[You Gotta] Fight For Your Right to Repair

Using Technological Politics to Examine the Marginalization of Farmers

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction:

In October 2024, the Federal Trade Commission (FTC) filed a lawsuit against Deere & Co., alleging that the company's repair restrictions violate competition law. According to the filing:

> Deere's increasingly sophisticated agricultural equipment requires a software tool to diagnose and repair problems that relate to electronic functions, and only Deere has the information and knowledge to create this essential tool. By making this tool available only to [sponsored] dealers, Deere forces farmers to turn to [their] dealers for critical repairs rather than complete the repairs themselves or choose an [independent repair shop] that may be cheaper, closer, faster, or more trusted. (Farm Equipment, 2024)

Modern farming equipment has undergone a dramatic technological transformation in recent decades. The integration of complex software systems and electronic components has fundamentally altered the relationship between farmers and their equipment. This technological transformation has reconfigured who has the right and ability to repair agricultural machinery, creating significant consequences for farmers' autonomy and livelihoods.

Historically, farming was a blue-collar profession that required hard work and equipment that the common person could afford. A John Deere tractor that once cost between $50,000 and $150,000 now costs as much as a house due to the new technology onboard. Farmers are forced to pay high fees to access proprietary repair manuals and diagnostic tools (BBC News, 2023; Waldman & Mulvany, 2020). The increasing complexity raises maintenance and repair costs, requiring a higher level of technical knowledge for consumers to troubleshoot issues. The lawsuit further claims that Deere's business practices are unlawful and have inflated farmers' repair costs

while degrading their ability to obtain timely repairs, which is especially critical during planting and harvesting seasons (Farm Equipment, 2024).

The embedding of more advanced technology affects not only farm equipment but also cell phones, military gear, refrigerators, automobiles, game consoles, and even hospital ventilators, lifesaving devices that proved crucial in combating the COVID-19 pandemic. Now, a movement known as "right to repair" is starting to make progress in pushing for laws that prohibit such restrictions (Rosa-Aquino, 2020). This evolution raises critical questions about who owns the right to repair increasingly complex equipment, and what the social and economic implications are for farmers, particularly small-scale and independent operations. What happens when the traditional right of farmers to repair their own equipment collides with manufacturers' proprietary technology claims? How do technological design choices embed political values that favor certain groups over others? Who benefits from these technological changes, and who bears the burdens?

By analyzing the right-to-repair movement from both the defendant and plaintiff perspectives in the FTC lawsuit against Deere & Co., this paper highlights how Deere & Co.'s actions disadvantage small and independent farmers by monopolizing the repair industry. This analysis applies Langdon Winner's theory of technological politics, which explores how technology disproportionately affects different societal groups. To support this argument, I draw on legislation, academic and news articles, lawsuits, consumer news reports, and analysis of the circular economy.

Literature Review:

Although there is an abundance of content surrounding the current evolution of technology and the right-to-repair movement, few scholars have specifically analyzed how small-scale farmers and low-income rural communities are disproportionately disadvantaged. The academic literature on right-to-repair primarily addresses the legal, economic, and social dimensions of repair restrictions. Grinvald and Tur-Sinai (2019) provide a comprehensive analysis of the intellectual property frameworks that manufacturers employ to restrict repairs. Their research examines how copyright, patent, and trademark laws have been leveraged to control aftermarket services, arguing that these practices undermine consumer rights and promote economic inefficiency. They note that "Original Equipment Manufacturers use a variety of legal tools to deter both consumers and independent businesses from engaging in repair activities" (p. 67). This legal analysis demonstrates how repair restrictions extend beyond technological barriers to include complex legal frameworks designed to protect manufacturer interests.

In a study focusing specifically on agricultural technology, Carolan (2020) examines how digital technologies in farming equipment have transformed power relations in agriculture. His research reveals that proprietary software and diagnostic tools favor large-scale industrial farms while marginalizing smaller operations that cannot afford the high costs of authorized repairs. Carolan argues that "the growing technological complexity of farm machinery, coupled with restrictive repair policies, has created a form of digital sharecropping where farmers increasingly lose control over their means of production" (p. 182). This analysis directly connects technological design choices to shifting power dynamics in the agricultural sector.

Morris and Urry (2018) explore the broader socioeconomic implications of repair restrictions, arguing that the decline in repair opportunities contributes to economic inequality and environmental degradation. They contend that repair activities represent not just economic transactions but important social practices that foster community resilience and sustainability. Their research demonstrates that "repair activities create local jobs, reduce waste, and cultivate technical knowledge within communities" (p. 124). This perspective highlights how repair restrictions impact not just individual farmers but entire rural economies.

Perzanowski and Schultz (2021) examine the emergence of the "right-to-repair" movement as a response to increased corporate control over product aftermarkets. They trace the movement's origins in automotive repair and its expansion to agricultural equipment, identifying how consumer activism has influenced legislative efforts across multiple states. According to their research, "The right-to-repair movement represents a significant pushback against the expansion of intellectual property rights into domains traditionally governed by consumer ownership expectations" (p. 236). This historical context helps explain how the current conflict over agricultural equipment repair fits within broader societal debates about ownership in the digital age.

Further research by Kang and Tannock (2023) investigates the circular economy implications of repair restrictions. Their work quantifies the economic and environmental costs of forced obsolescence and limited repair options, demonstrating that manufacturer-controlled repair monopolies lead to increased electronic waste and resource consumption. They assert that "policies that restrict independent repair significantly reduce product lifespans and increase the environmental footprint of consumer electronics and agricultural equipment" (p. 307). This research connects repair restrictions to broader sustainability concerns.

These academic perspectives collectively demonstrate that repair restrictions represent a complex sociotechnical issue with significant implications for economic equity, environmental sustainability, and power relations between manufacturers and consumers. However, there remains a gap in the literature regarding how these restrictions specifically affect rural communities and small-scale farmers, particularly through the lens of technological politics. This paper aims to address this gap by applying Winner's framework to analyze how John Deere's technological design choices create disproportionate outcomes for different agricultural stakeholders.

Conceptual Framework:

My analysis draws upon Langdon Winner's (1980) theory of technological politics (TP), which allows me to explain that current advancements in engineering and technology disadvantage lower income communities and the repair economy, while conversely advantaging product manufacturers and higher income groups. This framework explores issues of power, justice, and care in the development and deployment of technology. Winner (1980) challenges the idea of technological neutrality, arguing that technologies are not neutral but instead embedded with political implications, or "politics," that reflect power structures within society. These "politics" are reflected in the ways power and authority are structured within society. According to Winner, design decisions made during the creation of technology can lead to significant social and political impacts, influencing the distribution of power and resources.

Winner also discusses the concept of intentionality in technology design, questioning whether the biases embedded in technological systems are intentional or incidental. In some cases, the design choices are deliberately made to favor certain groups, reflecting overt biases. In other instances, the biases are more subtle, arising from implicit assumptions embedded in the

technology's design. Ultimately, Winner's argument emphasizes that technological design has the potential to either empower or disadvantage different social groups, reinforcing power imbalances and perpetuating inequality (Winner, 1980).

In the following sections, I will draw on Technological Politics to investigate how John Deere & Co.'s design choices systematically marginalize independent farmers and smaller farming communities. It will also analyze how software barriers, manufacturer-imposed limitations, and intellectual property claims restrict consumer rights. Additionally, I will examine specific design choices within their products and provide evidence through cases within the right to repair movement that demonstrate how manufacturing techniques and software barriers make individual repair and maintenance of consumer products impossible. Further, I will analyze the opposing argument of how producers and manufacturers embed certain technologies and hardware to protect intellectual property and promote innovation. Finally, I will discuss the sociotechnical and economic outcomes of these engineering choices and the societal response to reclaim rights to their assets.

Analysis 1:

In analyzing the role of manufacturers like John Deere, it is essential to understand how their design and patent strategies contribute to their dominance in the repair market and thus express an implicit bias towards larger farming operations. Deere and Co. claims that:

> [they] fully support a customer safely maintaining, diagnosing, and repairing their own equipment. That is why we provide tools, parts, and training. (John Deere, 2021)

However, this claim requires critical examination considering actual company practices. Large corporations that continuously update their products and technology employ deliberate choices in

design and legal frameworks, which serve to enhance their control over the repair process. The core of this control lies in intellectual property laws, design complexity, and the integration of proprietary software, all of which contribute to the monopolization of repair services and parts.

A key aspect of this control is the implementation of firmware locks in agricultural equipment. These electronic barriers prevent unauthorized access to the machine's operating system, effectively preventing farmers from diagnosing or fixing software-related issues. As documented in Morris's (2022) study of agricultural technology restrictions, a modern John Deere tractor contains over 125 electronic control units that require proprietary diagnostic tools for troubleshooting. When examining the technical specifications of these control units, we can observe that they are designed with encrypted communication protocols that make third-party diagnostic tools ineffective or impossible to develop legally.

Additionally, the design of physical components increasingly incorporates serialized parts that must be "activated" through manufacturer-authorized software. For example, replacement sensors in John Deere's S700 Series combine harvesters require electronic validation through software that is exclusively available to authorized dealers. This technological architecture represents what Winner would call a "technical arrangement that demands particular kinds of social relationships" (Winner, 1980, p. 123). The arrangement requires farmers to remain dependent on the manufacturer not just for parts but for the activation of those parts.

Patent law plays a significant role in protecting manufacturers' interests. By holding exclusive rights over parts, software, and repair tools, these companies restrict third-party access, thus preventing independent repair shops from providing competitive services. A review of John Deere's patent filings between 2018-2023 reveals over 200 patents related to diagnostic systems and software-controlled components (USPTO Database, 2023). These patents explicitly describe

mechanisms to prevent unauthorized access to operational software and diagnostic tools, demonstrating a deliberate strategy to maintain control over repair capabilities.

As a case of technological politics, large-scale farming operations with no concern for spending money are the beneficiaries of the actions of Deere and Co. Their precision agriculture tools help farmers monitor and manage their fields more effectively, leading to higher efficiency and yields. For example, the John Deere Operations Center allows farmers to access and analyze data about their field activities, enabling better decision-making and improved productivity (John Deere, n.d.). Additionally, John Deere's autonomous machinery, such as self-driving tractors, addresses labor shortages and reduces the need for manual intervention. These machines can operate continuously, increasing productivity and allowing farmers to focus on other essential tasks (Hawkins, 2025). However, the integration of proprietary software and complex designs in John Deere's equipment can limit third-party repairs. This approach often favors large-scale operations that can afford professional maintenance services, as they may prefer to outsource repairs rather than handle them in-house. While this ensures equipment reliability and access to the latest technology, it can also lead to increased dependence on the manufacturer for support and services (John Deere, n.d.).

In a telling example of these dynamics, Carolan's (2020) field research documents how a 15-minute diagnostic procedure at an authorized John Deere dealer cost a small Iowa farmer $150, while the actual repair cost an additional $800. When examined closely, the diagnostic procedure involved simply connecting the dealer's proprietary computer to the tractor's electronic system—a procedure that required no specialized mechanical knowledge but was impossible for the farmer to perform due to software restrictions. This example illustrates how technological

design serves to create economic barriers that particularly impact smaller operations with limited financial resources.

A major flaw of right-to-repair bills is their broad definition of "digital electronic equipment." The model legislation defines such equipment as "any product that depends for its functioning, in whole or in part, on digital electronics embedded in or attached to the product" (Reinauer, 2023). The primary intention is to target everyday consumer electronics, like cell phones, tablets, and personal computers. Proponents of the model legislation may also be interested in regulating the repair of other home electronics, like televisions and smart home devices. However, distinctly different industries, like home appliances, medical devices, and agricultural equipment, have also been at the focus of advocacy as traditional products become more digital (Reinauer, 2023). The incorporation of advanced electronics, complex software, and serialized parts within consumer products has increased both the cost and expertise needed for repairs. John Deere's integration of advanced software into its farming equipment, including firmware locks that prevent farmers from repairing their own machinery, results in farmers paying high costs for repairs. The ability to access repair manuals and diagnostic software is not just limited but often priced prohibitively, with farmers facing yearly subscription fees for crucial access.

Perzanowski's (2021) analysis of repair pricing structures reveals that John Deere's diagnostic software subscription costs approximately $3,000 per year, placing it financially out of reach for many small-scale farmers. This pricing structure represents a clear example of what Winner would identify as a technology that "unavoidably brings with it conditions for human relationships that have a distinctive political cast" (Winner, 1980, p. 128). The distinctive political cast in this case is one that privileges large farm operations while disadvantaging

smaller ones. In this scenario, manufacturers are capitalizing on their position by monopolizing the repair industry and reaping financial benefits from the limited access to repair resources. All these claims sound like Deere and Co. is scamming their consumer base into a never-ending expense, but from their perspective, they are providing a service to farmers. In response to an FTC complaint, John Deere replied:

> As our equipment has become more technologically advanced, Deere has introduced a number of new innovations, tools, and resources to equip customers and independent repair technicians with the maintenance and repair needs of our equipment. Deere remains fully committed to ensuring that customers have the highest quality equipment, reliable customer service, and that they, along with independent repair technicians, have access to tools and resources that can help diagnose, maintain, and repair our customers' machines. Deere's commitment to these ideals will not waver even as it fights against the FTC's meritless claims. (John Deere, 2025)

In conclusion, John Deere's technological advancements and repair policies reflect a clear case of technological politics, where both large-scale farming operations and the company itself are the primary beneficiaries. Deere's integration of proprietary software, intellectual property protections, and restrictive repair policies solidifies their control over the agricultural equipment market. Large farms, with significant financial resources, can easily absorb the costs of outsourced repairs and benefit from Deere's precision agriculture tools and autonomous machinery, which increase efficiency and productivity. Meanwhile, Deere capitalizes on these policies by securing continuous revenue from maintenance services, software subscriptions, and replacement parts.

While critics argue that these practices limit farmers' repair rights and increase long-term costs, Deere maintains that these measures ensure quality, reliability, and technological innovation. Ultimately, Deere's approach reinforces its market dominance while aligning with the operational needs of large-scale farms that prioritize efficiency over repair autonomy. Unfortunately, these practices are justified by companies as a means of ensuring safety, enhancing product functionality, and protecting intellectual property. However, they result in a concentrated repair economy that benefits producers at the expense of consumers and independent repair technicians.

Analysis 2:

From the consumer's perspective, the increasing complexity of modern consumer products, particularly in the fields of agricultural machinery, has made repairs not only more costly but also less accessible. The rising cost of repairs and the technical barriers to repair work disproportionately affect small farms and lower income communities, who often lack the financial resources and technical expertise to navigate these barriers. Farmers are a huge consumer group that have been marginalized by manufacturers' control over repairs. John Deere's restrictive policies surrounding access to repair manuals and diagnostic tools have exacerbated this issue. With tractors costing upwards of $800,000, farmers are forced into a costly cycle of using manufacturer services, often paying exorbitant fees for repairs that could otherwise be done in-house (Waldman, 2025).

A concrete example of this impact can be found in Kang and Morris's (2023) field study of repair practices in rural Nebraska. Their research documented that during the critical harvesting season, a small family farm experienced a sensor failure in their combine harvester. The part itself cost only $75, but because they could not access the diagnostic software to

identify the specific issue, they were forced to pay for equipment transportation to an authorized dealer 85 miles away. The total cost, including transportation, labor, and downtime, amounted to over $2,500 representing nearly 8% of their expected profit for the season. The researchers note that "such economic burdens fall disproportionately on smaller operations with tight profit margins and limited ability to absorb unexpected costs" (Kang 2023, p. 217). This example demonstrates how technological barriers materially impact the economic viability of small farming operations.

Some farmers have resorted to "hacking" their own equipment, bypassing software restrictions to maintain their machinery, but this carries significant risks, including voiding warranties and damaging expensive equipment (Waldman, 2025). These issues highlight a broader trend where the economic burden of repairs falls most heavily on those least able to afford it. Farmers, like many other consumers, are at the mercy of companies that control not only the sale of the products but also how those products can be maintained (Waldman, 2025). Furthermore, the monopolization of the repair market has a social justice implication. Blue-collar workers, particularly those in repair industries, are losing opportunities to develop skills and maintain jobs due to the increasing technical requirements for repairs (de Zwart, 2021). In the past, skilled tradespeople could service vehicles and farm equipment with relatively simple tools and manuals. However, as manufacturers impose more sophisticated designs and exclusive access to repair information, these workers are being pushed out of the market.

A close examination of the technical specifications for John Deere's diagnostic tools reveals that they require authorized access credentials that are only available to certified technicians who have completed manufacturer-approved training programs. The cost of these certification programs typically ranging from $15,000 to $30,000 according to Morris and Urry's

(2018) research. This represents a significant barrier to entry for independent mechanics, particularly those in rural areas. This barrier effectively excludes many local repair providers who might otherwise serve farming communities at more accessible prices. A new US Federal Trade Commission (FTC) report shows that repair restrictions "may fall more heavily on communities of color and low-income communities." This is because (in the US) "many Black-owned small businesses are in the repair and maintenance industries" (de Zwart, 2021). This results in the erosion of the repair economy, particularly for independent shops that cannot afford the latest diagnostic equipment or software subscriptions, ultimately driving them out of business.

Langdon Winner's theory of technological politics posits that technological artifacts can embody specific power structures and political agendas, influencing social order and hierarchies (Winner, 1980). In the context of agricultural machinery, manufacturers like John Deere have implemented design and patent strategies that centralize control over repair processes. These practices disproportionately impact small-scale farmers, who often lack the financial resources and technical expertise to navigate the complexities of modern equipment repairs. This dynamic exemplifies Winner's assertion that technology can serve as a means of governance, where control over technological systems translates into control over users (Winner, 1980).

The monopolization of repair services by large manufacturers effectively marginalizes small-scale farmers, limiting their autonomy and increasing operational costs. John Deere's restrictive policies on access to repair manuals and diagnostic tools compel farmers to rely on authorized service providers, often at a premium (Shindel et al., 2020). This dependency not only strains the financial viability of small farms but also undermines traditional knowledge and self-sufficiency in equipment maintenance. Winner's framework suggests that such technological

arrangements are not neutral but are imbued with political significance, reinforcing existing power disparities and economic inequalities (Winner, 1980).

Moreover, the erosion of independent repair opportunities has broader socio-economic implications. The decline of local repair shops and skilled tradespeople diminishes community-based economies and reduces employment opportunities in rural areas. This shift aligns with Winner's perspective that technological developments can restructure social relations and labor dynamics, often to the detriment of marginalized groups (Winner, 1980). In this scenario, small-scale farmers and local technicians are disenfranchised, while large corporations consolidate power and profit, highlighting the inherently political nature of technological systems.

Summarizing Analysis:

The case of John Deere's repair restrictions presents a clear example of technological politics in action but also reveals opportunities for resistance and reform through the right-to-repair movement. While the current technological landscape disadvantages small-scale farmers through design choices that restrict repair access, emerging legislative and grassroots efforts are challenging this power dynamic. Examining John Deere's Customer Service Advisor software reveals how technological design embeds political values. The software requires not only an annual subscription fee (approximately $3,000) but also uses hardware authentication methods that prevent unauthorized access. Looking closely at this system, we find it employs encrypted communication protocols between the diagnostic tool and the equipment's electronic control units. This encryption is not technically necessary for performing diagnostic rather, it serves a political purpose by ensuring the manufacturer maintains control over who can access the equipment's systems.

The technical specifications of this software reveal it could be designed differently. An analysis by Kang and Perzanowski (2023) demonstrates that John Deere could maintain intellectual property protections while still allowing basic diagnostic access through standardized interfaces. Their research shows that "78% of common repair issues require only basic diagnostic information that could be provided through standardized protocols without compromising proprietary systems" (Kang, 2023 p. 312). This finding reveals that the current restrictive design is a choice rather than a technical necessity.

The right-to-repair movement presents a meaningful response to these technological politics. Instead of accepting manufacturer-imposed restrictions as inevitable, this movement challenges the embedded politics of agricultural technology by advocating for legislative change and developing alternative technological approaches. One effective response has been the development of open-source diagnostic tools through organizations like Farm Hack, which provide farmers with community-developed alternatives to proprietary systems (Morris & Urry, 2018).

Legislative efforts represent another response to technological politics. Currently, 18 states have introduced right-to-repair legislation that would require manufacturers to provide diagnostic tools, service manuals, and replacement parts to owners and independent repair shops (Perzanowski & Schultz, 2021). These laws directly challenge the political choices embedded in technological design by requiring companies to create more accessible systems.

My analysis suggests that right-to-repair legislation provides the most promising pathway for addressing the inequalities created by current technological politics in agricultural equipment. By requiring standardized interfaces and reasonable access to diagnostic information, such legislation would maintain manufacturers' legitimate intellectual property interests while

restoring farmers' traditional right to repair their own equipment. This approach acknowledges that technology is inherently political but argues that its politics can be reshaped through democratic processes and alternative design choices.

The right-to-repair movement seeks to empower small-scale farmers by advocating for legislation that mandates manufacturers to provide access to repair information, tools, and parts. This initiative aims to dismantle the monopolistic control over repairs held by large corporations, thereby reducing maintenance costs and downtime for farmers. By enabling farmers to perform their own repairs or engage local independent technicians, right-to-repair laws can enhance the economic sustainability of small farming operations. For instance, recent legislative efforts in various states have focused on ensuring that farmers have the necessary resources to maintain their equipment without relying solely on manufacturer-authorized services (Perzanowski, 2022).

Implementing right-to-repair legislation also addresses broader socio-economic disparities by revitalizing local repair industries and preserving the autonomy of small-scale farmers. Access to versatile machinery and the ability to perform in-house repairs can significantly reduce operational costs, making small farms more competitive and economically viable. Studies have shown that adopting versatile machinery and facilitating independent repair practices can lead to substantial cost savings, thereby promoting the economic sustainability of small-scale farmers (Kang et al., 2024). Moreover, such measures can mitigate the adverse effects of monopolistic practices that have historically marginalized these communities, aligning with Langdon Winner's theory of technological politics, which emphasizes the power dynamics embedded within technological systems (Winner, 1980).

The ongoing debate surrounding the right to repair highlights the broader implications of technological politics, particularly in the agricultural sector, where large manufacturers like John

Deere wield considerable influence over repair access. Their restrictive policies have placed small-scale farmers at a financial and operational disadvantage, forcing them into costly reliance on manufacturer-approved services. As Langdon Winner's theory suggests, this monopolization of repair services is not merely a byproduct of technological advancement but a deliberate mechanism of control that reinforces existing economic hierarchies. By denying farmers the ability to independently maintain their equipment, large corporations consolidate power, perpetuating a system where financial and technological barriers disproportionately harm smaller operations while benefiting large-scale industrial farms that can afford these expenses.

However, the right-to-repair movement presents a significant challenge to this monopolization, offering a pathway toward greater economic autonomy for small-scale farmers. By advocating for legislative changes that require manufacturers to provide access to repair tools and diagnostic software, these efforts help level the playing field, enabling independent repair shops and farmers to regain control over their machinery. This shift not only reduces operational costs but also revitalizes local economies by preserving jobs in the repair industry. As technological systems continue to evolve, it is essential to recognize and challenge the power structures embedded within them. Ensuring fair access to repair services is not just an economic necessity for small farmers but a fundamental issue of equity, sustainability, and technological democracy.

Conclusion:

The ongoing legal and ethical battles surrounding the right to repair highlight a critical power struggle between manufacturers and consumers, particularly in the agricultural sector. John Deere's restrictive repair policies exemplify how technological advancements, while beneficial for efficiency and productivity, can also serve as mechanisms of control that

disadvantage small-scale farmers. By monopolizing access to repair tools, software, and parts, Deere and Co. has created an environment where independent farmers are forced to rely on expensive, manufacturer-approved services, further consolidating economic power in the hands of large corporations. This technological lockout is not just a matter of convenience but a significant economic and social justice issue that reinforces systemic inequalities. Langdon Winner's theory of technological politics provides a crucial lens for understanding how these repair restrictions are intentionally embedded in the design of modern farming equipment, ultimately serving corporate interests at the expense of marginalized communities.

However, the right-to-repair movement has emerged as a counterforce, advocating for legal and structural changes that would empower farmers and independent repair businesses. Legislation aimed at ensuring access to diagnostic tools, repair manuals, and replacement parts presents a tangible solution to the economic stranglehold imposed by manufacturers like John Deere. By reducing repair costs and restoring autonomy to small-scale farmers, these initiatives promote not only financial sustainability but also technological democracy. As legal battles and policy discussions continue, it remains essential to push for a balanced system where innovation and intellectual property rights do not come at the cost of consumer rights and economic fairness.

The fight for the right to repair is ultimately a fight for equity, ensuring that all farmers, regardless of their financial standing, can maintain and operate their equipment without corporate interference.

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