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The Disruption Delusion: Machines, Networks, and the Platformization of Industrial Production

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Abstract

"Disruption!" — eulogized the business literature and heralded yet another epochal shift in capitalist development: the relational governance that had given shape to the network society was dethroned by a novel mode of algorithmic governance that ushered in the new phase of platform capitalism. These sweeping generalizations, however, stand in stark contrast to the selectivity of the research on which these claims are based. Celebrating Uber and Airbnb as standard bearers of this new epoch, pertinent research primarily focused on the consumer- and communication-based internet — at least, so far. This paper seeks to contribute to the ever-growing body of research that accumulates compelling evidence for the distinctive realities of platforms in the realm of production. Rather than by a new breed of digital-native disruptors (that rapidly scale to monopolists), the development of platforms in the industrial realm is driven by incumbent manufacturing oligopolists. By engaging with the key tenets of consumer platform research (asset-light business model; network effects; frictionless scalability; algorithmic governance), the transformation of John Deere (the leading manufacturer of agricultural equipment) shall reveal this: instead of a categorical shift to a sharply delineated novel form, the trajectory from the provider of stand-alone physical products to the orchestrator of a digital-physical ecosystem amounts to a messy and tenacious process of variation and hybridization.

Keywords: Industrial platforms; Precision agriculture; Ag tech; John Deere.

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"You can check out any time you like, but you can never leave"
(The Eagles, *Hotel California*, 1977)

1 WYSIWYG: The Uber-Bias

Continuity is boring; nuance is tiring, and gradualism is for the hesitant. To attract any attention, societal change has to be framed in terms of high-caliber notions like revolution, breakthrough or disruption, at the very least. Instead of tracking tedious processes of incremental modifications, historical moments of rupture and transformative change have to be identified: what we are seeing are not legacies of the past, but the advent of a new epochal paradigm. Notwithstanding the critique of such dramatic simplification, such "epochalism" (Du Gay, 2003, p. 664) allows the construction of overarching grand narratives animated by a teleological logic in which history unfolds as a sequence of sharply delineated phases.

One of the more recent epochal shifts has even been dated to a specific year: in 2016, platforms dislodged networks as the key organizational paradigm and chief governance principle of a new era of economic and societal development (Lovink, 2021); the relational governance that had given shape to the network society (Castells, 2004) was dethroned by a novel mode of algorithmic governance that ushered in the new phase of platform capitalism (Srnicek, 2016; see also Kenney & Zysman, 2016; van Dijck et al., 2018). The mantra of disruption left no doubt that this shift was anything but gradual, and the authoritative manual for splitting asunder entire industries carried the befitting title "Platform Revolution" (Parker et al., 2016). Network effects were the propellant of this revolution, and winner-take-all-markets its most radical proposition. Uber and Airbnb were celebrated as the standard-bearers of this revolution that elevated platforms to the status of the "dominant organizational form of the digital age" (Gawer, 2022; see also Davis, 2016) and the "21st century ideal type of the firm" (Rahman & Thelen, 2019, p. 198), respectively.

This triumphalist portrayal of the epochal shift from network society to platform capitalism, however, is showing more and more cracks. These cracks have not been caused by attacks on the key assumptions of the orthodox account on platforms: they are not *wrong* as such; rather, they are criticized for being *incomplete*. The sweeping generalizations on the dominance of platforms in the digital age stand in stark contrast to the selectivity of the research on which these claims are based. Rather than covering the entire spectrum of economic sectors, platform research so far has primarily focused on the consumer- and communication-based internet[1] (Grabher & van Tuijl, 2020, p. 1006; Menon et al., 2020, p. 364; Butollo & Schneidemesser, 2022; Jovanovic et al., 2022, p. 2; Dolata, 2024, p. 10). Amidst the triumphalism of the ever-increasing market valuations of the US Big Tech companies Alphabet, Amazon, Apple, Meta and Microsoft as well as of the more specialized second-tier companies like Airbnb and Uber, the neglect of the vast spectrum of the production-based internet hardly appeared noteworthy — that is, until more recently.

An ever-growing body of research has extended the scope of analysis and accumulated compelling evidence for the distinctive realities of platforms in the realm of production and manufacturing (see, for example, Gawer & Cusumano, 2014; Kenney & Zysman, 2016; Menon et

1. For the sake of simplicity, the consumption- and communication-based internet in the B2C and P2P realm will be summarized under the term "consumer platforms" that are juxtaposed to "industrial platforms" as a shorthand for manufacturing-based platforms in the B2B-space. The notion "consumer", to avoid confusion, does not denote a specific economic role on the demand side, but rather is employed here as an umbrella term for a category of platforms (that do not operate in the context of industrial production).

al., 2020; Dolata, 2024; Feike & Rösch, 2024; Lerch et al., 2024; Sauvagerd et al., 2024; Van Dyck et al., 2024). On a most general level, rather than a dramatic event of disruption that inaugurates a new distinct phase of capitalist development, this research reveals rather messy and tenacious processes of transformation; and rather than hitting on radical newness, the focus on production brings path-dependencies to light.[2] Instead of the complete replacement of incumbent industries, we see their gradual reorganization: hybridization instead of substitution.

Whereas hybrid and fragmentary formations, viewed through the lens of the disruption logic, indicate a deficient state, somewhere between the "no longer" and the "not yet", the perspective advanced here acknowledges these formations as categories *sui generis*. Although this analytical strategy foregrounds hybridity and graduality, it does not preclude comparisons between stylized forms, like networks and platforms, for instance. However, rather than treating these forms as "arithmomorphic concepts" that systematically conceal processes of change and transformation in which concepts also contain elements of their opposite (Georgescu-Roegen, 1971, p. 45), they are apprehended as "ideal types" (Weber, 1968/1922): they afford a frame of reference against which actual processes of change and transformation can be perceived and conceptualized. Instead of canonizing ideal types as a normative state, they are pragmatically employed as heuristic devices that guide inquiry and hypothesis formation. Very much in the spirit of this analytical strategy, a critical engagement with the key tenets of the current platform orthodoxy reveals first hints (that later on will be followed up) to the frictions and constraints that preclude an outright disruption by industrial platforms.

Tenet #1: Assets lightness. Whereas the "asset-light" company (Parker et al., 2016) embodied the paragon of consumer platforms, industrial platforms run on asset-heavy "cyber-physical systems" (Menon et al., 2020, p. 363) that adhere to fundamentally different operational principles. *Tenet #2: Network effects*. Explorations of the disruptive force of consumer platforms revolve around the single most powerful escalating dynamics: network effects. Although the efficacy of this propellant of platform proliferation has been problematized early on (Boudreau, 2012), it is structurally limited in industrial platforms: their growth does not simply follow the arithmetic: more users = more value (Sjödin et al., 2021). *Tenet #3: Frictionless scalability*. Far from winner-take-all markets, the scope of industrial platforms is structurally limited since they operate in specialized sub-markets in which local and industrial domain knowledge comes at a premium and in which physical assets are subject to country-specific regulations (Sauvagerd et al., 2024, p. 6). *Tenet #4: Algorithmic control*. Whereas consumer platforms employ generic software architectures designed for standardized high-volume, low latency interactions (Feike & Rösch, 2024), the deployment of industrial platforms implies an intervention into highly interdependent socio-technical systems (Dolata, 2024, p. 33) that warrant lengthy processes of negotiation and trust building.

The paper starts off with a brief review of the epochalist perspective on capitalist development from the putting-out system to the current platform era in which the perception of the core-periphery architecture is largely based on research on consumer platforms (sections 2 and 3). By elucidating the specific limitations to the winner-take-all logic in the industrial realm, the focus then shifts from the replacement of forms to the processes of transformation and hybridization that, typically, are rife with challenges, setbacks and outright failures (section 4). The crucial steps of platformization from stand-alone product over smart and connected products to digital ecosystems will be elaborated by tracing the platformization of the leading agri-

2. Presumably the most far-reaching claims on the path-dependencies in the emergence of industrial platforms have been voiced by Steinberg (2021), who maintains that the organizational paradigm of Toyotism "is the unseen industrial and epistemological background against which the platform economy plays out" (p. 1069).

cultural equipment provider, John Deere (section 5). Reflections on the broader implications of platformization will conclude the paper.

2 Epochalism I: The Prehistory of the Platform

By taking advantage of the theoretical authority of the grand historical narrative, the platform — as an analytically distinct category — is stylized as the latest epoch-defining form in the development of modern capitalism. The progression of capitalism, in a sense, can be read as a book comprising four successive chapters, each with a clear beginning and end, and each contributing to the broader narrative, but distinct in its challenges and answers (see Table 1).

Table 1: An Epochalist Overview of Capitalist Development

	Industrialization	**Modernization**	**Globalization**	**Digitalization**
Organizational form	factory	corporation	network	platform
Governance apparatus	clock	chart	contract	algorithm
Governance logic	synchronization	subordination	collaboration	co-optation
Governance medium	machine rhythm	command	trust	lock-in
Market power	negligible	possessional	relational	infrastructural
Reach	single site	complex organization	industry segment	societal sphere

By superseding the notoriously unreliable putting-out system (Lazerson, 1995), the *factory* unleashed the economic dynamics of *industrialization*: Prometheus broke free of his shackles (Landes, 1969). Although the factory system habitually is associated with the arrival of monstrous machineries, it was the rather unspectacular instrument of the *clock* that served as the key governance apparatus: its mechanical precision dislodged the ambiguity of natural cycles and enforced the discipline (Thompson, 1967) that was a precondition for the *synchronization* of interdependent tasks (Mumford, 1934). Despite their technological advancement, though, early factories typically remained rather small-scale and single-site operations whose market power was *negligible*. Together with low barriers to entry and price-driven competition, the atomistic industry structure of the 19^{th} century, in fact, resonated with the ideal market world of neoclassical economics (Chandler, 1977).

With the process of *modernization* (Weber, 2016/1904), the factory got absorbed into *corporations* with an ever-broader spectrum of planning and marketing functions. The complex structure of departments, divisions and subsidiaries required elaborate schemes to manage the coordination across different units (Drucker, 2017): the ever more ramified configurations of *subordination* to authority as well as the lines of communication and reporting were specified in the novel governance apparatus of the organizational *chart* (Mintzberg, 1979). Since corporations, in contrast to single-site operation factories, routinely operated across multiple industries and geographies, their extensive webs of subsidiaries and branch plants afforded increasing *possessional* market power.

Consolidation into multi-layered bureaucratic organizations held out the prospect of efficiency gains under a certain condition: relative stability. *Globalization*, however, ushered in a new phase of heightened volatility that laid bare the limitations of rigid corporate hierarchies (Dicken, 1986): in turbulent environments, *networks* quickly proved superior to both, hierarchies (by providing flexibility), as well as to markets (by furnishing long-term *collaboration* aimed at sharing costs and risks) (Powell, 1990; Grabher, 1993). To leverage the advantages of relational embeddedness underwritten by *contracts*, previously fully integrated corporate behemoths morphed into nimble lead firms controlling sprawling global production networks geared towards the exploitation of location-specific comparative advantages (Henderson et al., 2002). The strategic network positioning of the lead firms as well as the specific network configuration engendered a form of *relational* power that secured a dominant role in increasingly oligopolistic markets.

The, so far, penultimate epochal rupture is associated with far-reaching processes of *digitalization* that paves the way for the shift from "Nikefication" to "Uberization" (Davis, 2016): from globally-dispersed production networks to ubiquitous digital *platforms*. Uber epitomizes the ideal of the asset-light platform orchestrator who avoids ownership over corporate assets (Davis, 2016) but, instead, aims at the far-reaching *co-optation* of assets for which it neither has to bear costs nor responsibilities (Stark & Pais, 2020). Instead of the contractual ties binding global production networks together, platforms are built around a digital governance apparatus (Stark & Broeck, 2024): *algorithms* regulate the interfaces and interactions through unilaterally imposed "uncontracts" (Zuboff, 2019, pp. 220–221). The algorithmic management of platforms extends their reach far beyond the specific industries in which they operate: by occupying gatekeeping positions as obligatory points of passage, platforms exert *infrastructural* power that stretches out far into economy and society at large (Yoo et al., 2024; Nieborg & Poell, 2025).

Examples? By controlling access to a massive customer base, Amazon exerts highly asymmetrical gate-keeping power that significantly conditions opportunities and practices of entrepreneurship. Although Amazon can lower barriers to entry and grant easier access to resources and infrastructural services such as payment systems (Yu & Sekiguchi, 2024), the platform orchestrator at the same time unilaterally imposes rules and policies that circumscribe the corridors of entrepreneurial operations. This form of "platform-dependent entrepreneurship" (Cutolo & Kenney, 2021) is further sustained by the practices of venture capital funds who avert financing potential competitors in the "kill zone" in which new ventures are immediately absorbed by incumbent platforms (Kamepalli et al., 2022).

Although Facebook, with already more than 3.065 bn active monthly users (Statista, 2024a), reaches more than a third of the world population, its influence in fact extends even further (Lovink, 2021). Rather than through an ostentatious display of raw corporate power and imperative directives, social behavior is influenced through affordances of the digital rendering and quantification of social relations culminating in a "sociometric subjectivation of actors" (Cardon, 2020, p. 214): actors understand themselves as nodes in elaborate relational topographies who incorporate novel metrics of (digital) reputation and influence into their behavioral calculus (Grabher & König, 2017). Through ceaseless monitoring and alerting, these "vanity metrics" act as "nudges" (Sadeghian & Otarkhani, 2023) for ever more self-conscious strategies to optimize the own social world. The social world, more generally, is reconfigured in a fashion that assures continuous relational labor and, hence, the perpetual production of relational data that fuels the Herculean engine of social media platforms: advertising (Beauvisage et al., 2024).

3 Epochalism II: The Architecture of Platforms

Even if the notion of platforms is pragmatically imagined as heuristic device of a Weberian ideal type, its categorization is confronted with formidable conceptual challenges. Despite their comparatively short history, platforms already have branched off in multiple trajectories and various manifestations as the variegated spectrum of platform typologies testifies. Each of these typologies is construed from a specific disciplinary angle and foregrounds particular platform dimensions respectively: whereas the *economic* perspective reveals market configurations and the dynamics of network effects (Evans & Schmalensee, 2016), the *strategic management* perspective is instructive for understanding the orchestration of ecosystems and the co-optation of complementors (Gawer & Cusumano, 2014); viewed from the *information systems and technology* angle, the digital architecture, data flows and integration through boundary resources come into view (Tiwana, 2013); and whereas the *organizational and sociological* perspectives focus on governance, collaboration and social (capital) dynamics (Stark & Pais, 2020), the *industrial organization* perspective provides insights into the integration of digital and physical dimensions as well as value chain transformation (Porter & Heppelmann, 2015).

Each of these disciplinary angles yields specific insights and helps to resolve particular disciplinary puzzles; and yet, as integrative approaches (Parker et al., 2016; Cusumano et al., 2019) have convincingly demonstrated, a combination of different approaches, that is attentive to the different conceptual assumptions, furnishes additional heuristic value: an integration uncovers the intricate interdependencies between various platform dimensions. The transformation of traditional physical assets into smart and connected devices (*industrial organization* perspective), for example, has direct consequences for the design of governance mechanisms (*organizational and sociological* perspective), the value co-creation with complementors (*strategic management* perspective) as well as the configuration of boundary resources (*information systems and technology* perspective). Very much in the spirit of elucidating interdependencies, the categorization of platforms starts off from an organizational and sociological angle that subsequently will selectively be complemented with other perspectives — whenever integration holds out the prospect of additional insights.

In the organizational strand of inquiry, the most basic and consistent design principles have rather early on been conceptualized as the architecture of platforms[3]. Viewed through this architectural optic, "the system is partitioned into a set of 'core' components with low variety and a complimentary set of 'peripheral' components with high variety" (Baldwin & Woodward, 2009, p. 19). The interrelations between core and periphery are governed by interfaces that specify the conditions for the access to the technical infrastructure (Dolata, 2024). This tripartite core/periphery/interface-design also affords a conceptual template for a systematic differentiation of the specific organizational manifestations of this configuration: core and periphery comprise the different "sides" of platforms and networks, and the respective interfaces

3. The architectural perspective originally has been developed in the (pre-digital) engineering design literature that conceived "the specification of the interfaces among interacting physical components" as the architecture of products and systems (Ulrich, 1995, p. 420).

are built around distinct governance modes as well. Global production networks and social media platforms provide illustrations of network and platform architectures respectively (see Figure 1).

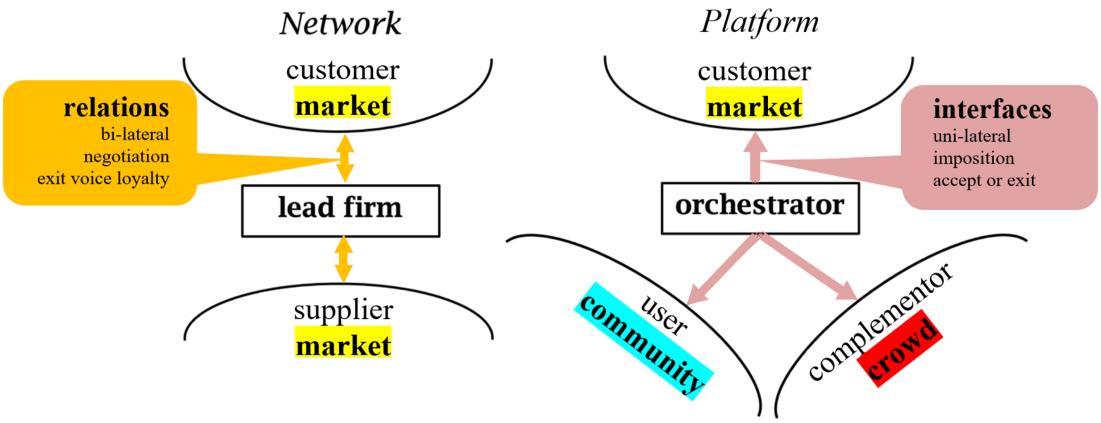

Figure 1: The Sides and Interfaces of Networks and Platforms.
Developed from Gawer (2021); Dolata (2024); Grabher & Ibert (2014); Tiwana, Konsynski & Bus (2010) and van der Vlist et al. (2022)

At the core of global production networks, "lead firms" (Henderson et al., 2002) set strategies for production, design and marketing and capture the highest value in the network through branding, innovation and control of intellectual property. The periphery, typically, is made up of a two-sided constellation in which the supply-side faces the customer market. The relationships between core and periphery are governed by a broad spectrum of interface design variants that ranges from market governance through classical arm's-length transactions with minimal coordination to captive governance with high levels of relation-specific investments and dependence on the side of supplier (Yeung & Coe, 2015). Whereas relations to the market side, in Hirschman's (1970) terms, are governed by "exit" and, to lower degree, by (brand) "loyalty", supplier relations are sustained through various practices of "voice" aimed at repairing rather than abandoning ties.

The emblematic type of interface design on the supplier side, phrased differently, is based on relational governance that galvanizes around trustful and long-term relations and affords the social infrastructure for joint innovation, technical support and sharing proprietary knowledge (Smith-Doerr & Powell, 2005). Relational, of course, must not be confused with egalitarian: power relations are an essential ingredient in global production networks (Henderson et al., 2002) and networks more generally (Grabher, 1993, p. 11–12). However, at least in the upper echelons of the supplier pyramids, power asymmetries are flattened out in favor of interfirm partnerships since "these key suppliers are *not* envisioned as mere satellites orbiting a dominant but benevolent patron, dependent and beholden" (Whitford, 2005, p. 17; emphasis in original).

In a manner analogous to the "lead firm" at the center of the global production network, the "orchestrator" governs the architecture of social media platforms. From its central position, the orchestrator defines and enforces rules, standards and policies that regulate behavior of platform members (Parker et al., 2016), and seeks to incentivize innovation while at same time capturing value through fees, commissions and, crucially, the monetization of data (Gawer, 2014).

And here the obvious similarities between network and platform architectures end. Although some consumer platforms with generic offerings, like Airbnb or Uber, for example, also operate two-sided configurations of their periphery, platforms in their archetypical configuration not only incorporate three sides, but also couple different types of social collectivities (see, for example, Kozinets et al., 2008; Grabher & Ibert, 2014): whereas the user-side of social media platforms is populated by communities of laterally related users who share practices, concerns, interests or beliefs (Faraj et al., 2011), the complementor side mobilizes more temporary and relationally rather thin crowds who provide critical contributions to the platform (Malhotra & Majchrzak, 2019) (see Figure 1). To categorize the customers of social media platforms as periphery, although correct from an architectural perspective, however, somewhat obscures the *central* role of the digital advertising market that, in fact, is funding "much of today's everyday digital world" (MacKenzie et al., 2023, p. 555; see also Nieborg & Poell, 2025): in 2023, Meta, for example, generated 97.5% of the total revenue of $116.6 bn from advertising (Statista, 2024b).

The decisive difference between network and platform architectures, though, resides in the mediatory elements between core and periphery — as the combination of the *organizational and sociological* with the *industrial organization* perspective reveals (see Figure 2). Whereas the interface in network configurations involves relational contracting, core and periphery in the platform context are intertwined through algorithmic interfaces (Gawer, 2021, p. 3–4; Stark & Broeck, 2024). Algorithmic interfaces are not simply passive fasteners that, once in place, remain fixed: rather, they are critical "boundary resources" (Ghazawneh & Henfridsson, 2013), as the jargon has it, that can flexibly be readjusted at the orchestrators' discretion: whereas relational contracting across network interfaces concedes at least some latitude for negotiations and "voice" to the periphery, the total control of boundary resources by the center leave the peripheries of platform architectures with the terse alternatives of brusque "exit" or wholesale "comply" (see also Dolata, 2024, p. 15–16).

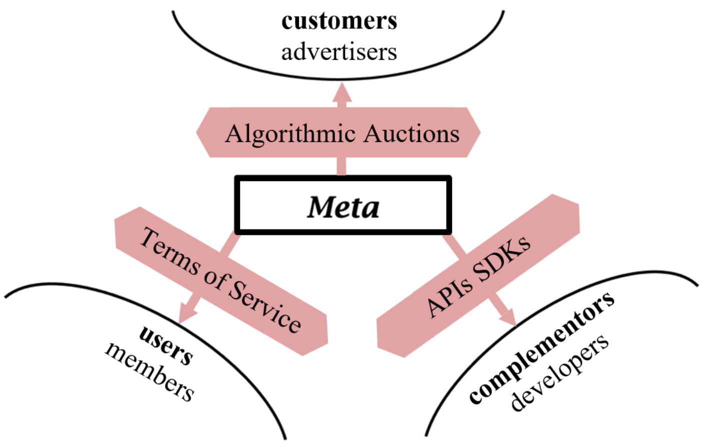

Figure 2: The Sides and Interfaces of the Meta Platform.
Developed from Gawer (2021); Dolata (2024); MacKenzie, Caliskan & Rommerskirchen (2023) and Viljoen et al. (2021)

Algorithmic governance, more generally, has shifted from top-down designs, in which the rulesets of algorithms are conceived by human programmers, to bottom-up machine-learning designs in which the algorithm is given a learning rule and trained on large data-sets in order to develop its own rules for decisions and categorizations (Srivastava, 2023, p. 991). With the increasing deployment of AI, algorithmic interfaces acquire agentic capacities: they are no longer limited to endlessly repeating the same processes which are "constant and automatic" (Bourdieu, 2018, p. 37), but are empowered to make independent decisions. The principal accomplishment of algorithmic interfaces, then, is no longer *automation* but *autonomy*, and agentic *performance* supersedes repetitive *prescription* (Filosa et al., 2025, p. 3)[4].

Since the overall value of platforms for users (and thus for customers) critically depends on the contribution of *complementors*[5], the design of the respective interface is of highest priority for orchestrators: the algorithmic interface has to incentivize innovative contributions by complementors — without relinquishing command which could compromise quality and value capture (Ghazawneh & Henfridsson, 2013; see also Rilinger, 2024). Balancing the conflicting imperatives of generativity and control is the key function of Application Programming Interfaces (APIs) that serve as the central building blocks of the platform architecture (Gawer, 2021, p. 4; see Figure 2): Control over APIs "amounts to control over the platform and its evolution" (Tiwana et al., 2010, p. 680). Construction principles of APIs are provided by Software Development Kits (SDKs) that facilitate the app development process with developer libraries, code samples, testing and deployment tools as well as guides and tutorials. APIs serve as the *lingua franca* (van der Vlist et al., 2022, p. 1) for the exchange of data and services and, hence, are much more than microscopic technical objects: they have evolved from simple programming interfaces into complex interconnected governance arrangements that exert infrastructural power (Yoo et al., 2024) and, indeed, articulate the processes of the assetization of data more generally (Birch & Muniesa, 2020; Hackfort et al., 2024, p. 2; Sauvagerd et al., 2024, p. 6).

The algorithmic interface between orchestrators and *customers* is based on a computational adaptation of "mechanism design". With its origins in (Nobel prize awarded) economic and game theory, mechanism design has become an authoritative science for engineering individual choice and optimizing value distribution in society (Viljoen et al., 2021, p. 2). In contrast to the Hayekian self-organizing market, mechanism design is about the creation of market mechanisms that reveal the preferences of actors through the respective design of "choice architectures like bespoke auctions, markets or voting systems" (Birch, 2023). In its algorithmic version, mechanism design governs the orchestrator-customer interface through "real time bidding" where an "impression" is auctioned in the 200–300 ms between the moment a user navigates to a webpage or opens a mobile app and the moment the advertisement loads on the user's device (McGuigan, 2019) (see Figure 2). The dominant advertising exchange, Google's AdX (that conveniently is integrated with Google's ad server DFP (DoubleClick for Publishers)) runs tens of billions of such algorithmic auctions a day (MacKenzie et al., 2023, p. 563). The bidding for discrete impressions heralds the shift from targeting larger audience segments defined by demographic features towards a "post-demographic" categorization by machine-learning algorithms

4. Rather than in the binary categories of yes or no, autonomy has to be conceived as both, gradual and relational (Thimm et al., 2024, p. 13). One of the most authoritative models for describing human-machine relations is the *human-in-the-loop* model (Liu & Gaudiot, 2022) in which *in-the-loop* refers to control that is executed directly, *on-the-loop* denotes systems whose actions can be prevented or aborted, and *out-of-the loop* pertain to systems that now longer require human control.

5. Whereas the contribution of *suppliers* to production networks is specified in exhaustive contracts, *complementors* are incentivized to provide extensions of the core offering of the platform to enhance its overall value (by providing a predictive-maintenance app on a smart factory platform, for example) (Parker et al., 2016; Gawer, 2021). The keyword in supplier relation is *compliance* (with negotiated agreements), the imperative for complementors is *creation* (within the boundaries of unilaterally imposed algorithmic interfaces).

that afford unprecedented levels of precision targeting (see also Zook & Grote, 2025, p. 6)[6].

Turning to the orchestrator-*user* interface, the strategies of orchestrators to maintain near-total control over the interface to users and to preempt any allegations of lawlessness has engendered an entire genre of Terms-of-Service (ToS) agreements that specify the rules on (un)acceptable user conduct or speech, serve as framework contracts establishing the conditions of litigation, and contain IP licenses (Palka, 2025, p. 2). These "uncontracts" (Zuboff, 2019, pp. 220–221) invoke the notion of a public domain that underwrites legal privileges to take (purportedly) raw data, to subject them to processing, and to impose the idiosyncratic understandings of legibility of each individual platform orchestrator.[7] ToS agreements, hence, "are performative acts of consummation. Together with the technical protocols that structure interactions [...] they work to leverage ad hoc and contingent trade secrecy entitlements into de facto property arrangements" (Cohen, 2019, p. 242). More generally, the legal design of ToS is not intended to sideline the law, but rather to catalyze shifts in legal accountability and to create new zones of immunity by advancing novel understandings of legality.

4 Gradualism: Platformization as Process

Inaugurating a new epoch of capitalist development, the design principles of ubiquitous consumer platforms, that were ennobled with regular appearances in movies and tv shows early on, in fact, have morphed into the architectural blueprint of platforms *per se*. The critique on this new orthodoxy produced by a structural bias of platform research (Menon et al., 2020, p. 364; Butollo & Schneidemesser, 2022; Jovanovic et al., 2022, p. 2; Dolata, 2024, p. 10) drew attention to a strand of research that, initially in relative isolation from the consumer platform research, had elucidated the distinctive features of industrial platforms already (Kenney & Zysman, 2016; Menon et al., 2020; Dolata, 2024; Lerch et al., 2024).

In terms of design principles, the architecture of industrial platforms resembles the basic configuration of consumer platforms, at least at a cursory glance: in a three-partite configuration of sides, a platform orchestrator at the center controls the peripheries comprising users, complementors and customers. The key differences in architectural terms, however, are again to be found in the interfaces between core and peripheries: whereas the core elements of network architectures are integrated through relational contracting, and algorithmic interfaces govern consumer platforms, industrial platforms rely on intricate amalgamations of relational and algorithmic networks (see, for example, Sjödin et al., 2021, p. 16; Butollo & Schneidemesser, 2022, p. 15; Dolata, 2024, p. 37; Madanaguli et al., 2023, p. 11).

A comparison of static architectures makes sense in an epochalist view in which change is perceived as a complete replacement of the existing formation by a new configuration — such as the substitution of networks by consumer platforms. Viewing history through the optics of a diachronic slide show, however, conceals the very dynamics that sets industrial platformization apart from the establishment of consumer platforms. Whereas research on consumer platforms

6. Post-demographic sorting, however, produces "post-narrative" categories devoid of any standard socio-psychological explanation and narrative. Paradoxically, this algorithmic categorization instigates a "return of the social" (Kotliar, 2020) by which unexplainable categories are assigned heuristic everyday-language labels by ad professionals (Beauvisage et al., 2024, p. 6112).

7. A behavior-tracking study revealed that only between 0,05% and 0,22% of users access the ToS. Even if accessed, only fractions of ToS are read and, habitually, are misinterpreted (Palka, 2025, p. 4). The popular meme that "I have read the Terms of Service" constitutes the "biggest lie on the Internet", apparently, is true (Obar & Oeldorf-Hirsch, 2018).

was preoccupied with the disruption of existing markets, the exploration of industrial platforms primarily foregrounds processes of metamorphosis (Van Dyck et al., 2024), framed in terms of "incremental platforming" (Cusumano et al., 2019), "platform co-evolution" (Tiwana et al., 2010), "platform layering" (Thomas & Autio, 2019) or "platform grafting" (Björkdahl et al., 2024).

Instead of aiming at the penultimate representation of the distinctive platform architecture, the pertinent research, then, seeks to conceive platform evolution as an evolutionary process traversing various stages (Lerch et al., 2024) from (1) *traditional product provider* over (2) *digitalized product provider* and (3) *digital business model provider*[8] to (4) *digital platform provider*. The usual conception of a smooth transition from step to step, however, should not disguise the fact that these transformations involve lengthy and resource-heavy phases of experimentation (Filosa et al., 2025), tensions and setbacks (Duguma & Bai, 2024, p. 62–63) and, of course, outright failures (Wlcek et al., 2023, p. 4).[9] A critical engagement with the key tenets of the current orthodoxy (derived from research on consumer platforms) reveals the frictions and constraints in processes of platformization.

4.1 Tenet #1: Assets lightness

The most obvious difference between consumer and industrial platforms, paradoxically, appears to be the most overlooked: at least in its textbook-version, the orchestrator of consumer platforms embodies the ideal of the asset-light company (Parker et al., 2016) whose very *raison d'être* is the eschewal of ownership of physical assets (Davis, 2016).[10] Consumer platforms, in other words, restrict themselves to controlling the digital infrastructure for interactions and transactions through software apps (which, then, afford access to physical assets owned by the platform users). Industrial platforms, in contrast, rely on a — "seamless" is the magic term here — integration of physical assets like manufacturing lines, machines, vehicles, sensors, activators and edge devices into the digital systems of data-gathering, monitoring and analytics (Porter & Heppelmann, 2015).

The entanglement of hardware and software into cyber-physical systems (Menon et al., 2020, p. 363) has profound consequences for the core functionality and operational principles of industrial platforms: whereas consumer platforms prioritize marketplace liquidity and

8. First generation digital business models were built around Product-as-a-Service (PaaS) offerings like the Power-By-the-Hour (PBH) programs that emphasize outcome-oriented contracting, where customers pay for usage or performance outcomes rather than for owning assets. Pioneered in the aerospace industry by Rolls-Royce, these programs are widely used in industries requiring high-value, high-maintenance equipment, such as aerospace, industrial machinery (e.g., with Cat Connect, Caterpillar enables customers to pay for machine uptime and productivity), and logistics (e.g., Daimler Trucks North America offers uptime and predictive maintenance services for commercial fleets).

9. The first most prominent casualty of industrial platformization was Predix, founded in 2013 by General Electric with big fanfare, great ambitions and the prediction to earn $ 15 billion by 2020. The great ambitions, in fact, were presumably one of the key reasons for the eventual failure of Predix that promised to create a universal operating system for the Industrial Internet of Things (IIoT). The attempts to cater to multiple industries simultaneously, diluted its relevance for specific knowledge domains and industries — which felt better served by the specific offerings of companies like Siemens (MindSphere), PTC (ThingWorx) or IBM (Watson IoT) (Wlcek et al., 2023, p. 4; see also Madanaguli et al., 2023, p. 2).

10. The admittedly rather extreme case of Amazon illustrates how far reality has departed from the text-book version of the asset-light company: in 2020, Amazon owned physical assets valued at $104bn, which is not far from the $119bn of physical assets of its old-economy rival Walmart (see also Rodrigue, 2020). In 2024, the value of Amazon's property, plant and equipment (PP&E) alone amounted to $39.40 bn (Nasdaq, 2025).

user convenience (in getting access to physical assets like apartments), industrial platforms are focused on enhancing asset performance by providing field data and analytics about critical asset parameters at the current status and across the entire lifecycle (Lerch et al., 2024; Filosa et al., 2025, pp. 2–3). A truck fleet platform like Fleetboard (by Daimler-Benz), for example, integrates vehicle telematics to monitor fuel usage, route optimization and predictive maintenance.

4.2 Tenet #2: Network Effects

Explorations of the disruptive force and meteoric rise of consumer platforms revolve around the single most powerful escalating dynamics: network effects. Although the efficacy of this propellant of platform proliferation has been problematized early on (Boudreau, 2012; Cennamo & Santaló, 2019), network effects have become synonymous with platforms. Once platforms "reach a critical inflection point, network effects kick in and growth follows an exponential trajectory" (Hagiu & Rothman, 2016, p. 2). The more users a platform operator can attract onto its demand side, the more users will be drawn to the supply side, which subsequently turns the platform into an even more lucrative option for demand-side users, and so on (Rochet & Tirole, 2003): the winner-take-all logic of platforms (Parker et al., 2016).

The single most important driver of platform growth, strong *direct* network effects, seems clogged for industrial platforms (Butollo & Schneidemesser, 2022). If at all, industrial platforms can seek to leverage *indirect* network effects which accrue from *data-network effects* (Gregory et al., 2021; Hagiu & Wright, 2023). Instead of relentlessly adding new users at virtually any cost (more users = more value), the acquisition of data from the already installed base of equipment is the chief imperative for industrial platform operators (better integration = better analytics) (Sjödin et al., 2021, p. 13). The *de facto* monopolist position of ASML, the producer of the "most indispensable machine in the world" (Tita & Maidenberg, 2024) — the photolithography machines for the manufacturing of computer chips —, for example, is attributed to its ability of feeding real-time data on utilization and process parameters from its unparalleled installed machine base into the continuous improvement of its technology (Tung & Wan, 2023).

4.3 Tenet #3: Frictionless Scalability

Already in the year 2000, prefiguring subsequent debates on the sharing and later the platform economy, Rifkin (2000) predicted the coming "age of access" in which digital network technologies would enable the production and distribution of goods and services at near-zero marginal cost. Once the digital infrastructure (like the streaming platform Spotify, for instance) is established, scaling (i.e., offering more users access to music libraries) incurs virtually no additional costs — and renders traditional scarcity-based pricing models irrelevant. The economics of straightforward platform scalability (by granting access instead of owning assets) did not materialize in the realm of industrial production (Grabher & van Tuijl, 2020, p. 1008). Instead of relatively low-cost digital infrastructures, the deployment of industrial platforms incurs high incremental costs for setting up physical infrastructures of manufacturing equipment, smart devices as well as data centers (Lee et al., 2015). Any further additions of physical assets that, due to their comparatively longer amortization periods, extend over relatively long investment cycles produce additional marginal costs (that do not vanish with scale) (Porter & Heppelmann, 2015).

Scalability, of course, is not just a matter of quantity but also of geography. The escalating network effects on consumer platforms, and social media platforms in particular, are not only driven by exponentially growing user numbers but also by extending the geographical reach. The purely digital environment and the homogenous user experience (practices and norms of online socializing have been globally standardized by the platform orchestrators) enabled copy-and-paste strategies across geographies (Zander et al., 2025, p. 8) — at least up until more recently: induced by geopolitical tensions, these uniform socio-technical solutions increasingly rub against national and supra-national regulatory frameworks (Zook & Grote, 2025). Even these forms of regulatory de-globalization, however, do not obliterate the fundamental difference to the highly localized geography of industrial platforms.

Far from the much-celebrated winner-take-all markets, the expansion of industrial platforms is limited since the design and deployment of physical infrastructures and assets have to comply with country-specific regulations and safety standards (Sauvagerd et al., 2024, p. 6). Physical assets of industrial platforms, naturally, are tied to specific local contexts — the power plant, the production line, the farm — and to regional contexts which provide for the time-critical logistics of maintenance, repair, and operational support. Since industrial platforms operate in specialized sub-markets, domain knowledge comes at a premium (Sturgeon, 2019; Meier et al., 2024) — as does knowledge on local conditions and preferences. Precision agriculture platforms, for example, rely on the integration of data on soil conditions, weather patterns, and crop types that are highly location-specific and elude any meaningful upscaling; vehicle tracking platforms in the European context, as another instance of local specificity, are primarily pitched towards the surveillance of truck drivers, whereas tracking platforms in the Latin American context are oriented towards routing across safe corridors.

The fragmentation of markets by industry and geography also affects (and this is one of the interdependencies between different platform dimensions announced earlier) the governance within the ecosystem: since market fragmentation limits the number of complementors they, in turn, have a greater say in the development of industrial platforms than in consumer platforms (Madanaguli et al., 2023, p. 11). Platform orchestrators have to negotiate and cooperate with users and complementors "on an equal footing", at least as long as the markets remain fragmented (Butollo & Schneidemesser, 2022, p. 10; Dolata, 2024, pp. 36–37). In the context of deploying MindSphere for example, Siemens partnered with machine manufacturers to develop smart factory solutions particularly for small and medium-sized firms early on (Siemens, 2018).

4.4 Tenet #4: Algorithmic Governance.

In contrast to the imperatives of client-specific targeting of industrial platforms, consumer platforms owe their disruptive vigor and straightforward scalability to far-reaching standardization (Feike & Rösch, 2024): consumer platforms run on standardized software architectures with rather generic user-matching, -payments and -feedback systems designed for interoperability and high-volume, low latency interactions. The standardization of services (like hailing a ride from A to B) allows almost frictionless scaling across geographies and user socio-demographics (Meier et al., 2024, p. 45). It is here, where algorithmic interfaces can play to their comparative strengths of speed and low cost. Moreover, with their digital-only architectures, consumer platforms are freed from the restrictions imposed by the physicality of industrial platform infrastructures and tangled legacy systems with layers of proprietary physical equipment, each with its own operating requirements and protocols (Lerch et al., 2024, p. 4).

The deployment of industrial platforms, indeed, amounts to an intervention into complex and highly interdependent technical systems as well as intra-organizational processes (Dolata, 2024, p. 33). The acquisition of a predictive maintenance solution, for example, requires "cross-functional decision-making involving, among others, purchasing, finance, administration and engineering functions" (Pauli et al., 2021, p. 184). On top of these organizational intricacies, the deployment of an industrial platform solution like predictive maintenance unavoidably impacts upon professional roles and identities and, consequently, can meet with respective resistance:

> I think we are used of being reactive [...] When a machine breaks down, a service technician goes out and fixes it and he is the "hero". With our digital fleet management solution, the idea is that the technician should monitor the machine and do services before we have a breakdown [...] But then he is no "hero" more of a disturbance, and that is something that both distributors and technicians have had a hard time to adjust to (a product manager of a construction side monitoring and optimization solution) (quoted in Sjödin et al., 2021, p. 11).

The equivalent to the algorithms that govern consumer platform interfaces, is a key tenet of the relational contracting whose time, allegedly, has long past: trust. What is more, trust in the relations with users is not inferred from some synthetic digital reputation indicators, but has to be built in a fashion that appears as the anti-thesis to the technically most advanced AI platforms: face-to-face meetings and physical inspection of products. As to the former, industry fairs still play a key role: "If you are not at the trade fair to introduce yourself personally, you don't stand a chance of winning people's trust" (a CEO of an energy platform; quoted in Meier et al., 2024, p. 48); as to the latter, the affordances and performance benefits of digital interconnectivity through the platform are demonstrated with specific portals and dashboards on site of the user (Jovanovic et al., 2022, p. 6; Bosquette, 2023) or are offered for a free trial period over considerable periods of time to evaluate platform functionalities in more detail (Peruchi et al., 2022, pp. 350–352). The buildup of personalized trust has to be further supported by the orchestrators by protocols and regulations that, first and foremost, encompass robust privacy and data protection standards, including non-disclosure agreements (NDAs) and blockchain technologies that afford accountability and transparency (Jovanovic et al., 2022). Needless to say, that these processes and practices of trust-building, intense negotiations and on-boarding demand infinite more personal involvement and time than the downloading of a consumer app from an app store — that hardly takes a minute and a handful of buttons to push.

5 Agriculture: From Product to Ecosystem

In contrast to the canonical accounts on disruption by heroic new market entrants, the agricultural sector represents a case *par excellence* of platformization driven by an oligopoly of long-established incumbents (Grabher, 2020, pp. 254–256). Instead of being challenged by a new breed of digital-native start-ups, companies like John Deere, CNH, Bayer or ChemChina that since long dominate global markets for agricultural equipment and inputs (like seeds, fertilizers and pesticides), are able to entrench themselves ever deeper in the sector through "oligopolistic platformization" (Sauvagerd et al., 2024).

And an entire range of barriers-to-entry fortifies the central position of incumbent manufacturers. While the development of complex machinery (like a combine harvester, for example) incurs classical capital barriers-to-entry of considerable upfront investments, data network effects are even more effective defenses against new market entrants (Hagiu & Wright, 2023):

the installed base of equipment grants exclusive access to data that are transmitted to the cloud-based platform infrastructure in order to improve proprietary algorithmic models (on seed productivity or weed identification, for example) as well as machinery (in terms of fuel efficiency, wear and tear and reliability) (Hackfort et al., 2024, p. 10).

Moreover, the dominant incumbent manufacturers command over the financial muscle that allows to cross-subsidize the "freemium" pricing strategies that, so far, hardly cover the operating costs of the industrial platforms. Whereas the prospect of ultimate market dominance (and price setting authority) of consumer platforms mobilizes venture capital even across extended loss-making periods,[11] the fragmentation of the agricultural sector frustrates any such the winner-*eventually*-will-take-all aspirations. Currently, and for the foreseeable future, "no platform market leader exists in the ag sector as each sectoral platform promotes its company's core business, such as selling agrochemicals or machinery" (Hackfort et al., 2024, p. 10). Since the investment motive of market dominance is absent, financing by the incumbent manufacturers has become paramount (Van Dijck et al., 2024, p. 5): John Deere, for example, selects each year a cohort of start-ups to test innovative technologies in real-world customer environments through its Startup Collaborator Program (Deere, 2024); and Leaps by Bayer (Bayer, 2024) is the company's strategic impact investment unit that has invested in more than 17 startups that provide specific solutions for sensing and improving soil and crop health (Bayer, 2025).

Incumbents, then, command a privileged position in setting up digital platforms and entrenching them ever deeper in the agricultural sector. Agricultural platformization, in fact, is less driven by the escalating dynamics of *network effects* than by the latitude afforded by the strategic *network position* that allows for an opportunistic pursuit of *tertius gaudens* and *tertius iungens* strategies respectively (on the *tertius* strategies, see Obstfeld, 2005).[12] Resonating with the phase models of industrial platformization (Sjödin et al., 2021; Lerch et al., 2024; Filosa et al., 2025), the transformation of the agricultural sector has been chronicled as a stepwise process — definitely not devoid of hurdles and backlashes (Sauvagerd et al., 2024; Van Dyck et al., 2024; see also Beinert et al., 2020; Hackfort et al., 2024). John Deere, "the Apple of ag tech" (Klaehne, 2023) due to both its technological leadership as well as its stringently guarded architecture, exemplifies this metamorphosis through the sequence of strategic pivots laid out by Porter and Heppelmann (2015).

The long history of John Deere, dating back to 1837, reads across vast stretches as a chronicle of a provider of innovative, yet *stand-alone products* (until 1995) that began with the self-scouring plough and culminated in a broad portfolio of equipment, primarily for agriculture, forestry and construction at the beginning of the 21st century (Deere, 2025a). The shift towards *smart products* (1996–2005) in which digital components like sensors, controls, microprocessors, and embedded operating systems amplify the capabilities of physical products (Porter & Heppelmann, 2015, p. 5), began at John Deere with the installation of Yield Monitors (1996) that scan the crop of combine harvesters in real-time; it continued with the deployment of StarFire GPS (1998) that enabled sub-inch accuracy for the location and navigation of agricultural machinery for critical tasks like planting and tillage (Deere, 2025b).

The critical steps towards *smart and connected products* (2006–2012) were taken with the

11. In 2000, a coquettish Jeff Bezos bragged "we are famously unprofitable" — referring to the fact that it took Amazon almost seven years to break even; Uber and Airbnb even needed approximately fourteen years to turn a profit.

12. Whereas the *gaudens*-strategy exploits the gap between unconnected networks to monopolize a broker position, the *iungens*-strategy aims at bridging those gaps to promote collaboration: Ron Burt's splitter vs. David Obstfeld's connector (Obstfeld, 2005).

roll-out of the telematics system JDLink (2006) that allows remote monitoring of machinery performance and diagnostics, Machine Sync (2011) for the wireless synchronization of combine harvesters and grain carts, and of the field monitoring system Field Connect (2013) that employs moisture sensors to optimize irrigation (Deere, 2025c; see also Van Dijck et al., 2024, pp. 5–6). These expansions of the digital solutions portfolio were the result of a diversification of collaborative relations: on the one hand, the collaboration with Monsanto (now: Bayer) that aimed at enhancing the compatibility between John Deere planting equipment and Monsanto seed prescriptions widened the range of complementors with incumbent input providers. On the other hand, and more consequential, the collaboration with Microsoft Azure who provided cloud solutions for remote monitoring and diagnostics from 2010 onwards, extended the relational architecture around John Deere with Big Tech.

Amazon Web Services (AWS), Google Cloud and Microsoft Azure, in fact, "form the backbone of the digital infrastructure in digital agriculture" (Sauvagerd et al., 2024, p. 10) serving the major incumbents, start-ups as well as public institutions like the United States Department of Agriculture (USDA): an agricultural version of the "Big Techification of Everything" (Hendrikse et al., 2021), to phrase it in the histrionic lexicon of the disruption debate. AWS has entwined itself in the agricultural sector by, amongst others, creating the curated digital catalog AWS Marketplace that allows agricultural firms to purchase and deploy third-party software and services to build solutions on the AWS platform (AWS Marketplace, 2025). Since Big Tech companies do not have access to the content of the data harvested from the installed base of equipment of the incumbents (Hackfort et al., 2024, p. 12), Google and Microsoft have set up test farms and developed specialized hardware to refine their industry-specific data analytics and algorithms (Sauvagerd et al., 2024, p. 10) — corroborating once again the critical role of domain knowledge.

With the opening up of its Operations Center for third-party developers, John Deere in 2013 took the final step towards integration into one of the largest agricultural *system of systems* — or ecosystems in contemporary parlance. Collaborations and alliances provided the relational base for extending the spectrum of hard- and software solutions accessible through the John Deere Operations Center (Sauvagerd et al., 2024, p. 5; Deere, 2025a & 2025b). In the domain of software complementors, the alliance with The Weather Corporation (since 2015), for example, provided the preconditions for integrating agronomic data and weather insights into operative prescriptions uploaded to John Deere equipment; the collaboration with Blue River Technology (acquired in 2017) secured access to machine learning and computer vision for precision spraying; and the partnership with Sentera (since 2020) augments crop performance monitoring with AI-driven aerial imagery.

Whereas the *software complementor* domain is populated by startups that, after years of relational contracting, might be vertically integrated into John Deere (Saroniemi et al., 2022), the segment of agricultural *input complementors* as well as of *infrastructure* providers is dominated by the aristocracy of reigning incumbents (see Figure 3):[13] as to the former, the alliances with Bayer (Monsanto), ChemChina (Syngenta) and DuPont (Corteva) advance agronomic data integration for seed selection, planting and crop protection; as to the latter AWS, Google Cloud and Microsoft Azure provide the cloud infrastructures for large-scale data storage, processing and analytics (Hackfort et al., 2024). In January 2024, John Deere entered a strategic partnership with Starlink (Tita & Maidenberg, 2024), a division of SpaceX (run by Elon Musk, the

13. If the evolution of platforms into "cloud empires" (Lehdonvirta, 2022) can meaningfully be likened to the development of feudalism during the Middle Ages, and platform sellers are the modern equivalent of the rising middle classes during the French Revolution, Big Tech companies, in fact, represent the aristocracy.

notorious uncrowned king of the new aristocracy), to extend the reach of its platform services into areas with "rural connectivity challenges" (Deere, 2025d) which comprise around 30% of US farmland and 60% of farmland in Brazil — where the satellite-based services have been rolled out first (Jewett, 2024).

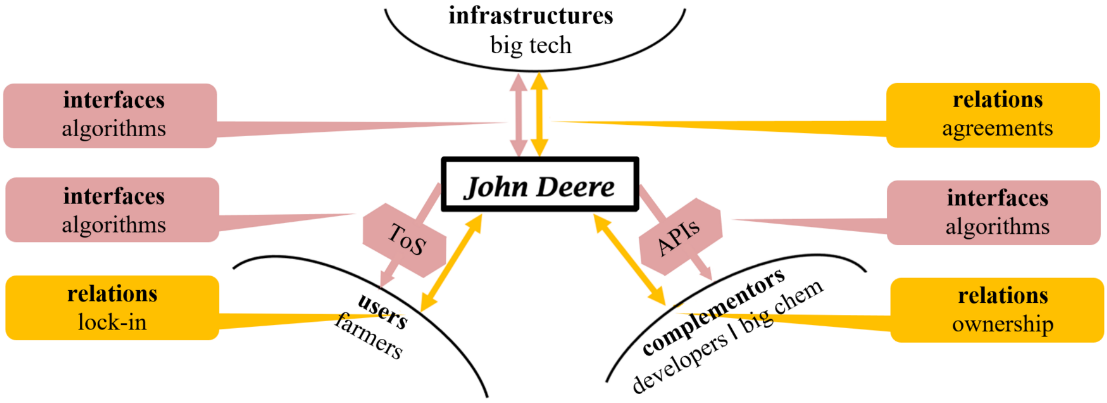

Figure 3: The Sides and Interfaces of the John Deere Platform.
Developed from Gawer (2021); Dolata (2024); Hackfort, Marquis & Bronson (2024); Sauvagerd, Mayer & Hartmann (2024) and Van Dyck et al. (2024)

The extensions and diversifications of alliances and collaborative agreements produced a complex platform architecture that (at the end of 2024) interconnected the offerings of more than 200 companies in the device, network and application layer of this ecosystem (Sauvagerd et al., 2024, p. 5; Deere, 2025a & 2025b). If the ecosystem is the engine, data are its fuel, and the assetization of data is its chief construction principle. For the actual implementation of the imperative of data assetization, the technology of "field mapping" plays a critical role (Miles, 2019, p. 4; Grabher, 2020, p. 255). In the John Deere ecosystem, tractors, combine harvesters and drones equipped with GPS receivers and spatial sensors collect data that are synthesized into "boundary maps" that provide the geospatial reference for machinery operations. The further layer of "performance maps" is computed from data collected through the spectroscopic sensors of combine harvesters, these "roving, metal algorithms" (Miles, 2019, p. 8): by monitoring crop yield variables like starch, moisture, protein and fiber, they identify zones of varying crop yield and crop health and thus, put more colloquially, pinpoint problem areas that need particular attention.[14]

Stacked upon each other and augmented with weather data (historical and real-time weather conditions) as well as seed and chemical recommendations (based on crop type and agronomic practices), "prescription maps" specify the application of inputs (like seeds, fertilizers or pesticides) for the various zones of the field through "variable rate technology (VRT)". John Deere's See & Spray application exemplifies the workings and the performance capability of VRT (Gullickson, 2022). With a massive, and by the installed base of connected equipment permanently updated, database of images, this technology employs advanced computer vision and machine learning to identify and calibrate the difference between weeds and plants and activates the specific nozzle that best correlates with the weed geolocation — approximately 20 times per second while the sprayer moves at an average speed of 12 mph through the field (Dulaney et al., 2023). While traditionally decisions about the dosage of

14. The treatment of the field as a *heterogenous entity* is a hallmark of precision agriculture (Finger et al., 2020, pp. 315–317).

pesticides and herbicides have been made on a field-by-field basis, VRT calibrates dosage to the sub-field level of the individual plant: precision farming indeed (Grabher, 2020, p. 255).

Although increasingly invisible (and deliberately so), the consequences of these most advanced versions of weaving digital dataflows seamlessly[15] into the physical fabric of the equipment, are hard to overlook. These data streams from the sensing and GPS-devices over the edge computing appliances and the modems for data-sharing and analytics in the John Deere Operations Center to the uploading of prescriptions on to the activators on the machines, rely on proprietary software that is subject to license agreements and IP protection (Hackfort et al., 2024, p. 6): data-flows are increasingly black-boxed, and the farmer is increasingly bypassed. "Digital locks" limit how and who can access, repair, and modify the machinery and, thus, hollow out the notion of ownership of the equipment.[16] Rather than owning, farmers instead have to license critical infrastructures and are obliged to share critical data for free in order to leverage the benefits that the equipment providers propagate (Miles, 2019, p. 7; see also Zook & Grote, 2025, p. 102). Resonating with the more recent managerial *idée fixe* of the inevitable shift from the product to a service logic, this trajectory towards Farming-as-a-Service (FaaS) holds the prospect of increased eco-efficiency — at the price of hollowing out the managerial authority of the farmer and undermining the role of the farm as basic business unit of agricultural operations.

6 Summary and Conclusion: For Boring Nuances

What, then, is the point of the John Deere story? The proliferation of platforms, up until more recently, has been narrated as an epochal shift: the relational governance that had given shape to the network society (Castells, 2004) was dethroned by a novel mode of algorithmic governance that ushered in the new phase of platform capitalism (Srnicek, 2016). The celebration of disruption left no doubt that this shift was anything but gradual, and the authoritative manual for splitting asunder incumbent industries carried the befitting title "Platform Revolution" (Parker et al., 2016). The sweeping generalizations of this epochal shift, however, stand in stark contrast to the selectivity of the research on which these claims are based that, so far, has primarily focused on the consumer- and communication-based internet (Butollo & Schneidemesser, 2022; Jovanovic et al., 2022, p. 2; Dolata, 2024, p. 10).

And here John Deere enters the picture. The present account seeks to contribute to the ever-growing body of research that accumulates compelling evidence for the distinctive realities of platforms in the realm of production and manufacturing (see, for example, Kenney & Zysman, 2016; Menon et al., 2020; Dolata, 2024; Feike & Rösch, 2024; Lerch et al., 2024). Rather than the overnight and wholesale imposition of a new organizational form by a novel breed of digital-native disruptors that rapidly scale to monopolists, the development of platforms in the

15. The stream of data harvested by John Deere includes "machine data" (i.e., diagnostic codes; machine settings; software and firmware versions; machine hours and lifetime usage; and machine location), "operational data" (i.e., field task details; area worked; route travelled; crop harvested and yield data; agronomic inputs applied; and historical information) and "administrative data" (i.e., data sharing permissions; users, machines, devices and licenses linked to account; number of acres and size and nature of fields; information on account usage) (Deere, 2025e).

16. After years of contestation by the "Right to Repair" movement, John Deere has reached an agreement with the American Farm Bureau Federation on a partial removal of the lock. Yet, as critics argue, this partial concession might undermine efforts to reach broader, legally binding terms of data sovereignty (Hackfort et al., 2024, p. 6; see also PIRG, 2024).

industrial realm is driven by incumbent manufacturing oligopolists (Sauvagerd et al., 2024; Van Dyck et al. 2024); and instead of a distinct new phase of capitalist development, this research reveals rather messy and tenacious processes of hybridization and transformation. By engaging with the key tenets of platform research (on consumer platforms), the tracing of John Deere's trajectory from the provider of stand-alone physical products to the orchestrator of a platform ecosystem revealed distinctive features that preclude an outright disruption.

Materiality. Whereas consumption platforms are built around software apps, industrial platformization involves the entanglement of hardware and software into cyber-physical systems (Menon et al., 2020, p. 363) to which neither network effects nor the zero-marginal-cost principle (Rifkin, 2000) apply. *Heterogeneity*. Industrial platforms continue to operate in specialized sub-markets in which domain knowledge comes at a premium (Sturgeon, 2019; Meier et al., 2024). Market fragmentation limits the number of complementors who, in turn, have a greater say in the development of industrial platforms than in consumption platforms (Dolata, 2024, p. 37). *Complexity*. Industry platform solutions imply interventions into complex intra-organizational processes as well as multi-layered technical architectures and legacy-systems. Whereas downloading a consumer app is a matter of a couple of seconds, onboarding onto industrial platforms involves lengthy procedures of negotiation and trust-building (Sjödin et al., 2021). *Security*. To reduce the risk of dependence from a single orchestrator and losing strategic information to complementors, extensive data-sharing agreements have to be negotiated and, in addition to sophisticated NDAs and blockchain technologies, traditional trust has to be built (Mancuso et al., 2024).

For the foreseeable future (if there is such a thing), these features will continue to provide robust barriers-to-entry and barriers-to-scale that fortify the position of incumbent oligopolies of manufacturers on the one hand, and big tech on the other, in shaping processes of industrial platformization. Although Big Tech companies will increase their infrastructural power as obligatory points of passage in data collection and analytics, the "Big Techification of Everything" (Hendrikse et al., 2021) seems more a threat (or a promise), at least for now. The totalizing perceptions of platformization as the unrestrained ravaging of an all-consuming Leviathan might make for a thrilling (and chilling) read. Yet, if an in-depth examination of industrial platformization (as exemplified with the case of John Deere) conveys a more general conclusion, it is this: transformation might unfold in a rather unspectacular fashion of piecemeal adaptations, sporadic frictions and partial drawbacks and failures. True, this sounds like boring "nuts and bolts"; but, then, nuts and bolts are indispensable.

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