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**VULNERABILITIES AND
BENEFITS OF MEGASCALE
AGRIFOOD PROCESSING
FACILITIES IN CANADA**

Jared Carlberg

VULNERABILITIES AND BENEFITS OF MEGA-SCALE AGRI-FOOD PROCESSING FACILITIES IN CANADA

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SUMMARY

Seventy per cent of Canada's beef production capacity is located in just two meat plants in Alberta. This is one of the most obvious examples of the high concentration in Canada's food-production sector. Industry has naturally tended to larger but fewer facilities, due to the economic imperatives of economies of scale. However, the COVID-19 pandemic has revealed the risks to Canada's food supply by having so much food production located in so few places. The work done at food-processing facilities entails large numbers of employees, often working shoulder to shoulder. There is a clear potential for a disease to spread quickly, leading to a disruption in food output, or even a complete shutdown of a critical facility. This is what happened during the COVID-19 pandemic. It could easily happen again.

Changing the structure of the Canadian food industry is one option to better insulate the industry against pandemic in the future, creating a greater number of smaller-scale facilities scattered in more places across the country. The question is whether Canadians are willing to pay for such changes. That payment could come through taxes, to fund the significant incentives required to entice food producers to move away from the larger and fewer facilities that provide them greater profits through economies of scale, or it could be in the form of higher food prices, as less efficient and more expensive models of production lead to more expensive products.

It may still be possible, however, for Canadians to enjoy a secure supply of the more affordable food provided by the highly concentrated model without having to pay for it, if facilities can be adapted to lower the risk of outbreaks. Mechanization can reduce the dependency on large numbers of workers, while those workers that remain could operate within more stringent safety measures. Safer plant design, more mechanization and fewer workers would, of course, come at some short-term cost, both in terms of the capital outlays required by facility owners and in terms of jobs lost. But in the long term, the result could well be a continued supply of secure, cheap food for Canadians. With that outcome evidently being what Canadians value most of all, the future of Canada's food supply is likely to be safer but as concentrated as ever.

INTRODUCTION

The world has changed in a profound way. On March 1, 2020, COVID-19 was barely registering in the public consciousness, a vaguely-threatening-sounding disease that was a problem half a world away. Three weeks later, it was raging across the globe, infecting millions and confining billions more to their homes for what would turn out to be months. Tens of millions of jobs were lost, hundreds of thousands of people died, businesses were shuttered and retirement savings evaporated overnight. For most, it was a once-in-a-lifetime event, one from which the world may take years to recover.

There are countless repercussions evident in the wake of the COVID-19 disaster. The one this paper focuses on is the effects of the outbreak upon megascale agrifood-processing facilities, or more precisely, how COVID-19 has affected a modern food industry characterized by megascale agrifood-processing facilities.¹ When necessary, in order to provide illustrative examples, this paper discusses these facilities in the context of the cattle and beef industry in Canada, due to its prominence in our country and its importance to Canadian food security.

The paper proceeds as follows: First, the drivers are outlined that have nudged Canada's agrifood-processing industries toward the use of megascale facilities. After that, an overview is provided of the relevant government policies and regulations that have contributed to this trend. Next, commonalities are explored among agrifood-processing sectors that make them vulnerable to outbreaks such as COVID-19. The next-to-last section of the paper discusses three potential strategic policy responses that could help make agrifood-processing industries more adaptable and reduce the risk of future outbreaks. The final section draws conclusions.

DRIVERS THAT HAVE MOVED CANADA AGRIFOOD PROCESSING TOWARD MEGASCALE FACILITIES

In 1776, Adam Smith penned *An Inquiry into the Nature and Causes of the Wealth of Nations* (often just referred to as *The Wealth of Nations*), a book that has become one of the most important works in the history of economic thought. In that work, Smith described the production of pins (what we would today call nails). He famously observed, after visiting a pin factory, that a single person working by himself could produce perhaps 10 or 20 pins per day, but that the 10 people working in that factory on a series of 18 distinct steps in the pin-production process collectively produced 48,000 pins per day due to the specialization of labour. This specialization, coupled with the existence of a single centralized facility and location

¹

While there is an important distinction between plant size and firm size, given the focus and space limitations of this paper, they are treated as (nearly) the same phenomenon. In terms of COVID-19 risk, facility size rather than firm size is the key factor.

for production, facilitated massive efficiencies that have become the overarching goal of almost all industrial production today, including the production of food.²

Megascale agrifood-processing facilities in Canada have become commonplace as the result of two main factors: the first and most obvious is the drive for greater efficiency in the pursuit of increased profitability. The well-known efficiency concept of economies of scale has driven production practices toward larger facility sizes in most industries, and agrifood processing is no exception. In simple terms, the profit of any business is revenue less costs. Costs, in turn, can be classified as fixed (those that exist regardless of whether the plant actually produces anything) and variable (those that increase as output increases). What drives increased scale of production is the opportunity to lower per-unit fixed costs as more units are produced (i.e., in a larger facility). Of course, it is reasonable to then ask whether there is a limit on the scale of production. Practically, there is sometimes almost no such limit, which is what we see when considering “natural monopolies,” most often observed with respect to utilities such as water, natural gas or electricity.

The second factor driving the move toward larger-scale agrifood-processing facilities is the desire for enhanced food security through the associated reduction in prices, although it is probably fair to say this is a byproduct of larger-scale food production as opposed to a reason for it. The efficiency argument described in the preceding paragraph provides profit opportunities, but it also, especially in an era of global competition in food products, leads to lower prices for consumers. This is because as costs decrease within a competitive framework (although of course there is a good deal of debate with respect to how competitive food/processing markets really are, especially in some subsectors), prices decrease as well. All other things equal, this leads to an increase in the welfare of food buyers, and makes a wider array of food products available to those who could not otherwise afford them.

RELATED GOVERNMENT POLICIES AND REGULATIONS THAT HAVE FACILITATED MEGASCALE FACILITIES

An analysis of the government policies and regulations that have facilitated the advent of megascale facilities is complex. This is because all three levels of government (federal, provincial and municipal) have the ability to implement at least a subset of these policies. For example, each of the three levels of governments has some jurisdiction over taxation, while only the federal level has jurisdiction over key areas such as competition policy or international trade. Furthermore, within government itself, especially the senior levels, different governmental and quasigovernmental agencies have jurisdiction over different

²

While this paper focuses to some extent on the role of the “invisible hand,” other determinants of the current state of the agrifood processing sector with respect to the presence of megascale facilities include government policies and other regulatory interventions. Space prevents a more fulsome discussion of these important factors.

areas (for example, the Canada Revenue Agency, the Department of Finance, and the Competition Bureau at the federal government level).

A range of strategies (i.e., policies and regulations) can be employed by communities and the levels of government representing them in an effort to attract investment; the efficiency arguments noted above describe why these tend to be large-scale facilities in modern times. Key reasons why communities want to attract these facilities centre upon the economic spinoffs they tend to create, which can include (most importantly) employment for residents, enhancement of the community's tax base in the long term (even when tax incentives, described below, are utilized to attract investment), a market for raw commodities and the creation of a "hub" that attracts additional investment as economic momentum is generated in the area. In order to accomplish these goals, governments use a variety of tools that have provided incentives for the trend toward large-scale agrifood-processing facilities.

Perhaps the most commonly used of these tools are tax incentives, which can be offered by any level of government but are most commonly associated with local governments. These incentives can include property tax reductions, holidays or waivers, and are designed to help provide immediate financial benefits to a new enterprise. A second tool commonly used to attract new investment is the provision of infrastructure upgrades; large-scale agrifood-processing facilities often have extreme needs for electricity, natural gas, water, sewer and even road and rail infrastructure. Enhancing the ease with which a new enterprise can be established in a community is a third common tool for attracting a new enterprise (or expanding an existing one); jurisdictions that make it relatively easy to start up, expand or relocate a business are more likely to attract investment. Fourthly, various levels of government often provide loans or loan guarantees for facilities, reducing the risk for the firm's owners and increasing the competitiveness of the community vis-à-vis other locations that may be vying for the facility.

COMMONALITIES THAT MAKE PROCESSING SECTORS VULNERABLE TO RISKS SUCH AS COVID-19

The degree of mechanization within megascale agrifood-processing facilities varies considerably by subsector, and even considerably within a given subsector (for example, in the meat-protein sector we tend to see high levels of mechanization for chicken processing, but less — although still considerable — mechanization for beef and pork processing). In turn, facilities with higher levels of mechanization tend to have not only fewer workers but also fewer workers within close proximity to one another. Needless to say, having workers in close quarters provides ideal conditions for illness to spread.

COVID-19 has provided a case study in the risks associated with modern megascale agrifood-processing facilities. In Canada, Cargill was forced to close its beef

processing plant in High River, Alta. and its facility in Chambly, Que. (near Montreal) after outbreaks of COVID-19 among its workers at those two facilities (close to half of High River's 2,000 employees reportedly tested positive, with one person having died as a result of their infection). Similarly, while the JBS beef processing plant in Brooks, Alta. did not close, it was forced to scale production back from two daily shifts to one. It is noteworthy that the Brooks and High River facilities are together responsible for more than 70 per cent of Canada's beef production. In addition, Olymel temporarily suspended operations at its Yamachiche, Que. pork processing plant after a number of workers became ill; it was later discovered that more than 100 employees had contracted the virus.

Other firms have chosen to try to keep their plants open even when outbreaks have occurred. Harmony Beef in Balzac, Alta. kept its plant open for processing despite a brief pause in slaughter, but saw nearly 40 cases (including 25 employees) associated with an outbreak at its facility. Because of the essential nature of their industry, companies were not required to close in the midst of COVID-19 outbreaks, even when facing outbreaks within their own facilities.

Chicken processors did not completely escape the reality of virus outbreaks. For example in British Columbia, Fraser Valley Special Poultry in Chilliwack, Superior Poultry in Coquitlam and United Poultry in East Vancouver were all closed as the result of outbreaks among their staff.

Proximity of workers to one another while carrying out their duties is the biggest single risk factor to this type of megascale agrifood-processing facility, but it is not the only risk factor. It is now generally assumed that the virus can be transmitted via air and can remain viable on surfaces for short periods of time. Tools, keypads, or any equipment operating surfaces inside plants thus provide the opportunity for virus transmission. Similarly, restrooms, break rooms, kitchen areas (with microwaves and refrigerators being touched by dozens or hundreds of employees per day) or other places where workers congregate lead to increased risk of infection. Even finished and packaged materials that are handled by multiple employees present a remote but nonzero risk of transmission.

An important risk associated with megascale facilities is the risk to food security. In the case of beef, as observed above, around seven-tenths of Canadian production capacity is housed in just two facilities, in one province (Alberta).³ The disruption to the supply chain resulted in reduced availability of beef, with associated price increases as one would expect. While some types of beef can fairly be considered luxury products, others, such as ground beef, are a staple in the protein needs of many consumers.

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The interested reader is invited to consult MacLachlan (2001) for a thorough history of the locational aspects of Canada's beef-processing sector.

POTENTIAL OPTIONS TO IMPROVE PROTECTION AND ADD ADAPTABILITY

Adam Smith's pin factory was mentioned earlier as one of the earliest known references to the division of labour in pursuit of efficiency. Another of Smith's works, 1759's *The Theory of Moral Sentiments*, mentions an "invisible hand" that, Smith asserts, works to guide resources to their best uses, independent of any explicit planning by resource owners. In other words, Smith is arguing that from an economic standpoint, things tend to independently, invariably and inevitably wind up the way they should, regardless of any explicit intention. It may therefore be fair to observe that striving toward greater efficiency, including in pursuit of economies of scale, has a good deal to do with the outcomes obtained as the result of guidance by an invisible hand, which is likely to be the profit motive allocating resources to the use that provides the highest return.

In a market-oriented economic system, it may be very difficult and/or expensive to overcome the competitive forces that have led to the current situation where megascale agrifood-processing facilities are commonplace. As noted earlier, economies of scale and the associated efficiencies have provided both higher profits and lower food costs, neither of which is likely to be easily sacrificed to mitigate the risks outlined above. The field of welfare economics studies the changes in and flow of costs and benefits associated with economic policies. Of the three groups it often considers — producers, consumers and taxpayers — producers, along the various stages of the supply chain, benefit from increased profitability, while consumers benefit from lower prices (especially lower-income consumers). If neither of these two groups is willing to see their overall welfare lessened as a result of policy change, then it may be the case that taxpayers are left responsible for any net cost increases that result.

Given the powerful economic forces that have led to the current system that employs megascale agrifood-processing facilities, developing a set of feasible strategies for change that have a reasonable probability of being implemented is no small task. Nevertheless, as the COVID-19 experience has shown beyond any doubt, given the risks to human health, food security and, yes, profitability, it is necessary to at the very least explore enhancements to the system currently in place.

One feasible enhancement to the current system is to encourage the development of smaller-scale (which is not to say small-scale) agrifood-processing facilities that are more regional in nature.⁴ The reasoning would be that if megascale facilities, with more workers and thus more interactions between those workers, carry a greater risk of disease spread, then perhaps smaller facilities with fewer workers and fewer interactions would lower the risk of disease spread. For example, perhaps instead of that 70 per cent of Canadian beef processing capacity being located in two plants in a single province, the entirety of processing capacity could be spread

⁴ Combinations of the three potential strategies presented here are not intended to be mutually exclusive and are entrusted to the imagination of the reader.

across provinces according to the size of their cow herds. Table 1 provides current provincial shares of Canada's national cow herd and shares of federally inspected beef slaughter capacity (beef processed in federally inspected plants is eligible for export; there are also provincially inspected slaughter facilities).

As Table 1 shows, there are in some areas significant disparities between where cattle are located and where they are slaughtered. Specific slaughter facilities together with their capacities and numbers of employees can be found in an appendix at the end of this paper. While it may be fair to characterize this as the natural result of guidance over the last century of the Canadian cattle industry by the invisible hand, it is also fair to say that if plant scale is to be reduced in an effort to mitigate risk, there are opportunities to bring economic development to regions across Canada that appear to have the cattle numbers to support medium-scale slaughter/processing facilities. Of course, in certain areas with very limited cattle populations it may not be feasible to establish processing facilities for the mere purpose of doing so, but from Table 1 it can be seen that in other areas, the size of the cattle herd is distinctly out of line with processing capacity.⁵ For example, Saskatchewan's herd size is 281.5 times as large as its yearly processing capacity, while Ontario's analogous ratio is 2.7 times larger and Alberta's is a comparatively minuscule 1.7 times.

TABLE 1: CATTLE HERD SHARE AND FEDERALLY INSPECTED SLAUGHTER CAPACITY SHARE BY PROVINCE, 2020

Province	Total Cattle	Percentage of National	Federally Inspected Slaughter Capacity (head/year)	Percentage of National	Cattle to Slaughter Ratio
BC	610,000	5.44%	15,600	0.45%	39.1
AB	4,505,000	40.15%	2,580,240	74.21%	1.7
SK	2,195,400	19.57%	7,800	0.22%	281.5
MB	1,000,000	8.91%	52,000	1.50%	19.2
ON	1,583,100	14.11%	587,080	16.89%	2.7
QC	1,115,000	9.94%	202,800	5.83%	5.5
NB	65,500	0.58%	-	0.00%	-
NS	75,000	0.67%	-	0.00%	-
PEI	60,100	0.54%	31,200	0.90%	1.9
NL	11,300	0.10%	-	0.00%	-
Canada	11,220,400	100.00%	3,476,720	100.00%	3.2

Source: Statistics Canada (2020), Canfax Research Services (2019), and author's calculations.

⁵ While a discussion of transportation economics is beyond the scope of this paper, it is worthwhile to point out that, for example, if the costs of transporting processed meat are lower than the costs of transporting livestock, it is sensible to co-locate livestock and processing capacity.

The numbers in Table 1 provide the opportunity to hypothesize what cattle processing might look like in Canada if slaughter capacity were matched provincially to cattle numbers. Saskatchewan, for example, currently has one federally inspected facility processing 150 head per week (7,800 per year) but would see that number jump to over 680,000 head annually if it had the national average cattle-to-slaughter capacity ratio of 3.2, an 87-fold increase over its current slaughter numbers.

The benefits and costs of a redistribution of processing capacity are complex. The primary benefit would, in theory, be the reduction of risk as the factors causing that risk in megascale facilities are mitigated. It should go without saying that any such new facilities would have to be constructed in such a way that mechanization would be improved and processing lines developed, so that not only could physical distancing be maintained by workers to the largest extent possible, but also reliance upon common areas and exposure to common surfaces could be minimized. A second significant benefit would come in the form of enhanced regional economic development: new facilities mean not only new jobs but also economic spinoffs, as money paid out in the form of salaries and wages is multiplied throughout the community. A third benefit could arise in the form of expansion of related sectors. For example, if Saskatchewan were to have a many-times-larger cattle-processing facility, it is certainly the case that the province's cattle-feeding industry would have to expand to meet this demand (currently, many Saskatchewan-raised cattle are transported for feeding/finishing in Alberta), which could in turn provide new markets for Saskatchewan feed grain and forage. Fourthly, there could be enhancements to food security as the supply chain would become more stable by being less vulnerable to major disruptions if a single plant had to be temporarily shut down as the result of a disease outbreak. Related to this, having more regional processing would also recognize consumers' growing preference for locally produced food.

There would certainly be significant costs associated with efforts to decentralize processing capacity away from megascale facilities. The efficiencies associated with the economies of scale that have driven plants to larger and larger capacities still exist and so reducing scale will result in lower profits to the cattle sector (cost increases would likely be passed along the supply chain and become the responsibility of the link with the least market power), or higher prices to consumers, or both. Another type of cost would come in the form of the public dollars that would be required to provide incentives to subsidize the construction of new facilities, or for loan guarantees or tax incentives associated with these projects.

A second potential strategy for mitigating the risk associated with megascale agrifood-processing facilities is to encourage alternative ownership structures that could facilitate the addition of new medium-scale processing plants across regions to a variety of agrifood subsectors. So-called "new generation co-operatives" (NGCs), an alternative ownership structure in the United States, were quite common in the Northern Plains states (mostly North Dakota and Minnesota, but also South Dakota,

Iowa, and Wisconsin) through the 1990s and early 2000s before fading somewhat in popularity later in that decade. Carlberg and Turko (2008) explored the reasons for the dearth of such entities in Manitoba, which had created enabling legislation to encourage their growth (as had Saskatchewan), and found that lower levels of farm income, a lack of development assistance, and a more favourable taxation and regulatory environment had hindered their development in that province.

While the specific NGC ownership structure may or may not be the ideal structure for emerging new agrifood-processing facilities — Grashuis and Cook (2018) provide a retrospective overview of several of the challenges associated the NGC experience in the U.S. — the encouragement of greater farmer ownership of processing should be explored as a strategy to mitigate the risks associated with megascale agrifood-processing facilities. Increased farmer ownership of processing facilities would help offset the negative effects of reduced profitability in the agrifood-processing sector, because it is likely that farmers would be more willing to accept lower profit-rates in processing given their ownership stake through vertical integration. In other words, while a “regular” investor might not be willing to put money into a reduced-profit, medium-scale enterprise in agrifood processing, some farmers may be willing to do so given that they would be processing their own commodities.

There are important benefits and costs to this type of alternative ownership strategy. One benefit would be the introduction of more private capital from a wider array of investors than may be possible under alternative scenarios. For example, a rancher-owned and/or feeder-owned processing facility would not require the public resource outlays that might be needed if (for example) the government were to provide the funding needed for the series of smaller, regional plants described above. In terms of costs, it is likely that some amount of tax revenue would have to be foregone in order to incentivize this type of organizational structure. For example, new generation co-operatives in the United States were often created under so-called “529 legislation,” which provided generous tax breaks for investment. This legislation thus caused U.S. state and federal governments to forego substantial revenues, although it could be argued that in the larger scheme of things, the revenues were not that significant, especially when considered in the context of the economic spinoffs created in the communities where the investments were taking place.

A third potential strategy for mitigating the risks associated with megascale agrifood-processing facilities is to make existing facilities less prone to disease outbreak through intraplant improvements. This could be accomplished by enhancing monitoring and safety measures where possible, ensuring workers are isolated from each other to the extent feasible, and increasing mechanization within facilities in industries where this may be achievable. In terms of monitoring and safety measures, during periods of increased disease spread risk, workers could be required to have their temperatures checked

The benefit to this type of strategy would obviously be reduced risk of outbreak by mitigating the factors that tend to facilitate such spread among workers carrying out their duties in close proximity. However, the costs associated with this strategy would not be trivial. Retrofitting plants or reworking existing plant designs, for example, could be expensive. Similarly, constructing new plants to meet new safety standards or to have higher levels of mechanization can require considerable outlays; although, in the longer term, these costs could be expected to be recuperated through lower use of paid labour (this has generally been one of the largest factors contributing to greater use of mechanization across most industries). Additionally, the loss of jobs (as human work is replaced by machine work) is a factor to be considered among the costs of this strategy. Certainly, in the post-COVID era, it is expected to take some time for employment to return to its pre-COVID mark.

CONCLUSIONS

The objective of this paper was to explore the vulnerabilities and benefits of the current system of megascale agrifood-processing facilities in Canada. It was argued that the current system has evolved mainly due to economies of scale in processing, which result from larger-scale facilities spreading fixed costs of production out across more units of output, reducing per-unit costs and increasing profits (and lowering prices) as a result. It was further argued that, aside from lower costs and greater profitability, an important benefit to this system is lower food prices and, as a result, enhanced food security.

Unfortunately, the existence of megascale facilities leads to significant vulnerabilities in times of disease outbreak. Having large numbers of workers in close proximity to one another, both during the production process and in common areas, creates conditions ideal for disease spread. Given the sheer size of many modern facilities, the effects of plant shutdowns upon food supply and security as the result of outbreaks is magnified. It is thus important to consider options for mitigating these risks in an effort to avoid future such disruptions to the food supply chain.

Three options for mitigating such risks were discussed. The first was support for smaller, regional facilities, which would result in a smaller overall disruption to food supply and security in the event of a single plant closure. The second was encouragement of alternative ownership structures, similar to the 1990s-era “new generation co-operatives” that were popular in the U.S. Northern Plains states. These co-operatives were farmer-owned and processed commodities into food products, encouraging regional investment and limiting plant scale. The third option explored was increased levels of mechanization coupled with enhanced intraplant safety measures. More mechanization would lead to reduced numbers of workers and thus a lower probability of disease spread, while enhanced intraplant safety measures would accomplish the same goal by keeping workers more insulated and less likely to be infected with a communicable disease.

It seems likely that the third option has the greatest probability of being adopted by industries characterized by megascale agrifood-processing facilities. The economic forces associated with economies of scale are too powerful to be overcome except at great cost and inconvenience and the public probably will not have much appetite in the post-COVID era for additional cost or inconvenience. While recent consumer trends toward local, organic and other boutique food ideals are strong, an upheaval of long-term trends toward increasing scale, which would result in increased prices, is not likely to happen. By contrast, in the post-COVID era there will be a significant public appetite for increased worker safety and reduced risk within facilities.

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APPENDIX: FEDERALLY INSPECTED SLAUGHTER FACILITIES, CAPACITIES AND EMPLOYEE NUMBERS, 2020

Owner	Location	Weekly Capacity	Employees
KML Meat Processors	Westwold, BC	250	18
Lambert Creek Organic Meats	Grindrod, BC	50	15
AAFC Lacombe Meat Research	Lacombe, AB	20	< 5
Bouvry Export Co. Ltd.	Ft. McLeod, AB	700	150
Canadian Premium Meats	Lacombe, AB	650	100
Cargill Meat Solutions	High River, AB	22,000	2,000
Harmony	Rocky View, AB	3,750	500
JBS	Brooks, AB	22,500	2,600
Northern Natural Processing	Wolseley, SK	150	30
True North Foods	Carman, MB	1,000	85
Cargill Meat Solutions	Guelph, ON	9,000	950
University of Guelph	Guelph, ON	20	< 5
Field Gate Organics	Zurich, ON	20	< 5
Local Harvest	Mt. Forest, ON	250	35
St. Helen's Meat Processors	Toronto, ON	2,000	250
Abattoir Jacques Forget Ltée.	Terrebonne, QC	500	70
Abattoire St. Germaine	St. Germaine, QC	2,000	200-300*
Les Viandes Valleyfield Inc.	St-Stanislas-de-Kostka, QC	1,000	100-200*
Viande Richelieu	Massaueville, QC	400	90
Atlantic Beef Products Inc.	Albany, PEI	600	155

* Denotes information not available; author's estimate based upon industry average.

Sources: Canfax Research Services, personal communication with packing-facility staff, publicly available internet sources, and author's calculations.

About the Author

Jared Carlberg Ph.D., is Professor of Agribusiness and Agricultural Economics at the University of Manitoba. His main research focus is upon issues in agricultural marketing, especially cattle and beef pricing and supply chains, but he also has an interest in the economics of food and nutrition, especially as they relate to the public cost of food-related chronic diseases. Dr. Carlberg was raised on a family farm at Osage, Saskatchewan and completed undergraduate degrees in both Finance and Economics as well as a Master's degree in Agricultural Economics at the University of Saskatchewan before receiving his doctorate in Agricultural Economics from Oklahoma State University in 2002.

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