Platforms in Industry – disruptors of traditional manufacturing?

February 2022

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Governing Work in the Digital Age
is a research project directed by Prof. Anke Hassel and kindly supported by the German Federal Ministry for Labour and Social Affairs
www.digitalage.berlin

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Introduction

The stellar rise of tech enterprises has shaken established hierarchies in various economic sectors. One aspect of their success has been the establishment of platforms, a form of economic organization that is not entirely new but has flourished based on new possibilities in the context of digitalization to capture and valorize data and to engage in matchmaking in multi-sided markets (Cusumano et al., 2019; Srnicek, 2017). In the consumer-oriented internet, companies such as Google, Facebook and Amazon have revolutionized and come to dominate established markets for software, communication and retail by combining functions of matchmaking and the distribution of web services with the economic valorization of data that is generated through the transactions of their users. While they offer new and superior services to their users, economic value is not generated through the sale of such services, in the classic sense, but by their capacity to possess and control market places and, as a consequence, to utilize the data of their users for advertising purposes or other forms of valorization (Staab, 2022; Zuboff, 2015; Zysman & Kenney, 2018). The platform model is contagious: by exploiting network effects and consciously designing their ecosystems to maximize the capture of value, platforms are continuously expanding their reach. Platforms seem to pop up across all sectors of the economy as a new mode of economic organization that is apt to capture value in the digital age.

Traditional industries are no exception. Digital platforms are playing an increasing role and are transforming the organization of production processes. They provide new opportunities for lowering transaction costs and valorizing economic data. At the same time, 'creative destruction' (Schumpeter, 2008: 81-87) in traditional industries that still employ millions of people could lead to major social upheaval. If such transformations are not shaped according to the interests of employees, they could erode established social compromises that are characteristic, at least of coordinated market economies.

Product platforms: transforming the rules of the game

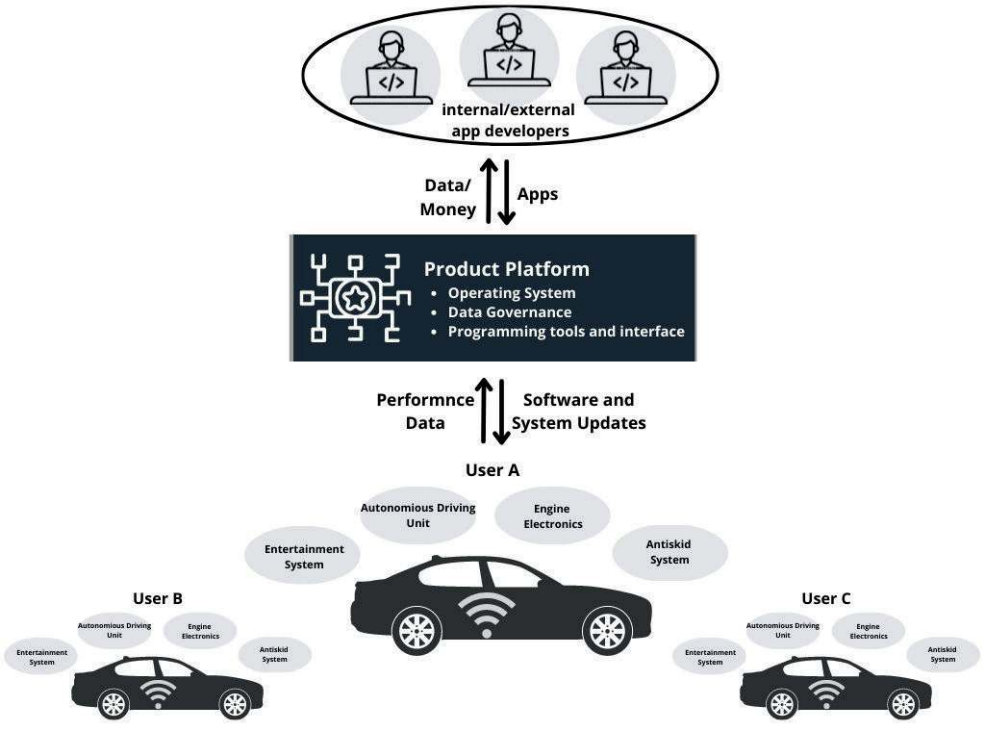
The most profound impact concerns those sectors, in which digitalization changes the characteristics of the product as such. A sector that has experienced a paradigmatic transformation in the course of the establishment of the internet and cloud computing is telecommunication, where the emergence of the smartphone has transformed the character of mobile telephones towards a terminal for accessing the internet with a myriad of software modules that can be customized according to the users' needs (Thun & Sturgeon, 2019). The Google/Android and Apple iOS platforms have emerged as the medium, through which external developers can contribute apps and through which they can be distributed to consumers with the effect of permanently expanding the range of the product's functions. In both cases, the digital transformation of the product has changed the rules of the game. Cell phone producers cannot exist without integrating operating systems and software ecosystems into their products, which

This work was supported by the Hans-Böckler-Foundation (research cluster "Economy of the Future", project 2019–505–3).

they cannot do by innovating on their own behalf. The capabilities to design and produce the physical product have become secondary to controlling software elements in product competition. Product platforms like Android or Apple iOS integrate the decentralized production of software and they constitute the hubs of ecosystems. This puts them in a position to also set the rules of the game. Hardware producers either manage to align themselves to this system by establishing own platform ecosystems (as Apple did) or tying themselves to the Android infrastructure. Either way, a growing amount of revenue in the business is generated through the distribution and use of software.

The emergence of the Internet of Things, i.e. the possibility to connect physical objects with the cloud, through which data and software can be continuously exchanged, broadens the prospect of sectoral transformation through the emergence of product platforms. The case of Tesla in the automotive industry is indicative of this. The company's core competence lies not in engineering but in software development (Boes & Ziegler, 2021). By connecting the car to the internet and integrating the control elements of each component through an operating system, Tesla is pioneering a cybernetic mode of innovation, in which product properties can be regularly improved through system updates – just as we are used to with regular computer software. At the same time, the software elements can be continuously improved through product life-cycle data. In particular, the data that is recorded from millions of rides can be used to improve the functions of autonomous driving (see figure 1).

Figure 1: Product platform in the automotive industry



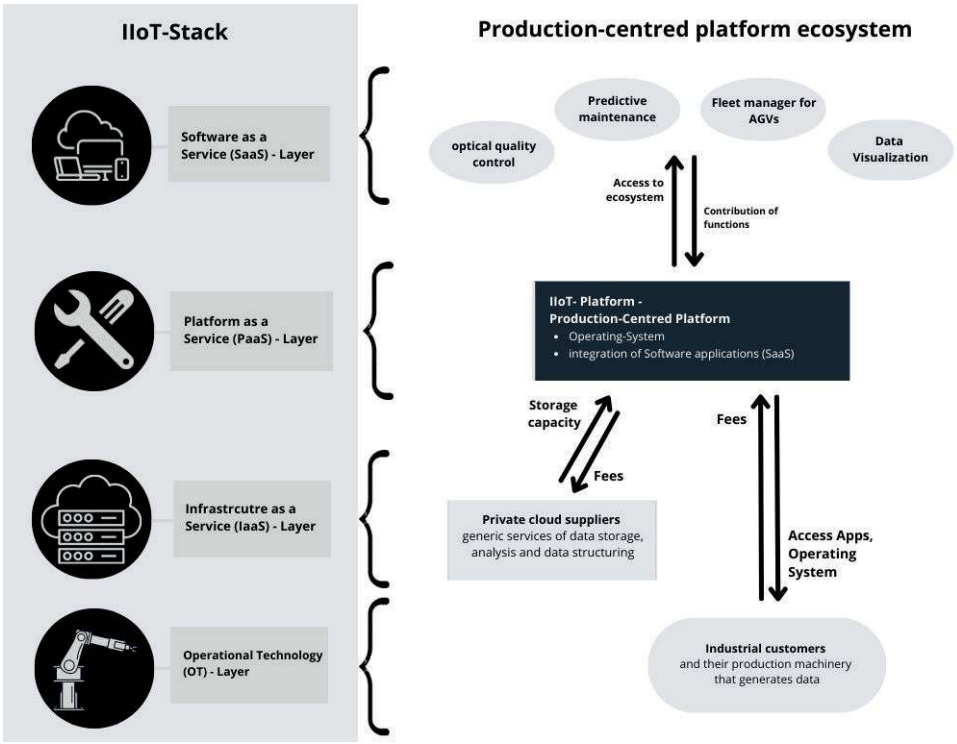
Not every sector will be exhibited to radical changes of this kind. The degree to which product markets are transformed depends on the possibilities to exploit life-cycle data and software in order to achieve qualitative improvements in product properties. This might be more apt in the case of autonomous driving than in the production of chemical products, for instance. What is certain, how-

ever, is that software plays a more important role across the board. Tech companies that design their innovation processes and business models around software therefore become relevant challengers to the incumbents (Ziegler, 2022). Digital platforms are a core element for organizing their innovation processes and software distribution.

Production-centred platforms: facilitators of Industry 4.0

Another type of platform is the so-called industrial internet of things (IIoT) platforms that take on a role as operating systems of (digitalized) industrial production (see figure 2). These platforms are used to improve production processes. The proliferation of the IoT in industrial production is linked to investment in "Industry 4.0" applications. By collecting data from production processes and using it in order to continuously adjust operations, manufacturers can explore new possibilities of enhancing productivity. Examples are applications for automated production planning and scheduling, the predictive maintenance of equipment based on AI analyses of machine use, and software to control fleets of automated guided vehicles (AGVs) in logistics. The precondition for this is that data from machines and control software are integrated at a common data layer and connected through the cloud. As with regular software applications, this requires an operating system, through which software can be accessed and run (Butollo & Schneidemesser, 2021a).

Figure 2: Procuction-centred IIoT platform



Industrial internet platforms based in Germany, such as Siemens Mindsphere, Adamos or Bosch IoT Suite, are offering an environment of modularized software components, from which industrial customers can source those software

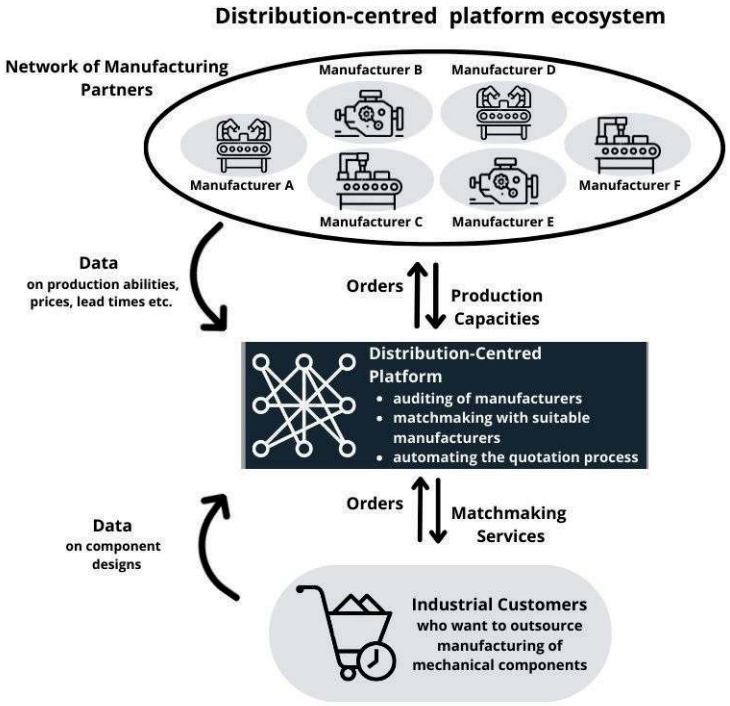
packages that match their needs. This is a form of industrial software distribution that is consciously designed according to the Android model. Potentially, this puts these platforms in an equally powerful position. They can integrate third-party apps into their ecosystem. By relying on the creativity and skills of thousands of external app developers, they can organize more dynamic innovation processes than traditional providers of industrial software that primarily relied on the in-house innovation of entire software packages. By charging fees for their services, they can also benefit from the distribution of software and retrieve a share of the productivity gains from their industrial customers. Finally, they occupy a strategic position in industrial value chains, as they might be able to access strategically important data on production processes that is needed to develop and train AI-based software. As in the consumer-oriented internet, sufficiently powerful platforms could benefit from network effects and become the gateway to industrial software, without which no enterprise of the future can operate.

There are, in other words, reasons for concern that industrial internet platforms (and cloud infrastructure providers such as Amazon Web Services) could become very powerful players or even reap most of the productivity gains from digitalization. However, there are signs that industrial internet platforms cannot become dominant quite so easily (Butollo & Schneidemesser, 2021a). First, industrial companies are much more reluctant to share their data with platform companies than private internet users. The platforms must guarantee that the data stays with the customers and this way there is no easy way to exploit the aggregated data across firms for innovation purposes. Second, because data cannot be pooled easily, network effects are limited. The value of a platform does not automatically rise with the number of industrial customers. More importantly for industrial customers than using a big platform is the availability of software applications that match their specific needs and that can be customized. The implementation of industrial software requires complicated processes of adaptation and interactions between software providers and their customers. This leaves space for specialized service providers that can circumvent platforms or bargain for attractive deals with them. Both aspects mean that platforms are not in a superior bargaining position vis-à-vis software providers and their customers. They act rather as service providers than the new masters of the industrial universe. However, that might be a completely different ball game once Industry 4.0, today still more of a promise than a reality, actually takes off.

Distribution-centred platforms: E-commerce in industrial value chains

Distribution-centred platforms that replicate approaches from e-commerce in industrial supply chains can potentially have transformative effects on industrial organization. They still play a marginal role in today's supply chain management but they are expanding their reach in industries that are characterized by predominantly small-scale producers that deliver highly-customized products. Platforms, such as US-based Xometry, Netherlands-based Hubs or German start-ups Spanflug, Facturee and LaserHub, are transaction platforms that focus on matchmaking between industrial customers and small-scale suppliers. In China, similar approaches are pursued by Alibaba ("Tao factory") and Pingduoduo in the garment and light industries (Butollo & Schneidemesser 2022).

Figure 3: Distribution-centred manufacturing platform



The business models of these platforms operate as follows (see figure 3): the platforms curate a network of suppliers of industrial components with diverse traits. Industrial customers can place orders with the platforms – often for small batches of customized products – and upload drawings and specifications of the desired parts. The platforms then match these requests with suitable suppliers that deliver the desired components. Often advanced digital technologies are applied in order to support manufacturability (check drawings, feasibility) and to calculate a suitable price range.

These decentralized production networks allow industrial customers to flexibly source customized products, while reducing the transaction costs involved in finding suitable suppliers. So far, these practices are mainly applicable where firms need to source a high mix of products in low quantities, for instance in prototyping or the production of fashion items. However, it could well be expanded to larger product batches and more complicated products in the future. Decentralized production networks mediated through digital platforms could thus achieve what the Industry 4.0 narrative promises: the highly-efficient production of customized products. Yet it does not require engineering-heavy (and expensive) “smart factories” of the Industry 4.0 kind. Flexibility is not achieved through highly-sophisticated production processes, but through matchmaking by platforms that source from a diverse supply base (Butollo & Schneidemesser, 2021b).

The effects on manufacturers are ambivalent. Small-scale producers that lack technological capabilities can gain additional contracts via platforms, expand their business and even tap into overseas markets that were hitherto difficult to access. Yet, they are also subject to increased competitive pressures, as the platforms (just like in business to consumer (B2C) e-commerce) facilitate price transparency. In small-scale industries, that often relied on local business relationships, this could also lead to a further globalization of the supply chains and producers

in high-wage countries could increasingly be challenged by cheaper firms in Asia, Eastern Europe, North Africa or Latin America (that may certainly benefit). Just like in B2C e-commerce, some vendors may benefit from new opportunities, and a reshuffling in these industries is likely. Independent of which producers will win and which will lose, platforms will prospectively become the main beneficiaries. Network effects apply, as those platforms with the largest and most diverse supply base can offer more attractive deals to their customers. Platforms can also record data on transaction processes and, in some cases, even the valuable product designs that are uploaded in the order process. Manufacturers, on the other hand, might lose direct contact to industrial customers, including the involved learning processes and stable business relationships.

Policy recommendations: industrial policies for the digital age and platform alternatives

These examples of three platform types represent different avenues of a digital transformation of industries. They highlight that substantive changes to the present industrial landscape not only stem from modifications in production technology, such as robotics or AI-based automation, but are rooted in systemic changes brought about by different modes of innovation, organization and transaction, integrated through digital platforms. The examples also show that change is often not linear in terms of a steady evolution of existing production technologies (which is, despite its revolutionary imagery, the basic assumption of "Industry 4.0"), but needs to be conceptualized as sectoral change, in which tech companies challenge the incumbents.

Since these transformations will have important consequences for economic development, employment, and social compromises worldwide, it is important that policymakers proactively shape these developments. This involves the following aspects in particular:

1. Industrial companies, trade unions and policymakers need an understanding that the digital transformation of industry is not limited to an evolution of production equipment, such as robotics, digital assistance systems or 3D printing, but involves systemic changes as well. Practitioners need to understand the scope of changes at the level of business models and in particular the role of platforms as a critical infrastructure of the digital age. New possibilities brought about by the IoT need to be acknowledged and enter the strategic thinking of management. At the same time, trade unions, companies and policy makers need to apply foresight mechanisms in order to detect possible changes at the sectoral level and to develop strategic responses.

2. An understanding of the central role of the IoT and platforms for the transformation of industrial sectors needs to result in policies to nurture the required skills. Yet, this is mainly not about investing in generic AI skills and Silicon Valley-type start-up strategies from scratch, but understanding the relationship between tech knowledge and business models with the established economic structure (Breznitz 2021). Key to applying advanced skills in AI and the IoT is to link generic knowledge with the domain-specific knowledge and skills from existing practices. This requires learning processes at the level of clusters and

between firms, but is also a bottom-up process: enterprises need to establish cross-functional interactions between employees with different fields of expertise and strengthen the capacities of their employees to engage with the possibilities of new digital technologies.

3. The relationship between platform business models and traditional industries involves questions of power and governance. The insights from the contemporary debates on platform regulation in the consumer-oriented internet need to be related to the industrial internet as well. The dual regulatory effort at the EU level around the Digital Services Act and the Digital Markets Act addresses political measures that prevent platforms from using their infrastructural power over cost to the detriment of other market participants, for example by enabling data portability between platforms (to avoid one-sided dependencies) and to prevent platform companies using the information on transactions for their own business interests. Such regulatory efforts, that address the role of platforms as de-facto infrastructures and seek to mitigate the unfair accumulation of power through the monopolization of data and information asymmetries in transaction processes, are equally relevant to industry as well. Policymakers need to address these questions at an early stage at the supra-national and national level in order to set fair rules of the game right from the start.

4. Digital platforms can be instrumental for a more rational and efficient design of production and distribution if public interest can be injected into their DNA. For instance, data-based transparency over the way products are used and discarded can support visionary innovation projects. Data on production processes can help to improve production processes and to reduce waste, especially if this data could be shared with all producers. Matchmaking between buyers and suppliers could lead to more efficient supply chain management and waste reduction. Private monopolies of these functions, however, create new power asymmetries and are not aligned with societal goals but with the goal of making money. There is an international discourse on platform alternatives that is relevant for the industrial field as well. Political options of multi-agent platforms, platform cooperatives and public platforms should be explored as instruments of improving the industrial structure and making the potential benefits of digitalization available for all. Often such non-profit initiatives might even be a precondition of getting some visionary approaches off the ground, especially if they involve secure and fair approaches to data sharing. Crucially, the goal of curbing the power of platform monopolies and finding cooperative approaches to reaping digitalization's benefits in the industrial realm needs to be linked to the goal of a comprehensive socio-ecological transformation: platforms should not be a vehicle for expanding the quest for profit and productivity beyond planetary boundaries, but can be one important governance element of a sound societal transformation.

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