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COMPENDIUM INDUSTRY 4.0

How Digital Platforms Change the Economy and What it Means for Policy-Makers

Short Summary, English version

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Introduction

We are in the middle of a process of fundamental change. Digital technologies affect every existing business model – industry's fourth revolution is set to begin. The compendium's second volume attempts to grapple with this transformation in order to determine the best economic and political decisions to be made.

We do this by approaching Industry 4.0 as a process of platformization of value chains, triggered by digital technologies. Digital transformation is not merely making products »smarter«, it is also changing the market structure to one essentially defined by digital platforms. These platforms are now virtual locations where services are offered based on accumulated data, and where added value is being redistributed.

However, not every digitalization and platformization process is a "disruptive" displacement of existing products. Platformization is rather a process of shifting, regrouping and redistributing added value through new business models. This is happening rapidly in some industries. Most susceptible are markets in the end-user sector. The »consumer Internet« has already transformed content markets like music and video, retail, and tourism.

B2B markets require more time. Hardware plays a key role in traditional industry sectors like automotive, aerospace, or farming equipment. As the compendium will show, the complexity of hardware can create market entry barriers. Nevertheless, platformization is real – it *is* an industrial revolution.

It is key to adapt rapidly to these new value chains. The losers in digital transformation will be corporations too focused on existing business models to adapt quickly to the new environment. Political decision-makers need to be aware of economic platformization in order to make informed decisions.

Part 1 of the compendium explains the mechanisms of digital platforms. Part 2 provides short overviews of the transformation in five sectors: automotive, aviation, smart home, banking and farming. Part 3 discusses political aspects of a platform economy.

1. What are Digital Platforms?

Digital platforms can be defined as products, services and technologies that serve as the basis for offering complementary products, services and technologies. They are structured as two-sided markets.

1.1 Structural Elements

Digital Platforms consist of two parts: [i]

— A stable **core** which defines the technical and economic rules of the platform. The stabilization and reutilization of core components results in scale effects which reduce the cost of the various products offered through the second part of the platform – the periphery.

— A heterogeneous "**periphery**", with a high rate of development. In the App Store, this refers to the app developers and their services. The companies within the periphery form a sort of **platform ecosystem**. They do not necessarily enter into business relationships with each other, but they are often independent participants on the same platform.

As for the parties involved, there are four to distinguish amongst:

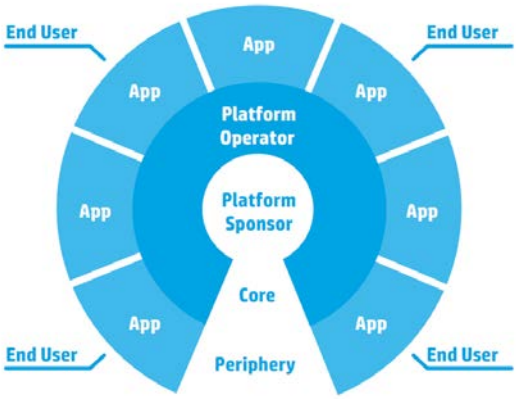
— **The end-user** is the actual customers of the platform, who uses it for his own purposes – be it the Smartphone user or a company using one of these platforms for its business operations.

— **The application developers (periphery)**: They develop programs and services on the basis of technological platforms.

— **The platform operator,** who runs a digital platform. The operator defines the rules and the governance of a platform – both technically, legally, and from a business model point of view. A platform operator can substantially influence the platform's technological developments by defining standards, specifying interfaces (APIs) and

controlling access to important information.[ii]

— **The platform sponsor,** who owns the intellectual property of the digital platform. A platform sponsor can also be the operator of a platform, but not necessarily so.



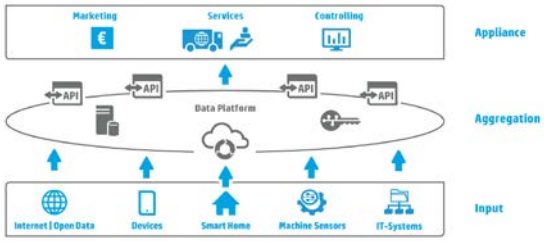
Graph 1: Structure of a digital platform

Though this can potentially give the platform leader a dominant role, a platform leader needs to consider more than just his narrow interests. A platform only generates the desired network effects if it remains attractive for the periphery and the end-user and does not experience an exodus to competing platforms.

The importance of the ecosystem for a digital platform cannot be overestimated. The periphery provides the benefits for end-consumers. Without a functioning ecosystem platforms dry up and become insignificant. This makes the role of the platform operator, the »healthcare manager« of the ecosystem[iii] who balances the various interests, a particularly interesting one.

1.2 Technology

Digital platforms rely on heterogeneous data input. Open data from the Internet (e.g. weather data) will be connected to data from devices (like location services transferred via mobile phone), machine data (measured and transferred via sensors) and data from installed systems or records (e.g. CRM or ERP software). This data will then be aggregated and made available for data processing according to a certain set of rules (e.g. APIs and security regulations). Data aggregation takes place in the core and data processing in the periphery.



Graph 2: Technology elements of digital platforms

1.3 Open vs. Closed Platforms

Chapter 1.2 mentioned that operators and owners of platforms could potentially exercise a great deal of power over the users of a platform. However, this is not necessarily the case.

It is key to understand that with regard to the distribution of decision-making power and, ultimately, value distribution, platforms can significantly differ in their relationship between core and periphery.

Take for example PC and mobile phone operating systems, which are very well-established platform business models. Graph 3 analyzes the distribution of power between core and periphery – the more open a platform, the more decision-making power is delegated to the periphery. Conversely, the more closed a digital platform is, the more power is concentrated at its core.

	Linux	Windows	Mac OS	iOS
Demand Side (User)	Open	Open	Open	Open
Supply Side (App Developer)	Open	Open	Open	Closed
Platform Operator (Hardware/OS)	Open	Open	Closed	Closed
Platform Sponsor (Design/IP)	Open	Closed	Closed	Closed

Graph 3: Open and Closed Platforms

Which platform is best for a platform builder, application developer, or end-user? It is essential to understand that there is no general “best” platform model. While open platforms provide a lot of autonomy to application and end-users, this often comes with some disadvantages. The dilemma can best be described as »control versus dissemination«. A very open platform can

promote rapid distribution. However, the price is a loss of control over its development, which could lead to quality issues.[iv]

Furthermore, we can assume that there is a U-shaped connection between openness and innovativeness of the platform. Too closed and a platform is not really absorbed by the ecosystem. Too open and its processes may become slow making it less of an incentive for innovation investments.[v]

1.4 Two-Sided Markets

On top of the abovementioned structural definition, we suggest adding another player, focused on business models, to the platform definition. Platform operators can tap into two different profit sources: the periphery (e.g. by charging for licenses to develop applications for the platform) and end-consumers.[vi] In such a triangular relationship, "asymmetric pricing models" are possible – i.e. one side of the triangle is charged a higher price in order to lower prices for the other side, mainly due to different levels of price elasticity. A market structured in this way is called a "**two-sided market**".[vii]

In our understanding, every digital platform is structured as a two-sided markets. Making the two-sided market structure a mandatory criteria has several advantages. Foremost, it distinguishes commercial digital platforms from other platforms like Wikipedia.

1.5 Drivers of Platformization

Why are more and more markets "platformized"?

— **First**, they are a very effective means for reducing transaction costs and lowering market entry barriers. Through a platform, a one-man operation can attract an audience of millions with limited marketing efforts. Think of a developer of a mobile phone app, who can reach his customers by simply uploading it to an app store.

— **Second**, digital platforms are subject to strong network effects. So long as all conditions remain unchanged, the usefulness of a platform for its unique participants and end-users increases with each additional user.[viii]

— **Third**, platforms can increase the flexibility of production systems. The stabilization and reusability of core components leads to scale effects reducing costs for variety made available by the periphery. This allows for the separation between a core consisting of relatively stable platform technologies and markedly more dynamic periphery technologies.[ix] In the context of Industry 4.0, which aims at economizing "batch size 1" production, such increased flexibility is key.

1.6 Platform Dynamics

How do platforms arise and how will they develop as they age and mature? Start-ups driving their own platforms make the most headlines. Such "Platform Entrepreneurs" (e.g. AirBnB, Uber, Amazon, Facebook) can indeed play a crucial role in platformization processes.

However, there are many platforms which are driven by consortia – a cooperation between various companies aimed at creating a common digital platform. Though entrepreneurs can react more quickly and organize a platform more stringently, a consortium is particularly strong when a market has too many unknown and complex variables for a single actor to surmount.

A common phenomenon is platform consortia trying to establish a more open platform in response to a successful attempt to create a closed one by a platform entrepreneur.

Examples include e-Readers (Tolino as a response to Amazon's Kindle), smart home (Qivicon as a response to Google's Nest), or connected car (the acquisition of Here by car companies as a response to Google Maps). Graph 4 shows different drivers and dynamics of platformization.

Driver Dynamic	Platform Entrepreneur	Platform Consortium
Evolution	Type 1	Type 2
Revolution	Type 3	Type 4

Graph 4: Drivers and Dynamics of Platformization

2. Platformization in Practice

Chapter 1 provides an analytical framework, which can help to understand platformization processes. An analysis of five different sectors of the economy shows that while platformization is a megatrend, it is not a uniform development. Rather, existing market conditions such as market structures, the level of entry barriers, and regulation play an important role.

2.1 Example 1: Automotive Industry

Automobile manufacturers (Original Equipment Manufacturer – OEM) are transitioning from hardware manufacturers to infrastructure generators and integrated mobility service providers.[x] The industry boundaries are blurring, added value chains are being reconfigured, new competitors are entering the market. Whereas the automobile was once an isolated capsule, it is now becoming an integral part of a comprehensive ecosystem - an element of the new »All-IP world«.

Already today, vehicles have the computing capacity of 20 PCs and process up to 25GB of data per driving hour. The embedded software of a Mercedes S-Class currently contains 100 million lines of code, a Boeing 787 in comparison has 14 million.[xi] In 1978, the percentage of electronics in an automobile accounted for 5 percent of total costs. In 2005, 15 percent. Today it is around 40 percent. Data is collected from 60 to 100 sensors – a figure that will double in the next few years. On top of that will be data from up to eight cameras – depending on the type of vehicle and equipment. All of this would make cars the ultimate mobile end device.[xii] Vehicles not only generate gigantic amounts of data (a predicted 545 petabytes in 2020)[xiii], they will also consume it.

Whoever wants to offer personalized and contextual services will have to connect users, not devices. That is why OEMs are currently investing in systems that permit individual user identification and thus a personalized vehicle. The car should be integrated into the daily routine, and the daily routine into the car. A BMW digitalization manager emphasized that »95 percent of the digital user experience takes place outside of the car, so customers will no longer accept if this experience does not continue or even become enhanced in their cars«.[xiv] This is even more essential now that increased automation is turning cars into a »third place« after homes and workspaces.

The next phase will see »users« as »consumers« along the »**customer journey**«. The connected customer will have access to all services using a uniform customer ID. The product is no longer the added value but rather a key to the connected brand and service world.

The increased amount of software in vehicles makes it possible to apply Internet technologies: IP networks, big data algorithms and digital platforms. Platform business models offer the greatest disruption potential. When Google founded the Open Automotive Alliance to develop Android Auto, the aim was to become the software platform on which OEMs based their hardware giving it exclusive monetization rights to data-based advertising.

Whoever is in control of the platform has access to the most important data sources.

As connectivity is a means of breaking from the pack, premium OEMs have been busy with technology developments for the past few years. **However, the first generation of OEM platforms will hardly be able to withstand the competition from Internet companies long-term.**

In order to hold their ground against the powerful network effects of Internet companies, the automotive industry will have to embrace the platform competition to avoid being cut off from this massive data access and its monetization potential.[xv] This will not be accomplished by one manufacturer alone, but will require a global alliance.

This was the impetus for Daimler, BMW and Audi to join forces in a bidding war against Uber, Google, Apple and Facebook for the

Nokia map service provider Here. Maps are the central technology for autonomous vehicles and digital in-car services, or rather extremely precise real-time maps for navigation and advertising.[xvi] In acquiring Here, the three automobile manufacturers have made true on their goal of designing an open platform for the automotive industry and seeking out additional partners.[xvii]

2.2 Example 2: Aviation

The airline industry's platform challenges are centered around data. The open exchange of connected and meta-information in the production chain is fundamental and must be guaranteed by everyone involved in order to promote synergies amongst all players.

This data is also valuable beyond the production chain. It has the potential to improve the »customer journey« by offering customized services. There is also the potential for increased safety. Developments made through Industry 4.0 can replace statistical conjecture about the current state of aircraft parts with concrete data eliminating the need for costly and unnecessary safety checks.

The collection of data from numerous sources along the »customer journey« is nothing new: from online booking and check-in to baggage drop-off, security check and duty-free shopping to the use of onboard Internet. It is even possible to link social media accounts with individual flight data to see if friends or acquaintances are on board or in the vicinity. On top of that is the data from frequent flyer accounts, and then technical performance data from airplane sensors connected to everything from turbine components to onboard refrigerators.

The aggregation of technical operational data helps predict problems that might occur on an airplane. This in turn makes it possible to identify solutions for potential issues in order to avoid delays and cancellations. Passenger data and frequent flyer preferences, on the other hand, are mainly used by marketing departments to deliver tailored advertising and offers to its customers.

However, the **penetrability of data remains a formidable challenge**. All of this data is collected in silos within specific business segments where it is independently analyzed and used to improve performance in that particular segment.

If traditional airlines want to survive they must monetize their potential with innovative concepts and correlate accumulated data across all operational sectors. This is a big challenge for traditional airlines as they have complicated IT structures comprised of various data structures making it tricky to find a starting point and connectivity between the vast amounts of data.

The entire situation is being further complicated by new players like Google. Intelligent solutions like GoogleFlights, which offer comfortable booking, are already in place, and they are using collected data extensively. Airlines have the capacity to positively affect the customer journey, but this will involve innovations that demand more acceptance and willingness on the part of customers to deliver valuable data.

The duopolistic nature of the industry provides yet another complication. Innovation is initiated almost exclusively by Boeing and Airbus. As customers of these OEMs, the airlines can influence the development of advances, but they have to align with both OEMs. Grassroots level innovation is stymied by this kind of market constellation.[xviii] If market conditions do not change, innovation will be one-sided and insufficiently implemented in the process chain.

2.3 Example 3: Smart Home

The concept of home networking is not new – the end of the 80s saw the first projects and products that could be operated by (remote) control (heating, washing machines, electric ovens).

Changes in technology and market structures have resulted in a new ecosystem for home networking, which consists of different actors from diverse sectors: smart homes (providing hardware and wireless solutions); brown goods (manufacturers of consumer electronic

like televisions and MP3 players); white goods (manufacturers of electric household devices like refrigerators); the IT industry (delivering PC components like desktops and laptops); media/gaming providers (like television broadcasters, game manufacturers and new media services); telecommunication/cable network providers (providing the communication infrastructure and Internet access); software providers (providing applications and supervisory bodies for home networking systems, media servers and user interfaces); healthcare/AAL (providing health services like remote monitoring and diagnosis of patients).

Traditional providers of home automation have reacted predictably to new challenges with an evolutionary strategy. They have started off by offering interfaces bridging old and new, so-called IP gateways that provide access to the underlying BUS technology from the TCP/IP network.

Providers from the IT sector like Google and Apple are attempting to establish their existing Smartphone platforms as crucial elements of home networking by offering direct interfaces in their operating systems.

Components for real world devices could then be developed to connect directly with the platform provider and communicate with user devices using Near Field Communication (NFC, WiFi) or the cloud. Smartphones are also the central interactive interface for the user. They serve as a remote control for the entire home network.

2.4 Example 4: Banking

Banks are not immune to digital structural shifts either. The first reforms of traditional banks are already evident. However, alignment with the digital age is only really happening on the customer added-value frontend within individual business sectors like online banking. Banks will have to start investing more in digital technologies. The question is how.

Having an appropriate digitalization strategy is an integral part of success. The new market players from the non-banking sector understand the language of the Internet perfectly.

It is in fact mainly the marginally regulated digital platform providers and FinTech start-ups that are penetrating new markets.

Banks are in possession of immensely valuable data with huge potential for addressing customer needs. Using the same data evaluation strategies as huge digital platforms, they can offer their clients a number of valuable additional financial services.

However, it will only be possible to maximize customer value and design leaner and more efficient internal infrastructures with intelligent data analysis. This will require cognitive self-learning systems that will make it possible to recognize, for example, helpful correlations in customer actions. Once customer clusters with similar behavior and preferences have been identified, new and unpredicted needs can be addressed using previous habits.

The implementation of cognitive self-learning systems can also be set in motion in internal segments like regulatory requirements in risk management. For example, legal requirements can be automated and their effects and application reviewed. Subsequently the automated application of new or altered regulatory provisions can be executed in different business segments.[xix] The use of self-learning systems will guarantee that results consistently improve and that every interaction will become more intelligent.

However, before banks can exploit the steady increase of data and modern algorithm-based analysis methods, they must reconcile the numerous different types of available data and make them machine-readable. At the same time, they must keep in mind that regulation forbids them from correlating personal customer data from one business sector with data from another in order to acquire possible insight from the new data set.

So how do banks remain competitive with this barrier? Maintaining a competitive edge depends on how quickly and flexibly traditional

banks respond to the challenges presented by technological developments, or more specifically the innovations of the digital structure shift.

Banks have to shift their business model to a platform serving as the basis for their own digital ecosystem. In order to minimize the repercussions of possible cutthroat competition, these digital ecosystems have to offer unique digital business services.

Given the substantial informational edge some existing digital ecosystems have, the complex demands of modern algorithm-based banking and the increasing cost and margin pressures caused by the changing competitive environment, one realistic scenario for future development is for key players to enter more readily into strategic alliances with suitable program interfaces in the added value network or with third-party providers. Future alliances in digital transaction and mobile finance service will most likely take place in the international arena. In the future, the knowledge and wealth of experience of individual players in isolated markets will not be relevant, but rather the intelligent connection between diverse infrastructures.

Regulation will be necessary to create a fair and balanced regulatory framework. The new competitors emerging from the non-banking sector are not subject to the legislative challenges that hold banks back. Their head start has left banks struggling to catch up. Only a regulatory structure can eliminate this disadvantage facing traditional banks. So long as banks ensure that personal data not be monetized via third parties or misused for non-business purposes, they should be permitted to carry out operational analysis on available data with the permission of their clients.

2.5 Example 5: Farming

Added value in the agrarian sector faces a unique set of constraints compared to other economic sectors. The majority of the work processes and production sites are on farmland and the entire economic success must be realized in a short harvest period. And the harvest, processing and non-parallel further processing of the harvested goods have high transport and storage demands. The complexity and division of labor between farmers and contractors has complicated the process of digitalization.

However, the past few years have seen the implementation of process-support and optimization technology in many areas. Productivity increases have shown how important technology is to farming.

Industry specific platformization processes have been popping up in agricultural technology, networking and data management and mobile technologies.

Assistance systems have made partially automated functions possible, providing relief for machine operators. Another current trend is real-time cooperation between operational agricultural machinery. Synergies from platform implementation in the automotive industry have been copied for agricultural vehicles.

Hurdles are also being overcome quickly. As not all devices are produced by the same manufacturers, many tractors were initially forced to mount control units from various manufacturers in their cockpits. The introduction of the ISOBUS[xx] and cross-vendor units solved this dilemma. There has even been an increase in the use of autonomous machines not pulled by tractors for harvesting and transport. And larger agricultural machinery producers have been extending their product line to include their own management software.

Increased networking has improved data management. This has been most evident in work processes and the relationship with the foodstuffs industry. Product development and resource usage is seamlessly documented in industry-specific Farm Management Systems (FMS) for traceability and process optimization. Since work processes cannot be mapped with standard software like the automotive industry, FMS makes it possible to acquire data in real-time from agriculture machinery. Upon leaving the field, an account and partial billing can be sent by fax or FMS directly to the client. A more detailed analysis can be sent from the

farm using WLAN making modern big data applications a possibility.

The second generation of FMS has seen the use of SaaS (software as a service, mainly via web browser) models. They include a number of import, planning and management functions. Interestingly, the trend in data networking has been more open and less manufacturer dependent.

Advances in ICT hold great potential for the optimization of work processes in agriculture. The significance of precision farming prior to the harvest will increase, not least of all for ecological reasons.

During the harvest and in downstream transport logistics, platforms will be implemented to support both the collaborative and allocated process character of the industry.

3. Political Aspects

3.1 Balancing Competition in the Age of Platformization

The question of the market power of digital platforms and the potential dependency on large IT companies has been a topic of political concern over the past few months. Differing notions on the mechanisms of market power, contestability and the role of network effects, and the distinction between the monopolistic attributes of closed vs. open platforms has made the discussion about regulation much more complicated.

However, **the most important thing to bear in mind is that the aim and purpose of competition regulation is not to serve as an industrial policy instrument.**

Competition regulation is only concerned with the question of whether or not market dominance exists and if it is being abused. How can this be determined?

- **Market Power Accumulation Mechanisms:** High fixed costs for setting up the platform software go hand in hand with marginal additional costs for setting up the offer of individual services. This can lead to temporarily strong market positions of individual platform providers. Positive synergies also enable a transfer of market position to other markets as is the case with video or shopping offers, browsers, (mobile) payment platforms, etc. The use of personal data also gives Internet platforms a competitive advantage over other providers.
- **Contestability:** Can platforms be replaced by more innovative offers? This appears to be the case. They are not resistant to network effects.[xxi] The competition between platforms and market concentration is in fact strongly affected by network effects, the risk of overload, differentiation between platforms and the potential for users to have multiple connections (multihoming). The phenomenon is such that politicians overestimate the stability of platforms and their threat to competition regulation and underestimate their innovative drive.

- **Differentiation between platforms**: The operator of an open platform does not exercise any control over the periphery, the operator of a closed one does. This makes closed platforms much more interesting from the perspective of competition regulation. Does the platform suppress periphery providers and block the development of competing platforms?

It is evident that the ICT industry must be considered across the entire value-added chain. When defining operational recommendations from the perspective of antitrust regulations, all these often contradicting aspects must be taken into account and carefully weighed.

Competition policy can smooth the way by creating a framework for the disclosure of interfaces and hindering abusive exploitation of market dominance along the ICT value-added chain. However, economic policy should be reserved when it comes to intervening directly. The approach should be a horizontal industrial policy one that promotes increased sensibility, transparency, interoperability and competition.

3.2 Platform Liability

Platform operators are the »middle men« of the 21st century. This puts them in the precarious position of operating with third parties that may use their platforms in illegal transactions. Over the years, a shift in regulation policies has seen a trend towards a significantly increased liability of platforms. Where are these regulations headed and what might the consequences of overregulation be?

In the past, regulations and jurisdiction have been platform-friendly – creating a **liability privilege for platforms**. A "notice and take-down" guideline stated that a provider was only required to take action once notified of infringements. These initial liability privileges were mainly oriented towards access providers, who were exempt from any responsibility, and host providers, who were subject to »notice and take-down«.

When eBay first appeared on the scene as a large sales platform, a number of new liability questions arose. Initially, jurisdiction and legal experts quickly agreed that platforms like eBay should receive the same liability privileges as host providers. In the 2000s, as eBay was beset with a number of product piracy cases by luxury labels, it faithfully adhered to the »notice and take-down« policy. If eBay received information about a counterfeit brand item, it was immediately deleted.

However, a number of manufacturers were not satisfied with just the removal. They demanded the names of the providers. When eBay refused citing data protection law, the manufacturers backtracked demanding omission saying eBay ought to commit itself to blocking counterfeit luxury goods and other brand items.

The rise of the Internet in 2004 ushered in a long period of legal uncertainty. When platform operators were made aware of legal violations, they could no longer just remove the disputed offers, texts, photos or videos from their pages.

They had to develop filter software and manual control mechanisms in order to meet their obligations to keep platforms clean. »Notice and take down« became »**notice and scan**«.[43]

Every violation that the platform operator was aware of was subject to duty of omission, inspection and auditing, regardless if it was an auction platform, discussion forum, rating portal, social network or search engine.

Today, the limitation of liability is further dwindling. Should a platform operator exhibit an "active role" with platform players, he too is liable. This is the case, for example, with eBay AdWord offers or advertisements. Should AdWords be activated, eBay is liable for trademark infringement whether it is aware of trademark violations or not. Another example is the sensational decision against Google Spain.[xxii] The European Court of Justice affirmed Google's responsibility for search results without even considering applicable liability privileges.

Digitalization has often been described as an uncontrollable development. The trend towards platformization has called this hypothesis into question. It may come as a surprise, but platformization might usher in a comeback for market regulation because is easier to regulate a platform than numerous small providers.

However, the trend towards overregulation could very likely put countries with strict regulation policies at a disadvantage, making them less flexible and adaptable to play in the first league of global Industry 4.0 platforms.

3.3 Changing Patterns of Consumer Protection Policies

The task of consumer policy is to mediate between consumer and provider interests. However, two-sided markets have given rise to the "prosumer". They are no longer simply consuming products and services, they are also producing them and offering them to other consumers. This has occurred through the democratization of the means of production, for example the programming of applications, the individualization of existing products and the voluntary disclosure of personal preferences for available products. The prosumer can influence product features and be included in manufacturing operations.

One advantage of digital platforms is the ability to **compare offers**. With little to no effort consumers can weigh up products, read consumer reviews and better assess a product's value for themselves.

Another advantage is **choice** itself. Product variety is scalable. Likewise the number of users that suppliers can reach using digital platforms is unlimited. On top of a wealth of options, individual desires of customers for personalized products are taken into account. Companies like Spreadshirt showcase their products on a digital production platform that allows for individualization.

The **connection to other end-users** is an additional advantage for consumers. The more users, the more attractive Internet market places and contact forums. The more people participating in a platform, the more value it has for individual consumers.

This network effect, however, may leave consumers feeling locked in. And it also makes them more susceptible to the concept of the »privacy bargain«. Meaning they are not directly paying for the use of the service, but they themselves are the products.

Where do consumer protectionists fit in to this model? How do they operate effectively in the digital world – be it as state institution, private association or consumer medium?

In order to guarantee a dynamic market and market regulation while considering consumer interests, competition is essential. When platforms enter into competition with their providers in the periphery, they can potentially position their own products more prominently. This makes platform providers more able to dominate markets and suppress competition. Such vertical integrations need to be closely monitored.

3.4 R&D Policy: To Fund or not to Fund?

The creation of platforms is a costly undertaking, and the question of funding is critical. However, public R&D funds are not suitable for resolving an innovation dilemma within a company. Considering the overarching strategic significance of digital platforms, the question remains: to what extent is a company willing to leave their construction to publicly funded projects that demand extensive transparency to the outside world?
What might a successful R&D policy look like?

First, we should acknowledge that the danger of overreach is always present. Government should resist the temptation to support certain platforms. It is not evident why the state should have more knowledge and strategic expertise of a topic as complex as digital platforms than the market players.

Government should, **secondly**, ensure a framework that is innovation-friendly. One thing is essential above all: do not seize on any protectionist measures for business models being challenged by digital platforms. This will only serve to stifle innovation. It is enticing to

succumb to this cry for protection in the face of too much disruption. The conflict between Airbnb and the hotel industry and the dispute between Uber and taxi commissions demonstrate how difficult the clash between platforms and pipelines can be. If a new, better service model infringes on existing law, one should not insist on maintaining the status quo by pointing out this fact. Instead, laws should be adjusted to make them relevant in the new age of digital platforms.

Third, platformization is an international phenomenon involving closely interlinked markets. We need to maintain an international perspective rather than develop a too narrowly defined national platform policy, especially with regard to standards.

Finally, direct subsidies should focus on creating test-beds. Such test beds could shed light on additional value and also serve as a starting point for other players to join.

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[i] cf. Carliss Baldwin | Jason Woodard (2010): The Architecture of Platforms: A Unified View. IN: Annabelle Gawer (ed.): Platforms, Markets, and Innovation. Cheltenham | Northampton. pgs. 19-44, here p. 19.

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[vii] cf. Jean-Charles Rochet | Jean Tirole (2005): Two-Sided Markets: A Progress Report.
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[viii] cf. Thomas Eisenmann | Geoffrey Parker | Marshall Van Alstyne (2006): Strategies for Two- Sided Markets. IN: Harvard Business Review, October 2006. pgs. 92-101. (http://mtm.uni-koeln.de/veranstaltungen-ws1112-hs-tuunainen-texteisenmann.pdf)

[ix] cf. Hirofumi Tatsumoto | Koichi Ogawa | Takahiro Fujimoto (2012): The Effect of Technological Platforms on the International Division of Labor. A Case Study of Intel's Platform Business in the PC Industry. IN: Annabelle Gawer (ed.): Platforms, Markets, and Innovation. Cheltenham | Northampton. pgs. 345-369, here p. 347.

[x] cf. Jörg Firnkorn | Martin Müller (2012): Selling Mobility instead of Cars. New Business Strategies of Automakers and the Impact on Private Vehicle Holding. IN: Business Strategy and the Environment 21, 4. pgs. 264-280.

[xi] cf. Robert Charette (2009): This Car Runs on Code. IN: IEEE Spectrum
(http://spectrum.ieee.org/transportation/systems/this-car-runs-on-code)

[xii] Tim Bradshaw (2015): Apple eyes the car as 'ultimate mobile device', FT.com, 27 May 2015
(http://www.ft.com/intl/cms/s/2/a519aa42-04b4-11e5-adaf-00144feabdc0.html#axzz3gQryutmh)

[xiii] Mark Fulthorpe (2015): Five Critical Challenges Facing the Automotive Industry – A Guide for Strategic Planners, IHS, July 2015.

[xiv] Interview with Joachim Becker IN: Süddeutsche Zeitung, 18 July 2015 (http://www.sueddeutsche.de/auto/it-in-der-autotechnik-wie-das-auto-zum-mobilen-endgeraet-wird-1.2567699)

[xv] Feng Zhu | Marco Iansiti (2012): Entry into Platform-Based Markets. IN: Strategic Management Journal 33. 2012. pgs. 88-106; Carmelo Cennamo | Juan Santalo (2013): Platform Competition: Strategic Trade-offs in Platform Markets. IN: Strategic Management Journal 33. pgs. 1331-1350.

[xvi] cf. William Boston - Ilka Kopplin (2015): German Car Makers Preparing Formal Bid for Nokia's Here Map Service
With China's Baidu. IN: The Wall Street Journal, 5 May 2015
(http://www.wsj.com/articles/german-car-makerspreparing-formal-bid-for-nokias-here-map-service-with-chinas-baidu-1430843087)

[xvii] cf. Thomas Fromm (2015): Kartendienst Here – Entscheidend für das Autofahren von morgen. (Map Service Here – Decisive for the Future Mobility) IN: Süddeutsche Zeitung, 21 July 2015 (http://www.sueddeutsche.de/digital/nokia-kartendienst-audi-bmw-und-daimler-kaufenhere-1.2575678); supplier Bosch simultaneously announces an with TomTom Maps (formerly Tele Atlas) – a interesting strategic platform reconfiguration of added value activities in the competition against Google | Waze.

[xviii] Bruce McDaniel (2014): Entrepreneurship and Innovation. An Economic Approach. New York.

[xix] The FinTech start-up BANCALIS is working on a similar business model. cf. http://www.bancalis.de/.

[xx] cf. the ISO 11783 standard – »Tractors and machinery for agriculture and forestry - Serial control and communications data network« (http://www.iso.org).

[xxi] c.f. quod vide

[xxii] ECJ from 13 May2015, C -131 | 12.