Update to agriculture, transportation, and the COVID-19 crisis

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Abstract
One year into the largest economic and health event of the past 70 years, this paper considers how agricultural supply chains and agricultural transportation have been impacted by the COVID-19 pandemic. Written as an update to Gray (2020), we are able to show that agricultural transportation systems have proven to be extremely robust and were able to innovate in real-time to address challenges in the agricultural and food supply chains. We are also able confirm that most of the transportation components are well-equipped to deal with the remainder of the pandemic and the recovery phase. Notably, innovation created new services, cost-saving technologies, safety innovations, new institutions, networks, and channels of communication that operated effectively to address the pandemic. These changes are likely to remain in place post pandemic.

Keywords
transportation, COVID-19, innovation, decision making

Résumé
Un an après le plus grand événement économique et sanitaire des 70 dernières années, cet article examine comment les chaînes d’approvisionnement agricoles et le transport agricole ont été touchés par la pandémie de la COVID-19. Rédigé comme une mise à jour de Gray (2020), nous sommes en mesure de démontrer que les systèmes de transport agricole se sont avérés extrêmement robustes et ont été capables d’innover en temps réel pour relever les défis des chaînes d’approvisionnement agricole et alimentaire. Nous sommes également en mesure de confirmer que la plupart des éléments de transport sont bien équipés pour faire face au reste de la pandémie et à la phase de rétablissement. Notamment, l’innovation a créé de nouveaux services, des technologies permettant de réduire les coûts, des innovations en matière de sécurité, de nouvelles institutions, des réseaux et des canaux de communication qui ont fonctionné efficacement pour faire face à la pandémie. Ces changements resteront probablement en place après la pandémie.
1 | INTRODUCTION

The COVID-19 pandemic is without question one of the largest economic and health events of the past 70 years. With a 4.3% annual contraction in global GDP (World Bank, 2021), economic effects were profound. As governments throughout the globe restricted travel, restricted business operations, and imposed physical distance requirements on their citizens, agricultural and food supply chains were forced to react to a plethora of new regulations and restrictions while continuing to meet the daily food requirements of 7.8 billion people. Transportation plays a critical role in virtually all agricultural supply chains. By and large, these agricultural supply chains proved to be remarkably resilient and were able to innovate, often at a breathtaking pace, to accommodate required changes in their mode of operation.

From an economic and policy perspective, perhaps the most intriguing question is to understand the processes that enabled the sector (including regulations around it) to respond to new and significant challenges and new information in almost real time. Innovations that could have taken decades to achieve in other circumstances were often made in days. This begs the question of the lessons that can be learned from both the successes and failures to address significant challenges of COVID-19.

This article is a follow-up to an article written a year ago titled “Agriculture, transportation, and the COVID-19 Crisis” (Gray, 2020). While the previous article was written in the early days of the pandemic in very much an ex ante perspective, this article is written a year into the crisis and is able to provide more data and updates on what has transpired in the first year of the pandemic. The prognosis and forecasts put forward in the earlier paper are compared to actual outcomes indicating where there is general consistency, and where there is significant divergence between the anticipated effects and outcomes. With the benefit of additional data, we will also discuss how the agricultural and transportation sector is likely to be impacted for the remainder of the pandemic, during the recovery phase, and what changes are likely to persist in a post pandemic economy. This brief concludes with a discussion of what we have learned about policy processes that can foster rapid innovation.

2 | BACKGROUND

Before addressing some of the economics, it is important to consider the enormous impact that COVID-19 has had on humanity and to remind ourselves just how quickly the new disease outbreak developed into a global pandemic. The World Health Organization (WHO, 2021) describes the following series of events. On January 1, 2020 the WHO requested information on the reported cluster of atypical pneumonia cases in Wuhan from the Chinese authorities. On January 11, the Chinese authorities sent the genetic sequence of the novel coronavirus to the WHO, and Chinese media reported the first confirmed death from the virus. By the end of January there were 98 confirmed cases outside of China. On February 11, the WHO officially named the virus COVID-19. By March 1, there were an estimated 100,000 cases in the world. On March 9, the WHO indicated that COVID-19 could be declared a pandemic. Tragically, as of February 28, 2021, 111 million people have been infected by COVID-19 and over 2.5 million have died with the disease (Dong, Du & Gardner, 2020). The United States leads the confirmed death toll with over 500,000 COVID-related deaths to date (Dong, Du & Gardner, 2020). Closer to home, the Canadian death toll, as of February 27, was 21,960 (Government of Canada, 2021). While several vaccines have been approved and are now being administered, more illness and deaths are anticipated even in the best-case scenarios.

The pandemic was also a very large economic event in the global economy profoundly impacting GDP, personal income, international trade, and government fiscal and monetary policy. These macro-economic effects resulted from government and private actions implemented to slow the spread of the virus while maintaining some level of economic activity. In April 2020, when Gray (2020) was written, the impacts of widespread shutdowns were being felt across the global economy, affecting heavy industry, construction, manufacturing, wholesale, retail, tourism, restaurant, and transportation services. Reflecting a dire and a very uncertain outcome between February 13th and March 23rd the Dow Jones stock index fell be 38% (Market Watch, 2021). Bolstered by massive monetary and fiscal stimulus, more targeted physical distancing, the development of new supply chains, the development of vaccines, many of these sectors have significantly recovered in the past 10 months, and some sectors of the economy are booming. Tech stocks related to online marketing, gaming, entertainment, home office services, home renovation, and larger ticket consumer items have seen a growth in production and demand. Of note, China was the first large economy to be impacted by the pandemic and took some extreme, and perhaps prudent measures that resulted in early containment of the virus. This allowed Chinese manufacturing to recover by mid 2020 avoiding a prolonged disruption in these supply chains. Except for a few countries, the rest of the world has
been less effective in controlling the virus, resulting in a second wave of infections, and the continued use of restrictions on large gatherings, domestic and international travel, and restrictions on in-person dining and beverage consumption. These sectors of the global economy continue to be hardest hit by the pandemic.

The disruptive economic impact of the pandemic was also very apparent in Canada and was not shared equally across sectors of the economy. Figure 1 provides an index of quarterly household expenditures in Canada for a number of food and transportation related services. While at home food and beverage expenditures increased by about 10% during the first three quarters of 2020, accommodation and beverage services dropped by over 60%. The purchase of foodservices fell 20% to 40%, perhaps indicating a shift to takeout and delivery purchases. The airline sector of the economy has likely been hardest hit, with passenger-miles remaining down over 90% from pre-pandemic levels (Stats Canada, 2021a), indicating that many consumers were saying at home.

The COVID-19 pandemic affected agricultural and food systems in very diverse ways. The necessity for consumers to eat daily meant that aggregate food demand was not greatly affected by the pandemic. This also meant the governments and industry quickly recognized the essential aspects of the food supply chains and worked cooperatively to address the supply challenges that did arise.

As Gray (2020) describes, the modern transportation of agricultural goods is dominated by trucking, rail transportation, container traffic, and bulk ocean shipping. Millions of tonnes of grain move to port by rail or truck and from port to port by bulk ocean transport. Longer hauls have some presence of intermodal containerized movement. Intercontinental trade of perishable items relies on refrigerated containers or air freight for high-value perishable products. Short hauls from farm gate to processor, processor to food manufacturer, food manufacturer to distribution center, and distribution center to retail are dominated by purpose-built trucks. Consumer pickup and door-to-door delivery services have become increasingly important in the last leg of food delivery. Each of these forms of transport has been impacted differently by the measures related to the COVID-19 pandemic.

3 BULK OCEAN FREIGHT

Much of the grain in the world is traded via 50,000 tonne bulk ocean freighters. These large ships are typically manned by small crews that spend months of time at sea. The isolation of these crews was intensified by the shipping companies and the measures imposed by local port authorities. As a result, the supply of these services was largely unaffected by COVID-19 illness.

As Gray (2020) noted, early on in the pandemic there was a significant decrease in the cost of these bulk ocean freight services. As shown in Figure 2, this decrease in freight rates was short lived. By July 2020, freight rates had almost returned to pre-pandemic levels. As also shown in the figure, these bulk freight rates movements were correlated with global steel production, which fell during the early days of the pandemic, but had returned to normal by July 2020. This price correlation is reasonable given that steel production requires large inputs of coal and iron ore, which are also shipped via bulk ocean freighters. The minimal impact on bulk ocean freight to-date suggests that this transportation sector is unlikely to be affected by the pandemic going forward.
RAIL MOVEMENT

Rail transportation is an essential link in the export of western Canadian grain primarily through the west coast ports in Vancouver and Prince Rupert. Gray (2020) noted that while the shipment of the large 2019 crop had been off to a slow start, the shipments had increased during the first months of the pandemic. This trend of higher rail shipments continued during the pandemic in rather a dramatic fashion. As shown in Figure 3, total rail shipments to western ports and processors were 51.6 million tonnes, exceeding the five-year average by 27% and the high 2019 shipments by 20% (Quorum, 2021). Despite record crop production, AAFC (2021) is forecasting a 2.6 million tonne reduction in the ending stocks of all principle field crops.

These record levels of grain rail shipments were enabled by three factors: the production of a large crop; grain terminal expansion and infrastructure in the port of Vancouver (Torshizi and Gray, 2018); and rail investments in locomotives new, high density hopper cars (Siekierska, 2018). As shown in Figure 4, like ocean freight, grain movement could have also benefited from reduced rail demand from other sectors, freeing up crews and locomotives for redeployment to the movement of grain. Irrespective of the causal effects, rail grain movement during the pandemic set new record highs,
reflecting a higher capacity to move grain. Going forward, the greatest risk to the rail transport of grain would appear to be a post pandemic boom in the shipment of other goods that would make the railways less able to respond to unanticipated increases in demand. In the past, this has led to congestion and higher grain export basis level (Torshizi and Gray, 2018).

5  |  MARINE CONTAINER MOVEMENT

Marine containers are increasingly being used in agricultural supply chains, connecting buyers and sellers with secure segregated shipments of products from seller to smaller purchasers around the world. As shown in Figure 5, total container-based grain exports have grown to 6 million tonnes annually, dominated by lentil, pea, and edible soybean exports. Given the quantity of production, containers are an important mode of transport for these crops.

Figure 6 reports monthly shipments of grain in containers in the past four calendar years. Like other grain exports, container-based exports of grain increased during the pandemic, suggesting that container movements were positively impacted by the pandemic.

In November 2020, Nicholson (2020) reported a shortage of empty marine containers available for grain export for the Port of Vancouver. This scarcity of empty containers occurred when the container shipping companies put out an urgent request to “immediately evacuate” empty containers for shipment to Asia so they could be reloaded with high-value Asian goods for shipment to North America during the Christmas season (Hemmes, 2021). As shown in Figure 7, this action is evident in the data showing a surge in both outbound empty and inbound laden container movement, in the last few months of 2020. Fortunately, the reported container scarcity did not result in reduced container-based export of grain which continued at a record pace in the last four months of 2020. On a calendar year basis, the 2020 exports of 6 million tonnes exceeded the previous record 2019 shipments by more than a million tonnes.

1 The estimate includes both inland and port stuffed containers, which covers about 96% of the actual movement.
The reports of container shortages do identify a vulnerability in the access to markets, which could become an issue if there is a post pandemic economic boom in overall container demand. For a growing number of high value markets there are no good alternatives to containerized movement. Captive buyers and sellers will have to build additional risk premia into their transactions with negative price consequences for grain producers and for industry development. Going forward, this vulnerability may need to be addressed through new supply chain relationships and/or other means.

6 | TRUCKING SERVICES

As Gray (2020) describes trucking services are vital linkages in many parts of the agricultural supply chains. Recognized as being vital to food supply chains trucking services were not subject to regulated closures but were subject to physical distancing protocols to protect employees and their customers. The protocols for the pick-up and delivery of farm inputs, farm produce, and intermediate or final processed goods to grocery distribution centers were quickly modified so that they did not require a trucker to leave the safe confines of their truck.

With the minor regulatory changes, the trucking sector, by and large, has been able to meet the demand for trucking services during the COVID-19 pandemic. A combination of factors may have enabled the trucking industry to meet the changing demand within the agriculture and food supply chains. A decentralized industry structure enabled a number of decision makers and markets to play a role in trucking service procurement. The solitary (or two) driver nature of truck operation reduced the risk of workplace spread. Finally, the decrease in demand from other sectors freed up trucking resources that could be redeployed to agricultural and food supply chains.

Early in the pandemic, the closure of roadside restaurants limited trucker access to restrooms. In rapid response to this issue many provincial governments installed portable toilets at trucking weigh stations. Government also relaxed and increased the maximum distance and time limits for drivers, to reduce the need for driver change and accommodation use on longer hauls. While truckers were exempt from some of the restrictions on international travel, they were in general subject to modified testing and quarantine protocols, which increased the cost international trucking services.

Going forward there is little reason to anticipate any major issues related to trucking that the market will not solve. Perhaps the more isolated nature of the job, brought about by physical distancing and quarantine requirements during the pandemic, could reduce the supply of drivers, requiring a higher wage or other measures to offset.
As shown in Figure 1, the pandemic had an extreme impact on food consumption habits. In the second quarter of 2020, the purchase of food services dropped 40% while grocery expenditures increased by 10%. While this recovered somewhat in the third quarter when the COVID-19 numbers decreased, renewed shutdowns during the second wave may have intensified the shifts away from in-person dining. These measures could also underestimate the shift to home delivered meals and takeout food.

The pace at which the food industry has been able to innovate to meet customer needs is certainly unprecedented. The home delivery market, which was already growing, exploded during the pandemic. Based on the revenue of traded home delivery companies, the 2020 industry revenue was 4 times the 2019 annual revenue (Curry, 2021) and this figure would not include the restaurant-owned food delivery service.

While in-person shopping continued, there was also a large shift toward grocery pickup and delivery. While initially these services were limited in supply and required ordering over a week in advance, the queues shortened as the supply increased. Most major grocery retailers now offer online ordering with store pick up and grocery delivery service. In its 2020 annual report, Loblaws reported $2.8 billion out of their total $51.86 billion retail sales were online sales, up 178% from last year’s online sales (Redman, 2021). General online retailers like Amazon Fresh have also entered the space, as have specialized delivery services like Uber Eats. The pandemic forced retailers to quickly innovate or be left behind. This growth in these on-line services will underestimate the reduction in the number of persons shopping as many families sent fewer people to the grocery store, made larger less frequent purchases, and purchased groceries on behalf of COVID-19 vulnerable friends and relatives, who did not want to risk shopping exposure.

Gray (2020) recommended subsidizing food delivery. However, governments did not move to directly subsidize grocery pickup or home delivery services, perhaps because this need was addressed by the market, and perhaps because public health authorities did not find that grocery shopping was a significant vector for COVID-19 transmission when physical distancing protocols were followed.

While many online shoppers may return to the store once the pandemic is over, they have also already incurred the sunk cost of learning how to use online delivery and may continue to use these services for their convenience. Given that food consumption patterns tend to be habit-forming, the effects of the pandemic are expected to persist beyond the pandemic, permanently impacting food consumption habits. This will be especially true in geographies where restaurants have gone out of business.

Price-conscious shoppers may also continue to use online shopping as a means to quickly search for the best deal in their district. In any case, the end of the pandemic will almost certainly reduce the demand for these online services in the short run, as more consumers travel and return to restaurants. This reduction in the demand could create a period of intense competition and where the capacity to serve the market exceeds demand.

**8 | POLICY IMPLICATIONS**

The COVID-19 experience demonstrates that if industry recognizes that change is necessary and inevitable, it can innovate very quickly. In February 2020, the term *social distancing*, soon to know as *physical distancing*, was a new concept. Three months later, nearly every business and every person had made substantial changes in the way they operated. Governments were simultaneously learning about a new pathogen, introducing regulations, and developing public messaging to prevent a public health disaster from an overwhelmed health system, while reacting to and designing radical new policies and programs to deal with the economic fallout of the health measures. Business owners and public and private employees had to change how they operated, as they collectively took actions to reduce health risk while considering social needs and the economic consequences of their actions. The agriculture and food sector was profoundly challenged with the need to continue to feed the world on a daily basis despite the wide-spread closure of restaurants and the changing operating practices at every point in the supply chain. Thankfully, the sector was able to respond to the enormous challenge, with relatively few COVID-19 related deaths and very few incidences of food shortages.

One could argue this was the invisible hand of the market operating effectively, but that would drastically underestimate the contribution of millions of Canadians, who recognized their social responsibility and made uncompensated efforts to dutifully do what they could to address the crisis. Governments, from senior politicians to the public servants delivering vital services, recognized the crisis and put solutions ahead of their self-interest. Often, collective action provided
pragmatic solutions to potential disputes up and down the supply chain allowing the sector to continue to operate in a new reality.

New processes were put in place to identify new issues as they arose with an expectation that solutions would be discussed, and the best available knowledge and management practices would be shared to find a pragmatic solution. While most businesses and public institutions put these processes in place internally, governments and industry organizations created new processes for information sharing, consultations and decision making. The AAFC COVID-19 Industry-Government Working Group was created and met regularly after March 24, 2020. The initial invite went out to 886 recipients in the agriculture and food sector and covered from the food retailer to farm input suppliers, provincial government officials, producer organization, etc. Attended by the Minister of Agriculture, senior AAFC officials, government officials from across the federal government, provincial governments, NGOs, private firms, and industry leadership from across Canada, the committee was a vital conduit for rapid decision making. At each meeting the industry was made aware of rapidly changing regulations, policies, and programs. Industry leadership identified both new and persistent issues. Practical and pragmatic solutions were often discussed. The Minister of Agriculture regularly attended, solicited, and fielded questions from the working group. Ministerial officials provided weekly updates and reported on progress toward solutions. With the importance and urgency of responding to the COVID-19 pandemic, the open committee mechanism allowed new problems to be addressed often within days or a few weeks of being identified, clearly demonstrating that very rapid innovation is possible. For example, about 2 weeks after committee members raised concerns over the impact of travel bans on temporary foreign workers, the government announced (on March 27, 2020) to the committee travel exemptions for travel of temporary foreign workers, with a long list of new safety protocols and employer requirements, to be eligible for the program. The committee continues to meet about twice per month. Hopefully, the positive experiences from this process have a lasting impact on industry-government communication and perhaps reset the clock on the expected timelines for governmental decision making and industry innovation.

9  CONCLUSIONS

There were relatively few apparent issues related to agricultural transportation systems. Early on, trucking issues related to toilets, border crossings, and long distance were quickly addressed though policy change. New protocols to maintain physical distancing were quickly developed and implemented by firms at virtually every link in the transportation chain. As noted earlier, the agri-food transportation systems preformed exceedingly well, in some cases setting records for the volume of movement.

All parts of the agricultural and food industry were focused on finding solutions to new challenges created by the COVID-19 pandemic. The unprecedented rate of innovation required new planning processes, institutional arrangements, and communication channels, which were accepted and supported by individuals and an industry determined to find solutions.

The resilience of the agri-food value chains to provide continual supply of safe food during the COVID-19 pandemic is an indicator of the robustness of the sector. This optimistic assessment may also understate some underlying issues of the food security (Deaton & Deaton, 2020) that could not be addressed in this paper. The pandemic disrupted employment, public transportation, pedestrian and closed public schools, perhaps having large negative impacts on those with ongoing food security issues. As we measure and report the tremendous innovation and the robustness of the agri-food value chains in Canada, the enormous hardship created by the pandemic should not be understated.

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