsible stance in order to avoid being seen to exploit shortages of food and other farming outputs.

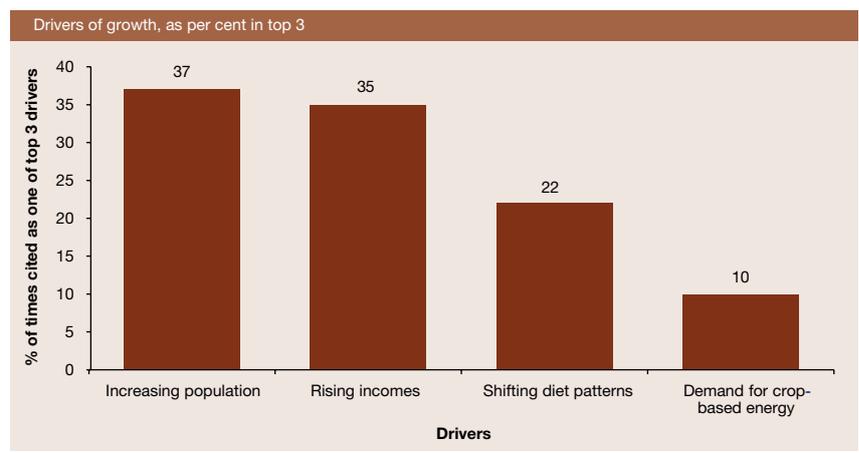
There is a parallel here with the pharmaceutical industry, where companies are concerned about being seen as profiteering from the swine flu epidemic and are taking steps to improve their image. Similarly, agribusiness companies need to be seen to be helping their customers grapple with the issues that they are currently facing rather than simply seeking to exploit the situation to sell more products.

Factors increasing demand for crops and hence agribusiness products

Our survey respondents agreed that four major factors will combine to increase demand: global population growth, rising per capita income leading to a shift in consumption patterns (these linked factors are shown separately in Figure 14), and growing demand for alternative energy sources.

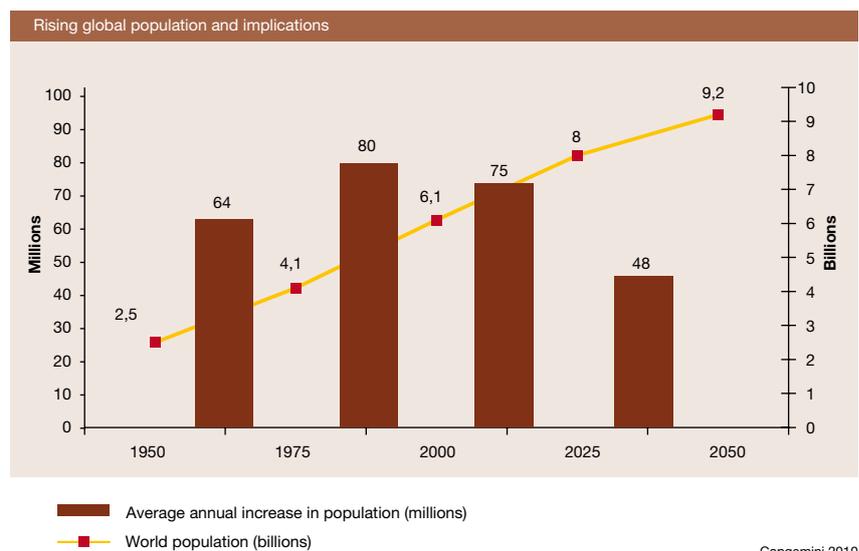
Below we discuss each of these factors, before considering the more general use of biomass for industrial purposes.

Figure 14. How respondents ranked drivers of growth in the industry



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Figure 15. Global population growth



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Increasing population

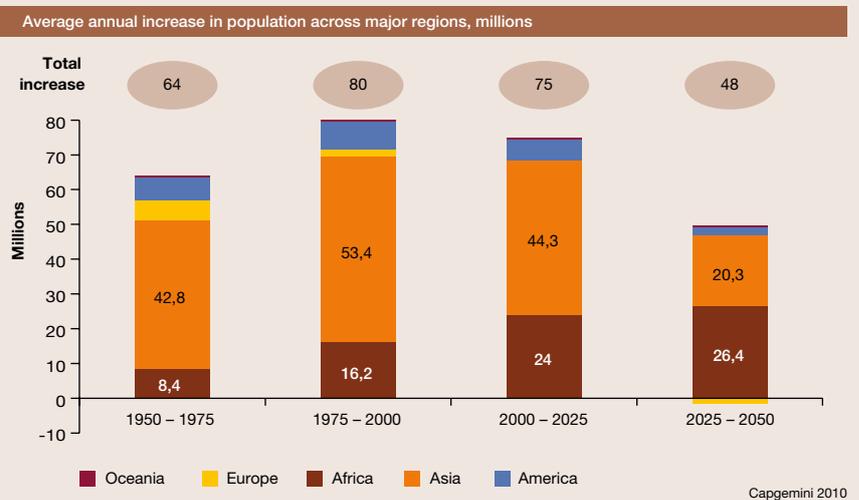
Population growth is considered to be the biggest factor impacting growth in demand: our respondents' views are confirmed by research linking historic population growth to increasing food demand. The world population has

more than doubled since the 1950s and is projected to reach 9bn by 2050, maintaining a growth rate of 1% per annum until at least 2050.

Regional variations in population growth

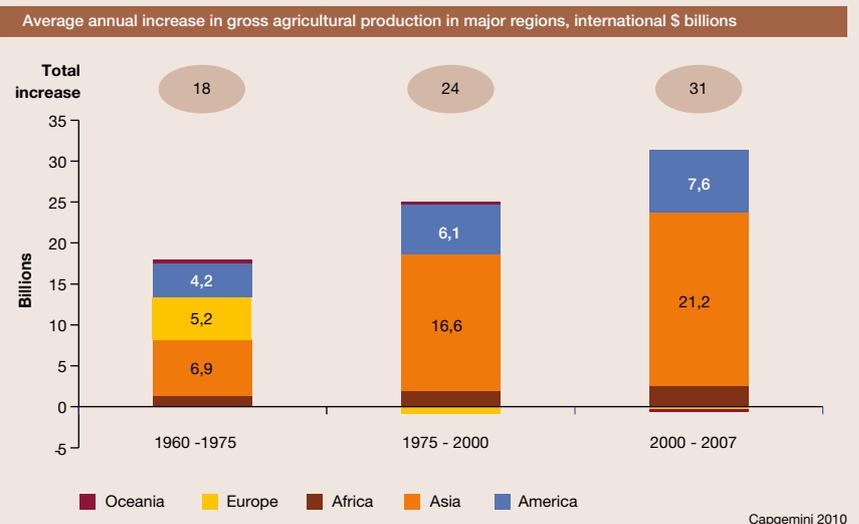
Though the pace of global population growth is slowing, it is expected to continue at 1% annually until 2025. Figure 16 shows where the growth is expected to occur. Until 2025 the increase in population will be mainly in Asia. However, post 2025, it is expected that a downward trend in China's population will significantly reduce Asia's overall population growth. After 2025, Africa will have the fastest increase in population.

Figure 16. Annual increase in population across major regions



It is interesting to compare the rates of growth in agricultural production between the same regions, bearing in mind that the United Nations Environment Programme predicts that global demand for food will increase by at least 2.5 times the current amount by 2050. What this indicates is a mismatch in demand for and supply of food, particularly on the African continent.

Figure 17. Average annual increase in gross agricultural production in major regions, international \$



Sources for this section: United Nations Population Department-World Population prospects-The 2008 revision; FAO Statistics- Production indices - accessed 05 November 2009

Rising incomes and shifting diet patterns

Less developed countries are expected to witness strong economic growth and a significant rise in income levels by 2020. History shows that the growing affluence of consumers in these countries is likely to shift dietary patterns towards more resource-intensive foods, particularly animal protein. As well as putting pressure on natural resources such as water, this trend will increase the demand for animal feed and the agribusiness products used in its production.

Demand for crop-based energy

Rising global energy requirements and environmental concerns mean agricultural crops must increasingly be available as an energy source, as well as providing food, feed and fiber. The so called “first generation” of biofuels have been produced from feed crops such as maize (a feedstock for the production of ethanol) and rapeseed (a feedstock for the production of biodiesel) which has in turn caused political, environmental and ethical debate about the use such crops for energy generation.

These first-generation fuels are likely to be superseded in due course by a second generation produced from plant material whose production does not compete for resources with food supplies: these can be made with waste material from food plants or from plants grown on non-arable land.

The emergence of the “second generation” of biofuels has a very significant implication for agribusiness. Whilst the crops used to produce first-generation fuels required agrichemical products that were already used for food crops,

some second-generation fuels will come from entirely different plants and technologies. These plants will be susceptible to different pests and natural plant competitors which may or may not be covered by current agrichemical portfolios. Companies that wish to maintain their revenue streams will need to consider producing biofuel-specific products – perhaps GM seeds that are disease-resistant and high-yielding, or pesticides and fertilizers specific to plants that in some cases have never been commercially cultivated in significant volumes before.

This presents both an opportunity and a risk as these products will require significant R&D investment at a time when the fuel producing technologies are still relatively untested to enable agribusiness companies to develop competitive advantage.



Industrial use of biomass

There is an important trend that is likely to affect the demand for crops and hence agribusiness products – one that the industry is not yet widely aware of, though certain players are already very interested. This is the industrial use of biomass. Here plant materials are fed into “biorefineries” in order to produce not only fuels but also power and heat plus plastics and chemicals that would traditionally be derived from petrochemicals. Biorefining is of enormous potential value as a way to lessen or remove the world's reliance on fossil fuels such as crude oil before the supply of these resources dries up.

Clearly, industrial use of biomass could be an additional source of demand for crops and hence for agribusiness products such as fertilizer and seed. However, there is a danger that industrial biomass will be competing with food and feed for other natural resources such as land and water. Therefore it will be important to find ways to create additional biomass without needing more land.

Part of the answer is likely to lie in making the land more productive by breeding better plants, using agrichemicals to increase their yield and generally cultivating them more efficiently. For example, in the case of sugar beet, a beet that comes out of the ground clean, without soil attached, is preferable, so that energy and water do not have to be used to wash it. This might mean breeding a beet with fewer external roots and fibers for earth to cling to.

In addition, as in the case of second-generation biofuels, it will be important to find ways to convert the otherwise unusable residues from food plants into energy and plastics. The advantages of using plant residues are clear, but the drawback is that it takes longer, for example, to refine wood chips than sugar beet, whose sugars are readily convertible into energy. Our ability to produce bioenergy from residues depends on the emergence of technology to make the process more efficient.

The agribusiness industry has a part to play in developing the relevant technologies, in collaboration with energy companies. For example, agrichemical companies can develop enzymes that can serve as a catalyst to free usable molecules faster and more efficiently from residues such as wood chips and corn stalks.

Industrial use of biomass (cont'd)

The United States Department of Agriculture's "Billion Ton Annual Supply" biomass report estimates that biomass consumption for the industrial sector will increase at an annual rate of 2% until 2030. Additionally, biomass consumption in electrical utilities will double every 10 years until 2030. The production of transportation fuels from biomass will increase significantly, with biomass use increasing from 0.5% of U.S. transportation fuel consumption in 2001 to 4% in 2010 and 20% in 2030. Production of chemicals and materials from bio-based products will increase from approximately 5% of U.S. chemical commodities in 2001 to 12% in 2010 and 25% in 2030.

The same USDA study suggests that 73% of the biomass supply will come from agricultural sources, including both dedicated energy crops and residues from other crops. Other likely inputs include forestry, aquatic biomass and waste.

Figure 18. Sources of biomass for industrial use

Primary biomass production				
Energy crops	Agricultural residues	Forestry	Aquatic biomass	Waste
<ul style="list-style-type: none"> • Hay crops • Sugar crops • Wood crops • Oil crops 	<ul style="list-style-type: none"> • Hay residues • Sugar residues • Wood residues • Oil residues 	<ul style="list-style-type: none"> • Wood platform • Wood residues 	<ul style="list-style-type: none"> • Algae 	<ul style="list-style-type: none"> • Industrial solid • Industrial pulp • Used vegetable oil • Municipal solid • Sewage sludge • Landfill gas • Organic manure • Animal platform

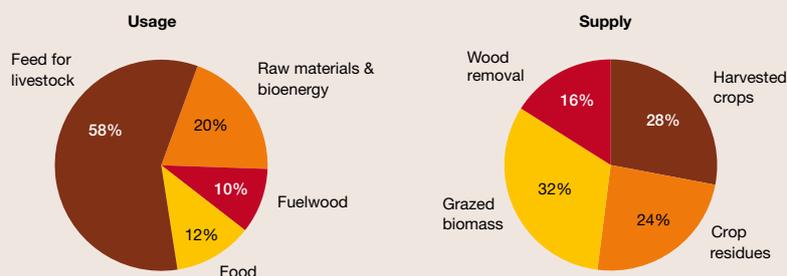
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Source: *Modelling of Energy-Crops in Agricultural Sector Models – Witzke et al, EU Commission, 2008*

As Figure 19 shows, in 2000 already 20% of total biomass was being used for industrial purposes globally; not all of the sources mentioned in Figure 18 were so far being exploited to a significant extent.

Figure 19. Usage and supply of biomass in 2000

Total biomass = 12.14 bn ton dry matter



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Sources: *Biorefinica 2009 - MinDirig Günther Jikeli, Federal Ministry for nutrition, agriculture and consumer protection, January 2009; Krausmann et al. 2008*

The supply side: limiting factors

While demand from all these sources is likely to grow rapidly, the supply of crops will come up against a number of constraints. Availability of land is the most obvious, but the limited supply of water, though much less discussed, is at least as important.

In this section, we look at three major determinants of supply: the limited amount of arable land available, the shortage of water, and the ability of agriculture to increase productivity.

Limits on arable land

Land usage cannot expand enough to support population growth with productivity held constant. To do so it would have to increase at the same rate as the population, which as we have seen is expected to increase at 1% per annum until 2050.

In practice, however, the area of land under cultivation is expected to increase only marginally: by 0.1% according to a study by the FAO. Arable land area in developed countries peaked in the mid-1980s and has since declined significantly – a trend that is likely to continue. In developing countries land use will continue to grow, but only very slowly. Globally, between 2m and 5m hectares of arable land are estimated to be lost annually through soil erosion, urbanization and industrial pollution.

The fact that arable land cannot expand to match the growth in population will clearly result in a significant decrease in the area of arable land available per capita (see Figure 21).

While the rate of decline is slowing, the earlier decline was offset by higher yields resulting from the more efficient agricultural techniques introduced following WWII (during the so-called “green revolution”). Most analysts feel that that rate of productivity increase will not be sustained over the next half-century unless new techniques are developed.

Those techniques are urgently needed. It is estimated that arable land expansion will be able to meet only 9% of increased food demand by 2050; the rest will have to be met by increasing productivity.

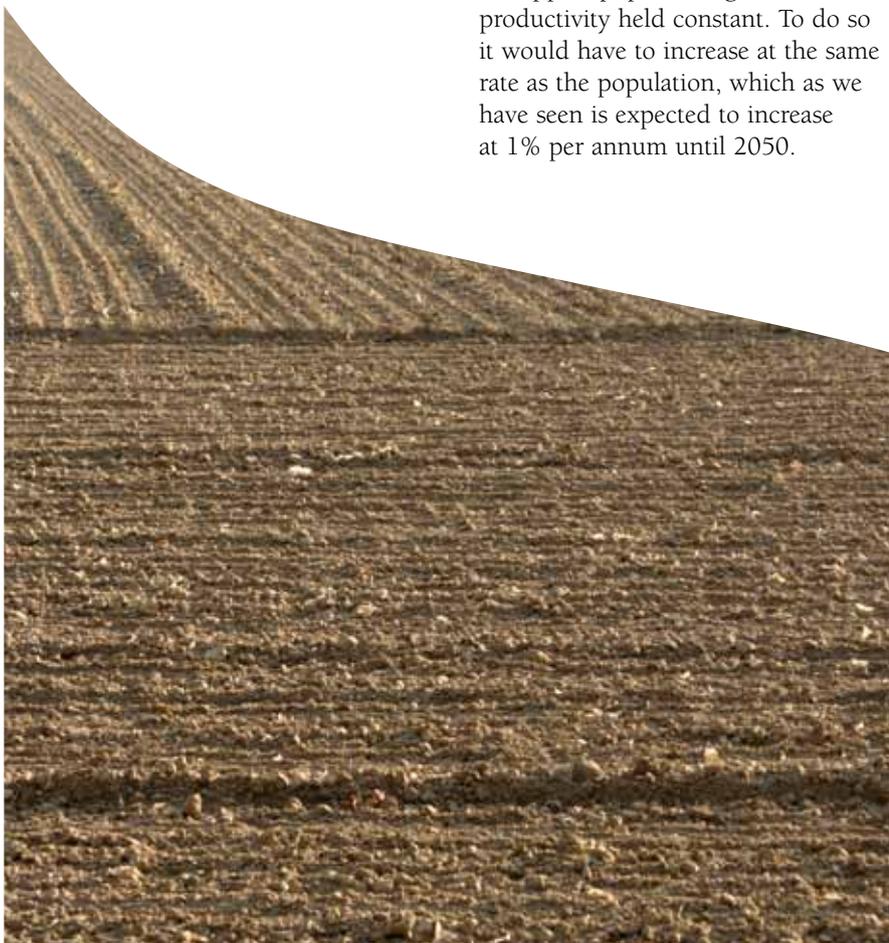


Figure 20. Area of arable land under cultivation, 1961 - 2050

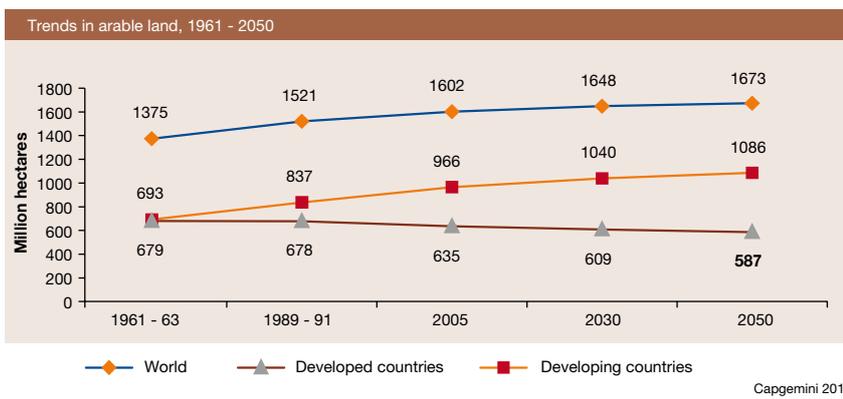
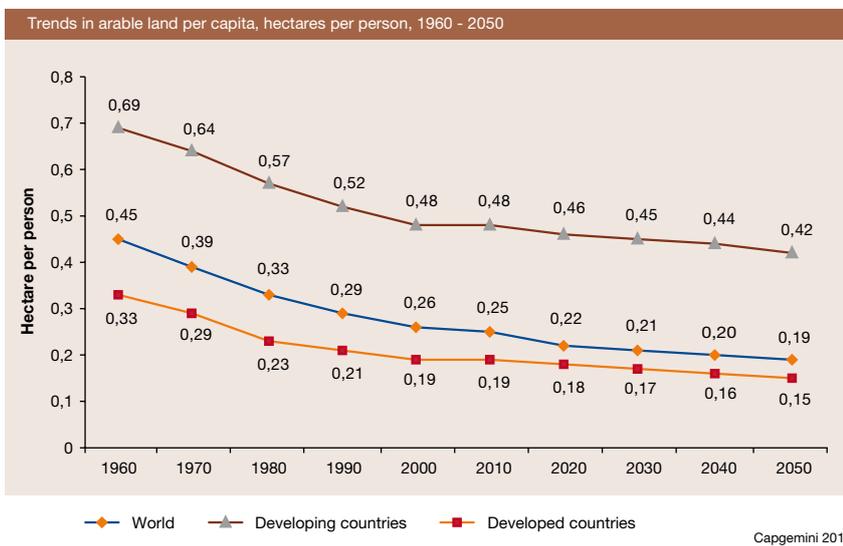


Figure 21. Arable land per capital 1960 - 2050



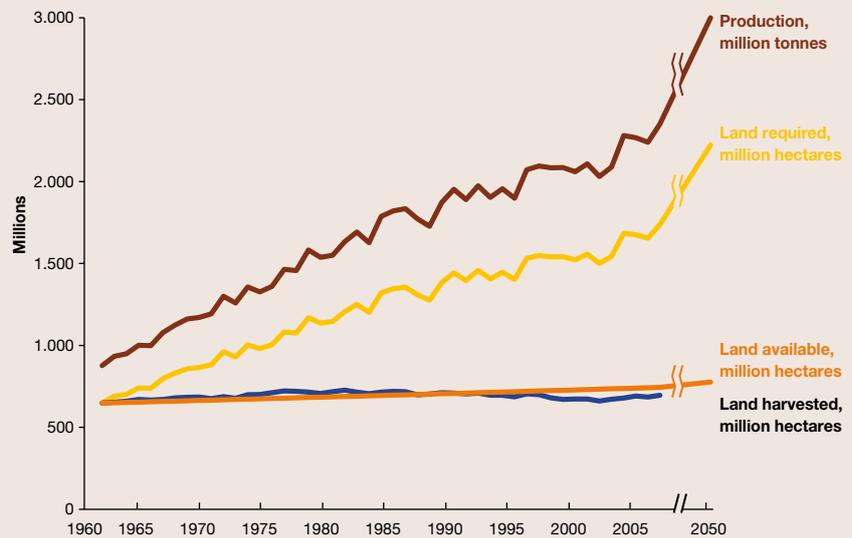
The example of cereals production shows why it is impossible to meet increasing demand through land expansion alone

Cereals currently occupy 51% of the world's total harvested area. In 1961, total cereal production was 877 million tonnes, harvested from 688 million hectares of land – a yield of 1353 kg/hectare. In 2007, while total production had increased by 168% since 1961, available land had grown at only 15%.

This increase in land, even with the use of multiple cropping practices, would have been able to meet only 20% of the increased cereals demand. To meet it in full would have required an additional 1737m hectares - and so there would have been a shortfall of almost 1000m hectares. Only with a yield increase of 149% was it possible to achieve this level of production.

Figure 22. Comparison of land required for cereal production at constant 1961 yields, 1960 - 2007 and 2050

Case example: comparison of land required for cereal production at constant 1961 yields, millions, 1960 - 2007 and 2050



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Source for this section: *The resource outlook to 2050 - Paper presented at the FAO Expert Meeting, 24-26 June 2009, Rome on "How to Feed the World in 2050", Jelle Bruinsma*

Limits on water availability

Water is becoming scarcer, particularly in developing countries. The average number of droughts has been increasing. Worldwide, around 1.2bn people live in areas of absolute water scarcity (where human water use has surpassed sustainable limits). By 2025, it is estimated that the figure will have risen to 1.8bn. The problem is likely to be aggravated in future by water pollution and by over-exploitation of surface and ground water resources.

Increasingly, agriculture itself is being seen as a major cause of global water scarcity. Currently, it accounts for as much as 70% of the fresh water withdrawals in the world. Water withdrawal for irrigation will increase by 13% between 2000 and 2050, with virtually all the increase occurring in developing countries. As populations grow, competition between agricultural use of water and other uses is expected to increase.

The limited supply of water for agricultural purposes is expected to constrain agricultural production severely, especially in water-scarce regions like the Near East, North Africa and South Asia. Here the industry is active in breeding programs for drought resistance and water use efficiency.

Source for this section:
Comprehensive Assessment of Water Management in Agriculture, 2007, International Water Management and Earthscan

Agricultural productivity

In the past, the majority of increases in the food supply have come from higher yields made possible by better agricultural and farm management practices (such as crop rotation), farm equipment and machinery, the use of chemical fertilizers and pesticides and more recently by genetic improvements. Given the above-mentioned resource constraints, agricultural productivity is the main lever available to increase supply in future, and it is also the area where agribusiness can make a major contribution.

A gap that must be bridged

We have seen in this section that a projected increase in global demand is going to be coupled with limitations of supply resulting from scarcity of natural resources like land and water. This gap between supply and demand dictates that those resources need to be used more effectively, and agribusiness is one of several major stakeholder groups that can help to make that happen, as we shall discuss in the next chapter.

*Additional sources for chapter 3:
World population to reach 9.1 bn in 2050 — UN news center, February 2005; Innovative Agriculture Helps to Meet Basic Needs of Life – Dr. Günther Eberz, Environmental and Scientific Affairs, Bayer CropScience; Agricultural Outlook 2008–2017, OECD–FAO, 2008; How to feed 2 billion more mouths in 2030? Here are some answers, FAO newsroom, July 2007*

4 Dealing with the Demand-Supply Gap

A shared responsibility

In the preceding chapter we saw that meeting anticipated growth in demand for the outputs of agriculture is bound to be challenging given the constraints on supply. Managing demand and eliminating waste both have their part to play, but the most important success factor will be finding new ways to increase yield. This will require significant effort on behalf of all those concerned, including political decision-makers, agribusiness companies, growers, retailers and consumers.

In this section we summarize (Figure 23) and describe the part that each of these groups can play.

Political decision-makers

Political decision-makers should build a platform to support a stable agricultural environment, for example through their ability to influence economic, social, environmental and educational conditions. They should encourage long term yield improvements and support the free flow of products between nations, making appropriate use of levers such as regulation and subsidies, and where possible increasing the consistency of regulations between regions.

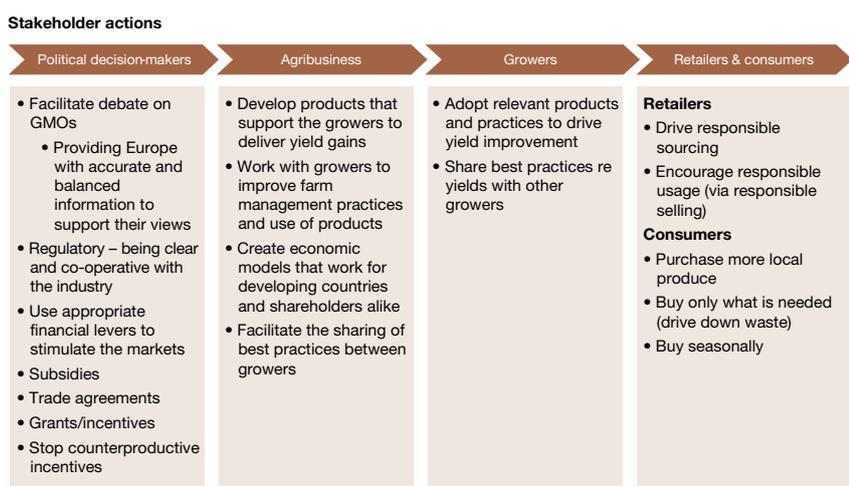
They must also facilitate the debate around the acceptance of GM crops – a debate which has proved fiery in Europe – by providing the population with clear, balanced information to enable reasoned judgments.

Agribusiness companies

Companies should support the development of safe seed and chemical solutions to increase yield. They have an opportunity to work with growers in a variety of ways to improve conventional farm management processes, as part of a shift from product- to service-based offerings. Specifically, they should aim to increase the benefit of their products by training farmers in, for example, the application of sprays and powders to maximize efficiency, or the selection of seed products best suited to local growing conditions.

Companies should also strive to create pricing models that will work for stakeholders, shareholders and those in most need. This is particularly important where the increase in demand for products comes from those countries least able to pay conventional prices for them.

Figure 23. Summary of actions required from each stakeholder group



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Growers

Growers need to improve and maximize the yields of chosen crops, with facilitation from political decision-makers and trade associations. Currently there is a wide variation in yields of a single crop between countries. Differences can be explained to some extent by agro-ecological environments, socio-economic and policy environments – all of which are difficult to overcome. However, there is also wide variation in farm management practices and selection and use of seeds, fertilizers, herbicides, pesticides and so on, suggesting that there is sometimes room for improvement in this area. Trade associations can help by sharing best practice with their counterparts in other countries.

In countries where yields are nearing the present global maximum levels, the ability to increase yields further depends on the continued progress of agricultural research, and in particular on agribusiness's success in developing higher yield varieties (whether through genetic modifications, hybridization or conventional selective breeding).

Retailers

Retailers can play a major part in encouraging the responsible purchase and use of foods. There is an obvious conflict here, as retailers are generally measured on sales and sales growth, which means they would rather that consumers bought more from them, even if it ends up as waste.

Food wastage is particularly common in developed countries in Europe and the Americas, and is increasing. Studies in Western Europe suggest that as much as 40% of food bought

is wasted. Bread and potatoes are the two most common waste groups but vegetables make up one fifth of all wasted food. More sensible usage of multiple purchase offers (e.g. “buy one get one free”) is one of the ways retailers can help to reduce wastage. In the UK, there have been proposals to legislate in this area if retailers do not voluntarily modify their use of these offers.

Retailers can also help their customers to make informed decisions – for example they can raise awareness of where foods are sourced through clear labeling.

Consumers

It is down to consumers to purchase and eat responsibly, that is to say, buy what they need and eat what they buy: 60% of all wasted food in the UK is not only uneaten but still in its package. As well as meal planning, there is significant scope for reduction in waste levels through better storage of food.

Where possible, consumers should buy seasonally available, locally produced food. They should reduce consumption of those goods that place greatest pressure on the food network, such as red meat; some such steps may also result in a healthier diet. Another example of potential change is that on Valentine's Day in the Western world we like to send roses as a token of our affections. We do so with little thought of where they are sourced, or the natural resources and land used to grow them.

5 Future Scenarios and their Implications for the Industry

The industry enters a period of uncertainty

In previous chapters we have outlined the challenges agribusiness players face with respect to the global tension between demand, supply and resource constraints. As they plan their approach to this problem, organizations will also have to deal with a number of other changes to the business environment, and in many cases to design strategies that accommodate more than one possible outcome.

During our interviews for this study, we explored a number of alternative scenarios that we believed would shape

the industry over the next three to five years. Interviewees clearly told us that several of these scenarios would have a particularly significant impact on the future of the industry.

In this chapter, we discuss some of the most important of those scenarios, and consider how they will affect agribusiness, particularly in terms of companies' increasing need to manage complexity.

When so many imponderables lie ahead, it is fortunate that agribusiness is more used to dealing with uncertainties than many other sectors. It has always been, and continues to be, heavily impacted by two key uncertainties: the weather and economic conditions.



Industry insiders predict future scenarios

Along with the major challenge of bridging the demand-supply gap, a number of future trends will shape the industry's next decade. We asked our survey respondents to state how they expected the industry and its environment to develop over the next five years in terms of a number of drivers. The results are shown in Figure 24. The blue circles indicate the average of responses in each category.

From this exercise, and from the earlier discussion of business models (see section 2), we have identified four key drivers of complexity.

These are:

- The impact of legislation on product portfolios
- Changing public perception of chemicals and GMOs
- The degree of product differentiation required between different markets, and
- The shift from products to service-based offerings

Combining the possible scenarios for each of these four drivers, as shown in Figure 25, illustrates the increasing complexity faced by the industry.

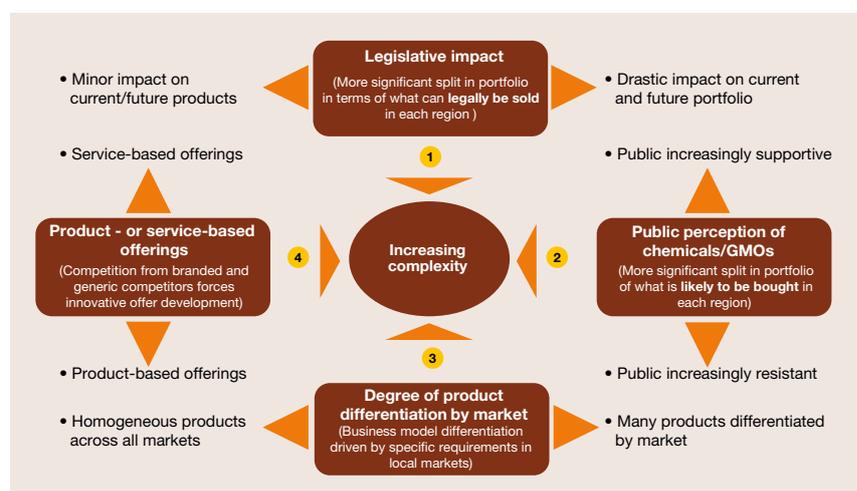
We now review each of the four drivers in turn, commenting on the possible outcomes, before moving on to a more general discussion of the implied complexity.

Figure 24. Predicted scenarios in 12 key dimensions

Driver	Best case		Worst case
Population growth	Population growth in line with UN projections	●	Significantly increased population growth
Regulation	Minor impact of regulations on current products and near-term prospects	●	Drastic impact on current and future portfolio
Credit availability	Free cash flow	●	Defaulting debtors and poor credit
Competition from rivals	Competitive situation as current	●	Drastically increased competition
Competition from generics	Low/no penetration of generics	●	High/increasing threat from generics
Price/availability of raw materials	Continue to drive value from purchasing power	●	Increase in population and demand leads to availability and prices
Counterfeits	Low penetration of counterfeits	●	High penetration by counterfeit products
Subsidies	Significant and stable subsidy environment	●	Significant reduction of subsidies, and unpredictable changes
Stance on GMOs	Public increasingly supportive	U.S. ● EU ●	Public increasingly resistant to GMOs
Growth potential in markets	Established market sizes remain static or even shrinking	●	Continued growth in established markets
Serving emerging markets	Can access and profitably serve new significantly growing markets	●	Issues impacting pricing and logistics in emerging markets – not profitable
Government policy	Political decision-makers support free market	●	Intervention e.g. subsidies/tariffs

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Figure 25. Combining scenarios for four key drivers reveals increasing complexity



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The legislative impact Toughening regulation, particularly in Europe, suggests that a likely outcome is an increasingly significant split in portfolio in terms of what can legally be sold in each region. It is widely expected that the EU and U.S. will continue to differ widely as to what is approved or not approved. There are two potential outcomes for countries that do not ban the use of products in the current portfolio. Firstly, the U.S. could become a “cash cow”: a market in which high or stable margins can be earned on more mature products. Secondly, a country like Brazil could become a high-growth market. By contrast, markets that maintain a more restrictive regulatory stance (including EU countries) could become costlier and more complex to serve as they will require increased R&D expenditure to develop products aligned to emerging regulation.

Public perception of chemicals and GMOs The historic trend has been the emergence of two camps. The first, led by the U.S., has a pro or open stance towards the use of GMOs to drive yield and nutritional benefits. The second, led by the EU, has an anti or closed stance. Once again, the likelihood, as confirmed by those interviewed in our survey, is a continuing divergence in these two camps. If realized, this trend will have a significant impact on the ability of EU-aligned countries to increase yields and support the supply side of the food shortage equation. A moral question could even be raised as to whether the developed countries in Western Europe should be able to make the demands they do on the international food network (such as year-round availability of all foods) if they are

unwilling to maximize their own production through use of GMOs.

Degree of product differentiation by market The growth that is being seen in emerging markets brings an additional layer of complexity in terms of local and regional requirements for products. The combination of diversity and specificity required by differences in local climate, soil and pest conditions means the likely outcome will be a greater need for an increasing number of differentiated products. Companies will also use these differentiated and configurable products to respond quickly to evolving conditions: for example certain pests become more prevalent in certain weather patterns, so the pesticides that a company will need to supply in a given region will depend to some extent on the weather there.

Product- or service-based offerings Twin competitive pressures from branded and generic companies suggest that successful companies will be forced to augment product offerings with specific services, such as training and support to growers, in order to protect revenues and margins. This scenario will require a greatly increased understanding of the needs of the growers in local markets driven in part by information from distributors and also through stronger relationships with growers.

In isolation, these changes suggest that businesses will need to cope with an increasingly complex environment in order to succeed. When the changes are combined, the likely degree of complexity increases exponentially.

Complexity – the traits that organizations need to succeed

Figure 26 shows how these complexities will affect organizations, both in terms of the types of flexible traits that they will require and the capabilities needed to support these traits.

The flexible traits that will be required to deal with the new complexity can be grouped into three categories: strategic (that is, those requiring an improved understanding of customer and competitor trends), operational (those requiring improvements or adjustments in how agribusiness companies execute) or technical. We now look at the requirements in each of these three categories in more detail.

Strategic requirements

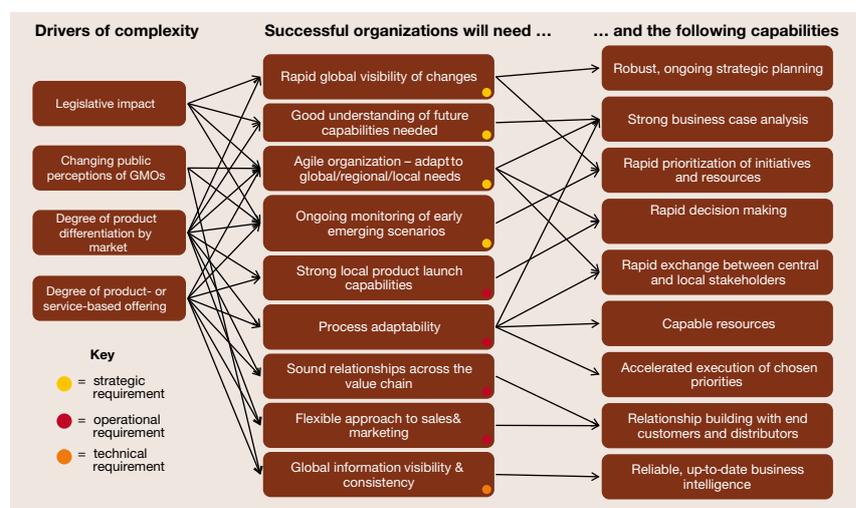
Rapid global visibility of changes

This visibility is needed to anticipate, predict and react to evolving market conditions. Companies must collect data on what is happening in each country they deal in, and from that data should build an understanding of local, regional and global trends.

Good understanding of future capabilities needed

Understanding future trends is only half of the battle. To ensure they are adequately prepared, companies must map these trends to the capabilities required to meet them. By performing something as simple as a gap analysis between current and future organizational capabilities, they can then decide how best to fill each gap, whether through re-training, recruiting or outsourcing services. The following section outlines major capabilities that we believe will be important.

Figure 26. Traits and capabilities that companies will need to deal with future complexity



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Agile organization Once trends are understood and the capabilities required to satisfy them have been identified, the organization must be able to adapt. In the case of some climate- or pest-driven local conditions, the company must be agile enough to deliver specific products to specific geographies within specific timescales. The need for agility is perhaps greatest with respect to the emerging markets in Asia Pacific and Latin America, with their diverse climate and local conditions.

Ongoing monitoring of evolving scenarios

The trends we have been discussing will interact in complex ways as companies strive to meet the divergent requirements of different geographies. For example, companies may find themselves moving from products towards services at the same time as they are moving from a homogeneous to a highly differentiated product

set. Monitoring and early sensing of the evolving scenarios will be vital to enable a fast response; this monitoring activity will require careful management to ensure that it remains a continuous and ongoing process.

Operational requirements

Strong local product launch capabilities Historically, many of the crop protection products have been launched globally, or at least in accordance with a global roll-out plan (according to which they were launched sequentially in local markets). This approach means that most product launch capability resides in global teams, which provide local support as necessary. In a scenario with more locally-tailored products, product launch skills will increasingly be needed locally. The challenge will be to provide these skills at a cost low enough to safeguard profitability.

Process adaptability In order to be agile enough to respond to a changing environment, organizations will need efficient and streamlined processes that are harmonized where possible and standardized where required. Active ownership and management of these processes is essential to provide the flexibility needed. An organizational ethic

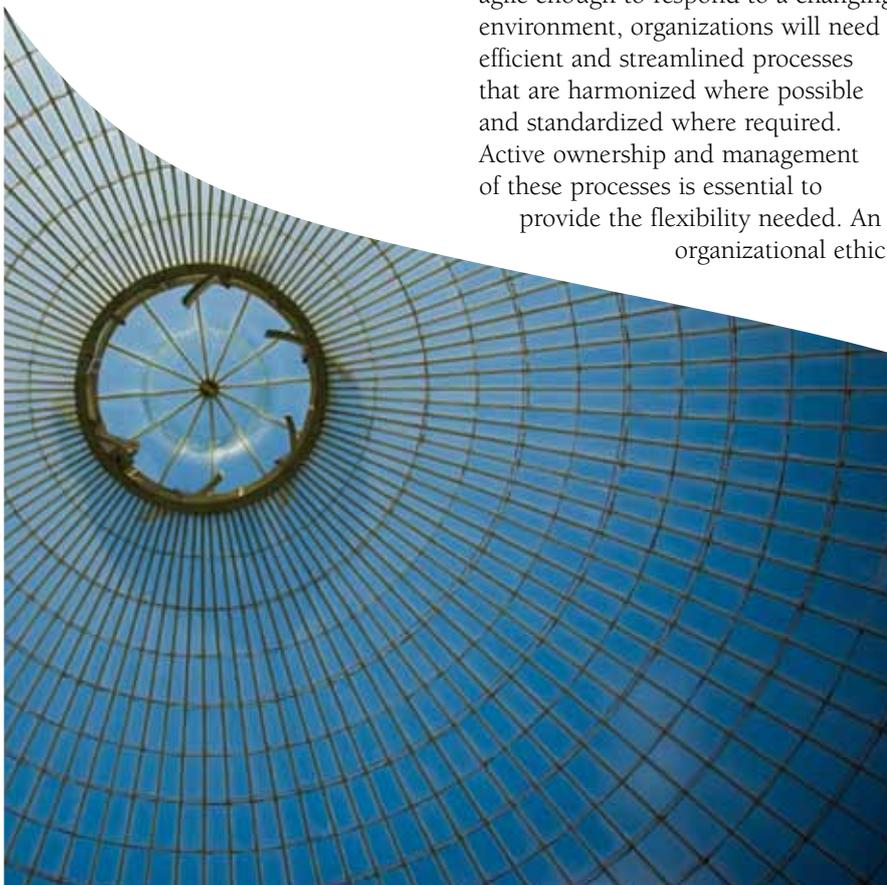
such as Lean (where all processes are designed to deliver maximum value to the customer with minimum wastage) is a perfect starting point for this type of active process management.

Sound relationships across the value chain If the sector does indeed shift towards an increasingly service-based offering then there will be a need to develop much deeper relationships with other stakeholders in the value chain – particularly the R&D and end customers (distributors and growers). Finding a cost efficient and effective way of engaging with end customers will be a key part of successful medium- to long-term strategies, as will forming collaborative partnerships with academia to drive plant science.

Flexible approach to sales & marketing The increasing need for local customization of product marketing and selling will require flexibility in the model, together with a greater understanding of the needs of the end customer. As with product launch, the challenge will be to find efficient ways of providing this flexibility without eroding profits or competitive advantage.

Technical requirements

Global information visibility and consistency If they are to obtain rapid visibility of shifts in market dynamics, companies will need a much improved ability to see and interrogate global data, and to do so rapidly. Data must be clean, consistent and collected in or near real time. All this puts greater emphasis on the implementation and management of master data and business intelligence strategies.



Complexity – what capabilities will organizations need?

We have just outlined the traits that we believe organizations will need to manage complexity successfully in the agribusiness sector of the future. To demonstrate these traits, a company will need to make sure it has sufficient capabilities in the following areas. As we argued above, it is advisable to conduct gap analysis to identify any shortfalls in these areas, and then take steps to acquire or develop the necessary capabilities.

Robust, ongoing strategic planning

Given the number of possible scenarios and the interplay between them, sound scenario modeling capabilities will be needed. Companies also need to identify a set of lead measures to help identify how the scenarios are actually playing out. Also required will be a clear, “evergreen” (that is, constantly revisited) set of plans for what is to happen under each of the different scenarios.

Strong business case analysis

Firms must be able to model business scenarios, apply business case techniques to all projects and programs, and, critically, map these business cases to their P&Ls. In this way they will obtain absolute transparency of why any given program is running; it will become easy to decide which projects and programs to stop, and which to prioritize, when a new scenario emerges.

Rapid prioritization of initiatives and resources

Organizations are already faced with a plethora of projects requiring investments of both capital and human resources. Increasing demands for flexibility and accelerated execution will compound these choices. It will be vital to have a robust process for portfolio prioritization and management – a process that must itself respond flexibly to shifting dynamics.

Rapid decision making

Businesses will need to be able to prepare for, make, communicate and then implement decisions more rapidly. This ability will depend on a clear awareness of the “burning platform” that necessitates the decision.

Rapid exchange between central and local stakeholders

Enhanced communications will be needed in both directions – from individual countries up to the organization's global leadership, and back down again from leadership to countries. Local stakeholders will have to inform leadership of what developments they are seeing, and what they believe the opportunities and challenges are. The organization's leadership will need to communicate to local stakeholders the decisions made on priorities, programs and changes. Clear and unambiguous communication, both upwards and downwards, will be vital if the organization is to capitalize on its opportunities.

Capable resources

Companies need people who are readily able to adapt to evolving scenarios, as they become clearer, by acquiring and applying new capabilities alongside their existing ones. They need people who expect change to happen, and

who embrace it as part of their job of driving competitive advantage.

Accelerated execution of chosen priorities

Sensing and planning are only one half of the equation. It is equally important to be able to execute the identified priorities quickly and effectively.

Relationship building with end customers and distributors

In order to offer more tailored products and services to growers and distributors, companies will need a better understanding of their current and future needs. That understanding can only be achieved by forging closer relationships with both groups.

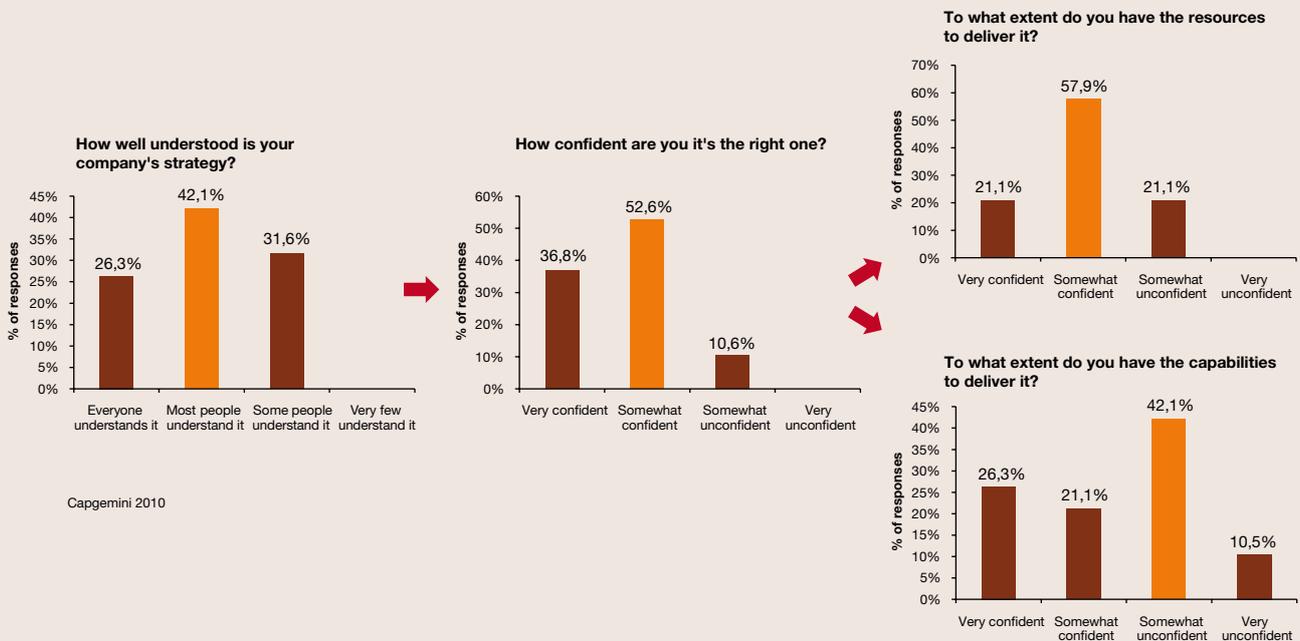
Reliable, up-to-date business intelligence

As we stated above, complex and rapidly-changing business environment requires data that is clean, consistent and collected in or near real time, with consequent requirements for implementation and management of master data and business intelligence strategies.

Complexity – organizations are up for the challenge

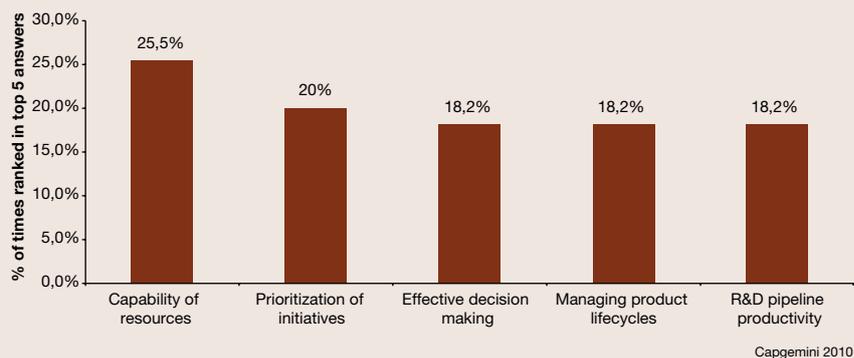
The majority of interviewees believe that their organization has the right growth strategy, that it is well communicated and they are resourced to deliver it, as shown in Figure 27.

Figure 27. Companies generally feel well equipped to deal with the future



However, consistently with our discussion above, interviewees felt less confident that they had the capabilities to deliver their strategy. When asked about the internal challenges to their strategy, most interviewees stated that the capability of their resources was the most likely barrier to success (Figure 28).

Figure 28. Internal challenges to realization of strategy



6 Conclusion

The agribusiness sector has seen impressive growth in recent years, and most companies in the sector have performed well. Challenges on the supply side of the international food network, combined with increasing demand, mean that this growth is likely to continue, though it should be remembered that the market is equally attractive to generic manufacturers. However, the intensifying difficulty of satisfying demand, given limited availability of land and water, places pressure on all stakeholders to take action, whether they are political decision-makers, agribusiness companies, growers, retailers or consumers. The industry needs to be seen to be acting responsibly, forestalling accusations of profiteering.

Whilst the agribusiness industry is used to dealing with uncertainties such as the weather and economic slowdowns, its dynamics are likely to become increasingly complex. This complexity is expected to be driven predominantly by the impact of legislation in certain geographies, the changing and varied public perception of GMOs and agrichemicals, the degree of product differentiation needed by the market and the potential shift from pure product to service-based offerings.

These complexities will, above all, require greater organizational flexibility. We have identified a group of capabilities that will be required to enable it, such as a robust strategic planning process that anticipates and allows for multiple outcomes in key dimensions of change, and accelerated execution of both of the responses to these trends and of broader transformational activities.

It all adds up to a tall order. The next few years promise to be an interesting period for the industry. For companies that find a way to manage the complexities, it could be a highly lucrative one.



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