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DOT AUTONOMOUS POWER PLATFORM: THE FUTURE Of farming

Marco Coppola wrote this case under the supervision of Professors Dwight Heinrichs and Michael Taylor solely to provide material for class discussion. The authors do not intend to illustrate either effective or ineffective handling of a managerial situation. The authors may have disguised certain names and other identifying information to protect confidentiality.

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In July 2017, thousands of farmers, agriculture equipment manufacturers, and other guests congregated in a field in Langham, Saskatchewan, northwest of Saskatoon, for the Ag in Motion 2017 trade show. The show featured the latest technologies from well-known agribusiness (Ag) manufacturers—products and services designed to improve farm management. However, one exhibit in particular managed to capture the attention of all in attendance: the Dot autonomous power platform (Dot) (see Exhibit 1). In its debut appearance, Dot captivated the audience with its unique *U*-shaped design, its autonomous capabilities, and its promise to make farming more efficient, more profitable, and more attractive to a new generation of farmers.

Norbert Beaujot, the Dot inventor, described Dot as “an autonomous vehicle, designed to replace the farm tractor, allowing a large-scale farmer to spend more time focusing on the farm business. Dot will make farming much more efficient and profitable.” In an interview at the Ag in Motion show, Beaujot explained that his goal in developing Dot was to address the question of how to make agriculture efficient again.[[1]](#footnote-1) Dot was capable of performing nearly all of the same functions performed by a traditional agricultural tractor, but it did not share any of the distinct physical characteristics of its predecessor. From the ground up, Dot was designed with efficiency in mind. It was shaped like an open *U* to carry implements instead of towing them; and it had no tractor cab, air conditioning, or other creature comforts that a tractor would need to accommodate an operator during long hours in the field.

Beaujot was weighing three options to commercialization his innovation; sell through traditional farm equipment dealers, create a Dot showroom with their own in-house sales-and-service team, or create a custom seeding and spraying business to further revise the technology while promoting it.

Beaujot was not new to innovation in agriculture. In 1991, he created a simple but powerful concept when he pioneered the first active-hydraulic, ground-following, individual row opener, which was capable of placing seed and fertilizer in the soil incredibly precisely. Beaujot continued to innovate and stay ahead of the curve on his own farm, and in 2002, he founded SeedMaster Manufacturing (SeedMaster). Beaujot was able to use SeedMaster’s 6,500 square metres of office, manufacturing, and assembly space to exercise his creativity and ingenuity, bringing his inventions to the world and acquiring more than 25 patents in his name.

The DOT DIFFERENce

Beaujot created a sister company, Dot Technology Corp., to design the Dot power platform. Dot was designed to replace the tractor on farms but not to look like one. Traditional tractors were designed to be heavy so that they could obtain traction when towing massive agriculture implements. Dot, however, was able to load and carry the implements instead of towing them, which made its loaded weight less than that of a tractor by itself. At a time when soil compaction and conservation were growing concerns, reducing the overall weight moving through the field was of great importance.

Dot’s capability to load implements meant that the total implement cost was reduced because wheels, axles, hitches, or many other components required to tow implements were not needed. This enabled farmers to use the same implement technology for each activity on the farm but at a substantially reduced capital cost.

Dot’s ability to operate implements autonomously in the field also allowed farmers to spend more time focusing on agronomy, working on their businesses, and enjoying life with their families—all activities they might otherwise have given up to time spent in the cab of a tractor. Dot did not experience fatigue like a human operator and operated with the help of sensors; this meant that the opportunity for errors or, even worse, fatal accidents, was nearly eliminated.

Dot was able to achieve all of this for a substantially lower consumer retail price than a traditional tractor and implement model.

AGribusiness PROBLEMS WORTH SOLVING

Agricultural producers were currently facing critical challenges while trying to feed the world. The most noteworthy issue was a substantial labour shortage, which continued to worsen year after year. The Canadian Agricultural Human Resource Council (CAHRC) released a study that found 26,400 agriculture-related jobs had gone unfilled across Canada in 2014, costing $1.5 billion.[[2]](#footnote-2) The same study also predicted that number would increase to 114,000 unfilled jobs—more than 25 per cent of the entire agricultural labour force—by 2025.[[3]](#footnote-3) Canadian farmers continued to lose millions of dollars each year as a result of the labour shortage; the need for a solution had never been more apparent. While many individual organizations were looking at solutions to this problem, the Dot team believed that the shortline manufacturers of Canada and the world needed to work together instead of individually to solve the labour shortage and other problem areas plaguing agriculture.

In addition to the labour shortage and fluctuating commodity prices, agricultural producers faced several other issues that directly affected their ability to maintain profitability and sustainability. These included soil compaction; high machinery costs; low trade-in values; a short growing season, depending on geographical location; on-farm accidents; and fuel costs and emissions.

An autonomous tractor, mirroring a traditional tractor but without a cab, directly addressed the labour shortage and safety concerns but did not address the other issues listed above. Dot, on the other hand, was able to address all of these issues by virtue of its unique design and meticulous attention to the demands of farmers. As noted earlier, Dot’s unique *U*-shaped design meant that implements could be loaded instead of towed, which drastically increased the horsepower efficiency and reduced the overall weight of the unit. The standardization of Dot units and available implements also meant that the value of used units would be based on engine and implement hours rather than on available options.

THE DOT SOLUTION

The Dot power platform was able to address the labour shortage in agriculture because it did not need an on-board operator to perform tasks in the field. Once its artificial intelligence (AI) functionality was successfully researched, designed, developed, and produced, Dot was expected to be able to make the same decisions human operators would make if they were present. This AI functionality was expected to be in use for the 2020 growing season in Canada. In many locations across the country, the growing season was short, so Dot’s ability to operate through the night without experiencing operator fatigue would greatly enhance farmers’ ability to safely complete seeding, spraying, and other tasks during short windows of opportunity. Researchers needed to commit a considerable amount of time and effort to the architecture of this AI system in order to make this a reality, but this system would enable producers to let Dot operate in their fields knowing it would do an equivalent or better job than they would do themselves.

Soil compaction was another agricultural issue that depleted the productivity of the soil and could lead to destructive crop diseases such as clubroot. The traditional tractor used in 2019 typically weighed between 16,000 and 20,000 kilograms (kg) before the addition of ballast. This was in addition to the 18,000–27,000 kg it towed to perform a task such as seeding. Dot, on the other hand, weighed a mere 6,800 kg on its own and approximately 18,000 kg when fully loaded to perform the same seeding job. This weight difference would help to drastically improve the productivity of the soil without compromising the quality of the work. Other factors besides weight that were considered during the development of Dot included tire flotation and weight distribution. Using a greater number of weight-efficient Dot units instead of extremely large tractors in the field would help to maintain the productivity of the soil for future generations—a growing concern among agricultural producers.

When farmers evaluated options for equipment purchases, their main concerns included price, utility, and reliability. An 18-metre air seeder and accompanying air cart could cost $600,000, not including the additional major investment in a traditional tractor to pull it. The tractor required to pull a large air seeder generally cost an additional $600,000. Dot Technology Corp. estimated that the price of its Dot power platform would be less than $345,000, and that the nine-metre air seeder would cost an additional $160,000. For comparison, this would result in approximately $190,000 in savings for those who purchased two Dot units and two air seeders—before calculating the savings a farmer would achieve by not having to pay salaries for on-farm labour, which was in short supply.

Dot-compatible or Dot-ready implements offered by other shortline manufacturers would be less expensive (without sacrificing quality) because they were designed to be carried instead of towed. This eliminated the added costs for extra steel, hitches, wheels, axles, and miscellaneous parts required to tow an implement. Since the goal was to remove the farmer from the field, not from the farm, this offering was valuable: the more shortline manufacturers collaborated to produce Dot-ready implements, the more on-farm activities could replace human operations with autonomous operations. This result would translate directly into significant savings in farm labour costs—assuming such labour was even available—and capital costs for similar equipment. The capital cost savings could be calculated based on the significant downscaling in terms of the number and size of power units, implements, and materials required. Labour savings could be calculated based on the number of hours that would have been spent by a human operator to perform the same tasks that the Dot could execute autonomously. This figure would vary across locations in Canada, due to varying labour rates and equipment costs, but it would result in labour and equipment savings in all cases.

Safety was one of Dot Technology Corp.’s main priorities during the development of the Dot power platform. The Canadian Agricultural Injury Reporting Agency (CAIR) reported 843 agriculture-related fatalities in Canada from 2003 to 2012, and 18 per cent of these had resulted from accidents in which people were run over.[[4]](#footnote-4) The successful development of an object identification and classification system for Dot meant these accidents would be substantially reduced, if not eliminated. This technology would be highly desirable as there was a trend among farm operators around the world toward working longer hours. Farmers suffering from fatigue were inherently susceptible to making mistakes, and the frequency and severity of these mistakes increased with each passing hour.

Lastly, due to the immense tractor weight required for traction, much of the horsepower available to traditional farm tractors was consumed simply to propel the units forward. From 15 to 40 per cent of a tractor’s horsepower was used just to move the tractor—before towing an implement. With Dot, however, the implement was loaded onto Dot’s frame rather than towed and served as the ballast needed for traction. This meant that Dot not only used its horsepower much more efficiently but also was inherently more fuel efficient and produced fewer emissions.

CURRENT CUSTOMER ALTERNATIVES

All autonomous tractors and other autonomous implements as well as traditional tractors were considered competition for Dot. While there was presently no commercially available autonomous solution aside from Dot, farmers still had the option to purchase traditional tractors, and for the next few years, that would be the fiercest competition. The Dot team had travelled to many countries, and while concepts and small autonomous prototypes were on the market, nothing was ready for the market quite yet.

The closest competition in the autonomous space was Case Corporation (Case), which in 2016 revealed an autonomous tractor that was being tested in the United States. Case’s product resembled the company’s existing traditional tractor but did not have a cab. While this product addressed the labour and safety issues present in agriculture, it did nothing to address soil compaction, high machinery costs, horsepower efficiency, or the emissions created due to inefficiency. Neither could Case’s proposed autonomous solution be easily transported on public roads—something farmers often had to do to move from field to field. Dot, on the other hand, could easily be loaded onto a trailer as it was much smaller than a traditional tractor. Where federal or local regulations allowed, it could autonomously follow a pilot vehicle.

Deere and Company (John Deere) was one of the largest traditional tractor and farm implement manufacturers in North America. While the company had not yet marketed a completely autonomous power unit, it had the resources to develop an autonomous solution if it chose to. As with Case, however, any autonomous solution that was anything other than a tractor without a cab would compete directly with the company’s main product line and immediately cannibalize sales, and like Case’s proposed solution, a traditional tractor that was made autonomous would solve only a fraction of the issues faced by agricultural producers in this period and would remain expensive.

A number of start-up companies had concepts or prototypes for swarms of small autonomous units, but to date, nothing had been publicly, successfully tested in fields. Small robots had the advantage of costing less and were arguably more accessible to smaller farmers, but they struggled with steep topography, high-clearance activities, and wet soil, and they required a great deal of attention in terms of continuously being filled with fuel or other inputs or charging. One of the front runners in the smaller-scale autonomous solutions market that could be considered a competitor to Dot was the Small Robot Company (SRC) from England. The Dot team met with SRC in 2018 and determined that it was still a couple of years away from having a minimum viable product; it would not be an immediate threat in the large-scale farming market Dot was targeting in the near future. Dot continuously monitored all existing and prospective competition and continuously adjusted its risk mitigation strategies.

TARGET MARKET

For the next three to five years, the company planned to focus Dot power platform’s marketing solely on its target market in agriculture. Following success in the agriculture industry, Dot would work with manufacturers in other industries such as mining, construction, and forestry to automate certain tasks. In agriculture, the immediate target customers would be large-scale farmers in North America, ideally those farming at least 800 hectares; partner farmers (those with patience and persevering values that were aligned with those of Dot Technology Corp.); and, potentially, specialty and row-crop farmers.

Following the Dot product launch in 2017, a deposit program was created to determine the demand for Dot units. In addition to determining market acceptance, the deposit program was also designed to gather information on the demographics of early adopters and to determine which locations service technicians would need to be available in before the units arrived there. The program was marketed modestly, with only two emails going out to Dot’s subscriber list at the time—approximately 1,200 people. The emails generated approximately 70 deposits from Canada, the United States, Europe, and Australia. The program was closed within the first two weeks as the next couple of years’ unit production capacity was filled.

Information from the initial deposits indicated that the farmers ranged in age from 25 to over 55 and farmed anywhere from 800 to over 12,000 hectares. While this information was encouraging, the range was vast and did little to help narrow the company’s definition of its target customer.

Each Dot unit was designed to serve approximately 800 to 12,000 hectares, or one unit per combine on the farm. Based on 2016 farm census data for Canada[[5]](#footnote-5) and 2012 farm census data for the United States,[[6]](#footnote-6) the Canadian and US markets for grain and oilseed production would equate to immediately addressable markets of 17,400 units and 129,900 units, respectively. Dot had an estimated retail price of US$260,000, which worked out to an immediately addressable market in Canada and the United States of approximately US$38.3 billion.

Dot used the term *immediately addressable market* to classify the market it could serve with its current offering of agricultural implements. Each Dot unit would need to be accompanied by implements in order to perform tasks in the field, which meant that the market among third-party shortline manufacturers for Dot-ready implements would be considerably larger than the market for Dot itself. These implements currently catered to dry-land farming, but the company was exploring opportunities in the construction, forestry, and mining industries, as mentioned above.

MARKETING OPTIONS

By late 2019, Dot had been marketed modestly, through digital campaigns, social media, speaking engagements, and trade shows. The initial product launch at the July 2017 trade show was received positively by the audience (the majority of whom were farmers) and this helped grow the Dot email list to nearly 2,000 subscribers in one year with no further cash investment. The company increased its number of social media followers to more than 4,000 in the same time frame. As a result of Dot’s disruption in the agriculture industry, the Dot team was invited to make presentations on the future of agriculture to audiences all over the world. Collectively, the Dot team had presented over 50 times since the summer of 2017.

The first round of Dot units was delivered to farmers beginning in May 2019. The relationship between these farmers and the company was slightly different from that of a typical sales agreement; Dot Technology Corp. would be working much more closely with the farmers as the units were still technically in development. However, this presented an opportunity to feature the first few owners in a marketing campaign, beginning when the units were delivered to the farms and incorporating the farmers’ thoughts on its performance and their views on Dot’s place in the future of agriculture. These testimonials would help to attract more early adopters and could sway the early majority, who needed to see the technology working on their neighbours’ farms before they would make a commitment to purchase.

The second round of units would be delivered in the fall of 2019 and would involve a similar marketing plan. This time, the marketing would focus more on the use of Dot in conjunction with human-operated equipment such as combines and semitrailers during harvest. Showcasing this crossover between autonomous and human-operated equipment would demonstrate how well Dot could be integrated into farm operations: farmers would not need to totally remove themselves from farms in order to realize efficiency gains from using Dot. The long-term goal was ultimately to remove the farmer from the equipment, freeing up time to optimize farm efficiencies.

Throughout this time, Dot would be present at trade shows, farm tours, and facility tours to continue to keep the market and public engaged with its developments. The company would be present at several major trade shows, including Canada’s Outdoor Farm Show, in Ontario; Ag in Motion, in Saskatchewan; the Farm Progress Show, at various locations in the United States; and Agritechnica, in Hanover, Germany. The company would consider other shows and attend as appropriate, but its main goal would be to market Dot in local markets and abroad to attract new implement partners. Attending trade shows with machinery was expensive, but these events created a great deal of interest and provided a venue for public demonstrations to audiences that otherwise would not see Dot. The company also conducted field demonstrations and facility tours at its field test sites twice per year to increase awareness about the product and buying opportunities.

Dot Technology Corp. intended to avoid promoting its product through traditional media such as print, radio, and television, and focused instead on digital media, which provided better tracking of the return on investment and made it easier to target specific market segments. Digital media also allowed the company to reach a national and global audience much more cost effectively than did traditional media.

The challenge facing the executive team now was how best to commercialize Dot. While farmers were traditionally conservative in their purchase decisions—although large-scale operators were less so—the operating interface of Dot was all new, and the reliability and safety of its disruptive technology when left unattended was undergoing continual refinement. Depreciation curves and saleability of used Dot power platforms and Dot-ready implements were not yet known. Sales, training, and servicing considerations for the Dot equipment also needed to be worked through.

Dot was considering three approaches to commercialization, which were not mutually exclusive: (1) focus on retailing Dot and Dot-ready implements through a network of farm dealerships in a traditional manner; (2) create a Dot showroom and sales-and-service team, selling primarily online in a virtual showroom, like Tesla; and (3) create a “pop-up” custom seeding and spraying business to further revise the technology while promoting it.

The Dot executive team was familiar with classic environmental-scanning models it needed to understand competitive realities and opportunities at societal, market, and organizational levels. More specifically, the team had to remain mindful of potential second-mover competitors while identifying and defining the following: (1) its composite stakeholder value proposition, seen through the lens of a specific go-to-market option; (2) the key resources and activities the Dot team would be responsible for, given a specific go-to-market option; (3) the company’s key partners, the resources they brought, and the activities they would perform, given a specific go-to-market option; and (4) the most favourable customer segments and relationship requirements for the specific go-to-market option. The team would also need to address capital investment requirements, margins, and volume, given a specific go-to-market option.

Moving forward

As an insightful engineer, Beaujot was quite aware that an approach to commercializing a disruptive innovation that assumed “if you build it, they will come” could be tenuous, particularly in a capital-intensive, cyclical industry with tight margins. He was confident of the value the Dot technology could bring to agriculture and other industries, but he wondered what questions his team needed to be asking at this point: what might they be missing regarding threats and opportunities, and how could they most successfully and efficiently commercialize Dot?

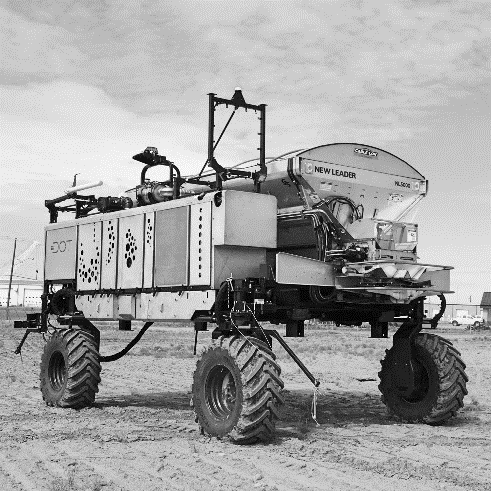
Exhibit 1: The dot in action

A truck driving down a dirt road

Description automatically generated

A large machine in a field

Description automatically generated

 A truck driving down a dirt road

Description automatically generated

Source: Dot Technology Corp.

1. “Scott Garvey Interviews DOT creator, Norbert Beaujot – AgDealerTV,” video interview, 8:27, AG Canada, 2017, accessed November 1 2019, www.agcanada.com/video/scott-garvey-interviews-norbert-beaujot-agdealertv. [↑](#footnote-ref-1)
2. All currency amounts are in CA$ unless specified otherwise. [↑](#footnote-ref-2)
3. Agri-LMI: Labour Market Information, *Canada’s Agriculture Sector Labour Market Forecast to 2025*, accessed July 3, 2019, https://cahrc-ccrha.ca/sites/default/files/files/Labour-Employment/factsheet\_NAT\_E.pdf. [↑](#footnote-ref-3)
4. CASA: Canadian Agricultural Injury Reporting, “Canadian Agricultural Injury Reporting: Agriculture-Related Fatalities in Canada,” 2016, accessed July 3, 2019, www.cair-sbac.ca/wp-content/uploads/2017/02/CASA-CAIR-Report-English-FINAL-Web.pdf. [↑](#footnote-ref-4)
5. “A Portrait of Canadian Farms,” Statistics Canada, May 17, 2017, accessed November 01, 2019, www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2017010-eng.htm. [↑](#footnote-ref-5)
6. “2012 Census of Agriculture: United States Summary and State Data,” *USDA: National Agricultural Statistics Service* 1, part 51, May 2014, accessed April 25, 2019, www.nass.usda.gov/Publications/AgCensus/2012/Full\_Report/Volume\_1,\_Chapter\_

   1\_US/usv1.pdf. [↑](#footnote-ref-6)