

**From the Farm to the Table:  
The Transformation of North American Food Processing  
and Implications for the Environment**

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## **Disclaimer**

This report was prepared for the CEC's Environment, Economy and Trade program by Dr. Guy Stanley, research director for the Pan-American Business Partnership at l'École des hautes études commerciales (HEC-Montréal), affiliated with l'Université de Montréal. The views expressed are those of the author and do not reflect those of the CEC or the governments of Canada, Mexico or the United States.

## **Executive Summary\***

What is the impact of the North American food processing system on the environment? This study examines that issue, employing the analytical framework developed at the Commission for Environmental Cooperation. By looking at the entire industry value chain,<sup>1</sup> this framework enables the researcher to develop a broad understanding of the linkages among the economy, trade and the environment.

### **Project Scope**

Drawing on government statistics and industry information, the study develops a synthetic overview of the contemporary food manufacturing sector. The research covers the full value chain, from developments in farming and seeds to production and distribution, including management and technology issues, insofar as these shed light on food manufacture.<sup>2</sup> As the bibliography reveals, most of the information is derived from studies by the US Department of Agriculture, Economic Research Service, supplemented by data from Agriculture Canada, Statistics Canada, the Organisation for Economic Cooperation and Development (OECD), the World Bank and industry. In answering the basic question of the study, this report shows how the North American food processing system has changed over the last 10 years and identifies the broad issues related to the environmental sustainability of that system.

### **Basic Findings**

Between the 1920s and the 1980s, Canada and the US developed an integrated, continent-wide system of agricultural production, sophisticated supply chain logistics and management, food manufacture and distribution. In the last 25 years, that system has greatly increased in efficiency as firms have streamlined supply chains and pursued expanded markets that were opened up by trade liberalization. Business has also made extensive use of new information, computer and telecommunications (ICT) technologies to enhance communication, coordination and control along the supply chain while rebalancing distribution channels. With the passage of NAFTA and its coming into force during that period, those processes have intensified in North America to the point where the industry may be approaching a major flex point—in other words, a moment at which the whole industry reconfigures itself. Giant food manufacturers, having created the integrated, scientific industrialized system we are accustomed to, now face significant competition from the store brands of large retail outlets. The latter's business models generate more cash and permit them to invest more than the competition in reshaping both value perception and the shopping experience. Canada and the US are each experiencing these changes. Meanwhile, developments in Mexico are telescoping 80

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\* Much of the information for this study was collected with the help of Chantal Soucy, MBA, research assistant on this project, which was managed through the auspices of CETAI-HÉC, Montréal.

<sup>1</sup> CEC Framework, pp. 27-34.

<sup>2</sup> The perspective, however, is a general one. Issues particular to dairy, fish and organic food (for example) were not pursued.

years of Canada–US development into 40 years, pushing the limits of the nation’s capacity to modernize as it struggles to match the efficiencies north of the Rio Grande.

What do these developments mean for the environment? The changes in food manufacturing over the last 10 years have altered farming in two ways. For grains and feeds, the introduction of herbicide-tolerant crops means a lighter use of chemicals produces high yields and more no-till techniques can be used. This in principle lightens the immediate impact on the environment; however, the concentration on high-yielding varieties significantly reduces the variety of germplasm under cultivation. The second impact is the move to greater concentration in livestock processing, which poses new challenges for regulators. The OECD has in fact noted these findings in its regular surveys of agricultural impact on the environment (see also Conclusions below). Again, the focus on high yields narrows the livestock gene pool, which may in turn make it more vulnerable to new disease vectors or climatic shocks.

The future impact of production and distribution changes is unlikely to be very different from the trends of the 1990s. Customers will shop in greater volumes and perhaps drive longer distances to the big box stores. But they will also shop less frequently. Additionally, the shift in consumer demand toward products with a demonstrable health benefit may well have a generally beneficial impact on public health. The change will nevertheless oblige governments to expand their regulatory controls to ensure that health claims can be verified. There is also the risk of food prices increasing to cover the costs of clinical trials designed to prove the claims made for these “neutraceuticals.” Thus, in contrast to the last 10 years, when the operation of the food manufacturing value chain altered significantly with only a marginal adjustment for regulators, the next decade may see the reverse take place.

The bigger issue raised by this study is whether the current food system will be able to evolve—or more precisely, to respond to evolutionary pressures. Is the system’s dependence on efficiency and linearity, together with the increasing levels of ownership concentration in every segment of the value chain, reducing its flexibility? Such rigidity would restrict the capacity of the system to respond to exogenous shocks from plant or animal diseases, climatic stresses such as alterations in average temperature and increases in damaging storms, or new discoveries whose introduction may reduce public confidence in the quality of the food supply.

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## **Chapter 1: The North American Norm—Vertically Integrated, Contract-coordinated Food Production**

### **North American Economic Integration**

The concept “economic integration” is often used but not well understood. In trade theory, integration follows trade liberalization, from free trade area to customs union to common market. But the reality of the NAFTA countries is otherwise: trade liberalization followed rather than led the integration process. European Union studies have developed a theory of functional integration in which central institutions are created by international treaty to promote integration by means of directives and court rulings. The directives are to be translated or transposed into domestic legislation; the courts enforce mutual recognition of national standards. In this European model, institutions rather than transactions bring about economic integration.<sup>3</sup>

Though clarity about the integration process—in particular that of NAFTA—is lacking, there is more agreement about its results: increased specialization and greater trade and investment between or among national economies. Consequently, all countries benefit from efficient exploitation of comparative advantage. An underlying assumption, however, is that in arrangements based on national treatment such as NAFTA, borders somehow continue to serve a purpose in limiting integration.<sup>4</sup> Governments and institutions continue to operate at arm’s length unless they decide to do otherwise.

This focus on the macro-picture minimizes the daily reality of integration at the micro-level. The NAFTA reality is that of “deep integration”: so integrated that regulations and practices at the local level are as important—if not more so—than national borders. The sign of deep integration is that corporate cross-border organization and the transmission of economic pressures across borders through essentially unified markets puts pressure on public institutions to harmonize standards and practices. If they fail to respond, industry finds an alternative solution. NAFTA is a Swiss cheese of deep economic penetration and generally protectionist public policy in all three countries. Policy still functions as though North American industries and economies were not in effect a single calculating machine (for example, the separate approaches taken with Bovine Spongiform Encephalopathy (BSE) despite the continent-wide meshing of the beef industry). Yet the Canadian and US economies are deeply integrated—especially the food system shared between Canada and the United States and, to which Mexico is rapidly becoming a full partner.<sup>5</sup>

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<sup>3</sup> Sands (2003) provides a useful summary of the theory on economic integration. Gillingham (2003), esp. chapter 15 and l'Envoi, argues that functional integration in Europe has been less successful than claimed.

<sup>4</sup> Helliwell 1998.

<sup>5</sup> Vollrath (2003) demonstrates (through studying price convergence) the integration of Canadian, Mexican and US beef and grains markets and their growing complementarities, in particular with high-value products trade. The study does not take industrial organization into account, but it is noteworthy that the growing integration is associated with greater trans-border FDI in the food sector as well as increasing vertical coordination by contract. See fig. 6, p.15. Also, see Hobbs and Young (2001) for a discussion of the Canadian side.

There remains the question of whether economic integration is a result or a process. The perspective of this study is that economic integration is a complex process. It involves investment and trade across borders; that is, joint production in cross-border companies. But the current situation also includes instances of resistance by domestic firms to joint production or the arrival of foreign competition—and their adoption of competitive business models that, in effect, are efficient responses to the same economic signals that attract foreign competition. The reality of North American economic integration is a regional patchwork of national and local comparative advantages, local adaptations and changing regional patterns of production in response to changing signals. The argument presented throughout this examination of the North American food system accepts this reality as a given, while its findings provide repeated illustration of the phenomenon.

### **Analytical Framework**

This study uses the analytical framework linking economic enterprise to the environment set out in CEC section IV, Linkages to the Environment, in assessing the effect of trade liberalization on the environment.<sup>6</sup> The framework goes beyond examining smokestack and effluent discharge to comprehensively assess the sector industrial organization, production methods, technologies, product standards and prices; in effect, the entire corporate value chain. In accordance with this framework, the study takes the trade and investment data as its point of departure for an examination of the industrial organization and practice issues in all three NAFTA countries.

### **The Canada–US Food System**

The “representative farm” is gone. What is happening in the agri-food industry today makes it one of the most globalized, technologized and sophisticated business sectors in the world. At the same time, it is entering a mature phase in which its major organizations are locked in a competitive struggle that may well transform the sector almost beyond recognition over the next generation. We might be approaching the end of a story that by the 1980s had already given Canada and the United States an integrated food system with the following properties:<sup>7</sup>

- regional specialization and concentration of agricultural production;
- collection, processing and packaging of products at the point of production rather than distribution;
- intensive product branding and promotion;
- myriad private chains of distribution networks that accept truckloads of agricultural and food products directly from shipping points; and
- dynamic competition among distribution channels, leading to retail outlets that virtually eliminate urban wholesale distribution.

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<sup>6</sup> CEC Framework: 27–34.

<sup>7</sup> Tropp et al., 2002, 94–5.

Ensuing changes in the 1990s have pushed agri-business to reach new levels of scientific and managerial accomplishment while developing even more complex multinational organizations, with advances in NAFTA countries usually leading the way. Now there are signs that these developments presage a flex point or radical change in the industry. But, it should be stressed, these are only signs: it is far too early to predict with certainty either that a dramatic change lies before us or when it will occur. The most important signs, however, are those that suggest we are near the limits of additional value creation in the old system while external pressures for change are increasing—especially on the health and environmental fronts.

The pivotal changes that characterized the 1990s are described in this chapter, while the pressure for future change is covered in subsequent chapters.

### **Change and Agriculture Systems**

Researchers in North American agriculture put forward a four-stage model to explain structural change in the North American agricultural system:<sup>8</sup> development of new technology, production in new geographic areas, growth and development, and new methods of vertical coordination. The discussion that follows reviews developments in the raising of livestock. Innovation with respect to seeds and grains is covered in chapter 3: Innovation and Productivity.

### **Development of New Technologies: Livestock**

The first steps towards developing the current system occurred in the 1950s, when research on antibiotics enabled farmers to raise large numbers of chickens in confinement while concurrent discoveries about anti-oxidants extended the shelf life of feeds. Fully automated feeding emerged in the late 1940s with advances that allowed medications to be distributed with the feed. This was combined with selective breeding to develop higher meat yields, especially on breasts, thighs and drumsticks. Similar techniques were subsequently applied to cattle in the United States, followed by the concentrated production of hogs. New advances in genetics, nutrition, housing and handling technologies now enable large numbers of pigs to be raised in large production units.<sup>9</sup>

These developments occurred at the same time that management innovations were leading to important organizational changes. The most significant changes were increased vertical integration in livestock production and new methods of coordination through production and marketing contracts. It is no exaggeration to say that the combination of three factors—concentration of livestock production, vertical integration of food firms backwards into feed and livestock production, and the increasingly widespread use of production contracts—revolutionized North American agri-business.

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<sup>8</sup> Martinez 1999, p.2, footnote 1.

<sup>9</sup> Martinez 1999, 2002; Ollinger 2000.



## The Value in Vertical Integration

Vertical integration is attractive to companies not only for reasons of quality control but also because it provides a built-in hedge against the risk of low prices. When prices fall they can hold off buying on the spot market and use their in-house supply to produce a reduced product volume. When prices are high, their captive supply enables integrated firms to capture extra value as a “producers’ surplus” when the final product is sold. They can either raise prices to reflect the higher input costs that the non-integrated competition must pay or maintain low prices and gain market share to the extent that their supply permits. In this connection, it should be remembered that companies integrate not only vertically but also geographically, across North America or perhaps the world. This provides additional diversification and protection against the risk of unfavorable conditions in any one locality.

The intensification of Canadian and US feed grain and livestock operations through contracting is matched by economies of scale in meatpacking, crushing and milling operations, as well as significant concentrations of wholesalers and distributors. The USDA data and Canadian business data indicate that five firms effectively dominate these sectors: ADM, Cargill and Bunge in the United States; Cargill and Tyson (Lakeside) in western Canada; and McCain and Maple Leaf Foods throughout Canada.<sup>10</sup>

### Vertical Integration: Livestock

Vertical integration of livestock production links breeders and growers to processors, usually by means of a production contract rather than by ownership. Contracting is the management process at the heart of the vertical integration process. The two together, vertical integration and contracting, have revolutionized the business of agriculture in recent years in three ways:

- they remove from the contractees—growers and breeders—much of the risk of cyclical prices;
- they have concentrated market power in the packers and processors, whose expanded capacities give them more control over prices than the atomistic relationship that would obtain in the absence of these arrangements; and
- they create a powerful adjustment mechanism for rapidly discerning consumer demand and de-commodifying the product to help segment the market and raise margins.<sup>11</sup>

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<sup>10</sup> MacDonald et al. 2000. See also Martinez (1999, 2000) and Ollinger (2000). Canadian concentration data are no longer reported by Statistics Canada, but see Harper and Burrough (2003) and Hobbs and Young (2001).

<sup>11</sup> USDA US Farm Census 2002, table 22, shows that average size of US farm holdings has remained constant over the last 20 years. However, average acreage of US *producing* farms has increased, and is about the same as in Canada. See graphic Number of Farms and Acres per Farm, 1850-1997 <<http://www.ers.usda.gov/Briefing/FarmStructure/Gallery/numberoffarms.htm>>. For Canada, see Agriculture Canada (2000).

Harris in particular demonstrates the important role of the integrator,<sup>12</sup> who leverages his capital by focusing on his competence as a manager, technologist or veterinarian. The breeder supplies land and labor and feeds the animals in return for a payment based on efficiency.

The impact of technological change on chicken production has already been mentioned. Hog production has now developed into a three-stage process, each with its own specialist: breeding, gestation and farrowing, nursery and finishing. For both broilers and hogs, even greater concentration occurred over the late 1990s, as facilities were constructed to raise animals in large numbers. This is especially marked in hog production because of its deleterious impact on the environment. By 1997, 29 plants with a capacity of 1.5 million hogs accounted for 84 percent of the hogs processed. Six plants with a capacity of 3.5 million head accounted for 29 percent of the hogs processed in the US.<sup>13</sup>

The data in Harris et al., (2002, table 1–2) show that contracting has advanced in all products destined for the supermarkets or chain restaurants and other food services. These contracts also characterize most of the cross-border agri-business relationships between Canada and the US.<sup>14</sup> By the mid-1990s, contracting and vertical ownership dominated the North American food system to the point that production contracts organized 97 percent of vegetable processing, 85 percent of broiler production, and 56 percent of market turkey production.<sup>15</sup> The proportion is even higher if marketing contracts are taken into account. Total output controlled by marketing contracts by the mid-1990s was 88 percent of citrus fruits and 30 percent of all milk.<sup>16</sup>

## **Slaughter and Products**

Throughout this period, as the production operations were evolving and becoming more streamlined, the downstream elements of the food manufacturing value chain were changing too. One of the most remarkable was the rapid rise of fast food chains such as McDonald's, Burger King, and others, as well as the introduction of the microwave oven and its acceleration of demand for microwaveable ready-made meals. These pressures moved backwards along the supply chain to dramatically affect the slaughtering process. The data show a steep increase in production of poultry parts and further processed parts, and steep declines in large portions and whole birds, as the change in consumer tastes took hold. Particularly striking is the rise of Styrofoam tray packs, a product unknown until the early 1970s, which constituted more than 24 percent of the slaughter plant product mix in 2000.<sup>17</sup>

## **Increasing Concentration of Production**

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<sup>13</sup> Harris et al. 2002, fig. 6.

<sup>13</sup> Martinez 1999.

<sup>14</sup> Hobbs and Young 2001, p.54, citing US sources.

<sup>15</sup> Harris et al. 2002, fig. 6.

<sup>16</sup> Harris et al. 2002, table 1–3.

<sup>17</sup> Ollinger et.al. 2000, table 4–3.

Improved technology and coordination between factory and farm was accompanied by a significant increase in the concentration of firms engaged in poultry and hog slaughter and processing. Four-firm concentration ratios in chicken slaughter and processing grew from 14 percent in 1983 to 41 percent by 1992, and in turkey from 23 to 45 percent.<sup>18</sup> Meat production shows the same trend towards regional specialization and concentration. The top four firms controlled 71 percent of the cattle slaughter, 43 percent of hogs, 41 percent of chickens and 45 percent of poultry in 1992, a trend that developed over 30 years.<sup>19</sup> The four-firm concentration ratios of the meat production industry also increased throughout the 1990s, exceeding 30 percent in all categories by late in the decade. In all cattle it attained 70 percent, in box-fed beef more than 80 percent, in hogs 54 percent, and in sheep and lambs 62 percent.

The percentage of slaughter in large plants also increased throughout the 1990s. While more than two-thirds of slaughtering occurred in large plants, the ratio for hogs is especially noteworthy—already approaching 90 percent by the end of the last century.<sup>20</sup>

### **Changing Regional Focus**

As technology and management processes changed, and firm concentrations in the industry rose, regions that had done business the old way saw production move to areas where factor inputs were cheaper and more easily controllable. Meat packing plants grew larger and as capacities grew, slaughter shifted closer to the region of least-cost, most-efficient production. States around Chicago, traditional site of concentrated cattle slaughter because of its pivotal position in the US railway network, lost ground to the Great Plains states, while at the same time gaining industrial jobs in the automotive sector. Between 1963 and 1992, the Cornbelt share of cattle slaughter fell from 41.0 percent to 17.1 percent, while that of the Great Plains states rose to 68.1 percent.<sup>21</sup> The same trends are apparent in hog slaughtering and processing.

Taking a national look at US production shows the growing regional specialization in hog production, as Chicago gives way to the Carolinas. These changing regional concentrations are accompanied by larger and larger operations in the emerging new producer regions. Poultry production also shifted to the South Atlantic region. Poultry, egg and meat production have been replacing tobacco production as the most lucrative agricultural endeavor in the region.

### **Same Trends in Canada**

Canada has not been exempt from the pressures to capture economies of scale and the benefits of vertical integration. Trends on the Canadian side show that the size of commercial farms has been growing and that for more than 20 years. Canadian farms

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<sup>18</sup> Ollinger 2000, table 3–1.

<sup>19</sup> MacDonald et al. 2000, tables 3–1 and 3–2.

<sup>20</sup> Loc.cit

<sup>21</sup> MacDonald et al. 2000, table 4–5; Martinez 2002, figs 5 and 10.

have been consolidating at about the same pace as US producing farms, driven by competition and the pressure for higher productivity. Between 1980 and 1997, the number of farms in Canada fell from nearly 320,000 to 280,000, while the average size in acres grew from 275 to 610 acres.<sup>22</sup>

In the US, the average size of farms has stayed around 440 acres while the amount of farmland has decreased only slightly, from 1.02 billion acres to 939 million.<sup>23</sup> Moreover, data on contracting show that even small farms of under 50 acres are involved in significant commercial production. Nevertheless, as in Canada, farming production in the US has become highly concentrated, with eight per cent of the farms producing 68 per cent of farm sales.<sup>25</sup>

## **Contracting**

Statistics Canada collects less extensive data than the USDA on contracting in agriculture. Anecdotal evidence, together with the presence of marketing boards for poultry and hogs and the Canadian Wheat Board for grains, suggests that the prevalence of this practice is much lower. These alternative arrangements constitute “single desk operations” that ensure a market price for all supplies bought and sold, with reference prices being based on the most efficient supplier. It is also designed for non-identified commodities. Consequently, under the single-desk arrangement producers and buyers come together around a single, fluctuating price. Risks in such an instance are borne by all parties; therefore the price of being wrong is paid throughout the supply chain. In the case of farmers, it can turn out that crops planted fetch less than the cost of the inputs—much less likely under contracting.

Despite this difference, production trends and tendencies are very similar in both countries. Take poultry production. According to Statistics Canada, the four-firm concentration ratio in chicken processing is 50 percent, with central Canada—Ontario and Quebec—accounting for 66 percent of all shipments and 61 percent of all plants. Ontario alone is the source of 41 percent of the shipments and 34 percent of the plants. As in the US, plants specialize in chicken or turkey slaughter and further processing.<sup>24</sup> As for beef and pork, Maple Leaf, Canada’s largest pork and poultry processor, ninth in the world, has 30 to 40 percent of its own food supply under contract and its own Maple Leaf brand<sup>25</sup>—about half the proportion of the Virginia ham kingpin in the United States, Smithfield Farms.

## **Conclusion**

Developments in crop science, feed and genetics that enabled large concentrations of animals to be raised like a factory product—combined with organizational innovations for quality control, such as contracting—have created a huge, dynamic food system

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<sup>22</sup>Agriculture Canada 2000.

<sup>23</sup>US Department of Agriculture 2004.

<sup>24</sup> See Agriculture Canada sector profiles, Poultry processing in Canada <[http://www.agr.gc.ca/poultry/index\\_e.htm](http://www.agr.gc.ca/poultry/index_e.htm)>.

<sup>25</sup>Pitts 2004.

across North America with regional specializations in output. The discussion up to now has treated these developments as though they emerged on their own from the interaction of numerous undifferentiated, perfectly competitive players. The facts are different: driving this new shape and format of agriculture is the intense competition of the food companies that link the farm to the supermarket shelf and the dining table. We now examine that competition to show how it, too, is becoming transformed by changing consumer tastes.

## Chapter 2: Fully Integrated Food Manufacture Meets Value-oriented Retail

Organizing the integrated food production system are the food product manufacturers—the household names whose prepared meals and other branded products are familiar residents of our refrigerators and cupboard shelves. The top 10 global firms in terms of annual sales are listed below.

**Table 1 – Top 10 Global Food Manufacturers by Sales\***

Company	Annual sales (billions of US\$)	Growth (%)
<a href="#">Nestlé S.A.</a>	64.4	26.4
<a href="#">Kraft Foods Inc.</a>	31.0	4.3
<a href="#">ConAgra Foods, Inc.</a>	19.8	(-28.2)
<a href="#">Tyson Foods, Inc.</a>	24.5	5.10
<a href="#">Unilever</a>	50.7	10.2
<a href="#">Cargill, Incorporated</a>	59.9	17.8
<a href="#">Mars, Incorporated</a>	16.2	4.5
<a href="#">Frito-Lay, Inc.</a>	14.2	(-1.6)
<a href="#">Groupe Danone</a>	14.2	10.4
<a href="#">H.J. Heinz Company</a>	8.2	(-12.7)

\*Source: Multex Investor Service (15.03.04)

These food giants have profited from globalization to diversify their sources of supply and increase the synergies they can bring through combining logistics, location of processing and distribution channels. (See Selected Food Company Strategies below.). The double-digit sales growth rates in the right-hand column generally show the results of acquisitions. Under closer scrutiny, as discussed below, the sector is under significant challenge.

As the food system revolutionized its operation during the 1990s, so did these corporate organizations. The food company giants went through extensive reorganization and reallocation of brand portfolios through a wave of mergers and acquisitions. The table below lists some of the major ones during that period.

**Table 2 – Leading Mergers and Acquisitions, 1999–2001**

<b>Transaction</b>	<b>Value (billions of US\$)</b>
Unilever’s acquisition of Best Foods	<b>20.3</b>
Philip Morris’ acquisition of Nabisco holdings	<b>14.9</b>
General Mills’ acquisition of Pillsbury	<b>10.4</b>
Kellog’s acquisition of Keebler Food Company	<b>4.0</b>
Tyson’s acquisition of IBP	<b>3.2</b>
Unilever’s acquisition of Slim Fast Foods	<b>2.3</b>
Proctor and Gamble’s acquisition of Iams Company	<b>2.05</b>
Coca-Cola’s acquisition of Orangina	<b>0.78</b>
Smithfield’s acquisition of hog-producer Carroll Foods	<b>0.5</b>
Nabisco’s acquisition of Favorite Brands	<b>0.475</b>
Unilever’s acquisition of Ben and Jerry’s	<b>0.326</b>

Source: Harris et al. (2002).

The 1990s were characterized by a stock market bubble in high technology that raised all corporate values until the crash at the beginning of this century. What distinguished the developments in the food sector, however, was that general expenditure on food grew more slowly than expenditure on other items in the consumer’s shopping basket, so that the share of the consumer dollar going to food or food products actually declined from 18 to 10 percent between 1960 and 2001.<sup>26</sup>

As food’s share of consumer spending declined, the intensity of competition—the cost of getting one brand chosen over its competitor—mounted. As a result, the cost of marketing rose from 70 to 80 percent of the food bill while the growers’ share fell from 35 to 20 percent.<sup>27</sup>

Studies in Canada confirm a similar ratio.<sup>28</sup> These studies suggest that integration adds a multiple of four to the value of the originating product. However, studies of profitability suggest that food companies are about as profitable as other manufacturing sectors, and that margins are approximately equal along the manufactured food value chain.<sup>29</sup> Countervailing power arises from the fact that demand for both food and shelf space is inelastic beyond a certain point and also that slotting charges are kept under control by government surveillance.<sup>30</sup>

This situation, together with the costs of reorganization, has put the branded manufacturers under tremendous competitive pressure. One result is that many of the leading manufacturers are encumbered with significant long-term debt service

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<sup>26</sup> Harris et al. 2002, fig. 2.

<sup>27</sup> Harris et al. fig. 1.

<sup>28</sup> Ferris 2003.

<sup>29</sup> Wen 2001 for Canada; Harris et al. 2002, esp. app.36.

<sup>30</sup> FTC, February 2001. *Staff report on slotting allowances*.

commitments that drain cash flow and render their performance and valuation sensitive to continued low interest rates.

### **Selected Food Company Strategies—and Some Problems**

At the end of 2002, the top global food companies had significantly reorganized, but for most of them the costs of reorganization significantly weakened their ability to generate free cash flow. Indeed, of the companies listed below, those that published results showed significantly encumbered cash flows from the previous decade's repositioning. This will hurt their ability to respond to the competition emerging from the new value proposition offered to customers by big box stores such as Wal-Mart as they expand their presence in the grocery business and, in particular, develop competitive in-store brands.<sup>31</sup>

- **The Globalizers**

*Nestlé's*—the category leader with worldwide operations in water, confections, prepared meals, pet food, milk and dairy products, and health care products. Well-positioned to continue its dominance, Nestlé's is continuing to strengthen its product line to match shifting tastes and consumer behavior. The company is now focusing on more efficient execution to improve margins. Its new arrangement with l'Oréal is part of a longer-range plan to transform itself from a food company to a health and well-being company with a strong line of nutraceuticals aimed at affluent retirees, the fastest-growing demographic segment in industrialized countries. Nestlé's reported higher profits in 2002, but lost value due to the impairment of goodwill on some acquisitions.

*ADM*—In the mid-1990s, 70 percent of the world's oilseeds were grown in North America. ADM reoriented the business so that oilseed now originates from South America, Asia and Europe. As well as expanding the food, feed and industrial uses of corn-based products, ADM is increasing the volume of high-value products from the starch stream, developing and capturing synergies from its transportation and milling network. Wheat processing is also globalizing, moving from 100 percent Canada-US in the ADM supply chain to 65 percent Canada-US, 9 percent Mexican, 10 percent European and 3 percent Chinese. The company is now working on healthy food portfolios (high protein-low carb, Novalipid zero/low trans fat oils). A private company, ADM does not make public a complete set of financial reports.

*Bunge*—A company with global presence in agri-business, fertilizer and food products. A Dutch company that moved to the US in 1999 and listed on the NYSE in 2001, Bunge operates globally with three main business lines: grain origination, oilseed processing and international marketing across 29 offices in 18 countries. It is Brazil's largest maker of fertilizer and phosphate-based animal feed products, focusing on Latin America. Bunge is the world's leading seller of bottled vegetable oil, premium shortenings and oils to the US food service industry, the global leader in canola oil production, and the world's largest corn dry miller. In 2003, Bunge established a partnership with DuPont, Solae L.L.C., to use biotechnology to enhance traits of soy. **In 2002, sales rose by US\$3 billion to US\$14.074 billion. Yet its cash flow from operations in 2002 (\$130 million) was only**

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<sup>31</sup> This section is based on company annual reports and investor presentations on corporate web sites.



**about 12 percent of the cash burned in business expansion and financed with additional debt (\$1.073 billion).**

- **The Dominator**

*Tyson Foods, Inc.*—Acquired IBP in August 2001 and became the world’s largest marketer of chicken, beef and pork products. It added a US bacon processing unit in May 2002. Tyson aims to increase value-added products from 50 to 75 percent of its product line by mid-decade. It rationalized the IBP production facilities using Tyson information systems. The company also boosted Mexican chicken sales by 36 percent with the acquisition of a Mexican production facility in the last quarter of 2001. **Sales in 2003 rose more than US\$1 billion to US\$24.5 billion, but cash from operations (\$1.080 billion) was entirely swallowed up by financing and investment, to the point that Tyson ended the year with US\$5 million less cash than in the previous year.**

- **The Innovative Diversifier**

*Sara Lee*—A pioneer in innovative foods, from frozen cakes to crustless bread, Sara Lee food products are now one of three business lines for this US\$18.3 billion global company with offices in 55 countries and sales to 200. In addition to food and beverages, Sara Lee also designs and manufactures intimate apparel and household products. **Sara Lee’s cash flow improved in 2002 (to \$1.824 billion) after declines the previous year, but payments on long-term debt (\$995 million) chewed up half the net cash from operations, and in 2002 the company added US\$1.8 billion in new long-term borrowing.**

- **Surfing the Wave of Consumer Trends**

*ConAgra Foods*—The company jettisoned its low-margin beef and chicken businesses to focus on top brands, including a range of improved snack products and frozen meals, and new “healthy choice” products. As well, ConAgra bulked up the food services division serving chain restaurants and school/institutional markets. It retained its agricultural products division, which sells seed, chemicals and fertilizer products to farmers. **Net sales dropped from US\$25.5 billion in 2002 to US\$19.8 billion in 2003, and ConAgra’s costs of reorganization meant that cash used in financing (\$829.3 million) exceeded its cash from operations (\$712.5 million) by 16 percent.**

*Kraft*—This 100-year-old brand manager streamlined its business holdings to emphasize a high growth/high return portfolio of global brands led by beverages, snacks, desserts, cheese and other enhancers, pizzas and convenience meals, and health and wellness products. Kraft reaches out to civil society groups on issues of third world suppliers, biotechnology and environment policies. Its North American division sells approximately the same products in Canada as in the US and a smaller range of products in Mexico. **In 2002, sales rose US\$1.5 billion to US\$3.4 billion, and the company derived US\$3.7 billion in cash. However, 70 percent of that cash (\$2.616 billion) went to pay financing charges, including those incurred in the Nabisco takeover.**

## Emerging Rivals: The Consumer Shifts to Value

Now look at the revenue figures for the top 10 food distributors in the United States.<sup>32</sup> In fact, the top revenue-earners for the last 12 months are mostly European. The giant American retailer, Wal-Mart, is not picked up in this stock listing, yet it is outperforming the others by far, with US\$217.5 billion in sales in 2002. Examining Wal-Mart, Safeway and Sysco, the biggest US chains, as well as Loblaws, Canada's largest grocery chain, reveals that these firms (except for Wal-Mart) have the same kinds of problems as many of the top brand manufacturers, but—with the exception of Safeway—not of the same magnitude.

**Table 3 – Leaders in Total Revenue**

Company	US\$ (billions)
<a href="#">Koninklijke Ahold NV</a>	\$60.7
<a href="#">Kroger Co</a>	\$53.8
<a href="#">Tesco PLC</a>	\$51.2
<a href="#">Safeway Inc</a>	\$35.6
<a href="#">Albertson's Inc</a>	\$35.4
<a href="#">J Sainsbury PLC</a>	\$31.7
<a href="#">Sysco Corp</a>	\$27.5
<a href="#">Etablissements Delhaize Freres et Cie Le Lion (GROUPE DELHAIZE)</a>	\$22.8
<a href="#">Supervalu Inc</a>	\$19.8
<a href="#">Publix Super Markets Inc</a>	\$16.9

Source: Reuters, 29.03.04

Safeway lost money in 2002 and closed its Dominick stores in the Chicago market. Sysco, the largest wholesale grocery distributor in the US, had a 12 percent increase in sales; although it is increasing debt, it has the cash flow to handle this. Loblaws has strong earnings growth for its sector, and although also bulking up on debt is generating good gains in cash flow.

**Table 4 – Operating Data<sup>33</sup>**

<sup>32</sup> Harris et al. (2002) contains data on supermarket M&A and sales by format that show rapid growth of new format stores over more entrenched rivals. Frank et al. (2003) analyzes the business challenge the shift to value means for their competitors.

<sup>33</sup> Source: company annual reports.

<b>Company</b>	<b>Net sales (2002) (US\$ millions)</b>	<b>Net cash from operations (US\$ millions)</b>
<b>Supermarkets</b>		
Loblaws	23,082.0	981.0
Safeway	32,399.2	1,938.5
Sysco	23,350.5	1,084.9
Wal-Mart	244,524.0	12,532.0
<b>Food Companies</b>		
Bunge	14,074	130.0
ConAgra	19,839	712.5
Kraft	29,723	3,720.0
Sara Lee	18,291	1,824.0
Tyson	24,549	820.0

Indeed, with the exception of Kraft, the top food companies shown here have weaker results and cash flows than the supermarkets. By far the most spectacular success in the sector is clearly Wal-Mart, whose growth is most striking in its number of super-stores, rising from 888 in 2000 to 1,258 in 2002. These stores are at the heart of the retail revolution that threatens existing paradigms.

Their success is based on rapidly changing consumer behavior. Consumers are cutting down on trips to the grocery store—shopping once a week or less—and increasingly buying and transporting in bulk at discount prices. This so-called “shift to value” as customers migrate to local super-stores is having major repercussions on food distribution.<sup>34</sup>

Significantly, behind the big floor plans lies a new business model that gives these stores a considerable edge over major food companies. Scale efficiencies arising from higher-volume operations and larger consumer purchases are translated back into further downward pressure on prices and more in-store help to improve the shopping experience. This in turn results in greater customer satisfaction, which generates significant commercial strength for super-store outlets.

In particular, these strengths enable the companies to integrate backwards up the supply chain, to use contracts to eliminate independent wholesalers and organize supply shipments directly to proprietary distribution centers in cities or regions close to big box outlets. Significantly, too, these stores have the market power to create in-store brands that can successfully challenge the dominance of the more expensive, better known food company trademarks. Research by McKinsey Global Institute<sup>35</sup> suggests that there is plenty of scope for super-store expansion over the next few years. So far, even in the US, only about 25 percent of grocery stores face direct competition from large-format outlets.

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<sup>34</sup> Frank et al. 2003.

<sup>35</sup> Frank et al. 2003.

That is about to change, however: anticipating the challenge, many local stores will themselves reorganize and reformat.

The super-store trend is well advanced in Canada, too. In the late 1990s supermarket chains that had developed significant concentrations in single provinces began to extend their reach nationally. Sobey's, the leading group in Atlantic Canada, acquired the Oshawa Group of Ontario. Loblaws, the leading retailer in Ontario, acquired Provigo of Quebec, and Metro-Richelieu of Quebec acquired the Loeb outlets from Provigo's holdings. By the year 2000, according to a study for the Canadian Competition Bureau,<sup>36</sup> the four top grocery chains in Canada accounted for 75 percent of industry sales. The biggest two chains, Loblaws and Sobey's, sold 75 percent of the five top store sales. By the end of the 1990s, food clubs in Canada made 5.4 percent of sales and in-store brands totaled 21 percent of sales—with Loblaws' President's Choice being an outstanding example of what the company calls "control label" brands, suggesting its upstream quality control. In the US, in-store brands now cover almost 60 percent of established brand products. Canadian supermarket chains acknowledge the competition from the value super-stores and have begun to respond by diversifying their product lines and extending their own in-store brands.<sup>37</sup>

### **Implication: A Food Manufacturing Realignment Approaching**

Putting these trends together shows a realignment with the following elements:

- multinational food companies like Nestlé's and Sara Lee, which are combining food products with health products or are diversifying into other in-store merchandise, will outperform others;
- in-store brands will continue to take share and margins from companies that focus on single product lines, such as Tyson and Maple Leaf;
- established brands, like Kraft, will come under increasing pressure from super-stores, which will sap value from those brands unless they can innovate and reposition them;
- food manufacturers like ConAgra with strong food service product lines will suffer less from the competition of super-stores and in-house brands;
- global producers, such as ADM, Cargill and Bunge, will continue to add value through global presence but will face challenges to their margins from backwardly integrating retail competition and (possibly) diminishing farm subsidies;<sup>38</sup>

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<sup>36</sup> Wen 2000.

<sup>37</sup> See, for example, management discussion in Loblaws' annual report for 2002.

<sup>38</sup> OECD (2002c) *Highlights of agricultural policies* 2072964, p.7, reports small overall declines in support by the end of the 1990s compared to the early 1980s, mainly arising from larger increases in global food prices than domestic prices. But it also notes considerable divergence, with Canada and US levels staying around 20 percent of farm receipts, compared to 38 percent for EU countries. In June 2003, the EU announced a change in support payments ostensibly de-linking them from output (see EU web site <[http://europa.eu.int/comm/agriculture/capreform/index\\_en.htm](http://europa.eu.int/comm/agriculture/capreform/index_en.htm)>). This year (2004) the "peace clause" (Article 13) of the agricultural agreement expired and subsequent to a complaint from Brazil the WTO ruled US cotton subsidies "illegal" i.e., non-compliant with WTO undertakings. The success of the Doha Round depends on support programs reducing agriculture subsidies.

- rising costs of marketing will spur exploration of novel distribution channels such as Internet shopping. Now used primarily as a back office coordinator for managing the supply chain, the Internet—something of an unpredictable wild card in its effect on current trends—also offers consumers and integrators direct access to producers.

Key to the future of food manufacturing is innovation, the theme of the next chapter.

## Chapter 3: Innovation and Productivity

### Innovation: Crops and Seeds

High crop yields underlie North American agricultural productivity. But scientific, research-based agriculture is relatively recent, dating back to the agricultural failures of the 1930s. Primarily with government support, researchers began to develop hybrid seeds with specific characteristics and to pass the developments to commercial seed companies. A commercial market for hybrid seeds—especially corn—grew from the 1940s to the mid-1960s to the point that 95 percent of the US corn crop was hybrid. (The intellectual property of hybrid plants can be protected by keeping its lineage secret. Because of their hybrid nature, the seeds from harvest are not useful.) Profits from sales were reinvested in seed development so that hybrid seeds maintained their advantage in yields. Other hybrid products were widely adopted: by 1960, 70 percent of planted sorghum acreage was hybrid sorghum. Other vegetable crops grown from hybrids are onions, spinach, cabbage and tomatoes. But the ability of farmers to reuse seeds from other crops limited the hybrid business.

Small seed companies with regional focus were mainly distributors of seeds created by others. In 1970, with the improvement of intellectual property protection for tuber or sexually propagated plants, the climate improved for commercial seed development. For the next 10 years, chemical companies acquired seed companies, only to shed them in the 1980s, as the genomic revolution opened a new door to crop development: genetic modification. Following the creation of the first genetically modified plant in 1982, companies such as Monsanto, Novartis and AgrEvo created international businesses based on a life sciences model combining agriculture, food and pharmaceuticals around a genomics science base. In the 1990s, however, as consumer opposition to GM crops mobilized, especially in Europe, companies hived off their agricultural divisions at substantially reduced values. Nevertheless, throughout the 1990s, US farmers rapidly adopted genetically engineered crop varieties, especially Bt and Ht corn (30 percent and 10 percent of the crop acreage) cotton (60 percent) and soy (80 percent).<sup>39</sup> With the exception of Ht corn, where the case is less clear, these innovations permitted reduced levels of pesticide use and tillage.

At the same time, yields in US agriculture (and indeed North American agriculture) increased enormously during the 20<sup>th</sup> century—for example, a doubling of output per acre for wheat and soy, a four-fold increase for cotton and a six-fold increase for corn.<sup>40</sup> Seed expenditures also rose, from 1.5 percent of total farm expenditures in 1910 to 4.0 percent by the year 2000.<sup>41</sup>

Similarly detailed studies for Canada are not available. Herbicide-tolerant canola is approximately 75 percent of the total canola acreage planted, but Round-Up-ready wheat

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<sup>39</sup> Fernandez-Cornejo 2004, fig 3.

<sup>40</sup> Fernandez-Cornejo 2004, fig. 4.

<sup>41</sup> Fernandez-Cornejo 2004, fig. 10.

is still awaiting approval.<sup>42</sup> Canada is just now in the process of surveying its seed producers under the aegis of the Canada Seed Institute. Nevertheless, the combination of improvements in seeds and farming methods has also generated significant gains in Canadian crop yields over the last 20 years. Cattle carcass weights have increased 33 percent and average corn yields are up almost 50 percent over the last 40 years. Overall primary farm productivity rates in Canada are increasing at the rate of 3.0 percent per year, close to the US rate of 3.1 percent. Conservation and low-tillage techniques are also in operation on some land under cultivation, but the trend to acceptance leveled off at around 17 percent.<sup>43</sup>

Canada also played a leading role in the development of genetically modified crops, beginning with Agriculture Canada's development of a variety of canola and transfer of its commercialization rights to Monsanto, which successfully commercialized it in Canada and the US. Canadian public funds also support research in wheat and pulses. Total public and private spending on crop research in the 1990s was about \$123 million.<sup>44</sup> The US, however, remains the centre of seed innovation in North America. Measured by companies introducing seed varieties, the four-firm concentration ratio varies from 100 to 72 percent. Seed innovation, a vital ingredient of the continent's agricultural system, has evolved into a highly expensive, time-consuming activity primarily conducted by no more than four firms.

Another aspect of this trend towards industry concentration and research targeting higher yields is a narrowing of the native plant genetic diversity in North America, although, because of collection and breeding activities internationally, the US is a net exporter of germplasm.<sup>45</sup> Although both Canadian and US governments have programs to overcome this problem, new technologies and new intellectual property rules have stimulated a reallocation such that most farmers now use privately developed seeds, and most seed innovation (measured in scientist years) is now performed by the private sector. Both the US government and the American Seed Trade Association are working to develop a cooperative program with a more explicit, principle-based balance.<sup>46</sup>

## **Productivity**

Spurred by innovations in seed crops and in livestock raising practices, along with management developments in vertical control, it should not be surprising to see that agricultural productivity in North America is the world's highest and continuing to increase. Between 1949 and 1999, multifactor productivity in the US food sector increased 18 percent. Statistics Canada does not report multifactor productivity for the

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<sup>42</sup> In May 2004, Monsanto announced its decision to defer further development of Round-up Ready GM wheat from the market. See <<http://www.monsanto.com/monsanto/layout/media/04/05-10-04.asp>>.

<sup>43</sup> Krakar 2003; Lydersen 2002. See also the Environment News Service (ENS) *passim*.

<sup>44</sup> Heisey and Thirtle 2001, p.9, table 3.

<sup>45</sup> Fernando-Cornejo 2004, p.31.

<sup>46</sup> Heisey and Thirtle 2001, esp. pp.14–15.

food processing sector. But it does show value added for the 1990s: growth rate over the same period (1988 to 1997) is 18 percent, or 1.8 percent per year.<sup>47</sup>

Throughout that 50-year period, US product innovation grew, peaking in 1995. From that year to 2000, new product introductions fell by 49 percent. Only calcium-added and organic product introductions increased.<sup>48</sup> As Canadian and US products are virtually identical, the trend is probably true in Canada as well, although the timing may be subject to some delay.

One reason for the drop in innovation could well have been improved use of customer information, so that while fewer products were launched, their success rate would be higher. A Canadian study shows the use of advanced technology is directly linked to increases in market share.<sup>49</sup> A fuller explanation lies in the industry reorganizations discussed in chapter 2. As share values rose, and market access expanded under trade liberalization, companies turned to mergers and acquisitions to reposition and reinvigorate their brand portfolios. Then, as the wave ended, companies, saddled with debt, turned their attention to improving execution and efficiency in order to raise margins and free cash flows.

## **Conclusion**

This chapter considered innovation in seeds and should be read together with the discussion of the changes in the livestock industry. The analysis shows that innovation with crops followed the same model as innovation with livestock, in that science and management changes led to greater concentration and industry reorganization, with a reduction in native plant biodiversity and new product innovation. Taken together with the analysis in chapter 2, drawing attention to the challenge of the value-driven super-stores, the question arises: will retail outlets concerned with expanding sales and multiplying in-house brands pick up the challenge of innovation? Will established food manufacturers, whose debt payments are swallowing sales revenue, be able to rely on innovation to counter the threat to their sales posed by in-house value brands? The evidence shows that established food manufacturers are repositioning their product lines so they can more convincingly make health claims.

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<sup>47</sup>Krakar 2003.

<sup>48</sup>Harris et al. 2002, table 1–6.

<sup>49</sup>Sabourin et al. 2003.



## Chapter 4: Food Processing in Mexico

In the 1980s, Mexico abandoned its post-revolutionary policies of protecting tradition and domestic enterprise and decided to open its borders to trade and investment which, it was hoped, would accelerate the pace of modernization while raising the standard of living. In 1986, Mexico joined the General Agreement on Tariffs and Trade and in 1989 began negotiations for membership in NAFTA, which came into force in 1994, the same year Mexico received acceptance into the OECD. NAFTA eliminated all agricultural tariffs for member countries by the years 2005–2008. In 1994, food manufacture was the largest manufacturing sector by output value, accounting for 26 percent of manufacturing output and 17 percent of manufacturing employment.<sup>50</sup> In general, the sector has subsequently followed the GDP growth rate, including a reduction from 4 to 1 percent growth in 1995–96 in the wake of the peso crisis.

As part of its national modernization program, the government undertook to upgrade the land tenure arrangements affecting small holders, in effect reinforcing property rights that had been restricted for farmers holding small plots acquired in post-revolutionary land reform. This was designed to allow small farmers to buy and sell and consolidate plots of land so that they could become more efficient. Farm aid programs were also adjusted to encourage market-oriented production. The result is a surprisingly robust agricultural sector that has proven able to withstand competition from US and Canadian producers as trade barriers came down. More generally, the rise in prosperity in the second half of the 1990s also enabled domestic food companies to succeed against global and North American brands and even move northwards, in some cases, into North American markets.<sup>51</sup> There remains, however, a deep concern about the impact of Mexico's agricultural transformation on small producers of corn and other traditional crops. Increased competitive pressure on small farms fuels migration northward. Pressure to buy supposedly high-yield seed increases pesticide use and discourages the planting of varieties suited to particular locations.<sup>52</sup>

Economic liberalization is modernizing urban life even more rapidly than in agricultural areas. The role of Mexican women is changing; more and more women work outside the home. Commutes to work are increasing. People increasingly have less time to shop. In northern states in particular, the way of life has Americanized extensively, to the point that Mexican shopping habits are rapidly matching those of their northern neighbors. In consequence, the food growing, wholesaling and distribution system is taking on the same attributes as those in the US—telescoping 40 years into 20.<sup>53</sup>

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<sup>50</sup>Library of Congress, no date. Country Study: Mexico.

<sup>51</sup>World Bank 2004, chapter 3.

<sup>52</sup>Oxfam 2003.

<sup>53</sup>Tropp et al. 2002.

Key aspects of the evolution include the following:

- collection, processing and packaging of products at the point of production rather than distribution—an accelerating trend;
- intensive product branding and promotion;
- growth of private chains of distribution networks that accept truckloads of agricultural and food products directly from shipping points; and
- competition between more traditional neighborhood street outlets and strategically placed modern supermarkets with superior quality and efficiencies for produce as well as local brands.

Already Mexico's leading food retailer is Wal-Mart de México, with other global firms scrambling to establish a presence. Mexico's leading food retail chains, Soriana and Comercial Mexicana, are also rapidly expanding their number of outlets to counter the invasion. At the same time, traditional sellers continue to offer more convenience and, together with the mom and pop small stores (*abarrotes*), smaller unit packages more appropriate for those who continue to shop daily. The new outlets are the favored distribution channels of the big global food brands—their style of business is not geared to the needs of local producers, who lack consistent quality control and the liquidity that permits formal invoicing rather than cash on delivery.

Still, so-called “artisanal” food products continue to hold 34 percent of the packaged food market, the small companies and regional producers having an edge with their broad array of local flavors. In order to survive, they must develop the modern organizational methods and technologies of their more efficient foreign rivals. Indeed, the global firms are beginning to acquire the leading small companies in pursuit of exotic local flavours to add zest to their traditional, over-standardized brand staples. Recent partnerings include Italy's Barilla with Herdez (pasta) and Grupo Lala's acquisition of Latin Lac's assets (dairy). Maizoro (ready-to-eat cereal) is up for sale. Also notable: canned food remains popular in a hot country without refrigerators in every household, and here local producers such as Herdez, La Costenia and Sabormex are leaders, owing to their understanding of and respect for local tastes.<sup>54</sup>

Mexican companies are also pushing northwards. The world's second largest producer of corn flour, Grupo Minsa, had a market share of 28 percent in Mexico and 18 percent in the US in 1998, and with the end of the tortilla subsidy that year began to install new technology for greater efficiency in its Mexican, US and Guatemalan factories.<sup>55</sup> In January 2002, Grupo Bimbo acquired George Weston Bakeries holdings in the western US (GWB West) for US\$610 million. The acquisition means that Grupo Bimbo will now manufacture bakery products for such well-known labels as Thomas, Entenmann's and Boboli, among others, from Indiana to Seattle and Dallas. The three bottled/canned food companies also have partnerships with US brands. But as Mexican flavors grow in popularity north of the border, the possibility arises of these companies, with their extensive Mexican distribution and plant networks, becoming more valuable if they were

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<sup>54</sup>Euromonitor 2003.

<sup>55</sup>*Food Processing* 2002.

integrated more closely into the North American system. Clearly, the companies are potential takeover targets from the North if they themselves fail to penetrate aggressively northwards, as Grupo Bimbo is doing.

However, the rate of growth and modernization of the food manufacturing sector depends on a continuing rise in Mexican prosperity, a trend whose rate has begun to slacken. In particular, the lack of adequate educational and capital resources is fuelling emigration and slowing economic growth to rates at which continued rapid modernization is threatened.<sup>56</sup>

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<sup>56</sup>OECD 2003a, *Economic review: Mexico*.

## **Conclusion:**

### **Food Processing in NAFTA Countries and the Environmental Impact**

The analytical framework employed in this study highlights the importance of changes along the value chain from farm to table that occurred in the 1990s and the early years of the 21<sup>st</sup> century. The principal adjustments are directly related to capturing the economies of scale made feasible by recent developments in trade liberalization, the ability to raise animals in larger concentrations, and the development of high-yield seeds. Farms, manufacturing firms, distribution channels and retail outlets have all changed so as to increase economies of scale via swifter throughput, higher volume and accelerated turnover. In some instances—particularly water and pesticide use and hog production—the environmental impact has been well documented.<sup>57</sup> What this review of recent changes in the food system suggests is that the new food system also has other environmental effects—some positive, some negative. These effects have come about, for example, through reduction of biodiversity (negative), through the use of genetically modified organisms (GMOs) and low tilling practices (positive in some respects but posing questions for many about the long-term effects of these changes), through vertical integration and coordination (diversity traded for efficiency), through changing distribution (high-volume truck transportation) and through changing shopping habits (use of cars for high-volume shopping, but fewer shopping trips).

Overall, the changes in the food system are emergent: that is, they are the result of millions of economic agents—led by consumers—following their best economic interests as they see them in the light of knowledge available to them at any particular time. As seen in the case of Mexico, the new system has an extraordinary power to compel emulation when trade liberalization opens the door to the expansion of pressures to match successful agricultural practices in the North. Europe, although outside the scope of this study, is also experiencing similar pressures to reorganize its own food system along the lines of this high-science, high-throughput model. Indeed, some European companies are leading these changes.

The newer question this study raises is about the environmental impact of the organization of the North American food system. Does it enhance or inhibit sustainable environmental practices? The short answer, from the evidence presented in the studies cited, is that the food system operates principally according to one feedback loop—that of customer demand. Changing patterns of consumer demand are pushing food company investment into exotic flavors, organic foods and health-promoting products. Increasingly, large producers are promising to remove trans fats from their menus (e.g., Unilever, McCain's) and virtually all large North American food producers are developing "healthy food" product lines in light of new fears about obesity. There are no independently operating feedback loops for environmental behavior: the application of local, state and national environmental laws is the chief local inhibitor with respect to hog

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<sup>57</sup> OECD 2001, *Improving the environmental performance of agriculture: Policy options and market approaches*.

production, water use, and other practices. The release of GMO seeds and products onto the market is controlled by the Food and Drug Administration in the US, by Agriculture Canada and Health Canada in Canada and by appropriate agencies in Mexico. But the organization of the food system is free of oversight except in respect of unfair trading practices and anti-trust or competition policy.

Yet as consumer awareness grows of the impact of farming practices on the environment, it is reasonable to expect that shoppers will begin to factor that aspect into their buying decisions. This suggests that there may be an opening for governments to support a rating system that links brands to corporate sustainable practice upstream through their supply chains.<sup>58</sup> Given the rising debt and falling margins evident throughout the industry, however, there may be a flex point coming in which store brands will take over the number two brand slot in each category. This suggests there may be a bigger environmental payoff from including distributors in the rating scheme with a view to creating a new area of competition between the main camps in the current food system.

Finally, it is arguable that today's food system—in effect a significantly accelerated version of the system whose origins go back to the 1940s—may be approaching its development limits. The escalation of marketing costs, the lack of new value from re-jigging brand portfolios and the decline of innovation may signal a forthcoming change to a new model. This new paradigm, as some observers characterize it, would replace today's "productionist" paradigm with a "life science integrationist" paradigm in which the big stores integrate backward, using life science technology to accelerate the trend to nutraceuticals—foods that can make realistic health or therapeutic claims. What is required, however, or so some argue, is more legislative and international regulatory practices to move the industry towards an ecological integrationist paradigm that would favor diversity and small and medium-size producers.<sup>59</sup>

The bigger issue these alternative scenarios raise is that of the capacity of the current food system to evolve: is its dependence on efficiency and linearity, together with increasing levels of concentration in every segment of the value chain, building in rigidities that will restrict the system's capacity to respond to evolutionary challenges? Potential hazards include exogenous shocks from plant or animal disease, climate changes such as alterations in average temperatures and increases in damaging storms, or new discoveries that reduce public confidence in the quality of the food supply. This is the broader environmental issue that this study reveals.

## **Reflections and Suggestions Arising from the Study**

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<sup>58</sup> See the argument in Carpentier and Ervin 2002.

<sup>59</sup> See Lang 2003.

- ***The study raises the question of food sector adaptability and agricultural diversity.*** Yet the analytical models in common use do not enable us to evaluate diversity. How much diversity is necessary or optimal? How should the benefits of diversity be maintained or enhanced? At this point, analysts lack the tools to answer such questions.
- ***The data for this study are taken overwhelmingly from USDA studies. Of particular interest, the extent and effect of contract farming outside the US are not well documented.*** This is not to suggest that agencies in Canada and Mexico do not collect comparable data; however, they unfortunately do not make it as readily available. It is increasingly important for policy analysts to have ready access to full North American data for continent-wide analysis.

## Annex A—North American Food Trade

The following tables are taken from Harris et al. 2002.

**Appendix table 39—Leading exporters of processed foods to the U.S. and top recipients of U.S. processed food exports**

U.S imports from:	Imports, 2000	Share of processed food imports	Change	
			1998-99	1999-20
	<i>Million dollars</i>		<i>Percent</i>	
Canada	8,400.5	22.8	12.6	8.4
Mexico	2,933.5	8.0	11.6	11.3
Thailand	2,233.9	6.1	11.7	9.3
France	1,964.8	5.3	17.8	-3.5
Italy	1,578.4	4.3	4.4	9.9
Australia	1,398.6	3.8	8.1	27.0
Netherlands	1,221.4	3.3	6.8	18.1
United Kingdom	1,199.8	3.3	15.5	2.9
New Zealand	1,073.2	2.9	-1.3	12.9
China (mainland)	1,025.8	2.8	16.3	17.3

U.S. exports to:	Exports, 2000	Share of processed food exports	Change	
			1998-99	1999-20
	<i>Million dollars</i>		<i>Percent</i>	
Japan	6,213.6	20.7	6.1	3.3
Canada	5,746.5	19.1	3.7	5.6
Mexico	3,369.0	11.2	1.0	16.9
South Korea	1,839.6	6.1	46.1	32.9
Hong Kong	885.3	2.9	-12.3	-4.8
United Kingdom	741.3	2.5	-1.1	-11.9
China (Taiwan)	730.2	2.4	4.7	-0.2
Netherlands	704.6	2.3	1.1	-5.2
China (mainland)	661.5	2.2	-46.3	46.3
Germany	497.3	1.7	-20.7	1.7

Source: USDA, ERS.

**Appendix table 40—U.S. processed food exports, by food category and top destination countries, 201**

Country	Value
<i>Thousand dollars</i>	
Meats:	
Japan	2,922,858
Mexico	1,372,252
South Korea	1,152,440
Canada	824,319
Hong Kong	555,859
Dairy:	
Canada	209,364
Mexico	199,502
Japan	105,706
China (Taiwan)	51,652
South Korea	43,882
Processed fruits and vegetables:	
Canada	871,130
Japan	700,340
Mexico	315,863
Netherlands	143,881
South Korea	122,257
Grain mill products:	
Canada	826,520
Japan	569,243
Mexico	434,714
Netherlands	203,467
United Kingdom	130,201
Bakery:	
Canada	315,450
Mexico	35,117
Japan	15,385
Australia	8,922
United Kingdom	8,775
Sugar and confectionery:	
Canada	466,858
Mexico	250,480
Japan	187,264
Germany	128,893
Spain	93,305
Fats and oils:	
Canada	426,100
Mexico	396,982
Switzerland	205,794
Philippines	200,887
Japan	170,177

*Continued--*



**Appendix table 40—U.S. processed food exports, by food category and top destination countries, 2000--Continued**

Country	Value
	<i>Thousand dollars</i>
Beverages:	
Canada	534,640
Japan	273,932
United Kingdom	225,057
Mexico	158,108
Netherlands	125,642
Miscellaneous food:	
Canada	1,292,154
Japan	1,268,691
South Korea	282,582
Mexico	206,005
Mainland China	144,133

Source: ERS trade database.

**Appendix table 41—U.S. processed food imports, by food category and top originating countries, 2018**

Country	Value
	<i>Thousand dollars</i>
<b>Meats:</b>	
Canada	1,909,975
Australia	827,615
New Zealand	539,146
Denmark	211,230
Argentina	116,673
<b>Dairy:</b>	
New Zealand	331,027
Italy	148,074
Ireland	133,721
France	130,376
Netherlands	118,399
<b>Processed fruits and vegetables:</b>	
Canada	756,146
Mexico	554,122
Spain	268,292
Mainland China	205,798
Costa Rica	178,977
<b>Grain mill products:</b>	
Canada	631,020
Thailand	161,709
Germany	66,700
India	46,277
Netherlands	41,625
<b>Bakery:</b>	
Canada	467,589
Mexico	104,118
Italy	59,815
Denmark	54,739
Germany	48,450
<b>Sugar and confectionery:</b>	
Canada	616,819
Brazil	270,317
India	246,957
Ivory Coast	246,310
Mexico	238,554
<b>Fats and oils:</b>	
Canada	482,126
Italy	322,191
Philippines	189,408
Malaysia	119,950
Indonesia	92,966

*Continued--*

Appendix table 41—U.S. processed food imports, by food category and top originating countries, 2000--Continued

Country	Value
	<i>Thousand dollars</i>
Beverages:	
France	1,607,496
Mexico	1,266,413
Canada	870,735
Netherlands	828,432
United Kingdom	792,408
Miscellaneous food:	
Canada	2,547,701
Thailand	1,815,639
Mexico	659,321
China (mainland)	640,776
Chile	491,247

Source: ERS, trade database.

### Grubel-Lloyd Index of Intra-industry Trade<sup>60</sup>

Table 15 CANADA-US INTRAINDUSTRY AGRI-FOOD TRADE OF PROCESSED FOOD	1993-95	2000-02
	<b>Meat of bovine animals, fresh or chilled</b>	0.933
<b>Meat of swine, fresh chilled or frozen</b>	0.143	0.282
<b>Bread, pastry and cakes (w/o cocoa)</b>	0.942	0.758
<b>Chocolate and preparations with cocoa</b>	0.769	0.559
<b>Spirits and liqueurs</b>	0.122	0.289
<b>Plants, live</b>	0.989	0.543
<b>Beer, made from malt</b>	0.192	0.272
<b>Malt extract and flour prep. with &lt;40% cocoa</b>	0.769	0.987

<b>Tomatoes, fresh or chilled</b>	0.222	0.764
<b>Water, non-sweetened</b>	0.045	0.145

Source: STATISTICS CANADA (Consumer goods). Note: Items are top ten relevant categories of Canadian exports to the United States by value.

The index table measures intra-industry trade in like products between Canada and the United States. A value of 1 would mean perfectly balanced two-way trade. A value of zero would mean one-way trade only. Fluctuations can be explained by weather. Note that the majority of values are increasing, indicating that intra-industry exchange is growing in the products listed.

<sup>60</sup> Agriculture Canada 2004, p. 18, Appendix.

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