HONEY BEE MANUFACTURING LTD. CANADA
www.honeybee.ca

INTEROPERABILITY IN FARMING OPERATIONS

The need to interoperate with OEM equipment and other related systems

Q4/2020

ABSTRACT

As modern equipment becomes more technically advanced, there is greater opportunity that the technical tools available to developers, can be employed to exploit the end user and control market activities.

The “ying and yang” of technology, is its ability to deliver useful advancement, while at the same time, allow OEMs to exert anti-competitive positions in the marketplace.

Agriculture is of strategic importance to every nation. The stability and productivity of companies who participate in the production of food and fibre, should be protected in a way that reflects Agricultures strategic importance.

This paper discusses three areas of negative impact on the sustainability of food and fibre industries. These factors are primarily created by larger players in the sector and facilitated by weak legislation. All three areas, when abused, anti-competitive in nature.

They are:

- OEM only, authorized repair.
- OEM only, authorized implements.
- OEM control, of private user data.

These three areas of activity are relatively new in Agriculture.

Historically, repair and interoperability were available to the end user, and farm data stayed on the farm. With the introduction of embedded technology, the normal market conditions are changing for the short line manufacturer and the farmers.

This paper digs deeper into the resulting mechanisms and harms.

"Copyright law is neither designed nor intended to regulate the functionality of equipment and vehicles. That is the purpose of patent law. To the extent the software code embedded in modern equipment is original, it can be protected by copyright. But that protection cannot extend to asserting control over the functionality and interoperability of competing equipment. Such a broad interpretation of copyright would undermine the patent system and frustrate both competition and innovation. Exceptions like those recognized under U.S. law are one important tool for preventing this form of copyright overreach."

Aaron Perzanowski, Professor of Law, Case Western Reserve University, Cleveland Ohio

"Canada's digital lock rules have long been among the most restrictive in the world, extending far beyond international treaty requirements. The harm to many sectors is becoming increasingly apparent with agriculture improbably finding itself on the front lines of a copyright issue. The good news is there an easy fix envisioned by the legislation. The Canadian government should use its regulatory making power already found in the law to exempt activities that have no reason to be captured by a copyright law provision."

Professor Michael A. Geist, Canada Research Chair Internet & E-commerce Law,
University of Ottawa, Faculty of Law

"I fully support the move by Canadian Short line manufactures and equipment dealers to have an exemption introduced into Canadian Copyright Law that grants them the ability to reverse engineer heavy and agricultural equipment locked by TPMs for the purposes of interoperability. This would place Canada on equal footing with the US Copyright Law which permits this act as an exemption to the prohibition on circumvention. The over-reach into the repair aftermarket by agricultural technology providers, by way of TPMS, is currently being recognised and investigated by the Australian Competition and Consumer Commission (ACCC) in Australia and we are looking to countries like the US and Canada, who are recognising the need for copyright exemptions to address the competition and market consequences of this technological over-reach."

Professor Leanne Wiseman, Griffith Law School, Griffith University, QLD AUSTRALIA
Associate Director, Australian Centre for Intellectual Property in Agriculture

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Executive Summary

Honey Bee Introduction

Greg and Glenn Honey grew up on a farm in Bracken, Southwest Saskatchewan [100+ years in operation]. In 1979, they started building their own equipment to meet their own needs on their farm, the first major project being a 425 Horse Power tractor.

From a 67' self-propelled swather to a power-unit sprayer combo, they built or adapted nearly everything that they needed for their farming practice. Naturally, the duo began marketing some of their products. The most popular among these was the Grain Belt Header, which offered increased capacity, better cutting, and better feeding. Its rugged and simple design also ensured that the product would be a staple on farms for years to come.

In the fall of 1987, the Grain Belt platform was growing in popularity, so they decided to make the move to Frontier, Saskatchewan. Their new location had enough space for increased production capacity and a product line expansion. Today, Honey Bee has over 100,000 square feet of production and warehousing space, enabling them to provide customers from around the world with a diverse offering of draper platforms for a wide variety of crops and conditions.

By Farmers for Farmers. Honey Bee is evolving the tradition of the draper platform from the Grain Belt and is setting its sights on the future through the new AirFLEX platform, which carries forward the simple robust design of the Grain Belt, while meeting the needs of today's producers. Honey Bee has come a long way from those days back on the farm. With a strong commitment to product research and development, Honey Bee's objective has always been to manufacture equipment that farmers want and are happy to own.

Honey Bee is a small company, with 160 employees from 9 surrounding rural communities in our area. We are here [map]: https://goo.gl/maps/McMM4VcNAs5oWed27

Open interoperability is the key.

Agricultural equipment is big business where the larger OEM players are primarily located outside of Canada. Brands like John Deere, Case IH, New Holland, and AGCO are joined by CLAAS, Versatile and others in manufacturing the motorized prime movers that all agricultural implements are mounted on, or towed by, to perform work on the farm. The stated goals of these companies is to deliver on their SVA policies [Shareholder Value Added]. This is normal market economy behaviour and they are not faulted for this behaviour.

We all benefit from OEM equipment to get work done.

It's fair to say that most agricultural equipment and implement manufactures started on a farm, by farmers.

Large equipment corporations have moved away from this to a greater extent, and participate in construction, mining, and forestry equipment. Their main business is engine driven machinery.

Historically, there has been a symbiotic relationship between equipment manufacturers, implement manufactures, and farmers. All three parties have worked together to deliver products and solutions that facilitate the work of the whole. Repair information and parts were always readily available, and adapting implements onto equipment was straight forward work. Farmers have always innovated new farming practices and associated machinery modifications to deliver the results they wanted.

Today, we are seeing the addition of electronic technology to machinery. In some cases, this adds value for the farmer [e.g. auto steer and variable rate seeding]. In many cases, technology is added for the purposes of manufacturer benefits, at the expense of the farmer [OEM benefits, shortline and farmer pay].

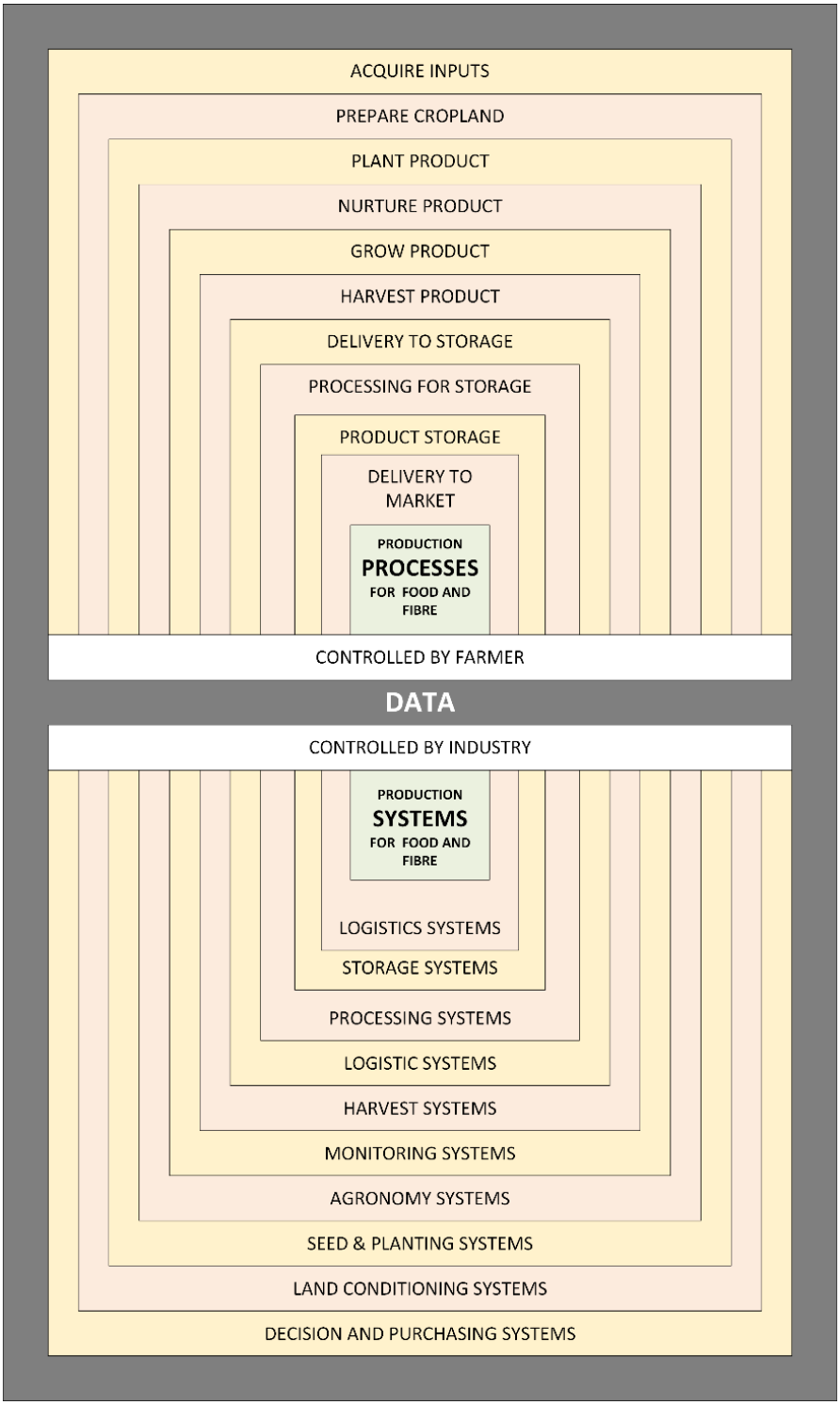
For clarity, we are pro OEM equipment and open to useful technology application on the farm, but the symbiotic relationship between equipment, implements, and farmers is a necessity, and not optional. If anyone in this relationship becomes abusive, then we all feel the pain. Today, we are feeling the pain.

Today, there is no robust debate on the OEMs use of digital locks and keys in an anti-competitive manner. This paper hopes to change this, and shine bright light on the "dark web" of a growing monopoly that exists today.

Interoperability in Agriculture

The Agricultural Ecosystem comprises many "systems of systems"

When we consider the production of food and fibre, we need to look at the architecture of the process in some detail. The image below attempts to illustrate [SIMPLIFIED] the relationship between systems and processes on the farm. This ecosystem contains multiple systems that are either loosely or closely coupled.



In all the activities, data can be generated. Data is shown here as foundational, however, in practice the data is not portable or interoperable between all the systems represented. It is important to note that the processes are performed and controlled by the farmer, but that the resulting data is stored and processed on the industry systems. Some of this data is directly beneficial to the farmer, but the vast majority of the data surrounding a farm operation is difficult/impossible to access. The data that is accessible is either temporal [readouts during operations], or stored/transmitted in a proprietary format that works with a single system, but is unlikely to work with another of the systems on the farm. The farmer would typically purchase his data back and access it on a proprietary software tool. This is normally system/brand specific.

Data is only one part of the "glue" that ties systems together. Not all systems are digital. On a farm, 90% of the work to be done will involve machines working in dirt. Not a single grain of wheat makes it to market without much working of dirt! Dirt contains a lot of things, but not data. Not directly anyway. The majority of the systems on the farm will be mechanical in nature. They can generally be divided into stationary systems [e.g. crop dryers and storage bins], Mechanized systems [e.g. trucks, tractors and combines], and implements of work [e.g. towed tillage and seeding tools, front mounted harvesting tools].

Historically [until 2021], mechanized agriculture has benefited from the ability to “mix and match” OEM and shortline products to create an good tool for performing a specific task. Made better by the farmer through tinkering and modifying the products, to meet the need as expected. This resulted in an innovation cycle, that was continuous, as long as new products were being released. The smart players in the Ag industry, would watch this closely and participate with farmers in tinkering with a design to find improvements.

The addition of digital technologies into the mix, was helpful at first. Later it became a barrier to tinker and interfered with the ability of the farmer to “mix and match” his equipment. In 2021, we find that new products will use technology to actively block efforts by the farmer or the industry short line players, to tinker or “mix and match” systems. For inexplicable reasons, major OEMs are moving to a position of brand purity and tinker-proof designs. John Deere is the first to go down this road, with the proprietary 2021 model X9 Combine and related harvesting header implements.

So on what level do farmers need systematic interoperability? This is a trick question.

Mechanical Systems

In the past, pure mechanical products had no issue with interoperability. Parts to adapt anything to anything were made or bought. There was no possible way to prevent this. Mechanical “systems” are just devices that perform a task and are easily modified to suit applications uniquely. The result is that the word system was not heard on the farm in the context of equipment. The farmer’s system of farming only spoke to his practices and norms.

Hydraulic Systems

Hydraulic systems were the first true system on agricultural equipment. No wires were involved. Just levers directly connected to valves. This would have been a big step in convenience and allowed for smaller and easier to operate controls in the cab of the equipment.

Electrical Systems

In order to move the hydraulic controls out of the equipment cab, electrically controlled valves were introduced to allow for remotely located valves to be controlled by switches. This cleaned up the cab and allowed for a more user friendly control system. This was advanced in the day, but still simple to operate and support.

Electronic Systems

Early forms of automation used electronic circuits to provide additional forms of simplified operation. Sequencing of processes, and implement height control were initial uses. This was followed by automatic steering with the addition of a global positioning system receiver [GPS]. Most would consider this the first generation of technology in farm equipment. There was not computers/microcontrollers/software involve in most of the “technology” of this generation. Just pure electronic circuits. This generation was technology added ON TOP of existing systems. The operator could chose to use it or not. If it had issues, the technology was not used and the work carried on.

Software Systems

Eventually, microcontrollers/computers/software began to replace the single function electronic circuits. This allowed some updates to features or performance of features, through software updates. Touch screens started to replace physical switches, and new functions for storing presets became useful.

The conveniences started to be outweighed by the issues, after a few years of software enabled equipment. OEMs started to realize that software could also deliver additional revenues. Dealer only service came into practice, soon followed by brand purity moves to lock out short line implements. Farmers also had the privilege of having their work related data being collected in a system that they would have to pay the OEM to gain access to. And then pay for an application that could read the proprietary formatted data, before use.

Weaponizing convenience, is the best way to sum up the conversion of equipment to software based devices. By creating a closed ecosystem, OEMs are able to ensure that their ecosystem supports "loyalty" to their brand platform. Tied selling ensures "loyalty" through lack of choice. Tied selling is illegal in Canada. High technical complexity and extensive use of embedded software, are good ways to bury the "tying agreements" deep in the bowels of modern products. The only hint of it, is seen when the key is turned and the operator must "accept" the terms of use that show up as the front page to operating the equipment. OEMs have learned the "value" of vertical integration on their products.

In the paper "John Deere's Attempted Monopolization of Equipment Repair, and the Digital Agricultural Data Market - Who Will Stand Up for American Farmers?", Thomas J Horton states it well: https://works.bepress.com/thomas_horton/27/

...Deere likely will argue that its repair policy follows a growing trend in the agriculture industry to offer integrated solutions that are efficiency enhancing and pro-consumer. Deere's new restrictions ostensibly parallel the recent efforts by Bayer/Monsanto to prevent farmers from replanting last year's seeds and from using different companies' crop protection systems. American Antitrust Institute President Dr. Diana Moss notes: "Economic evidence from soybeans and cotton indicates that seed prices under vertical integration tend to be higher than under licensing arrangements across firms." Dr. Moss adds that **"integration enhances both the ability and incentive to bundle proprietary systems that do not interoperate with rival technologies."** Deere's repair policy creates similar vertical integration in the agricultural equipment industry that will possibly generate higher repair prices, greater waiting times, and reduced choices for farmers...

Systematic Interoperability

Interoperability has been replaced with complexity. Using software as the core equipment functionality, means that the OEM continues to exert control over the product after it has been sold to the farmer. Software has been added in a way that is proprietary and complex, to prevent system level interactions by the farmer or the industries short line participants.

Complexity is the new common denominator in modern products of all kinds. In farm equipment, the addition of complexity for the sake of technology that delivers low levels of value for the farmer, is not desirable. So why does it exist? In the consumer electronics realm, complexity is used to deliver feature rich experiences for non-work activities. This is also now a common occurrence in our automobiles, but we can select to have it or not, as these technical options are functionally optional to the operation of the vehicle. They are optional features.

In agricultural equipment, the choices made by the designers, is to make technology an integrated part of the equipment, that cannot be optioned out, or bypassed to continue work when it fails. This is unfortunate on several levels. Farm equipment is used for work, not a hobby, or a casual

pastime. Ideally, non-critical functions provided by technology, should be implemented in a way that if they fail, or are undesirable, they can be switched off and controlled manually. For the most part, this is not the case today. A technical failure normally results in total equipment seizure in today's products.

Current implementation of technology in farm equipment is poor. Really poor. A 15 year old car has better systems design than current combines and tractors. This is starting to change with more automotive standards about to be released on farm equipment in the next few years [AUTOSAR]. Some standards are used today, like CANbus, but the way they are used is poor. In a car, there will be at least 5 isolated bus circuits [communication paths] that are divided by function and importance. This way, a bad turn signal switch doesn't make you lose control of other key functions like steering, brakes and throttle control. In combines today, all systems are on ONE common CANbus, and that same turn signal switch failure will cause you to lose control of ALL other functions. This is an example I have seen with my own eyes.

Digging into the reason for this, I read the 5000+ page system troubleshooting manual for a combine. In it, I found the single CANbus and the 50+ controllers attached to it. The issue with a single CANbus is that a failure on it will also prevent the use of any diagnostic tool that reads fault codes from the CANbus [like using the OBDII diagnostic port in your car]. The technology is less at fault, it is more the design and implementation of it in a mission critical application of performing time sensitive work on the farm.

The other issue that arises, is the implementation of "alpha" technology on equipment platforms. The word *Alpha* is a term used to describe a technology development that is in very early days of development. Typically technology developments start at Concept, and work their way through Alpha, Beta, and onwards to Release versions. The Release version is when the technical development is fully evolved and tested to be safe, reliable, and has all tools in place to be supported when deployed. Today, we see in the Ag industry, many technical developments that are released at the Alpha and Beta stages of development. This is not helpful and increases failures due to low reliability, low interoperability, and lack timely support tools for service.

Mark Young, in his paper entitled **"The Age of Digital Agriculture"** makes the following observations:

https://s3-us-west-2.amazonaws.com/climate-com/images/the-age-of-digital-agriculture.pdf

... According to AgFunder research, more than $7.5 billion was invested in "agtech" in 2016 and 2017. But if you ask farmers if they're seeing billions of dollars' worth of innovation on their operations, you'll probably get a funny look and an emphatic "no." While we're seeing technology advances on multiple fronts, it's often challenging for farmers to realize these advancements. Too often, we're seeing innovative products from multiple, disparate ventures that have been created in closed environments, requiring farmers to purchase and navigate many different applications to receive a full spectrum of benefits.

Simply put, farmers need technology tools that are built and delivered to intuitively meet their needs in an organized way. If we're asking them to try to shift between a dozen different apps as they're planting a field, the digital ag industry is not meeting their needs in a realistic manner. As an industry, **we need to cultivate and support new agricultural technology in open, collaborative ecosystems**...

Unnecessary complexity is added when technology is poorly implemented. This is a problem of the OEMs own making. Application of industry standards and best practices within an open ecosystem, would go a long way to make 3rd party involvement on OEM platforms more feasible.

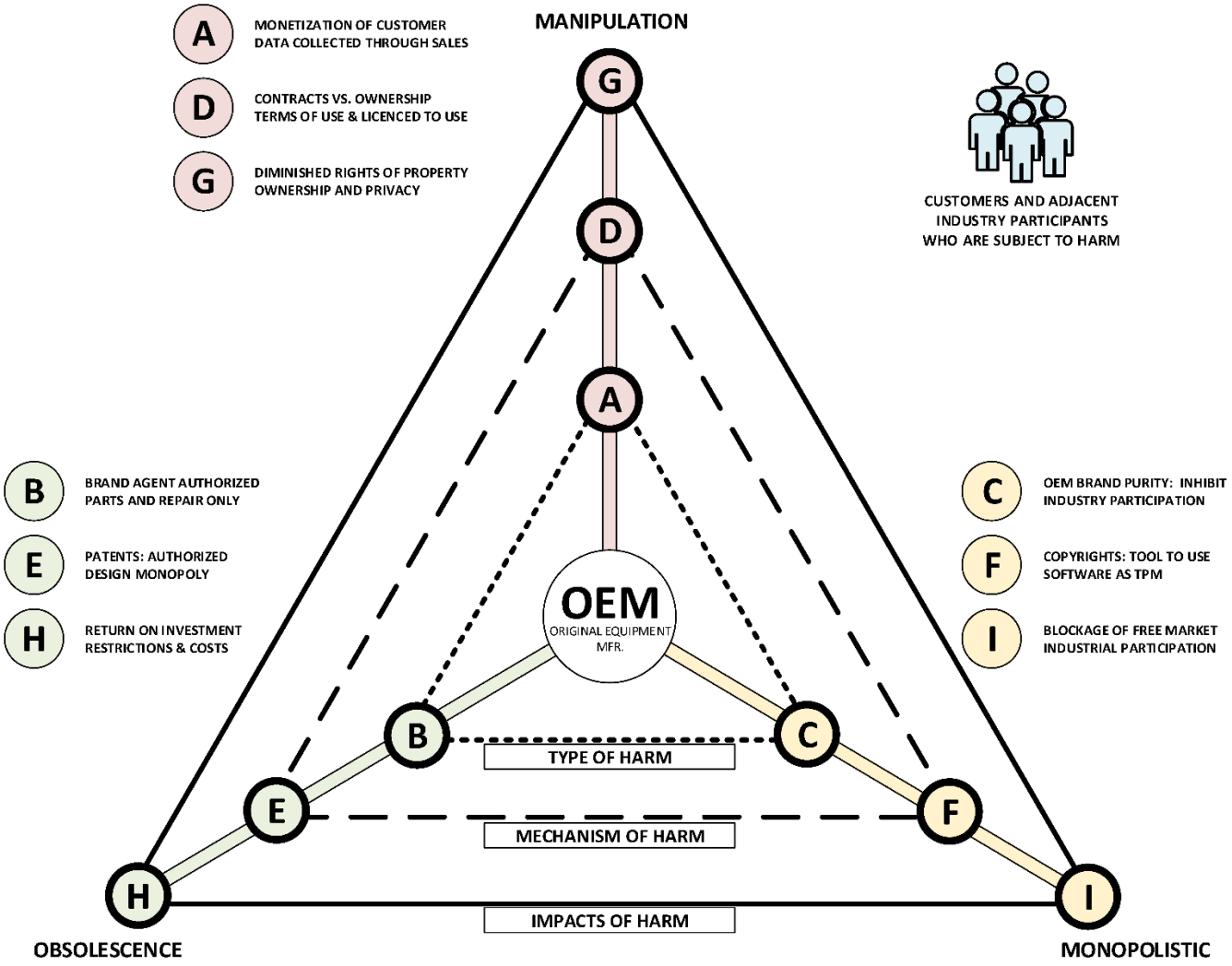
Digital integration has been weaponized

The Iron Triangle of the Agricultural ecosystem

Illustrated below, is the general points of interest on the Agriculture equipment ecosystem. It generally demonstrates the barriers to access to normal product ownership and exclusion from systematic interoperability.

The OEM is surrounded by legally reinforced barriers to entry. These are primarily technical protection measures [TPM] that are created with a combination of software [copyright protected] and electronic hardware devices used for authorized use of equipment in a way that is only acceptable to the OEM.

Farmers and the Agriculture short line industry are prevented from used or interfacing with the equipment as they wish, to achieve the levels of performance that they desire.



The Iron Triangle of the Agricultural ecosystem

Anti-competitive behaviour in our industry

Mechanical exclusion

There is a growing trend for OEM proprietary parts not being made available to 3rd party manufacturers. The latest of these, is the IDEAL combine "auto connect" system components, which allows the combine to automatically mate to the PTO, Hydraulics, and Electrical connections on the header. John Deere has a new PTO coupling system that is proprietary [nonstandard], but it IS available for purchase to anyone who wants it from their parts departments. Historically, it was common to make interoperability parts available to whomever needed them, 3rd party or otherwise.

Technical exclusion

Increasingly, OEMs are introducing proprietary and/or encrypted digital interfaces that are not open to 3rd parties. AGCO 9000 series swather tractors are using controllers that look at the harness on the header that contain unique ID in the wiring, that is recognized by the tractor. The ID establishes the available functions and the required hydraulic flow to the header. Initially, we got around this by developing our own tractor pump control that was switched into the tractor's pump control wiring when the Honey Bee header was installed. When it was not installed, the AGCO pump controls where in use. This required a custom controller and software, with its associated harness, to be a duplicate system to the tractors own system. This was a costly development for Honey Bee, but was required in order to sell our products onto this platform. Historically, it was common to provide straight forward connections and hydraulic performance to any attached header.

John Deere follows up this with the 2021 X9 combine and family of combine headers. Now public knowledge, JD has been working towards a product for the last few years that intentionally makes it impossible for farmers to fit another brand of harvest header to the new X9 combine. While technically possible to reverse engineer a solution to achieve systematic interoperability, such a work around will only last until the next equipment software update from John Deere. Short line manufactures who design implements for the X9, will just be burning money with no reliable result. In the case of the X9, the technical lockout is achieved with proprietary and encrypted signals between the combine and header. John Deere has indicated that no form of adapter for other brand headers will be forthcoming. The effort to secure brand purity is intentional and effective.

Innovation exclusion

3rd parties are being blocked from innovating into our industry. When a short line is spending engineering budgets on mechanical and technical integration work arounds, we are not spending on innovations that are valued by the farmer. Developing interoperability is NOT the innovation that benefits the farmer. There were several product developments put on hold while we worked through achieving interoperability on the AGCO platform. This is not how our business should be spending its engineering budget. The AGCO example is not the only one we have encountered.

Both CNH and JD are moving towards AUTOSAR based technical architectures, that will feature controllers on all implements in the next few years. AUTOSAR is good on one hand, as is moves Ag towards automotive standards, including standardized diagnostics. On the other hand, it gives the OEM a bevy of tools that they would not otherwise develop for their own in-house protocols. Most Ag equipment today runs on bespoke technical developments that are unique to each OEM. They are poorly designed systems when compared to the best practices of modern automotive

standards. Moving to AUTOSAR, will give OEMs access to pre-existing packages for encryption of signals and data, as well as higher levels of complexity. www.autosar.org

One thing that is sure to come with AUTOSAR, is the ability to use digital locks and keys more broadly in their products. These exist today, but will look like child's play, compared to what is coming. The ways that we work around lock outs today, will not work in the near future. At this point, legislation for open interoperability will be our only remedy.

It is clear from the stated positons of the organizations that lobby on behalf of the larger OEMs, that closed, brand specific, ecosystems are the desired direction forward for the larger OEMs. There is little indication otherwise, and in fact, a concerted effort to convince farmers that this is in their best interests… This is evident on the lobby websites for the OEM: www.aem.org & www.r2rsolutions.org [*warning*: links are heavy with misinformation].

Continued participation of innovative industrial developments by 3rd party manufacturers, will be wholly dependent on mandated availability of the tools and keys required to interoperate on OEM host equipment.

Data tethered products

OEM controls "loyalty" through "tethering" physical products to software authorizations. When something is tethered, it is tied to restrict movement. E.g. "the horse had been tethered to a post". Tethered is a past tense verb, meaning that it has already happened. When someone buys a tethered device, it is already permanently connected to the manufacturer. This is how an OEM can enforce loyalty to their brand of products. The intent is that the farmer can only get all the value from the product if they only use the OEM brand tools to do so.

On some consumer devices, there are ways to break free from the tether using the practice of "Jail breaking" a device to allow it to function free from connections to the OEM. Unfortunately, this is not possible with Ag equipment today. When an OEM lobbies against the right to repair their brand of equipment, they will often argue that they do not want anyone to tamper with their products. By tamper, they mean "Jail breaking" the tether that digitally ties the equipment back to the OEM for data collection and authorization control.

The OEM would like the definition of tampering to mean the access of embedded source code. This would be the measure that prevents owners from defeating emissions systems. It may also prevent the power output of an engine from being increased to the maximum output it was designed for [a software setting that they would prefer you paid for]. These digital authorizations extend to what parts can be used, who can perform the repairs, what implements can be attached or used, and what tools you can use to access your farm data. Walled garden indeed.

Aaron Perzanowski describes it best in his discussions on the tethered economy.

"The Tethered Economy" a paper by Aaron K. Perzanowski

https://scholarlycommons.law.case.edu/cgi/viewcontent.cgi?article=3052&context=faculty_publications

"Abstract: Imagine a future in which every purchase decision is as complex as choosing a mobile phone. What will ongoing service cost? Is it compatible with other devices you use? Can you move data and applications across devices? Can you switch providers? These are just some of the questions one must consider when a product is "tethered" or persistently linked to the seller.

The Internet of Things, but more broadly, consumer products with embedded software, are already tethered. While tethered products bring the benefits of connection, they also carry its pathologies. As sellers blend hardware and software—as well as product and service—**tethers yoke the consumer to a continuous post transaction relationship with the seller**. The consequences of that dynamic will be felt both at the level of individual consumer harms and on the scale of broader, economy wide effects.

These consumer and market-level harms, while distinct, reinforce and amplify one another in troubling ways. Seller contracts have long sought to shape consumers' legal rights. But in a tethered environment, these rights may become non-existent as **legal processes are replaced with automated technological enforcement.** In such an environment, the consumer-seller relationship becomes extractive, more akin to consumers captive in an amusement park than to a competitive marketplace in which many sellers strive to offer the best product for the lowest price.

At the highest level, consumer protection law is concerned with promoting functioning free markets and insulating consumers from harms stemming from information asymmetries. We conclude by exploring legal options to reduce the pathologies of the tethered economy."

Data exploitation

Practically speaking, any and all data captured by an OEM platform, remains the property of the OEM, not the user who bought the equipment. Technically, they deny this in privacy statements. The reason for tethering digital systems to equipment, is for the purpose of providing an avenue to exploit farm data for commercial gain. On the face of it, digital systems are purported to add features and essential functions to farm equipment. While this may be true to a limited extent, the true value for the OEM is to acquire commercially useful data sets from the farm.

A useful data set is one that is contextual and not isolated. Farm data can be given context by the GPS position and other data entered by the farmer at the start of working a field. Data without this context would have very limited value. Data generated in the context of a business, in this case a farm, should be used by the business owner [farmer] to make solid commercial decisions.

Most businesses would consider this type of data as private and proprietary to their business operations and not for public disclosure. The type of farm data we are discussing here is the equivalent of accounting data. How many businesses do you know that would freely share their accounting data, to be sold onwards to their suppliers and customers? Not many, I suspect.

And yet, digital tethering gives OEMs this exact ability. This is further reinforced by the End User Licence Agreements and Terms of Use that the farmer is obliged to accept before using the equipment. One could consider this as anti-competitive use of digital tethering, based on a dependency ensuring that the farmer cannot opt out of the scheme.

This is a clear example of why legislation for data privacy is required in the absence of corporate ethics.

Intentional blocking of interoperability brings sustainability issues

The agricultural equipment ecosystem

Interoperability means that a Honey Bee harvest header can “plug-and-play” with the OEM combine. Historically this has been provided in a straight forward and obvious way, just like the way that a keyboard plugs into a computer. Today, we are starting to see encrypted digital interfaces on the OEM products that block us from connecting and operating our harvest headers on these OEM platforms.

Further, there is no technical information or parts forthcoming from the OEM. So, it is not possible to achieve the required adaptations independently of the OEM direct involvement with Honey Bee engineering team. The net result is “authorized use only”.

This is controlled by the OEM digital locks and keys that are unavailable to implement manufacturers. The vast majority of these machinery platforms are manufactured by companies in the United States and sold worldwide. For Honey Bee to continue to participate locally and globally on these platforms, we need to have the ability to connect the two and operate them in a straight forward manner.

Interoperability between different manufacturers of Ag products is key to successful innovation efforts in the Short Line industry. By nature, all Short Line products are hosted on 3rd party equipment. The mechanical, and systems interfaces, between the Short Line product and the host equipment, is key to successful innovation and function. Below, we detail the main aspects that come into play in the relationship between Full Line and Short Line companies.

Full line manufacturer

Ag Full Line OEM manufactures a combine. It is sold to Farmers through a branded retail outlet, the Ag Equipment Dealer. Full Line manufacturers are the engines of industry. They are key players in all industrial sectors and provide the primary motive platforms to perform work. Their size and scope enable them to develop well integrated and functional equipment solutions that are the backbone for productivity and innovation in industry.

As capacities, functions, and reliability increase, technology is also increasing in the Full Line offerings. Advancements in technology application to heavy equipment has brought desirable advantages to industrial customers. The increased complexity of Full Line product offerings is the normal side effect of these technical advances. Technical advances provide competitive advantage that comes with the cost of development. Developers take measures to protect innovations for market opportunity to recover these costs.

Historically, equipment sales have been the primary source of profit for the Full Line OEM. Increasingly, parts and the sale of farm data to 3rd parties, are adding significant revenue streams.

Full line dealer

Equipment Dealers are almost always Full Line brand specific with some diversity in Short Line offerings. Dealers have a bound responsibility to provide complete and timely product support to Farmers for the equipment and products they sell. This is not trivial, with significant investments in people, parts, and tools are needed to achieve this requirement.

Dealer services are sold to the Farmer to recover the investments to deliver these services. Key service responsibilities are legislated, which indirectly mandates the investment in service

capabilities. Dealer market share is increasingly based on the quality of service support to the Farmer.

Parts and service sales is the primary source of profit for the OEM Dealer. Short Line implement sales is another [healthy margins].

Short line manufacturer

Ag Short Line OEM manufactures an implement [combine header] that is mechanically carried by the combine and powered by its hydraulic, mechanical and electrical supplies. The Short Line header performs its specific harvest tasks in a different way than what is available from the Full Line, and is dependent on interoperation with the OEM combine. The Short Line product may use the combine to perform other Ag functions, that are not available from the Full Line OEM, e.g. swathing with a combine.

A Short Line company seeks to provide solutions in the gaps of the main Full Line offerings. These gaps are related to cost, reliability, performance, weight, functions and features. For a Short Line to be relevant, the resulting products need to address specific Farmer requirements that are not currently met, in a way that is desirable. One of the main Farmers' desires is that the Short Line equipment is "plug and play" with the Full Line host equipment.

Extensive modifications to the host, in order to achieve interoperability, are not desirable, and compromise the Short Line offering in the market. Plug and play can be defined as the ability to mount an implement on the host machine and connect to existing interfaces for power and data functions as expected. Any modifications to the host to achieve this are not attractive or allowed.

Implement sales are the primary source of profit for the Short Line OEM.

Short line innovation under lock

In order for the Ag Short Line OEM to deliver this innovation, they are required to reverse engineer the Full Line OEM product to determine the required technical information for realizing attached and interoperating hardware and embedded software developments.

Full Line OEM technical details for innovation on their platforms is not available. When asked, their policy is not to share. This is one fundamental difference between Ag and other platform products. Short Line developments on platform products are not supported by the platform Full Line OEM.

A missing element in the Full Line/Short Line equation, is the availability of Full Line equipment technical data packages that provide the necessary information to facilitate integrations of Short Line product, onto Full Line host equipment.

The result is the Short Line must reverse engineer the host equipment and develop their own technical data package. This is time consuming, expensive, and incomplete. Mechanical interfacing is less complicated than system interfacing. Host systems are mostly black boxes, and difficult to decipher.

When the Full Line takes intentional actions to render reverse engineering economically unviable, and when relating to software, illegal, the Short Line is limited in the ability to fully integrate with the host. Work around solutions are the common result. These are less desirable to the Farmer and diminish the value and opportunity of the Short Line in the market.

The Short Line costs for reverse engineering can be as high as the product development costs for the marketable result. These costs are becoming unsustainable for new products targeted for use with highly digital Full Line hosts with increasingly closed systems and undocumented interfaces. These costs also consume engineering budgets that should be spent on innovation.

Open interoperability

Legislation that MANDATES open interoperability is required to create an open ecosystem that promotes the interests of the farmer.

How this is done, and which technical standards are employed, can be developed by industry. Legislation will ensure that it is done and enforce if it is not. Without legislation, there is no enforcement. Unfortunately, the time to develop useful legislation could take 5-10 years…

Honey Bee recently worked with the Competition Bureau of Canada [2019] and got nowhere, because the legislation on any form of mandated interoperability does not yet exist. The anti-competitive behaviour had no legal context to apply. This will change and efforts are under way to update legislation to make this possible in future.

The OEM could easily provide interoperability on their products. We know this, because we have been interoperating for over 40 years at Honey Bee without any major technical challenges. Recently, this has changed. The OEM move to close off interoperability is being done to secure the full revenue stream for themselves. This is happening at the expense of the short line/aftermarket industry and limits productivity on the farm, by limiting access to 3rd party innovation.

Open interoperability relates to open and/or standards based, mechanical, hydraulic, electrical, and software configurations that support innovative products, other than the host OEM, being fitted and operated on their platforms. A closed system disallows all of this. All the opportunity goes to the OEM. Unlike other products that are designed to be open platforms for innovation, Ag OEMs do not have any kind of "developer program" in place to encourage 3rd party participation, authorized or not.

Mark Young, in his paper entitled **"The Age of Digital Agriculture"** makes the following observations:

https://s3-us-west-2.amazonaws.com/climate-com/images/the-age-of-digital-agriculture.pdf

… the industry must acknowledge that no single company will provide a fully comprehensive solution. Companies of all sizes, from established organizations to fledgling startups, are developing innovations, but **open collaboration is a proven method that provides increased value**. This value gets realized across the ecosystem, from the farmer customer to the other ecosystem partners as well…

Outdated laws benefit dominant OEMs

Who are the dominant companies in our industry and do they define the rules? Patents refer to an invention, whereas copyrights refer to the expression of an idea, such as an artistic work. Is technology art or invention? I think invention, but the law says art. My position is that we have a consumer protection problem and a corporate governance problem. To complicate this, we also have an outdated legislation problem, that does not address the highly consolidated equipment industry as a whole, or the advanced use of technology to create defacto monopolies.

What is a dominant OEM?

When Honey Bee was working with the Competition Bureau of Canada on the issue of interoperability, the biggest challenge was for them to understand how the OEM is a dominant player in our market space compared to the short line. They could only see OEM vs. OEM when discussing the question, and not OEM vs. Short Line.

This speaks to having a clear definition of the mechanisms of harm to our industry, farms, and economy. This is a group discussion that needs to take place. A single voice will not move the needle.

Copyright law

Copyright law can be used to block interoperability while protecting “creative art”. The spirit of the law is to protect creative art. The letter of the law, allows for loopholes that companies use to block interoperability and allow “authorized use” only. Several copyright law reviews in recent years only start to discuss this, but the laws have not been modernized to address the abuse.

The obvious example in Canada is the lack of an exemption to circumvent in our copyright law, for the purposes of interoperability, specifically for equipment. The US copyright law made this exemption as a result of a recent review. The net result is that Canadian firms are not on the same footing as their US counterparts in this respect, giving US companies the advantage over Canadian firms.

Intellectual Property law

IP law allows interoperability while protecting IP. Patents are the correct form of protection for intellectual property, and do not need to be augmented or superseded by private contract law. All OEMs hold patents for their key IP. Should Canadian legislation change for the better on copyright exemptions, and competition accountability, then the OEM patents would continue to be in force.

OEM contract law

Implied contract law supersedes legislation protections. Private contracts in the form of End User Licence Agreements and Terms of Use are tools used to create weaponized technology in products. These private contracts override the consumer and industry protections given by copyright and completion law. Agreeing to these private contracts obligates you to forgo your existing legal protections from monopolistic abuse. That's a pretty powerful weapon...

Typically, one cannot opt-out of these private contracts. You either agree, or you don’t have access to product functions. When you turn the key on a combine, the contract pops up, and you MUST press Agree to start work. There is no option to disagree. There is no using the system at all, except

by agreement. I hold that these contracts in themselves are anti-competitive. They are never explained to the buyer, just implied.

Competition law and mechanisms of harm

Competition law mandates compliance if dominant company status can be assigned, and anti-competitive behaviour is evident. Identifying mechanisms of harm is the core work in evaluating anti-competitive behaviour. No competition case can proceed without having this fully defined, and its relevance to competition law stated. To have a successful case, the mechanisms must define a clear and hard case of anti-competitive behaviour, resulting in anti-trust harm. Showing a softening of competition is not enough. Only then, can a remedy be found and applied. Mechanisms of harm must be defined. The two types of mechanisms are active and passive. An active mechanism is a decision taken to forgo competition, while a passive mechanism is one in which anti-competitive behaviour is a result of other commercial, or technical decisions, which did not consider the impact on the resulting market behaviour. Active would be considered hard intent to be anti-competitive, and passive the unintended softening of competition. You can imagine that the line between hard and soft intent could look fuzzy if the hard intent was designed to look unintentional. Software, copyright laws, and private contracts can all be used to achieve the “soft” look.

See Appendix B.

Agricultural protection law

Agricultural ACTS can protect the farmer and our industry from all of the nonsense. These acts are historically provincial law designed to protect the Agricultural sector in provinces where Ag is an important economic driver. These acts exist in Alberta, Saskatchewan, Manitoba, and Ontario. These Acts are all the same for the most part. They speak to the responsibilities of the equipment dealer, the protections and warranty coverage for the farmer, and the details of the commercial sales agreement between the two. This relates to the implement manufacturer as per the prescribed parts availability and timeliness of parts delivery in support of the dealer and farmer activities.

What the acts don’t cover, is any protection for the Agricultural industry as a whole, in respect to OEM consumption of farmer data or required interoperability between all brands of equipment. I think that the data protection for farmers could be included in the Agricultural acts, but the interoperability will probably need to be a separate act, due to the requirement for interoperability crossing multiple industrial sectors. Most likely, this will need to be in the form of an “Industrial Equipment Interoperability Act”, that caters to all industrial equipment sold in Canada, into the Agriculture, Construction, Mining/Oil, and Forestry sectors. The other sectors face the same issues that we have in Ag. Although, because Ag has its own code, it could be limited in scope if required.

North American Product Classification System (**NAPCS) Canada codes**: 331 & 332 [NAICS 3331]

Full list: https://www150.statcan.gc.ca/n1/en/pub/12-003-x/12-003-x2017001-eng.pdf?st=2DuLmS-9

33111 - Agricultural, lawn and garden machinery and equipment [NAICS 33311]

33211 - Logging, construction, mining, and oil and gas field machinery and equipment [NAICS 33312, 33313]

Concluding remarks

Harm to Farmers

Farmers care most about farming. This involves several mechanically aided activities that result in the food we eat. 90% of the work on a farm is mechanical interaction with dirt. This is hard work and it needs to be performed within time and weather windows that cannot be altered. Missing these work windows, results in a loss of money and food. Farmers are not working with huge sales margins. Costs must be controlled to be viable over the life of the farm, not just the year we are in.

Any factors that impact the farm operation in a negative way, can have long lasting consequences to the sustainability of a farm. Beyond the obvious performance indexes of measurement, there are less tangible and more impactful consequences that relate to farming becoming a wholly unattractive profession to next generations. When rights and freedoms to operate a farm become more and more constricting, the ability to attract continued participation may diminish. The alternative might be large commercial farm owners slowly diminishing the number of farm owners to the point of no competition. At that point we all feel the harm.

Harm to innovation

Farmers could be considered the original innovators. All farm equipment companies were started by farmers. Inventing new ways to perform the work of farming has always been a part of the farm. Tinkering, designing, modifying, all towards improving the performance and reliability of farm tools. Farmers pick the “best of breed” equipment to best meet the needs of their specific crops, location, environment and desired performance.

Locking farmers out of participation on agricultural equipment is a big mistake. Beyond repair, innovation should be our main driver for ensuring that farmers continue to contribute to the industry in practical ways. Food is only one of many contributions that farmers make to our nations. Farms and the farm industry are economic drivers in rural communities, globally.

There are thousands of short line manufacturers for every major OEM. They are not subsidized and would not exist if they did not have purpose. Farmers need to have a choice in the tools they use to best meet their needs. Failing to provide this will limit our ability to grow our agriculture output to feed the worlds growing population.

Harm to economy

Economies want stability but seek disruption. Standing still while other nations are moving forward is going backwards. Encouraging economic growth must encompass all willing participants. Independent repair and farmer innovation are two ways that rural communities can participate in the local and national economies. Legislation should promote willing participants to follow their interests in creating jobs and delivering service wherever they are located. All economies benefit from more doers and not just buyers...