ifo STUDY

Industrial digital economy – B2B platforms

ifo INSTITUT
Leibniz-Institut für Wirtschaftsforschung
an der Universität München e.V.

A study commissioned by:
BDI
The Voice of German Industry

Industrial digital economy – B2B platforms

The present study was commissioned by the Federation of German Industries (BDI). Our special thanks go to the interview partners, the numerous experts for their constructive contributions and especially to the sponsors of this study.

Study for the
BDI – Federation of German Industry
Breite Straße 29
10178 Berlin

Submitted by
ifo Zentrum für Industrieökonomik
und neue Technologien
Head Prof Dr Oliver Falck

and

ARC Econ GmbH
Managing Director Dr Johannes Koenen

Editors of the study
Prof Dr Oliver Falck
T.: +49(0)89-9224-1370
E-Mail: *falck@ifo.de*

Dr Johannes Koenen
T.: +49(0)176-81182350
E-Mail: *johannes.koenen@arc-econ.com*

Responsible for the translation
BDI – Federation of German Industry

Picture credits
P. 1: wEL2zPX3jDg | unsplash.com
P. 7: 243959675 © Artem | stock.adobe.com
P. 14: f3mHE2UH2zM | unsplash.com
P. 16: 244122205 © sittinan | stock.adobe.com
P. 21: 191020027 © zapp2photo | stock.adobe.com
P. 25: 270351322 © dusanpetkovic1 | stock.adobe.com
P. 35: 219100685 © ipopba | stock.adobe.com
P. 38: 1148820 | pexels.com

Design & Layout
www.man-design.net

Status: 09.07.202

Digital version
Simply scan the QR code with your smartphone
or tablet to open the digital version.

https://english.bdi.eu/publication/news/Industrial-digital-economy-B2B-platforms

Table of contents

List of figures

Executive Summary

In terms of growth and market position, B2C platforms („business to consumer", such as Facebook, Amazon or eBay) are a success model of the global digitalisation of the economy. B2C platforms have long since become part of everyday life for most individuals. Therefore, they have been the focus of public, scientific and political attention in the past. In contrast, digital platforms for companies (B2B - „business to business") are still in an early phase of development. For German industry, however, digital B2B platforms are of major importance. As intermediaries, they establish connections (e.g. networks or marketplaces) or offer an intelligent infrastructure for exchanging data and information (e.g. machinery and equipment). Thereby, they enable new value creation through user interactions – be it transactions on marketplaces or a data-based improvement in the efficiency of business processes.

In this study, we analysed three types of digital B2B platforms: 1) **marketplaces for goods and services**, 2) **marketplaces where data can be traded and exchanged**, and 3) **platforms in the context of the industrial Internet of Things** (IIoT platforms). These types of platforms offer companies access to digitalisation, opportunities to increase efficiency, new channels for purchasing and distribution, and new approaches to innovative business models. Successful platforms in this area often originate from the industry itself, or are closely linked to its processes. This is reflected in the success in a young market: According to independent industry studies (Forrester 2019), German platforms are among the world's leading providers in the IIoT sector in particular. In a still young market, however, this is not a position on which industry and politics should rest. Rather, the focus must be on shaping the regulatory and economic environment in Germany and Europe so that the competitiveness of German IIoT platforms is maintained and promoted.

The main reason why platforms are interesting for companies is network effects and economies of scale. Customers benefit when they can interact with a larger number of users, e.g. because it increases the reach of providers or enables users of IIoT platforms to cooperate better. The economic literature to date often derives strong growth and scalability of platform models from these two types of effects and, based on this, a tendency towards the establishment of monopolies or oligopolies.

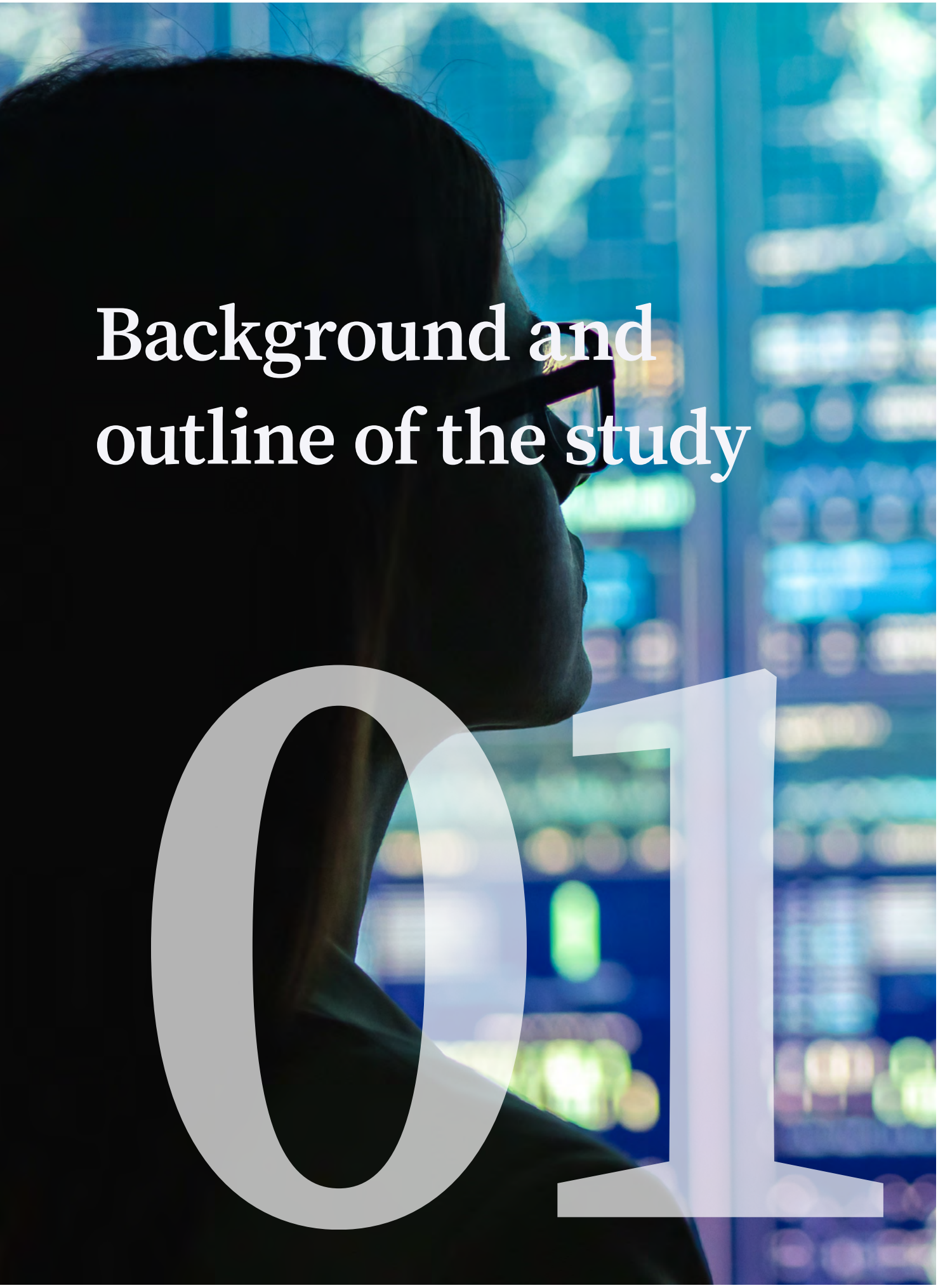
In reality, however, empirically intensive competition between platforms can be observed, especially in the B2B sector. This has already been noted in the scientific community (for example, Evans and Schmalensee 2017 and 2018) and is also reflected in the empirical part of this study. From the perspective of politics and business, the question arises as to which factors are responsible for functioning competition between B2B platforms. This study seeks to close this important gap in understanding conceptually and with reference to practice, and identifies the following central factors:

On the one hand, B2B platforms are structurally fundamentally different from platforms in the B2C sector. The interactions - among users, as well as between users and the platform - affect relatively symmetrical players – especially when compared to the B2C context. For example, companies can negotiate individual contracts. On the other hand, there are numerous factors that favour competition between platforms, especially in the B2B segment. The most important are:

- **Negative network effects** resulting, for example, from competition between players on a platform, weaken the positive network effects.
- When competing with one another, platforms have various **options to differentiate themselves** and thus to survive against platforms with stronger positive network effects, for example: Price strategies, quality and range of services, complementary services as well as openness and transparency.
- **Specialised offerings** with a focus, e.g. on industries or functions, succeed in making successful market entries in segments in which already established providers – other platforms or „analogue offerings" - are active. Each industry has its own requirements for products and processes, resulting from regulations, norms and standards, as well as the peculiarities of supply chains and customers.

By analysing **10 representative case studies from the 3 types of platform stated above**, the study elucidates the role these factors play in competition in practice, based on the functioning and competitive environment of the respective platform.

In the context of platform competition, **the role of data** is currently the focus of interest from both a business and regulatory perspective. Using empirical examples from the ten case studies, the study illustrated that data-centric B2B platforms primarily provide a neutral infrastructure to which companies entrust their data securely against unwanted access. The examined business models explicitly do not provide for unintended use or monetisation of user data by the platform operators. It has also not been observed that the data stored on the platform leads to a lock-in of users of B2B platforms.



Background and outline of the study

01

THE ROLE OF PLATFORM COMPETITION FOR INDUSTRY

Digitalisation and data are of rapidly growing importance for the European economy. According to the EU Data Market Study[1] published in 2017, data-based activities will account for around 4% of total European economic output already in 2020. The outbreak of the global COVID 19 pandemic has given a further boost to the digitalisation of economic activity. Digital platforms play a special role in this regard. Platforms encourage digital interaction between several user groups and thus, enable additional value creation (Belleflamme and Peitz 2018). As intermediaries, they promote and accelerate new digital business models for their users.

This study distinguishes between three types of[2] digital platforms: 1) marketplaces for goods and services, 2) data marketplaces and 3) IIoT platforms (Industrial Internet of Things). These categories shall be defined as follows:

- **Marketplaces** enable transactions of products or services between buyers and sellers.
- **Data marketplaces** represent a special case of industrial B2B platforms. They do not trade products and services, but information and data sets. Here too, the marketplace operator acts essentially as an intermediary. Unlike „traditional" marketplaces, however, there were no functioning markets for data in the past. Therefore, this type of platforms aims to establish a new category of goods tradable in the future.
- **IIoT platforms provide** users with an infrastructure that enables the systematic integration, aggregation, storage and collaborative use of industrial data.

Platforms used by companies (B2B platforms) play a prominent role in the process of digitalisation in German industry, whether in mechanical engineering, the steel industry or the intelligent networking of devices. Due to their importance for the economy, they are increasingly becoming the focus of German and European politics.[3] Platforms in the area of the Industrial Internet of Things (IIoT) make the data and information from countless sensors and „smart" devices available and usable. Thus, they form the basis and prerequisite for new data-based business models and services in industry and beyond. B2B marketplaces have the potential to multiply the reach of their users, make processes more efficient and reduce the entry costs for digital sales and purchasing channels. They thus take on an important bridging function for the digitalisation of, in particular, medium-sized industrial companies.

Both in regulation and in science (see, for example, Karle et al. 2019), competition between platforms has become a major focus. The question to which extent platform models with strong economies of scale and network effects have a tendency to monopolise markets is central to this (BMWi 2019). However, intensive, substantial competition can currently be observed in industrial B2B platforms. It is of great importance, both for possible regulation and for the economy, to understand which factors enable and favour competition between B2B platforms: a question that has not yet been sufficiently addressed scientifically. It is precisely this topic that this study aims to make an important contribution to understanding, both conceptually and with empirical practical relevance.

[1] Cf. *https://ec.europa.eu/digital-single-market/en/news/final-results-european-data-market-study-measuring-size-and-trends-eu-data-economy*

[2] The types marketplaces and IIoT platforms are also used in this form in other studies on the topic, such as BMWi (2019). The individual categories could be subdivided even further, for example BDI (2019) also distinguishes between supply chain management & logistics platforms and networking platforms, which can be found under 3) in our categorisation.

[3] See for example, the guest article by Federal Minister of Economics Altmaier in the Handelsblatt in October 2019, available at: *https://www.bmwi.de/Redaktion/DE/Artikel/Digitale-Welt/20191028-die-zweite-welle-der-digitalisierung-handelsblatt.html*

Based on a clearer understanding of which factors explain and favour B2B platform competition, answers to the following questions, for example, can be found:

1. Is the observed situation with intensive competition only a snapshot, or can competitive markets with platforms exist in the long run?

2. Which factors and framework conditions are prerequisites for, or favour competition? How does the environment of a platform (e.g. the type of services provided, the focused industry, the competition between customers) contribute to whether or not competition can develop?

This understanding will help to formulate strategies to positively shape these framework conditions if necessary. If, on the other hand, regulators and policymakers ignore these factors, and the specific nature of platforms, there is a risk that investment and innovation incentives, or the entire industrial platform ecosystem, will suffer (Koenen et al. 2018). Rather, the aim should be to shape the environment in Germany and Europe in such a way that the competitiveness of German IIoT platforms is maintained and promoted.

APPROACH OF THE STUDY

The study is based on several interlocking analytical steps. In **Section 2** the basic concepts of platform economies are presented and explained, based on the current economic literature. Existing research focuses primarily on the positive network effects of platforms and the resulting possibility that „winner-takes-all" effects can occur, i.e. that a dominant actor emerges. Although this prognosis often does not match the empirical evidence, the factors that promote competition between B2B platforms have not yet been sufficiently analysed scientifically (Evans and Schmalensee 2017 and 2018).

Based on the existing evidence, we derive a number of factors that contribute to intense competition between B2B platforms and are suitable to explain this competition. This results in an analytical framework that includes factors that promote strong, automated scaling of platform models as well as factors that explain the coexistence of multiple vendors in a competitive relationship. This analytical framework therefore allows us to answer the questions stipulated in the introduction to the study.

In **Section 3**, the analytical framework will be applied to ten selected case studies representing the three types of platforms mentioned above: 1) traditional marketplaces, 2) data marketplaces and 3) IIoT platforms (Industrial Internet of Things).

When selecting the platforms for the case study, it was ensured that both, new companies (start-ups and companies not yet profitable) and established players were taken into account. In addition, the case studies are divided into independent platforms, and those that have links to a global industrial, software or infrastructure group as a subsidiary or spin-off (see Figure 1). In this way, we ensure that a broad spectrum of perspectives and experiences is taken into account in the study.

Figure 1: Platform types and case studies selected for the study

	MARKETPLACES	DATA MARKETPLACES	IIOT PLATFORMS
CONNECTED TO A COMPANY	• Wucato • CheMondis*	• Data Intelligence Hub	• MindSphere • SAP Asset Intelligence Network
INDEPENDENT	• Mercateo • bevazar		• Cumulocity IoT • ondeso • MIP

source: own illustration, * organisationally independent subsidiary

The case study analysis focuses on the following questions:

1. How does the platform work in terms of background and business model?

2. In which competitive environment is the platform operating? Who are the platform's main digital or analogue competitors?

3. What are the central differentiating factors of the platform? To which degree do network and scale effects exist and work (on the respective sides of the platform)? How is the degree of openness of the platform to be assessed? What conditions are attached to participation, what is the degree of portability and is there a lock-in? What role does data and its use play in the platform's business model?

4. Finally, it will also be discussed whether the platform model is contributing to digital change in the industry.

The case studies are based on several sources of information. On the one hand, publicly available information such as documentation and materials from operators, professional articles in industry publications, studies and reports from associations and media coverage were used. This public information is supplemented by guided interviews with platform operators, users and other stakeholders in the platform ecosystem. For this purpose, 25 telephone or personal interviews were conducted between December 2019 and April 2020.[4] The guideline for the 60 to 75-minute interviews with representatives of companies operating a platform can be found in the annex. The interviews conducted were divided as follows:

- 15 interviews with representatives of the case study participants, or members of the management of competing platforms

- 10 interviews with platform users (members of the management) and responsible persons in the areas of strategic purchasing/sales.

Based on these concrete case studies, the study derives findings and conclusions about the contribution of platforms to the digitalisation process in the German industry.

A central feature of platforms is their **handling of data.** Data can not only play an important role for the business model of the operator, rather, it can also influence the options and strategies of platform users. Therefore, the handling of data has come under the spotlight of regulation. In **section 4**, the study presents the key insights from the empirical case studies concerning the role of data in the context of B2B platforms. The final **section 5 summarises** the key findings of the study and draws a conclusion.

[4] To gain a better understanding of the ecosystem, several interviews were also conducted with people responsible for platform venture capital.

The economy of B2B platforms

02

In the past, the focus of the scientific literature on economic platforms was mainly on social networks and marketplaces in the B2C sector (i.e. on platforms that address consumers on at least one side of the market): Examples and applications from this field form the practical foundation for the development of theoretical models whose central driving force are network effects (in the following section, we discuss these effects in detail). Only recently, studies with an explicit focus on B2B platforms have been published (see BMWi 2019 with further entries), which present an empirical analysis of the importance and diffusion of the sector in German industry. The focus of the present study is complementary to this approach - it aims at a better understanding of the microeconomic mechanisms shaping the different types of B2B platforms and their competitive environment.

The existing academic literature places positive network effects in the focus of the analysis and derives from this a tendency of platform of rapidly and significantly scaling. However, it can be noted that empirically this tendency is much less pronounced in many platform markets (especially in the B2B sector) than theory would suggest (Evans and Schmalensee 2017, 2018). Although initial theoretical explanations exist for this (see Karle et al. 2019, Jullien and Sand-Zantmann 2019), a systematic explanation with reference to practical examples from the B2B sector is still largely lacking. This study closes this gap in the following sections by analysing the various factors that are conducive (or detrimental) to platform competition on B2B markets and by presenting their relevance for industry.

NETWORK EFFECTS AND ECONOMIES OF SCALE

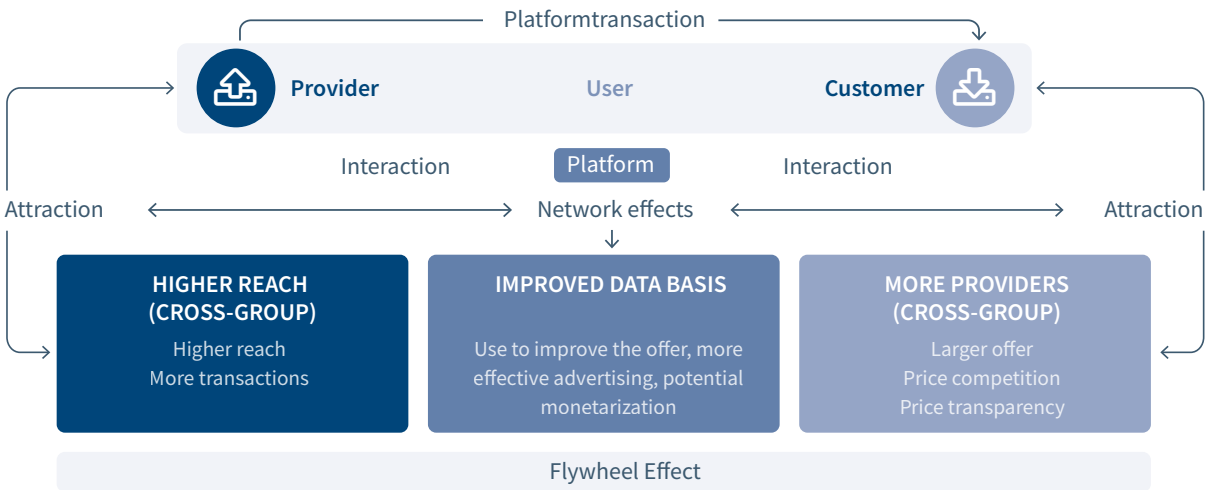
Positive network effects

Network effects are a central economic feature of platforms (e.g. Belleflamme and Peitz 2018, Haucap and Stühmeier 2016). If network effects are present, then the benefit of platform participants depends on the total number of platform users. Marketplaces, on which sellers/providers on the one side face buyers/demanders on the other side of the market (see Figure 2), are the best example to illustrate these effects. The individual members of a group of actors benefit in particular, if the other group (the so-called cross-group) is more strongly represented. This is referred to as indirect network effects:

- From the point of view of **demanders**, more suppliers mean a larger range of goods and services. Competing offers lead to more transparent pricing and, due to competition, also to lower prices.

- For **suppliers**, in turn, more demand on a platform means a higher reach, a larger number of transactions and thus higher expected revenues.

Figure 2: The impact of positive network effects on transaction platforms



In addition to the indirect network effects mentioned above, there may also be positive direct network effects on the side of the platform users. For example, users on the platform can benefit from the experience of others (e.g. through their ratings, or indirectly through statistics on the decision-making behaviour of the group). These become more precise and relevant as the size of the demand side increases. The exact nature of the positive network effects influences the behaviour of the platform operators towards the respective user groups. If the network effects emanating from a market side are stronger, the platform has an incentive to make the conditions for this side comparatively more attractive, in order to attract more market participants. This can be done at the expense of the other market side: For example, suppliers on the platform could be asked to guarantee „best prices" (Boik and Corts 2016) in order to appear more attractive to demanders.

In addition to attracting more users, network effects can also strengthen the position of platform operators by providing a better data pool. When operated, platforms generate data regarding the activities of platform users. This data and meta-data can represent a competitive advantage, for example when advertising is used as an additional means to generate revenue. As a resource, this data can also be used to „train" artificial intelligence applications. This can be used to improve the own offer (e.g. by recommending more relevant products). Finally, there is also the possibility - largely unused in the B2B sector - of monetising the data itself.

What do these effects together mean for platform models? If such positive network effects exist, platforms become more attractive for their users, the larger user groups are already active on them (Armstrong 2006). Thus, the success of the platforms themselves increases. Once a critical mass has been reached (which can vary greatly depending on the industry, sector and platform model), the growth of the platform is, in theory, like a flywheel. It should be emphasised that the driver of growth is the greater benefit that platform users derive from the more pronounced network effects.

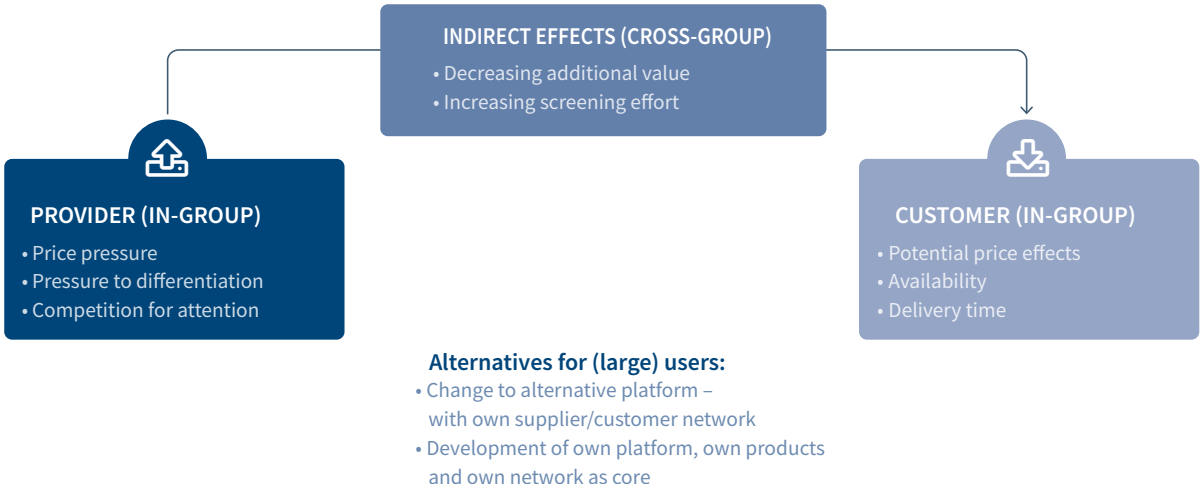
Thinking through this process, the benefit to users of a platform would theoretically be maximised if a single platform were to unite all users in each market segment - there are thus certain structural similarities to a natural monopoly (Yang and Ji 2016). This tendency is further reinforced when there are positive economies of scale, e.g. when more users have to cover certain fixed costs. Hence, based on this line of argumentation and the empirical observations, especially in the B2C sector, the literature derives general monopolisation tendencies in platform markets (e.g. Farrell and Klemperer 2007).

In practice, however, intensive competition between different platforms can be observed in many markets - both in the B2C sector and especially in the B2B sector. This applies, for example, to platforms for hotel bookings or ridesharing in the B2C sector, but also in particular to platforms in the B2B segments that are analysed in this study. There are various explanations and reasons for a functioning competition between platforms, which we will discuss in the following sections.

Negative network effects

Why are platforms not automatically natural monopolies? The first explanation is that in practice, network effects need not be exclusively positive. Especially in the industrial B2B context, various factors contribute to the fact that network effects can be reversed and thus do not endlessly favour the growth of the platform. Such negative network effects on platforms have recently come into the focus of academic literature, see for example Belleflamme and Peitz (2019).

Figure 3: Examples of negative network effects



The most obvious negative effects are in the area of direct network effects. The more **providers** are active on a platform at the same time (with similar products or services), the greater the price pressure that can be expected on them. It is more difficult to differentiate oneself qualitatively, or in terms of price from the other offers on the platform. Furthermore, the larger the number of providers, the more difficult it is for individuals to be found. As a result, either the demand for one's own products falls, or companies must increasingly invest in enhancing and maintaining the visibility of their offer (for example through search engine optimisation or advertising). As a result, the expected revenues and profits from the activities on the platform decrease - and alternative platforms become more attractive in relative terms, even if (or precisely because) they have not yet reached the same number of providers. New findings from the economic literature suggest that tougher competition between (corporate) users of a platform may be associated with a stronger tendency of providers to single-homing on platforms (Karle et al. 2019). This means that sellers only become active on one of the competing platforms and thus reduces direct competition on the various platforms.

Particularly in the B2B context of marketplaces, mirror-image-like mechanisms also apply to the **demand side**. If large players in particular enter the platform as new demanders, their procurement volume can have a direct impact on the price of goods, which is detrimental to other buyers. At the same time, the availability of products and their delivery times may be negatively affected.

Even indirect network effects are not necessarily only positive. For demanders, for example, the additional benefit of an additional supplier with similar products quickly diminishes from a certain point onwards. The more suppliers are active on a platform, the more effort must be made (by the platform operator or by customers) to identify and exclude inferior, or potentially dubious offers.

STRUCTURAL DIFFERENCES BETWEEN B2C AND B2B PLATFORMS

Before going on to discuss other factors affecting competition between B2B platforms, it is important at this point to examine some basic structural differences between B2B and B2C platforms. These either have a direct impact on scalability and competition, or are likely to reinforce the effect of individual factors that we will discuss below.

Some key structural differences between B2C and B2B platforms are the following:

- For large B2C platforms, the activities of individual users have little influence on the platform's turnover and profit. In contrast, companies that operate on B2B platforms generally have a much larger relative weight. One reason for this is the higher transaction volume in absolute terms - if one compares, for example, corporate purchasing with the demand of a private individual. In addition, commercial platform users have their own network of suppliers, customers or cooperation partners, the loss of which would

have a noticeable impact on platform operators. In the IIoT context, it can be observed that the acquisition of major customers can even become a driver for entering new markets and for internationalisation.

- Interests and needs differ much more between corporate customers than in the consumer sector (Economist 2016). B2B platforms (only) have a chance to succeed if they make processes in companies more efficient, increase their revenues or enable new business models. However, this usually requires specialised solutions tailored to individual industries or even individual corporate customers – prohibiting strong, automatic scaling.

- On industrial B2B platforms, comparatively symmetrical companies meet at eye level in terms of organisation and professionalism. This means that issues such as access to, or protection of data can be resolved through bilateral, individualised contracts between users (rather than through general terms and conditions of operators or legal regulations). On the other hand, (especially independent) B2B platforms are currently usually much smaller in terms of turnover and employment than a large proportion of the users active on the platforms. Large platform users are in some cases even (potential) competitors as platform operators. In these cases, the company's own products or the existing network of suppliers, customers and partners form a cornerstone for achieving the critical mass necessary for one's own platform.

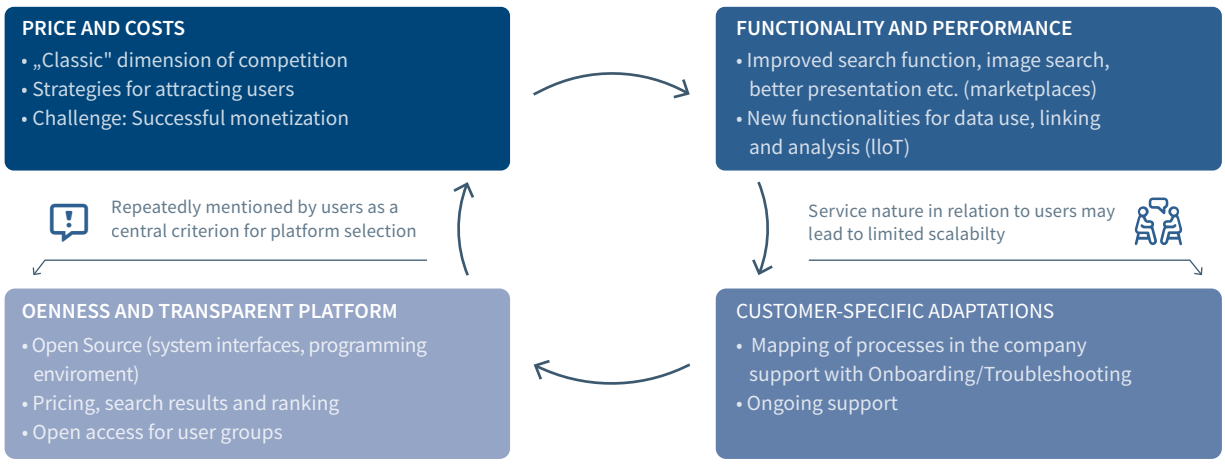
DIMENSIONS OF COMPETITION AND DIFFERENTIATION

In two of the B2B platform types we are investigating (marketplaces and IIoT platforms), both intense competition with a large number of established providers and market entries by new platforms can be observed. These include new trading platforms with a specialised industry focus, spin-offs or start-ups from groups and specialised IIoT offerings with solutions to clearly defined problems.

Platforms which are new on the market or which are smaller in size have to compensate for the respective possible disadvantages along other dimensions. In the presence of (positive) network effects and economies of scale, differentiation is thus a prerequisite for effective competition between platforms (Jullien and Sand-Zantman 2019, Cennamo and Santalo 2013). Differentiated platforms address individual customer groups more strongly than their competitors and thus compensate for possible disadvantages in terms of economies of scale and network effects. Henceforth, several platforms can coexist in the long term.

A woodcut-like view of platforms and the reduction of economic mechanisms to network effects neglects the fact that there are many other aspects of how offers differ (see Figure 4). In the following sections, the study illustrates how platforms in one sector can differentiate themselves from each other and thus promote sustainable competition.

Figure 4: Dimensions of competition and opportunities for differentiation



Pricing strategies

The first dimension of competition is the price and cost of using the platform: examples are subscription fees companies have to pay for accessing an IIoT platform, or the surcharge per transaction on a marketplace. Platforms can poach users from one another by reducing costs and prices. It should be noted that in a commercial context there are strong, clear-cut incentives for buyers to reduce costs.

The pricing of platforms can be adjusted over the course of various development steps. New platforms strive to achieve the necessary critical mass to fuel rapid growth. At the time of market entry and in the early stages of platform development, in terms of pricing, this often means in practice that prices/fees are set very low - in many cases even at zero -, so that there is not even a contribution to cost recovery. This free offer is intended to bring a critical mass of users to the platform.

Once this is achieved, the difficult process of contributing to the platform‘s financial results by introducing positive prices begins. Platform operators then have to compensate rationally decisive users for the loss of free access through improved (and possibly costly) functionality, which in turn keeps operating costs high.

Functionality and performance

Besides price, a second way of differentiation between platforms is the dimension of functionality and performance. In the area of marketplaces, platforms can differentiate themselves, for example, in the area of product searches: faster searches, more relevant results, or the ability to integrate images into the search function.

For IIoT platforms, there are numerous possibilities for differentiation through the functions offered. Especially in the area of data usage and analysis, enhanced functionalities can offer platform users considerable additional benefits: For example, a better understanding of the causes of component and system failures enables more accurate forecasts and, by means of adapted maintenance, downtimes can be reduced. In addition, data security and reliability serves as a means to differentiate – for example by hosting on servers located in Germany[5]. A further dimension concerns the possibilities of configuring the platform, for example to create alarms or automatic rules. Functionality does not necessarily have to be linked to a more comprehensive range of services and options. For less experienced users, it can instead be an advantage if standardised „plug and play“ solutions are implemented to facilitate the entry into IoT solutions.

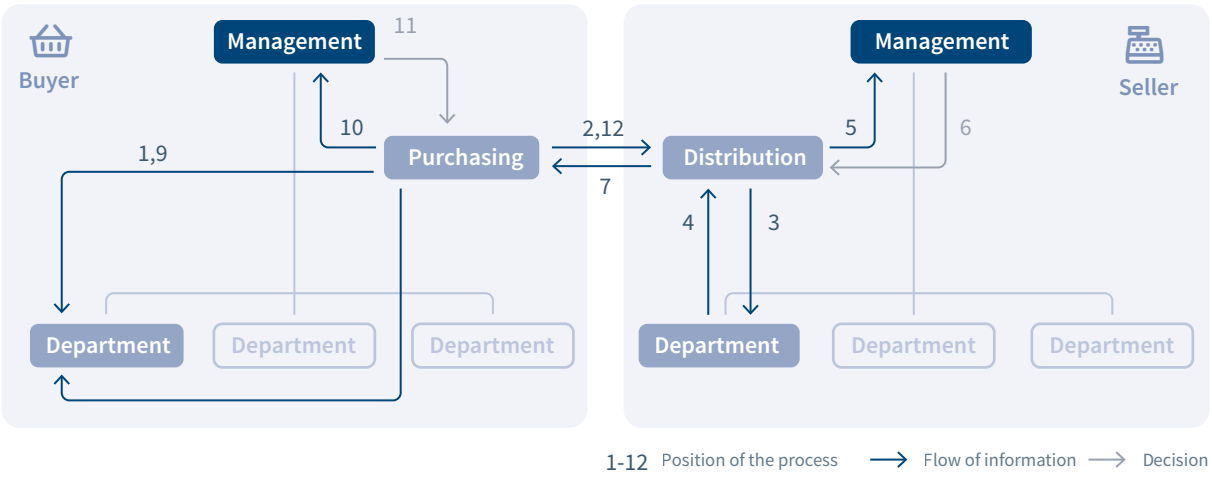
Complementary customised services

While B2C platforms provide a relatively standardised offering worldwide - be it social networks or trading platforms - B2B platforms are characterised by the fact that the benefits for companies are much higher when the offering is tailored to the individual user's requirements. In many cases, however, this adaptation requires individual and personal activities by the platform operator's staff (Kiel et al. 2016). These activities have a strong service character; and similar to a service, they are not easily scalable.

In general, marketplaces and transaction platforms can and must be tailored to the requirements of customers in various ways to maximise the resulting benefits. A central benefit of this type of platform is to digitally streamline and accelerate the often time-consuming processes in purchasing (see Figure 5).

[5] It can also be relevant to the decision whether the servers are subject to the American CLOUD Act (H.R. 4943), which guarantees data access to American investigating authorities under certain circumstances.

Figure 5: Schematic representation of a purchasing process



To realise these productivity gains, the digital processes on the platform must be able to mirror internal company processes, such as approvals by management functions, coordination with the specialist department and interactions between the buyer's departments and those of the seller. This requires a considerable degree of individualisation. The productivity potential can only be fully harnessed if processes can be automated via individually defined interfaces in the merchandise management / ERP / IoT systems. This individualisation requires both an initial investment from both sides (which reduces the incentives of users to work on several platforms at the same time) and constant coordination and readjustments in the course of the cooperation.

In the area of **IIoT platforms**, the service character of the offer is even more pronounced. The individualised interfaces between users (or their machines, devices, etc. and, where applicable, their network) and the platform are a basic prerequisite for the smooth operation of these services. The possibilities offered by complex IIoT platforms, especially in the area of data analysis and use, exceed in some areas the capabilities and capacities of most non-specialised users. Therefore, platform operators must empower users to deal with these possibilities and use them effectively. This can take various forms: documented pilot projects that are closely monitored, or coaching and consulting in the area of customer relationship management. However, these are obviously individualised activities with a strong service character. At the same time, platforms are increasingly working on the development of „out of the box" solutions that allow users to implement and develop their own applications.

Why are these service aspects of B2B platforms so important? On the one hand, smaller platforms can use complementary services to compensate for possible size disadvantages in network effects. On the other hand, these service aspects inhibit the speedy scaling of B2B platforms, as they are limited by personnel capacities. These service aspects are thus one of the most important reasons why competition between B2B platforms can exist.

Openness and transparency of platforms

Another dimension of differentiation is the degree of openness. In the sense of a spectrum, the openness of a platform describes the degree to which the platform regulates participation, development or usage (Eisenmann et al. 2009).[6] Compared to closed platforms, open platforms impede the possibilities of users, developers or providers of complementary services relatively little, especially in the following areas (Broekhuizen et al. 2019):

- **Access:** Open platforms do not prevent users from accessing and using them. Reasons for the exclusion of users are, on the one hand, safety and quality aspects (and thus in the interest of the entire ecosystem). On the other hand, platform operators with their own product or service offerings have an economic incentive to exclude competing offerings from using the platform.

- **Software and development environment:** Open platforms use open source software solutions, and open protocols and interfaces, while less open platforms rely on their own proprietary applications.

- **Pricing and distribution channels:** Users are often active on several platforms (multihoming) or operate their own digital distribution channels in parallel. Less open platforms restrict the freedom of users to multi-homing or to setting prices outside the platform via their terms of use. One example is the guarantee not to offer lower prices outside the platform (best price clauses)..

The degree of openness of a platform is a fundamental strategic variable for platform operators (Parker and van Alstyne 2018). On the one hand, less open platforms are better able to secure a larger share of the revenues and yields generated on the platform. On the other hand, the incentives for users to enter and innovate suffer from this (Ondrus et al. 2015).

A related property to openness is the transparency of platforms. Transparent platforms create clear rules, for example for pricing and ranking of search results. Openness and transparency of platforms are used - in addition to the other factors mentioned - as criteria for the selection of, and, if necessary, for changing a platform.

SPECIALISATION AND INDUSTRY FOCUS

A trend towards specialisation is perceived by industry observers and players as a fundamental trend in the field of trading platforms (see also Roland Berger 2018). Providers specialising in industries are thus not „niche products“, but market players who hope to gain advantages from their strategic positioning in order to compete with larger generalists.

What are the advantages of specialised platforms with which they can compensate for possible size disadvantages and therefore missing network effects? Every industry has its own requirements for products and processes, resulting from regulations, norms and standards, as well as the peculiarities of supply chains and customers. Striking examples are the food and chemical industries. Marketplaces or IIoT platform operators who are very familiar with these peculiarities have direct advantages, for example in screening suppliers and products, or in offering complementary services such as consulting or networking. Providers on specialised platforms can address a specialist audience and do not compete with offers and products from outside the industry. In addition, the industry context allows the platform operator to implement specialised search algorithms that may deliver better, and more relevant search results.

In the area of IIoT platforms, there are also examples where sector-specific partners join forces with providers of generic platform infrastructure to establish a specialist and sector-specific platform. In such a scenario, the industry partners, with their specialist know-how and the technology partners (in this case the IoT platform operators) complement each other.

[6] As an alternative definition, platforms could be called "closed" if they are only open to a predefined circle of users.

INTERIM CONCLUSION

Various economic factors are decisive for the development of platforms, their market position and competition between operators. Of particular importance are the positive network effects: Platforms that have reached a critical mass become more and more attractive for users as their size increases. These network effects - and the associated prospect of a strong market position - have brought platform models into the focus of corporate strategies and company start-ups on the one hand, and of politics and regulation on the other.

Especially in the area of industrial B2B platforms, we have identified several economic mechanisms that promote competition between platforms:

1. **Competition on platforms** (both between suppliers and between customers) limits the effectiveness of positive network effects in practice.

2. Industry expertise and industry-specific requirements and conditions enable the existence of competing **specialised platform offerings**.

3. B2B platforms have a strong **service character** - processes on the platform must be individualised for the respective user. In the IIoT context, consulting or joint implementation of pilot projects are crucial - at least in the current market phase – for successful platform use. However, these activities cannot easily be scaled up and thus, prevent unrestrained growth.

4. Among other things, platforms can **differentiate** themselves from existing competitors through functionality, openness and transparency.

5. Large and professional users of platforms have the prerequisites to become **potential platform competitors**, even within a short time, as their own products, customers and suppliers can form the core of a platform. The technical know-how is often available, or can be purchased externally.

In the next section, we use ten case studies to illustrate the consequences that the interaction of these factors can have when applied to B2B platforms in the areas of marketplaces, data marketplaces and IIoT platforms.

Case Studies

03

In the following paragraphs, we present the case studies from the three areas that form the empirical core of this study. For each of the areas, we begin by describing the general environment and the generally effective modes of operation and mechanisms, before we analyse the individual platforms in detail.

MARKETPLACES

While B2C transaction platforms such as Zalando, Delivery Hero or Amazon are part of the everyday life of most Germans, the development in the B2B sector still lags far behind, when compared globally. While the European share of global B2C transaction volume in 2017 was around 27%, almost on a par with the US or Asia, the European share of B2B business is much lower, at only around 4% (Roland Berger 2018, see Figure 6).

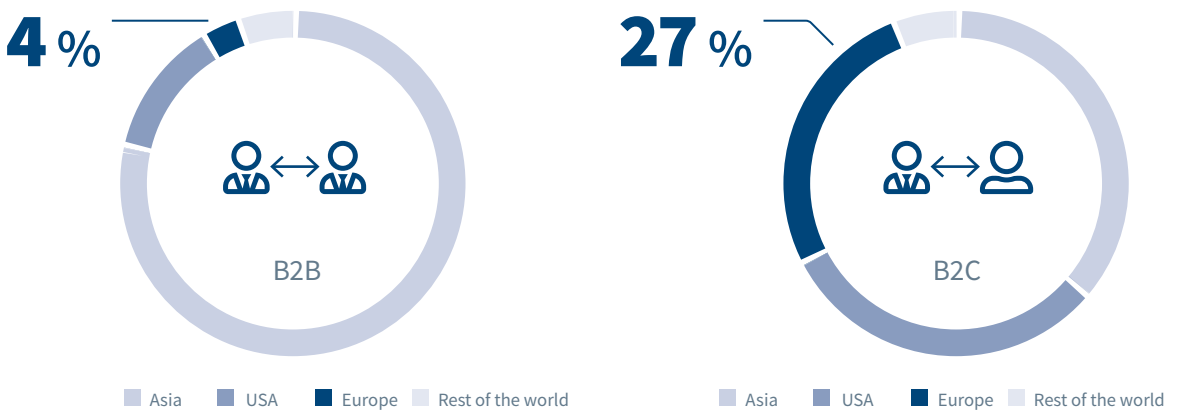
The value of the B2B e-commerce market is estimated to be around six times the size of the B2C market[7]. Asian companies, such as Alibaba or Rakuten, have achieved a prominent position amounting to almost 80 percent pf the global B2B volume. But the share of sales generated in the USA, which currently stands at 13 %, - driven in particular by Amazon business - is also around three times higher than in Europe. The development of B2B platforms in Germany has accelerated considerably in recent years (e.g. ibi 2019). Various factors have contributed to this development:

- Since the market launch of Amazon Business in Germany in 2016, one of the major global players has also been active in the German market and is pursuing an ambitious growth strategy with the interface familiar from the B2C sector.
- Alibaba, the world's largest industry representative, is also driving its growth in Germany and Europe. Investments were made in company sides and logistics hubs in Belgium, Spain, the Czech Republic and Germany (etailment 2019).
- According to industry representatives, purchasing behaviour in the B2B sector is increasingly shifting to digital channels (in the wake of the B2C segment). In addition to the advantages of digital trading places for users discussed below, this development is also justified by the fact that habits and demands from private B2C use are being transferred to business interactions..

In this dynamic environment, with market entries by the world's largest players, the strategies of established and new German providers to compete in this increasingly competitive market are of particular interest. These factors will determine, among other things, whether the competition currently observed can be sustained in the long term.

[7] See for example: *https://de.statista.com/statistik/studie/id/44436/dokument/statista-report-b2b-e-commerce/*

Figure 6: Share of global B2B/B2C e-commerce merchandise value 2017 by region



Source: Roland Berger (2018)

Some **central aspects of transaction platforms** are valid across the case studies considered.

- **From the buyer's point of view**, they offer the possibility of simplifying and standardising purchasing processes for certain groups of goods (often in the commodities sector) and thus reducing transaction costs. This frees up capacities for more complex activities, primarily in purchasing. In addition, the digital environment, with its options to search and compare, increases the transparency of prices and offers.

- **From the point of view of the sellers**, platforms open up new customer groups active on the platform and thus increase the reach. For manufacturers and distributors who do not yet have their own digital sales channels, they offer an entry opportunity with relatively low initial investments that nevertheless meets the process requirements of the transaction partners (bridging function).

- Successful platforms are in particular **closely linked** to the processes of the buyers. Therefore, the interfaces have to be tailored and individualised to the user's needs. This requires investments both on the user's side (e.g. in the settings of the procurement software used and the definition of the interfaces to the other systems), as well as on the platform operator's side. As a result of these required setup investments, the tendency can be observed that buyers are often only active on one platform (single-homing), while manufacturers and distributors serve different customer groups on several platforms.

In the following, we present four examples of transaction platforms from different sectors.

Mercateo - independent, cross-sector marketplace

Background

The open trading platform Mercateo, which was founded in 2000, is a pioneer in the field of B2B transaction platforms in Germany in terms of its founding date and size. It is a general, cross-sectoral trading platform. According to the company, more than 16,000 manufacturers offer their product ranges (currently totalling more than 50 million articles in the EU) on the platform, which is actively used by around 100,000 companies. The platform is independent, without any connection to a manufacturer or wholesale group. Like the other case studies in this section, Mercateo functions as a marketplace - this means that the platform does not operate its own warehouses, but mediates transactions between suppliers and buyers and charges a commission for this (trade margin). This distinguishes the platform's approach from Amazon Business, for example, which maintains a physical distribution network and also sells its own range of goods.

On the Mercateo marketplace, transactions are mainly carried out with commodities or C-goods. Prices for these standardised goods are formed according to transparent rules in the competition between suppliers for given customer requests. The process ensures that the price offers of the losing suppliers do not become public and that supplier-specific prices are not published platform-wide. In addition to the marketplace, Mercateo offers two further modules which, in addition to integration into group-wide systems, are aimed in particular at small and medium-sized companies and show strong complementarities with the core business:

1. An **eProcurement software** that provides suppliers with a digital interface to buyers (and integrates the Mercateo marketplace).

2. **Mercateo Unite**, a digital network for mapping supplier and customer relations at company level (analogue to professional networks at individual level). The aim of the network is to enable more complex transactions (e.g. included value-added services around the product, such as assembly or configuration) via the relationships between members, which cannot be implemented in an anonymous marketplace environment.

Competitive environment and economic characteristics of the platform

As already mentioned in the introduction, the competitive environment of the general marketplaces is characterised by strong competition from internationally active platforms, both currently and in the future, following the entry of Amazon Business into the German market and due to the increasing activities of the industry giant Alibaba. Accordingly, Mercateo‘s B2B marketplace is in direct competition with other foreign, and also German marketplaces such as Simple System or Wucato. Whether this intense competitive situation will endure in the long term depends on the extent of the predatory competition, in other words, on whether the respective players can maintain their position in the market. There are currently no apparent competitors to the B2B network Mercateo Unite (business model innovation). This favours the development of the ecosystem, including strategic cooperation with global market leaders such as SAP Ariba. Mercateo is affected by several of the economic factors discussed in section 2

- **Network effects**: As one of the largest European B2B trading platforms, Mercateo has considerable appeal. On the platform, the price is formed by a competitive mechanism between interested suppliers. On the B2B marketplace, where suppliers compete anonymously for shopping baskets, the price is formed by a competitive mechanism between interested suppliers. An increasing number of providers with similar product portfolios can therefore be expected to offer lower prices for individuals (the direct network effects on the provider side are accordingly - as with all marketplace models - not only positive). The situation is different on the Mercateo Unite network platform: here, as the size of the network increases, more and more of the company‘s own business relationships can be transferred to a digital environment with higher process efficiency.

- **Differentiation through functionality and complementarities between products**: With its own eProcurement software, on the one hand, a larger group of customers is given easier access to digital procurement (the platform thus offers digitisation newcomers a further bridging function), and on the other hand, the usage complementarities strengthen the position of the marketplace. The Unite network offers the prospect of both expanding the number of users of its own services and opening up new, more complex product groups on the platform.

- **Openness and transparency**: Mercateo is strategically positioned as an independent platform with open access. According to providers on the platform, the marketplace is characterised by a high degree of transparency with

regard to the rules of pricing and the ranking of search results - both were explicitly cited as reasons for choosing the platform. Moreover, Mercateo does not use its position as an intermediary to exert price pressure on providers, beyond the competitive mechanism..

Wucato - cross-sector marketplace

Background

The Wucato Marketplace GmbH was founded in 2015. It is a subsidiary of the Würth Group, a trading group operating worldwide. Wucato is a neutral, cross-sector multi-supplier platform. This means that the same conditions apply to all suppliers. When Wucato was first established on the market, the established suppliers of the Würth Group formed the core of the platform and thus accelerated the original growth, but in the meantime, external suppliers - including competitors to the Würth Group - represent the majority of the players making up over 80%. According to the platform, there are currently some thirteen million articles available on the marketplace.

The platform offers individual design options for both sides of the market on different levels. Suppliers can be active in two different roles on the platform. On the one hand, as independent dealers with free choice over product range and pricing, and on the other, Wucato can assume the role of dealer for the supplier. Interfaces to the players (e.g. in ERP systems) can be individually adapted and designed. In addition, the workflow functions on the platform can be tailored to the customer‘s purchasing processes in order to mirror and fulfil their specifications (e.g. release processes or authorisations). Customers can individually select the range of products available to them and, for example, integrate their own suppliers (with their own framework contracts) in addition to existing platform suppliers.

The example of Wucato clearly illustrates an interesting aspect of competition in the field of B2B platforms. In the initial situation before Wucato was founded, the Würth Group had various strategies for digitising its sales channels at its disposal. The group had already gained experience in the field of digital sales and procurement in pilot projects. Due to the developments mentioned in the introduction and the growing competition on the European B2B platform market, there was a certain pressure of time, action and decision. For example, instead of using only existing trading platforms more intensively, the group decided to develop its own neutral digital B2B marketplace as a spin-off.

As a „corporate start-up“, in addition to benefitting from financing security and the experience from previous projects

with digital distribution channels, the following prerequisites were advantageous for this decision:

- With the product range of the Würth Group, as well as its network of customers and suppliers, there was a **significant core of products and users** for the platform that was **established in the market right from the start**. Furthermore, the internal purchasing department of the Würth Group generates additional volume.

- **The understanding of general and industry-specific customer needs** (especially in the metalworking industry) was based on the decades of expertise and experience of a large trading group. The understanding of quality and the exact properties and uses of products, which also resulted from long-standing relationships with suppliers, was incorporated into the design of the digital platform.

- With the parent company in the background, Wucato was able to send a credible signal to market participants from the outset that the platform is designed for sustainable and long-term operation.

- The utilisation of the digital infrastructure that has been established, such as the operation of a computer centre in Germany, can be controlled across the Group.

These factors helped to establish Wucato as a new, serious competitor in the cross-industry B2B marketplace segment within around two years from its conception in 2014.[8]

Competition and economic characteristics of the platform

Wucato is located in the same competitive segment as the previous case study and is exposed to competition from the large international B2B marketplaces, in addition to its national competitors.

With regard to Wucato, some of the characteristics of platform economies relevant for competition can be particularly illustrated:

- **Network effects**: The initial growth of the platform has been accelerated by the pre-existing network of suppliers and buyers, which has helped to achieve the necessary critical mass. Aware of the importance of network effects, Wucato made the strategic decision to open the platform to external suppliers (including competing manufacturers). This enables users, for example, to completely migrate their existing established supplier network, when they switch to the platform.

- **Complementary services and support:** Due to the spin-off, some of the supplier relationships in the Wucato network „analogue“ already existed before the online platform was established. In many cases, the needs of these platform participants may differ from the requirements and habits of purely digital users. At the same time, these companies are accompanied and supported by Wucato in their digital transformation (for example, by automating purchasing processes or by opening up digital distribution channels). In order to tailor processes to the needs of its customers, Wucato not only maintains digital contact channels, but also enough telephone and personal (service teams) capacities that scale with demand. These additional contact points contribute to long-term customer loyalty. On the other hand, these multi-layered relationships enable suppliers and customers to be involved in the further development of the platform.

[8] Wucato stand beispielsweise bereits im Januar 2017 als eine von sechs deutschen B2B-Plattformen als Wettbewerber zu den globalen Handelsplattformen im Fokus des Branchenmagazins etailment (etailment 2017).

CheMondis - specialised marketplace in the chemical industry

Background

CheMondis is a digital B2B marketplace specialised in the chemical industry. The CheMondis GmbH was founded by Lanxess, but operates completely independently in the market. The marketplace for chemical products is open to approved suppliers of chemicals and verified buyers. Chemical products are subject to legal regulations - chemical products in Europe must be certified according to the European REACH regulation[9] - and are highly standardised and therefore can be clearly specified. In combination with a check of platform users upon registration, this enables the platform to ensure the quality of the products offered.

Pioneers, such as the steel distributor Klöckner, have shown that there is considerable potential for digital distribution channels in the trade with raw materials. This also applies to a large extent to the chemical industry: The role of intermediaries or distributors in traditional business usually involves the purchase, repackaging and finally the resale of chemical products (Applico 2020). A large number of smaller, often local companies operate in Europe. Consequently, the market for chemicals is highly fragmented. According to the industry association cefic, there are currently well over 20,000 companies in the chemical industry in Europe (cefic 2020). In certain areas, the fragmentation of the market is accompanied by a certain lack of supply transparency.

Digital trading platforms like CheMondis can help to reduce this lack of transparency: The buyer receives a structured overview of the offer, and at the same time, central information such as specification and availability is made available on the platform via search functions. In addition, the purchasing and sales process is standardised and simplified, which can reduce process costs in purchasing and sales. For small and medium-sized companies, the platform in turn offers an increased, international reach and, if necessary, access to digital sales channels. This is particularly important as the industry association itself describes the current degree of digitalisation in the chemical industry in Germany as a weakness (cefic 2020).

From the perspective of industry representatives in strategic purchasing, relationships between suppliers and buyers for certain types of chemicals and chemical raw materials play a central role. For example, they allow a certain degree of flexibility in the event of unexpected fluctuations in demand, which ensures the efficient operation of plants.[10] The CheMondis platform offers an environment in which even more complex individual (and long-term) agreements can be digitally reflected and whose functionalities are constantly further developed in line with user requirements.

Competitive environment and economic characteristics of the platform

In the area of marketplaces for chemical products, CheMondis faces various types of competitors, both nationally and especially internationally (Applico 2020):

- Some **European chemical groups** operate their own B2B marketplaces or B2B webshops, in particular OneTwoChem (Evonik - marketplace) and Asellion (Covestro - webshop). GoBuyChem, a distributor (the British company Noah's Ark Chemicals) has also implemented its own marketplace.

- **Chinese B2B marketplaces** are also strongly represented in the chemical sector with companies such as Molbase (founded in 2013) or OKCHEM (founded in 2016). Under the brand 1688.com, the industry giant Alibaba is also active as a marketplace in the chemical sector.

- In addition, **new market entries** by independent players can be observed (e.g. the German company Pinpools, or the American company Knowde).

Accordingly, the platform environment is characterised by intense competition with a high market entry dynamic and frequency. The key competitors also have a sector focus in the chemical industry. Different specialisations (for example in the food sector) are a factor that makes competition appear possible, even in the long term. Other factors that we have identified as relevant to competition can be illustrated by the example of CheMondis.

[9] EU Regulation Nr. 1907/2006 (Registration, Evaluation, Authorisation and Restriction of Chemicals).

[10] The parties grant each other advantages that may exceed the contractual or legal requirements in trusting the future benefits from the relationship. This type of relationship is referred to in the literature as a "relational contract" (Baker et al. 2003). In this way, efficiency gains are possible compared to purely contractual solutions, see for example Calzolari et al. (2019) for an empirical analysis in the automotive industry.

- **Service character:** The platform is designed to meet the chemical industry's special requirements for safety, quality and certification. Efficiency increases are made possible through individualised integration with the sales and purchasing processes of the platform users, including interfaces with their ERP systems.

- The platform also aims to bring information to a fragmented market. Here, the desired **network effects** play a central role: from the buyer's point of view, additional providers increase the availability of inputs and thus the benefit derived from the platform. For sellers, new sales opportunities are opened up outside the (often regionally concentrated) existing customers.

bevazar - independent specialised marketplace

Background

bevazar is a start-up founded in 2019, which offers a specialised marketplace for companies in the beverage industry as an independent platform. The platform's offering is designed to cover the entire range of goods and services required by breweries and bottling plant operators, from spare and wear parts, consumables and packaging to services and raw materials. As a marketplace, bevazar is a pure intermediary of transactions between the purchasing department of plant operators and the sales team of manufacturers and other suppliers. Formally, the platform acts as sole transaction partner for buyers, which allows for the standardisation and acceleration of purchasing processes.

The main target group on the purchasing side is medium-sized breweries and bottling plants; for these companies there is a considerable need to catch up in terms of the degree of digitalisation in purchasing (Stracke and Homann 2017). As a specialised „one-stop shop", the platform is intended to help reduce transaction and search costs and, in particular, to increase the selection, availability and transparency of the range of products on offer. On the seller's side, the platform aims to act as a bridge in the digitalisation process for companies whose digital distribution channels are weak or non-existent, thus increasing their market penetration and reach.

In order to reach the necessary critical mass of users as an independent start-up, bevazar relies on the one hand on the existing industry experience and specialisation, which is accompanied by an existing network of suppliers. In close cooperation with buyers, the relevance of the products available on the platform is ensured. On the other hand, the business model aims at differentiation through the quality of the digital marketplace and its functionalities.

Competitive environment and economic characteristics of the platform

Using bevazar as an example, it can be clearly demonstrated which components support the competition for specialised transaction platforms. In principle, three groups of competitors can be distinguished:

1. **General marketplaces** like Mercateo, Wucato or Amazon Business. Since bevazar's product portfolio is supposed to cover the entire demand of breweries or bottling plants, the platform meets established, cross-industry competitors in certain areas, such as accessories and packaging.

2. **Existing digital distribution channels** of manufacturers and intermediaries in the beverage industry. Some of the players in the beverage industry operate websites with integrated web shops or similar functionalities.

3. **Marketplaces of beverage industry groups** with links to equipment manufacturers (e.g. TetraPak), or players from the wholesale trade

Against this background, what factors enable differentiation from these competitors?

- bevazar aims to differentiate itself from existing tools by specialising in the beverage industry, e.g. by focussing on the product portfolio, functionalities, language or processes.

- Regarding the functionality of the marketplace, bevazar aims to **differentiate** itself **qualitatively** from existing competitors. Essential factors are for example the intelligent search function, which is „trained" to generate relevant results and to allow image searches. For advanced functions, such as the automatic handling of articles in merchandise management and ERP systems, automated tagging of products to increase their visibility, or consulting services regarding the profitability of products, separate subscription models are considered.

- Another important differentiating feature in this specific market, in which the manufacturer side is highly concentrated relative to the medium-sized filling industry, is the **platform's independence**. Accordingly, companies are addressed on the marketplace regardless of the composition of their machinery. This neutrality is particularly important with regard to the trade in spare parts or the range of consulting services.

DATA MARKETPLACES

The sources of industrial data are growing rapidly in number, quality and scope. Plants, machines, sensors and IT systems generate digitalised information. This data is widely regarded as a resource for further increasing productivity in industry and thus ensuring long-term prosperity. In this section, we discuss an example of a data marketplace. While there are numerous established examples of platform types of marketplaces for goods and services and the IIoT platforms discussed below, data marketplaces are currently still in a very early stage of development. With the Telekom Data Intelligence Hub, we are discussing one of the first providers.

Data marketplaces are in some respects a hybrid between the „classic" marketplaces and IIoT platforms. What is traded (or exchanged) is a commodity that must be defined and made tradable at the same time. Similar to IIoT platforms, an important component of the service is the provision of a secure and resilient data infrastructure. Some examples of the efficiency-enhancing exchange of data are discussed in the IIoT section, which illustrates the overlap between these types.

Data marketplaces are potentially efficiency-enhancing when they provide actors with access to data from which they can generate additional value or productivity gains (Jones and Tonetti 2019). A functioning market for „data" would make this possible (Coase 1960), but currently only a very small fraction of existing industrial data is shared or traded openly and transparently (Koutroumpis et al. 2017). There may be business reasons for this, for example, if data allows conclusions to be drawn about key competitive factors of the data generator (e.g. IP/know-how, or production and capacity utilisation). In addition, there are some fundamental economic challenges, in particular communicating the value of data vis-à-vis potential customers, defining the product, pricing in a new market, as well as the role of intellectual property and personal rights (Thomas and Leiponen 2016). Even though some players have been founded in recent years to exchange data (Meisel and Spiekermann 2019), data marketplaces and data trading are still a relatively new, and little tested phenomenon.

Telekom Data Intelligence Hub - cross-industry data marketplace

Background

Deutsche Telekom's Data Intelligence Hub (DIH) is a data transaction platform that has been on the market since 2018. The core idea of the DIH is to act as a neutral intermediary or broker on an open data marketplace, mediating between providers and buyers of data. As the operator of a neutral, certified and cloud-based infrastructure that meets the strict requirements of the International Data Spaces Association (IDSA) and maintains data sovereignty in data exchange, DIH also creates the technical basis for the simple and secure exchange of data between transaction partners. In this function, DIH is also able to cover further needs with regard to data, such as secure storage and further processing. These services can be modularly extended by existing AI functions, which can be used to combine data sets and analyse them, based on established algorithms and routines. In a cloud-based „AI workshop" with proprietary or open source tools, platform users can develop their own AI approaches and enable more complex functions. As a further field of application, the DIH infrastructure is also used by city administrations and public bodies in the context of providing Open-Data. For

this purpose, the architecture must be tailored to the specific legal requirements for the provision of public data, for example to ensure availability and free access.

A central challenge in data trading is the definition of the „product". Unlike physical goods, there is no rivalry in the use of data - in principle, data can be reproduced and used as desired, without restricting individual users. Accordingly, in data transaction, it must be pre-defined in detail for what, and in what period of time, data is used and whether it may be passed on. If this is not possible, this fundamentally limits the incentives to sell data. In practice, bilateral contractual solutions have so far been used in the B2B sector. The next step is to transfer licensing models - as known from the software world - to data and make them technically enforceable. Approaches for technical solutions in which buyers are released for use on the neutral DIH infrastructure already exist and are being further developed in parallel in research and practice. Thus, the basis for trading data in the B2B sector is increasingly being improved.

The DIH is provider-neutral in all sectors (except telecommunications) and operates across all industries. It enables users to combine a wide range of information across industries to create new insights and added value. For example, international weather data in the context of route information for the logistics or insurance industry can gain considerable additional relevance. On the other hand, its vendor neutrality also enables competitors within an industry to offer their data securely. With the increasing breadth of the data available on the platform, network, scale and connectivity effects can be exploited in combination with the existing analysis tools.

Competitive environment and economic characteristics of the platform

While data marketplaces are a rather recent phenomenon, the DIH nevertheless competes with different offers (Meisel and Spiekermann 2019):

- **Cloud providers** are building their own general **commercial data marketplaces**, such as Microsoft Azure and AWS Data Exchange. In addition, there are commercial providers specialising in individual areas, such as weather, geo or address data.
- In the public sector, **government platforms**, such as *data.gov* or *govdata.de* provide administrative and public data.
- Other private initiatives, such as IOTA Marketplace or Advaneo Data Marketplace are experimenting with **new models** for exchanging data, or aggregating freely available information.

Telekom DIH, on the other hand, has a number of economic differentiating features. In a relatively unproven environment, the architecture of the Data Intelligence Hub offers the certainty of securing data sovereignty and compliance with German and European legal regulations. Data sovereignty is guaranteed over the entire data life cycle as a result of the implementation of the concepts and standards of the International Data Spaces Association (IDSA)[11]. The Data Intelligence Hub also offers possibilities for the integration of data exchange and data analysis/data science. This is achieved by the additional option of being able to use corresponding software products within the platform environment directly, and without additional technical effort. In addition, DIH is able to scale or expand solutions as required, if users demand storage capacity, for example, due to the **complementarities to other areas in the Group**. Finally, in brokering transactions between players within industries, Deutsche Telekom can act as an infrastructure provider (apart from the IT industry) that is **not dependent on any particular industry** and has a stable business area (it will not be a competitor in the future either).

[11] As a non-profit association, IDSA has established a first standard for secure and data protection compliant data exchange and trade, based on years of research by Fraunhofer Institutes (the DIN SPEC 27070).

IIOT PLATFORMS

In this section we will discuss five different IIoT platforms. First of all, we focus on three platforms which, as general IIoT platforms, offer a broad and continuously expandable range of services and functionalities, which are defined below. The remaining two platforms, MIP and ondeso, provide specialised services and are discussed in Section „Specialised IIoT platforms - MIP and ondeso".

A general IIoT platform offers users the following central functions (e.g. BCG 2017):

1. Connection of systems, networks, devices and applications
2. Data aggregation, storage, and analysis (in real time if necessary)
3. Device and asset management features
4. A toolbox or environment for the development and application of IIoT solutions

Thus, analogous to operating systems such as Android or iOS, general IIoT platforms provide similar capacities and possibilities, the specific characteristics of which differ, depending on the context of use and the needs of the platform participants. Two of the general IIoT platforms discussed are subsidiaries of global corporations. Another case study covers an independent general (I)IoT platform.

Figure 7 schematically illustrates the structure and mode of operation of general IIoT platforms. Data from platform users, for example plant operators, is transferred to the platform infrastructure. This data can be fed from a variety of sources: operationally, for example, sensors in products, machines and plants; in addition, information from ERP or CRM systems. Therefore, the platform infrastructure must provide interfaces to the systems and devices to be connected. Both a proprietary, closed solution and an approach in which the interfaces are disclosed are conceivable. On the other hand, capacities for storing the information and files are required. In most cases, these capacities are provided by one of the large cloud providers („Hyperscaler") Amazon Webservices, Microsoft Azure, Google Compute Platform, Alibaba Cloud or Tencent. Edge computing capacities can also be implemented for applications that are particularly critical in terms of time or security: This regards dedicated hardware that is placed in physical proximity to the user (i.e. at the „edge" of the cloud), for example to reduce latency, increase active computing capacity, meet increased security requirements (e.g. with regard to data privacy) or reduce the volume of data transfers to the cloud.

Additional services can be added to this basic platform infrastructure on a modular basis as required: For example, a development environment to extend the functions of the platform according to the needs of the users, or ready-made options for data analysis, or the application of algorithms in the field of artificial intelligence (AI). Another goal for IIoT applications is the creation of „digital twins“ for physical objects (products, machines or entire plants) - these enable them to virtually mirror the development, functioning and state of physical objects, and thus, to monitor and analyse them from other locations.

IIoT platforms only generate added value for industrial users if they increase the efficiency of the operated plants and processes (data-based efficiency improvements are being investigated by Brynjolffson et al. 2011), or enable new business models and revenue potential. Global competition in the industry puts considerable pressure on plant operators to increase efficiency, which is passed on to the manufacturers of the machines used. In order for the data collected on the platform to lead to an increase in efficiency, it must be possible to make data available for external analysis or new services. This requires interfaces for exchanging data with machine manufacturers or service providers, as well as concepts for making selected data usable in a secure environment for a defined period of time.

The following example illustrates how IIoT platforms can generate both economies of scale and complementarities in data usage in an industrial context: Plant operators in an industrial sector typically have a large number of machines from different manufacturers installed in their machine parks.

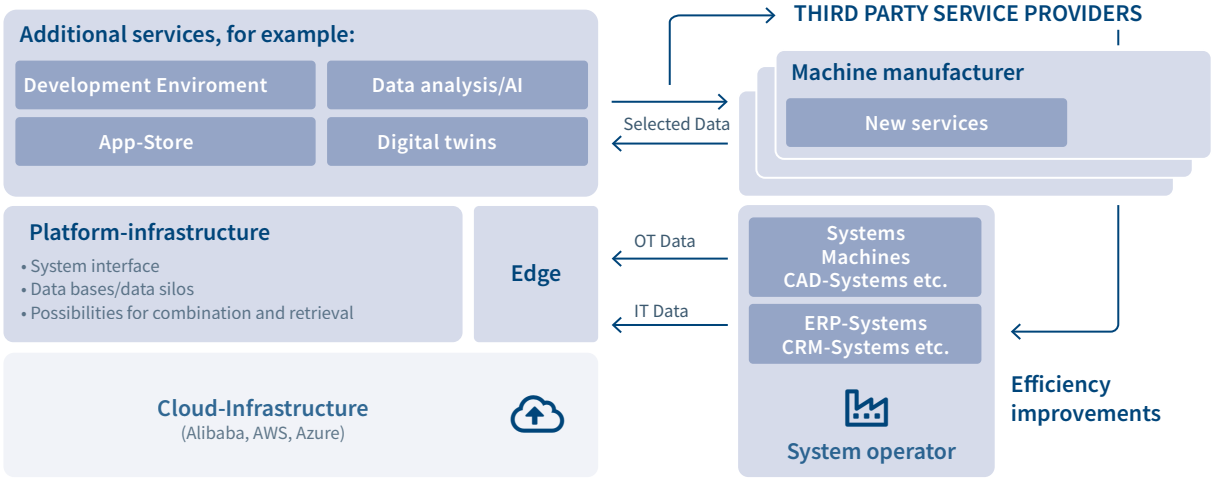
- If the operators each share the information on a particular type of machine with the manufacturer, the latter is able to use the improved data basis to increase the efficiency of this type of machine (for example, by reducing downtime and damage by utilising predictive maintenance). In principle, this exchange of information could be organised bilaterally between each individual operator and each manufacturer - but even this would require considerable coordination effort.

- If, on the other hand, information on all machines is aggregated and shared, then the necessary information is available to increase **the efficiency of entire machine parks**. Obviously, this cannot be implemented through bilateral exchange - it is only made possible by integrating a central platform. It must also be determined who is responsible for the aggregation and analysis of the data: Operator, equipment supplier or third-party service provider.

Common IIoT Platforms - MindSphere, SAP AIN and Cumulocity IoT

In the following section, we first present three case studies of German general IoT or IIoT platforms and then analyse their common competitive environment. Subsequently, MIP and ondeso, two specialised IIoT platforms, will be discussed.

Figure 7: Structure and information flows of IIoT platforms



Siemens MindSphere - IoT platform of a global industrial group

Background

MindSphere is the industrial IIoT-as a Service (IIoTaaS) offering from Siemens and thus belongs to one of the world's largest industrial groups. MindSphere has been operational since 2015 and open to third-party providers since 2017, bundling many of the company's digital activities. As a general IIoT solution, MindSphere covers all the application scenarios described in the introduction. According to industry analyses by the independent institute Forrester, it is considered one of the world's leading IoT solutions in the industrial environment[12]. MindSphere is cloud-based and compatible with the major infrastructure providers (see Figure 7). There are a number of features that differentiate MindSphere from its competitors.

With MindSphere, Siemens is pursuing an open ecosystem strategy with non-proprietary data formats, interfaces and protocols; the approach is comparable to the mobile operating system Android. MindSphere develops and operates the IIoTaaS solution by involving users and developers and investing in data security and protection. On the other hand, applications can also be developed by users and specialised programmers due to the open interfaces. Thus, MindSphere is open to an ecosystem of application and application developers.

The monetisation of the platform is based on three pillars: 1) a subscription model that enables usage of MindSphere at a fixed monthly cost, 2) fees for transactions of applications (by MindSphere or independent developers) that are marketed in an AppStore, and 3) individual services, such as training or advanced support, thus complementing the core offering of the solution.

Economic characteristics of the platform

With its background as an equipment supplier with a worldwide installed basis of intelligent machines, there are considerable complementarities between MindSphere and the group's traditional business. Efficiency improvements in the operation of the systems increase the benefit to customers, or even enable the development of new data-based business models. As a provider that can contribute both hardware and software expertise, MindSphere (Siemens) is also able to offer, or develop solutions for the connection of machines and plants. For example, the MindConnect Nano connectivity product makes the data of older machines digitally accessible. Finally, the group has an already installed worldwide sales and service network, which is also available to MindSphere users.

Two further aspects worth mentioning are the low-code platform Mendix, acquired by Siemens, with which IoT applications can be created even without programming know-how, and the integration of data from MindSphere into existing PLM tools, with which digital twins can be efficiently created and connected.

SAP Asset Intelligence Network - digital asset management

Background

The SAP Asset Intelligence Network (AIN) is a cloud-based platform of the SAP software group, which has been offering a business network for the exchange of data and information for industrial companies (equipment suppliers, plant operators, and service providers) since 2016. The infrastructure is based on the SAP cloud platform. The functions of AIN can also be enhanced by the SAP Leonardo system to include IoT applications, AI and data analysis. In combination with these additional components, AIN thus represents a general IIoT platform whose structure largely reflects the schematic representation in the Figure 7.

The AIN revenue model is based on subscriptions and is divided into basic and premium users. In the basic model, no fees are charged to users, which favours entry to the platform and the creation of network effects. Premium users pay monthly fees, while complementary services are available to them in return (for their own onboarding and for connecting partners, or for the further development of functionalities). Furthermore, premium users can grant basic memberships to other corporate partners in order to integrate their systems into the network.

At its core, AIN is designed to serve as a basis for collaborative scenarios across company boundaries – for example, when plants are to be jointly operated, monitored and maintained. As a fundamental step, this requires the joint digital recording and management of machines and equipment

[12] Siemens (2020) presents key results of the independent industry report Q4 2019.

(equipment directory) and their standardisation across companies. Manufacturers of machinery and equipment can provide master data for their products, which should define them clearly and unambiguously. In practice, this plays an important role when, for example, spare parts have to be identified and procured, or information such as maintenance protocols or calibrations have to be retrieved digitally. This process of directory creation illustrates both the potential, and the challenges of digitalisation in the IoT sector. This is because there are currently no established standards for the digital documentation of industrial assets, which instead are often stored in manufacturers‘ systems, often with a manufacturer ID, brief description and technical plans. However, digital documentation that makes assets and their components clearly identifiable is a fundamental prerequisite for a wide range of services - from the simple search for spare parts (including the possibility of checking alternative offers from non-brand manufacturers, if necessary) to digital collaboration across company boundaries in the maintenance or monitoring of machines and systems. Thus, a digital equipment directory makes a fundamental contribution to standardising processes across companies, and increasing the reliability of industrial data.

Economic characteristics of the platform

Several economic features enable the platform to differentiate itself from its competitors and enable it to actively participate in the development of flexible (quasi-)standards for digital documentation. Within the SAP group, **complementarities** exist **between AIN and other services**, such as Leonardo or HANA. A broad base of companies is already networked with this infrastructure via interfaces in their ERP systems. As an **industry-neutral global technology group**, SAP is regarded as a strategic partner and co-innovator by companies in industries, such as mechanical engineering, chemicals or oil (Produktion 2016) - jointly developed solutions with regard to standards can be implemented in their supplier and customer networks and thus carry weight on the market..

Cumulocity IoT Platform - independent general IoT platform

Background

The Cumulocity IoT platform was originally developed by Cumulocity GmbH, based in Düsseldorf, Germany. It has been in operation since 2013 and has been part of Software AG since 2017. The underlying technology was developed by Nokia Siemens Networks in 2010 and spun off from

that company. The company's original (still relevant, but no longer exclusive) focus was the telecoms sector, where it was a service provider for infrastructure providers implementing the networking of external devices (in the sense of M2M/machine-to-machine, as IoT used to be called). Today, Cumulocity IoT offers the extensive features of a general IoT platform (see Section „Data marketplaces"). These features can be accessed by users locally („edge", or on premise), cloud-based, or in hybrid models (where instances in the edge communicate with instances in the cloud). It is also possible for customers to run the Cumulocity IoT platform in a cloud („virtual private cloud") or their own data centre, and provide services to their customers.

The core of the functions is the scalable and powerful connection, and management of various types of „things", i.e. devices such as machines, vehicles or meters, whose data is collected centrally on the platform in real time. On the one hand, the interfaces to the platform can be customised for any new device. For a growing selection of device types, the platform also offers predefined „plug and play" connection options, which significantly reduce the entry barriers and the configuration or programming effort for users, thus, constantly expanding the platform's target group. The interfaces (APIs) to the Cumulocity platform are focused on security, transparency and stability. The documentation of the Cumulocity APIs is also openly accessible to non-customers.

In a second step, the platform offers standardised functions for visualising individual and aggregated device information in interactive dashboards, as well as predefined analysis services. In the third step, platform users can also define routines that automatically initialise processes, for example when the status of devices triggers a predefined alarm on the platform. This functionality also enables the integration of device information into business processes within the company. Machine data can also directly trigger processes in other IT systems (e.g. MES, ERP or CRM) and vice versa.

In addition to the platform's ready-made functions, users can customise the platform, e.g. by creating their own business rules, analysis services or Cumulocity IoT applications, in order to develop new services and business models in the future. In selected areas, e.g. in water supply or building management, so-called „solution accelerators" – i.e. modules for IoT applications in these business areas, which can be extended, combined and individualised by users - are available. In addition, Cumulocity IoT is the core technology of ADAMOS, in which Software AG as technology partner and operator has joined more than 20 partners from mechanical and plant engineering to form an industry-specific consortium in order to advance the topics of IIoT and Industry 4.0, from a technical perspective.

One revenue model of the platform is subscription fees, which are typically based on the number of devices, data, message and transaction volumes and the range of functions. For larger IoT initiatives, it is also possible to sign fixed-term contracts to enable IoT throughout the company at a fixed price. In addition, companies can license the Cumulocity IoT platform infrastructure for their own operations, to offer it as their own IoT platform („white labelling").

Economic characteristics of the platform

The platform invests both in new functionalities, as well as in being accessible to a wider base of users. In cooperation with powerful lead customers, Software AG strives to continuously develop the platform's functions (often in the form of so-called co-innovation projects, in which Software AG and its customer share the effort equally). Here, too, services are of considerable importance: Dedicated consultants are seconded to implement projects together with customers and, if necessary, provide ongoing advice on the platform's possible usage in a specific context. At the other end of the user spectrum, the possibilities for standardised („plug and play") services are being further expanded in order to reduce the entry barriers for digitally less experienced companies.

The competitive environment of general IIoT platforms

Although the market for general IIoT platforms is still at an early stage of development, both technically and in terms of adoption by users (cf. vbw 2019), there is already a broad international field of competitors from different sectors, pursuing their own approaches. Against this background, it is all the more remarkable that, according to Forrester, with the three case studies dealt with and the Bosch platform, four of the world's fourteen leading IIoT platforms are operated by German companies.[13] Different classes of competitors can be distinguished:

- **IIoT platforms of global IT and conglomerates** such as IBM (Watson IoT), Hitachi (Lumada), ABB (Ability) or General Electric (Predix).[14]
- **Providers of cloud infrastructure** (in particular Microsoft Azure, AWS and Alibaba Cloud) are continuously expanding the functions of their services, including their own edge offering, and are thus assuming a competitive role in the IIoT platform market in addition to the infrastructure perspective.
- **In addition, independent IIoT platforms** such as the American companies, like PTC and C3.ai, have also established themselves on the world market.
- Analogous to the competitive environment in marketplaces, industry companies with the necessary technical capacities are potential competitors. In addition to complete in-house developments (with a high investment outlay), companies can rely on white label solutions or development cooperation.[15]

Thus, intensive competition can currently be observed in a relatively early market phase.

Specialised IIoT platforms - MIP and ondeso

In addition to the general IIoT platforms, there are also specialised offerings from German companies that aim to make industrial processes more efficient, in close cooperation with equipment suppliers and plant operators. In the following, we will take a closer look at two case studies: MIP and ondeso.

MIP - independent platform with focus on manufacturing

Background

The Manufacturing Integration Platform (MIP) operated by the MPDV Mikrolab GmbH is able to generate a digital image of the complete manufacturing process and the manufacturing operations, which is interoperable with other digital systems (e.g. ERP) and embedded in an open ecosystem. MPDV has been active in technical data acquisition for the manufacturing sector since 1977 and has built up expertise in the digitalisation of manufacturing during this period. This also includes the existing inventory of plant and machinery and the software systems used in various industries, from automotive manufacturing to the metal industry and the food and pharmaceutical sector. For more than 20 years, the company

[13] See *https://www.forrester.com/report/The+Forrester+Wave+Industrial+IoT+Software+Platforms+Q4+2019/-/E-RES146958#*.

[14] In a detailed report from the early days of development (Economist 2016), market players explain their respective strategic orientation. This differs, for example, in how ownership of algorithms developed on the platform is handled.

[15] The Swedish industrial group Atlas Copco, for example, originally pursued its own development strategy, which it then expanded in 2019 through a cooperation with Microsoft (see *https://customers.microsoft.com/EN-GB/story/773140-atlas-copco-azure-belgium*).

has been implementing digital systems for production control and optimisation, so-called Manufacturing Execution Systems (MES), which establish interfaces and coordination between ERP systems and production.

With the platform MIP, these functions are considerably extended. Individual machines to entire manufacturing systems can be created on the platform and deliver predefined information to their digital twins - for example, functions can be viewed and monitored from any connected location and can also be traced and analysed via stored data. This information can be combined via connected ERP systems with information such as product-specific incoming orders, or the stock of operating materials. This information is then available in an integrated form, for example to plan production and coordinate it with purchasing. MIP is equipped with an open system structure that is compatible with the systems of different suppliers and manufacturers. Thanks to its many years of industrial experience, MPDV can draw on a broad, manufacturer- and industry-spanning know-how in the manufacturing environment and in the digitalisation of production.

With the help of open, documented interfaces, MIP's functions can be modularly extended via Manufacturing Apps according to the needs of the user - for example, for the evaluation of data or the automated creation of key figures. MPDV has opened the platform for this purpose to an ecosystem of cooperation partners who can sell their specialised solutions via the platform (MIP Marketplace). In addition, manufacturing companies can integrate their own existing legacy applications into the platform. To this end, the platform provides a semantic toolset, as well as MIP consultants and development support for development and implementation.

Competitive environment and economic characteristics of the platform

MIP is thus on the one hand in competition with „classic" MES providers; on the other hand, the field of application increasingly overlaps with the functions of the general IIoT platforms discussed above. Various factors contribute to differentiating MIP from these competitors:

- **Specialisation**: Since its inception, MIP has been closely aligned with the needs of manufacturing, and aims to make its processes more efficient and productive. The generated information is not just „raw data", but can be used directly in a semantic manufacturing context. In this context, it is also possible to build on more than 40 years of experience in the field of data acquisition and production optimisation.
- **Service character**: MIP applications aim to improve the manufacturing and production processes of production sites and to increase their efficiency. To achieve this, the platform must be individually adapted to the physical and organisational conditions on site. Consulting and support play an integral role in both the implementation and porting of legacy software and in new developments. Through these interactions, MIP learns more about users' requirements and can thus, further align and improve its offering to meet them.

ondeso - Platform for IT security and maintenance of industrial software

Background

ondeso is a specialised IIoT platform that has been active on the market since 2010. As was shown several times during the course of the study, a fundamental trend in German industry and with regard to plant operators is that machinery fleets are becoming increasingly heterogeneous, as companies combine machines from different manufacturers with each other („best of breed"). In the best case, this contributes to the optimisation of the productivity of the plant, as the optimal solution is selected for each application. However, plant operators are faced with the challenge that the machines in operation have considerable differences in the implemented software - for example, with regard to safety aspects, programming environment, new releases and updates. In order to ensure smooth plant operation - without unnecessary and costly downtime - releases and patches must be kept up-to-date for safety reasons on the one hand, but also synchronised with the processes and maintenance cycle of the machinery.

The ondeso platform thus serves two sides of the market: Plant operators ask for the security and stability of the software of their machinery. On the other hand, equipment suppliers have an interest in efficient processes, tailored to the needs of individual customers, for maintaining the software of their machines, as this has a positive contribution on the effectiveness of the products and is beneficial for customers. In addition, the need for the physical presence and the associated travel of service staff on site is reduced. ondeso uses interfaces to market participants on both sides to bring the information (on updates and releases) and files of the machine manufacturers into line with the structures and

processes of the plant operators. Based on a digital inventory of the software applications and operating systems of all machines in the plant (or even across locations), ondeso - unlike various manufacturers of individual machines - can help to ensure that the physical and digital maintenance cycles within the entire plant are coordinated. In this way, the platform - as mentioned in the introductory section on IIoT platforms - reinforces the complementarities within machine parks and can contribute to increasing overall efficiency. The platform's revenue model is based on fees for licences and services. ondeso's clients include large German industrial groups with a strong market and negotiating position vis-à-vis platforms and service providers. Similar to the general IIoT platforms, ondeso provides a secure infrastructure for data and files of the platform users and does not access them itself in any form.

Competitive environment and economic characteristics of the platform

The range of services offered by ondeso is in competition with the services of the equipment and machine manufacturers themselves. These are interested in selling their own services and some operate their own platforms in the IIoT sector. In addition to these established competitors, new companies are emerging, particularly in the American digital start-up ecosystem, whose business models are in part related to ondeso's approach. What economic factors contribute to ondeso's differentiation from its competitors?

- ondeso offers plant operators added value, in particular through the **close integration with the processes** within the plants. The coordination with the physical maintenance cycles must be carried out individually and adapted continuously. Thus, the activities of the platform have a **service character**. Due to the required complementary investments by the users, there are few incentives for multi-homing (parallel use of different platforms).

- As an **independent provider**, ondeso is able to work with different equipment suppliers and manufacturers to offer operators a comprehensive service from a single source. This reduces the friction caused by heterogeneous machine parks.

The role of data on industrial B2B platforms

04

An important issue requiring separate analysis is the role and handling of data on industrial B2B platforms. With regard to platforms, data receives considerable attention, concerning both competition and regulatory policy. For example, a paradigm shift in competition policy is called for, in which a focus should be set on the handling of data, instead of on the observed prices (Just 2018). The availability of data is partly seen as an entry barrier for competitors, which has already been the subject of private antitrust proceedings in the USA (Graef et al. 2015).

After having examined the business model and the competitive situation of ten German industrial B2B platforms in the case studies, we draw some conclusions on the handling of data and its role for competition. It is useful to distinguish between marketplaces on the one hand and data-centric platforms on the other.

THE ROLE OF DATA ON B2B MARKETPLACES

Marketplaces in the B2B context need to collect data from their users in order to operate the platform and process transactions. Furthermore, the transaction data itself is generated. In contrast to the B2C context, the direct monetisation of this data - for example, by enabling target-group-specific advertising - is not part of the business model of the B2B platforms under consideration. However, the resulting data can bring **indirect competitive advantages**, for example by enabling platform operators to make more relevant recommendations and improve search functions. This would be problematic from a competition perspective if it led to a lock-in of users on platforms. There is currently no indication of such a lock-in for the platforms analysed:

- In the B2B sector, **providers** are typically active on several platforms at the same time (multi-homing), each of which is used to address different target groups.

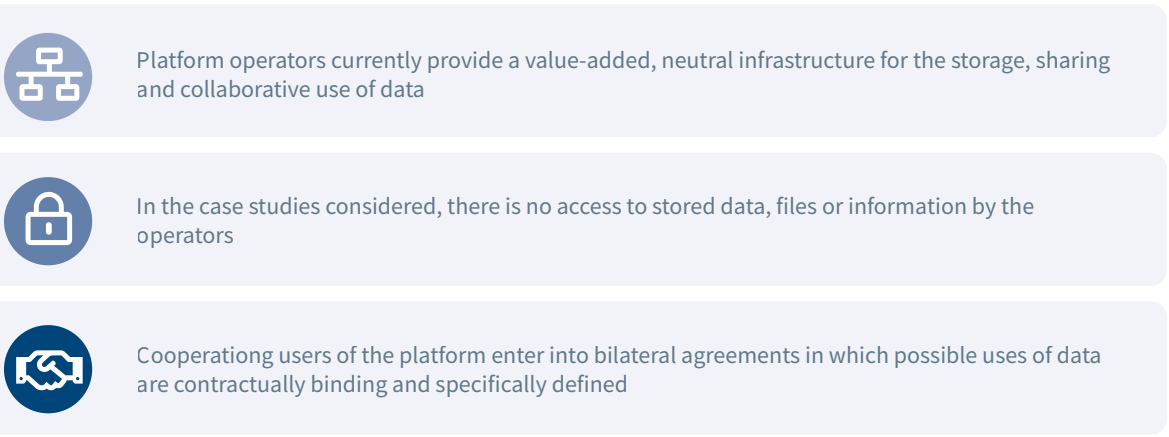
- **Demanders**, on the other hand, typically use a single platform intensively (single-homing). However, this cannot be explained with regard to a lock-in based on aggregated data. Rather, the fixed costs involved in adapting the platform to the physical purchasing processes mean that the use of a single platform minimises process costs from the buyer‘s perspective.

THE ROLE OF DATA IN IIOT PLATFORMS

The value proposition of IIoT platforms and data marketplaces is obviously closely linked to the data that is made available and usable by the platform. This data is imported into the platform from the users‘ systems via interfaces that are either completely open, or whose documentation is publicly available. Relative to the effort that has to be made in order to coordinate the processes in the company with the digital platform, the effort of the actual data migration can be considered low. Users of IIoT platforms have also noticed that larger users are currently still selecting platforms on a project-oriented basis, depending on partners and functional requirements - in other words, they are sometimes using several platforms in parallel (multihoming). This kind of behaviour is familiar from the times of earlier network economies, when clear positive network effects had not yet emerged. This may therefore be a snapshot of the early market phase.

From the point of view of the operators, the specific data of the users is not relevant for the business model. Rather, platforms provide a secure, neutral infrastructure, the aim of which is precisely to ensure that the shared data can only be used and accessed for contractually defined purposes. Any violation would constitute a legally sanctionable breach of contract and would fundamentally undermine confidence in the neutrality of the platform, and thus, endanger the market position. Figure 8 summarises the central arguments on the role of platform operators with regard to the transferred data. How competition will evolve on digital platform should be analysed based on the business model of existing platforms (Nooren et al. 2018).

Figure 8: The role of data on IIoT platforms and data marketplaces



Source: own illustration

Conclusion

When assessing the competitive situation of industrial B2B platforms, there are considerable differences across the three types of platform examined (marketplaces, data marketplaces and IIoT platforms). In the area of marketplaces, established business models exist and compete with both German providers and international competitors. At the latest after the entry of key international players into the German and European market, there has been intense competition in the marketplace sector in recent years. Nevertheless, new providers continue to enter the market - for example, with a specialised focus on individual industries or with a corporate focus. A key driver for such activities is the considerable pressure on German industry to digitalise.

A large number of international competitors are also competing for the data-based platform models (IIoT platforms and data marketplaces). In contrast to the marketplaces (where the largest industry representatives are American or Asian companies) German platforms in the IIoT segment play a leading role worldwide, according to independent industry studies: four of the fourteen most important IIoT platforms are based in Germany, according to the latest Forrester study. However, in a still young market, this is not a position on which industry or politics should rest - the focus must rather be on shaping the environment in Germany and Europe in such a way that the competitiveness of German IIoT platforms is maintained and promoted.

The current intense competition between platforms in the various market segments is a snapshot. However, one central question has so far received little attention in the literature: Which factors contribute to the fact that competition between digital B2B platforms can exist in the long term? In this study, we can identify from the literature and from the empirical case studies, several relevant factors to which this applies:

- **Negative network effects** resulting, for example, from competition between users on the platform reduce the impact of economies of scale and positive network effects.

- The offer of different platforms in the same segment can be **differentiated along different dimensions**, so that platforms address different user groups more or less strongly. Central factors here are price strategies, differentiation through functionality and performance, and the openness of the platform.

- One factor that is particularly evident in the case studies discussed is the strong **service character of industrial B2B platforms**. In order to lead to increased efficiency for users, the platform's offerings must be closely aligned and individualised to the processes and needs of the customers. On the one hand, such individualisation is an important differentiating feature for the platform, but it is difficult to scale automatically.

- In the B2B platform market, **specialisation** is also a significant factor - familiarity with the requirements of specific customer groups and industries, with their processes and success factors, is an important differentiating factor compared to more general platforms.

In ten case studies, we have both empirically described the current competitive situation and examined how these factors affect the model of the respective platforms. They thus provide valuable information on the question of whether the observed competition in the respective segments can be sustained. A summary evaluation of the underlying case studies is provided in the concluding Figure 9.

In this context, it can be seen that all offers (to varying degrees) are geared towards generating and using positive network effects. With regard to negative network effects, competition between the providers on the platform is particularly important in marketplaces. With regard to differentiation characteristics, each platform strives for innovation and better functionalities in a dynamic market environment. A stronger service character results partly from the history (e.g. due to grown "offline" relationships), or in the IIoT sector from the implementation of a service that directly competes with services (e.g. from equipment manufacturers). A strategy of specialisation in certain functionalities or activities can be observed particularly among providers in the IIoT sector, while in the case of marketplaces, an additional (service) offer rounds off the sector focus. A strong industry focus is a distinguishing feature of marketplaces - in the case of specialised IIoT providers this is induced (to a lesser extent) by their current customers and specialisation in their needs. Complementarity with other in-house offerings (e.g. complementary digital services or facilities that are made more efficient or given new functions by the platform) depends on the structure in which the B2B platform in question is embedded. This summary evaluation underlines how the different factors contribute to strategic differentiation and competitive positioning.

Figure 9: Competitive factors from the case studies

	Marketplaces				Data Marketplaces	IIoT-Plattformen				
	Mercateo	Wucato	CheMondis	bevazar	Telekom DIH	MindSphere	SAP AIN	Cumulocity IoT	IMIP	ondeso
Positive network effects	☑	✓	☑	✓	✓	✓	✓	✓	✓	✓
Negative network effects	✓	✓	✓	✓						
Differentiation by ...										
... Functionality and performance	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
... Service character	✓	☑	✓	✓	✓	✓	✓	✓	☑	☑
... Openness	✓	✓	✓	✓	✓	☑	✓	☑	☑	✓
Specialisation				✓					☑	☑
Sector focus			✓	☑				✓	✓	✓
Complementary with other services	✓	✓			☑	☑	☑	✓	✓	

Legend: ✓ existing ☑ very pronounced

Specialisation refers to the focus on specific functionalities or services, **Sectorialfocus** on (a) specific Industry(ies)

Source: Own representation

References

Applico (2020): "Marketplaces Are the Next Big Thing in B2B Chemical Distribution", article by Alex Moazed, 18. Februar 2020, available online: *https://www.applicoinc.com/blog/marketplaces-are-the-next-big-thing-in-b2b-chemical-distribution/.*

Armstrong, M. (2006): "Competition in Two-Sided Markets", The RAND Journal of Economics, 37(3), pp. 668–91.

Baker, G., Gibbons, R., and K. Murphy (2002): "Relational Contracts and the Theory of the Firm", The Quarterly Journal of Economics, 117(1), pp. 39-84.

BCG (2017): "Who will win the IoT platform wars?", study, available online: *https://www.bcg.com/de-de/publications/2017/technology-industries-technology-digital-who-will-win-the-iot-platform-wars.aspx.*

BDI (2019): "German Digital Industry Platforms", available online: *https://bdi.eu/publikation/news/deutsche-digitale-b2b-plattformen/*

Belleflamme, P. and M. Peitz (2018): "Platforms and network effects." Handbook of Game Theory and Industrial Organization, Volume II. Edward Elgar Publishing, 2018.

Belleflamme, P. and M. Peitz (2019): "Managing competition on a two-sided platform", Journal of Economics & Management Strategy, 28(1), pp. 5-22.

Boik, A., and K. Corts (2016): "The effects of platform most-favored-nation clauses on competition and entry", The Journal of Law and Economics, 59(1), pp. 105-134.

Brynjolfsson, E., Hitt, L. and H. Kim (2011): "Strength in numbers: How does data-driven decisionmaking affect firm performance?", working paper, verfügbar unter: *https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1819486.*

Broekhuizen, T. L. J., Emrich, O., Gijsenberg, M. J., Broekhuis, M., Donkers, B., und L. Sloot (2019): "Digital platform openness: Drivers, dimensions and outcomes", Journal of Business Research, im Erscheinen.

Calzolari, G., Felli, L., Koenen, J., Spagnolo, G., and Stahl, K. O. (2019): "Trust, investment and competition: theory and evidence from German car manufacturers", available online: *https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3395187.*

cefic (2020): "Landscape of the European Chemical Industry 2020", sector report, available online: *http://www.chemlandscape.cefic.org/wp-content/uploads/combined/fullDoc.pdf.*

Cennamo, C., und J. Santalo (2013): "Platform competition: Strategic trade-offs in platform markets", Strategic management journal, 34(11), pp. 1331-1350.

Coase, R. (1960): "The problem of social cost", in Classic papers in natural resource economics, Palgrave Macmillan, London, pp. 87-137.

Economist (2016): "Siemens and General Electric gear up for the internet of things", 3 Dezember 2016, available online: *https://www.economist.com/business/2016/12/03/siemens-and-general-electric-gear-up-for-the-internet-of-things.*

Eisenmann, T.R., Parker, G. and M- Van Alystyne (2009): "Opening Platforms: How, when and why?" in A. Gawer (Editor) Platforms, Markets and Innovation, Edward Elgar Publishing, Cheltenham, UK and Northampton, MA, pp. 131–62.

Etailment (2017): "Digitalisierung der B2B-Welt: Diese Player müssen Sie kennen", 30 January 2017, available online: *https://etailment.de/news/stories/B2B-Markplaetze-Gute-Geschaefte-mit-Geschaeftskunden-20279.*

etailment (2019): "Wie Alibaba seine Europa-Expansion beschleunigt", 9 December 2019, *https://etailment.de/news/stories/alibaba-AliExpress-Expansion-22728.*

Evans, D. and R. Schmalensee (2017): "Network Effects: March to the Evidence, not to the Slogans", Antitrust Chronicle, August 2017, available online: *https://mitsloan.mit.edu/shared/ods/documents/?PublicationDocumentID=4243.*

Evans, D. and R. Schmalensee (2018): "Debunking the ‚Network Effects' Bogeyman", Regulation, Winter 2017-2018, pp. 36-39.

Farrell, J., and P. Klemperer (2007): "Coordination and lock-in: Competition with switching costs and network effects", Handbook of Industrial Organization, 3, pp. 1967-2072.

Forrester (2019): "The Forrester Wave: Industrial IoT Software Platforms, Q4 2019", available online: *https://www.forrester.com/report/The+Forrester+Wave+Industrial+IoT+Software+Platforms+Q4+2019/-/E-RES146958.*

Graef, I., Wahyuningtyas, S. Y., and P. Valcke (2015): "Assessing data access issues in online platforms", Telecommunications policy, 39(5), pp. 375-387.

Haucap, J. and T. Stühmeier (2016): "Competition and Antitrust in Internet Markets", Handbook on the Economics of the Internet, pp. 183-210.

ibi (2019): "B2B-E-Commerce 2020 – Status quo, Erfahrungen und Ausblicke", study, December 2019, available online: *https://ibi.de/veroeffentlichungen/B2B-E-Commerce.*

Jones, C. I., and C. Tonetti, C. (2019): "Nonrivalry and the Economics of Data", NBER Working Paper No. w26260.

Jullien, B. and W. Sand-Zantman (2019): "The Economics of Platforms: A Theory Guide for Competition Policy." TSE Digital Center Policy Papers series 1.

Just, N. (2018): "Governing online platforms: Competition policy in times of platformization", Telecommunications Policy, 42(5), pp. 386-394.

Karle, H., Peitz, M. and M. Reisinger (2019): "Segmentation versus Agglomeration: Competition between Platforms with Competitive Sellers", Journal of Political Economy, im Erscheinen.

Kiel, D., Arnold, C., Collisi, M. and Voigt, K. (2016): "The impact of the industrial internet of things on established business models", Proceedings of the 25th international association for management of technology (IAMOT) conference, pp. 673-695.

Koenen, J., Krüger, S. and F. Pavel (2018): "Study on contractual relationships between online platforms and their professional users", Study for the EU Commission (DG Connect), available online: *https://publications.europa.eu/en/publication-detail/-/publication/b3d856d9-4885-11e8-be1d-01aa75ed71a1/language-en.*

Koutroumpis, P., A. Leiponen and L. Thomas (2017): "The (unfulfilled) potential of data marketplaces", No. 53. ETLA Working Papers.

Lange, J., Stahl, F. and G. Vossen (2016): "Datenmarktplätze in verschiedenen Forschungsdisziplinen: Eine Übersicht", Informatik-Spektrum, 41(3), pp. 170-180.

Lundborg, M. and I. Gull (2019): "Digitale Plattformen als Chance für den Mittelstand", Mittelstand Digital, published by WIK GmbH, October 2019.

Meisel, L. and M. Spiekermann (2019): "Datenmarktplätze – Plattformen für Datenaustausch und Datenmonetarisierung in der Data Economy", Fraunhofer ISST report, available online: *https://www.isst.fraunhofer.de/content/dam/isst-neu/documents/Publikationen/Datenwirtschaft/2019-2_ISST-Bericht_Datenmarktplaetze-ISSN-0943-1624.pdf.*

Ondrus, J., Gannamaneni, A. and K. Lyytinen (2015): "The impact of openness on the market potential of multi-sided platforms: a case study of mobile payment platforms", Journal of Information Technology, 30(3), pp. 260-275.

Production (2016): "SAP Asset Intelligence Network – Die Plattform für Anlagendaten", published on August 3, 2016, available online: *https://www.produktion.de/digital_supply_chain/sap-asset-intelligence-network-die-plattform-fuer-anlagendaten-353.html.*

Parker, G., and M. Van Alstyne (2018): "Innovation, openness, and platform control", Management Science, 64(7), pp. 3015-3032.

Roland Berger (2018): "B2B Marketplaces are blossoming", study, available online: *https://www.rolandberger.com/en/Publications/B2B-Marketplaces-are-blossoming.html.*

Nooren, P., van Gorp, N., van Eijk, N., und R. Fathaigh, R. (2018): "Should we regulate digital platforms? A new framework for Evaluating policy options", Policy & Internet, 10(3), pp. 264-301.

Siemens (2020): "MindSphere von Siemens führt industrielle IoT-Dynamik fort", available at: *https://www.plm.automation.siemens.com/global/de/our-story/newsroom/mindsphere-industrial-iot-momentum/69589.*

Stracke, S., and B. Homann (2017): "Branchenanalyse Getränkeindustrie: Marktentwicklung und Beschäftigung in der Brauwirtschaft, Erfrischungsgetränke- und Mineralbrunnenindustrie (No. 368)", Study of the Hans-Böckler-Stiftung, October 2017.

Thomas, L. and A. Leiponen (2016): "Big data commercialization", IEEE Engineering Management Review, 44(2), pp. 74-90.

vbw (2019): "Plattformen – Infrastruktur der Digitalisierung", Association of the Bavarian Economy, January 2019.

Yang, Q., and Y. Ji (2016): "The platform economy and natural monopoly: regulating or laissez-faire?" Fudan University, Shanghai, 200433.

Appendix – Platform Operator Interview Guide

The scheduled call duration is between 60 and 75 minutes. The topics of conversation can vary depending on the conversation partner and platform model. Therefore, topic areas are defined, but no final set of questions is given. The sample questions below are intended to illustrate the topic areas and objectives.

DEVELOPMENT, BACKGROUND AND BUSINESS MODEL (ABOUT 10 MINUTES)

Sample questions:

- How long has the platform been on the market?
- If possible, briefly outline the business model of the platform.
  - What are the key benefits your customers derive from the platform?
  - What are the key components of the revenue model?
- How does the platform complement other offerings of your group?
  - What role does the platform play today (probably in 2-3 years) for the business model of your company?
  - How does the platform relate to other products/services/distribution channels?
- Which groups of users are active on your platform?
  - Are they in competition with each other? In what form is this most strongly expressed (price competition, differentiated products, competition for attention/visibility)?
  - Which USP or central advantage does your platform offer to the respective user groups?

MARKET ENVIRONMENT (APPROX. 5-10 MINUTES)

Sample questions:

- How has the market in which you operate changed over the past 3-5 years?
- How do you estimate the relative development of digital to "classic" offers in the short and medium term?
- Market dynamics - How are sales developing in the market in which you are active
  - ...current?
  - ...probably in the next 3-5 years?
- Are there factors in your core market (e.g. Germany, EU, etc.) that you perceive as central disadvantages (advantages) compared to other markets (e.g. USA, China, India)?

Competitive environment and openness of the platform (approx. 5-10 minutes)

Sample questions:

- Who are your key competitors?
  - Online/offline?
  - National/international?
  - Already active/potential new market entries
- Are your users typically active on multiple platforms? What is decisive for this decision?
- What requirements do users (of the different groups) have to meet to be active on your platform (e.g. certification)?
- Can users generally switch between platforms? How is the portability/migration capability of data ensured if necessary?

INVESTMENTS AND GROWTH (APPROX. 5-10 MINUTES)

Sample questions:

- What investments are currently planned in the near future to further advance the development of the platform?
  - Are there factors in the environment that hinder investment decisions?
- What role do investments play in particular in the following areas
  - Capacity to store and back up data?
  - Capacities for data evaluation and analysis?

- "Make-or-buy" - which activities do you keep within the company, or do you implement with strategic partners, or do you make purchases?
  - What are the main drivers for these decisions?

THE ROLE OF AND THE HANDLING OF DATA (ABOUT 10 MINUTES)

Sample questions:

- What role do the following play in the platform's business model
  - ...machine data?
  - ...user data?
  - ...transaction data?
  - ...other kinds of data?
- What are the key benefits for the users of the platform from the data available to you?
- What paths to monetisation, if any, are being pursued?
- What are the central pillars of your data governance strategy in terms of ensuring
  - … data quality?
  - … maintenance and enrichment of data sets?
  - … protection of company data and sensitive information?
  - … compliance with legal requirements (Germany/EU/International)?

REGULATORY ENVIRONMENT (ABOUT 5-10 MINUTES)

Sample questions:

- Do you perceive regulation at the national and European level as a relevant competitive factor vis-à-vis e.g. American or Chinese platforms?
  - What is the role of data protection (GDPR) in particular?
  - To what extent do these factors influence your investment decisions?
- Are there concrete regulatory obstacles that currently stand in the way of the further development of the platform? Do you see a need for political action?
- What role does the European internal market play in the scaling of the platform? Where in particular are there problems here?

REMAINING TIME FOR OTHER TOPICS (10-15 MINUTES)

ifo INSTITUT
Leibniz-Institut für Wirtschaftsforschung
an der Universität München e.V.