



Big Digital Platforms

Growth, Impact, and Challenges

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In recent years we have witnessed the rise of the platform economy. The world's most valuable public companies are five American technology firms: Microsoft, Amazon, Apple, Alphabet (Google), and Facebook. These companies are closely followed by Chinese tech giants such as Alibaba, Tencent, Baidu, and Xiaomi, and many more US-based internet companies such as Netflix, eBay, Uber, Salesforce, and Airbnb. Most of these organizations are young (Apple and Microsoft being the adolescents) and were able to grow extremely fast due to the digital platforms they provide. The most common types of platforms are *transaction platforms* that match supply and demand (e.g., Amazon, Alibaba, Airbnb, Uber, and Baidu). Other examples are *technology platforms* that provide a technical infrastructure that other people can build upon (e.g., Microsoft's software platform and the App stores of Google and Apple). These digital platforms have radically changed the way we work, do business, socialize, learn, move, produce, etc. Such platforms can be found in any domain, ranging from learning (e.g., Coursera, EdX,

Udacity, and FutureLearn) to smart homes (e.g., Amazon Alexa, Apple Homekit, Google Assistant, Philips Hue, and Samsung SmartThings). The rise of these digital platforms is highly relevant for BISE (Business & Information Systems Engineering) authors and readers, because they combine new business models with technological innovations (e.g., machine learning).

The Winner Takes it All For sure, large-scale digital platforms make our lives easier (Kenney and Zysman 2016; de Reuver et al. 2018; Stummer et al. 2018). Products and services are delivered faster and more cheaply. These platforms have also made it easier to connect people and businesses. Uber connects drivers and passengers that would otherwise never get together. We find information that we would have never found thanks to Google. We may establish valuable connections through LinkedIn. Using Amazon we are able to buy almost anything at a lower price and in a more convenient manner. Amazon Marketplace enables third-party sellers to sell products alongside Amazon's regular offerings. Imagine that there were 50 competing Ubers, Googles, LinkedIns, and Amazons, all covering different segments of the internet, professions, or product types. This would lead to inefficiencies and frustration. Therefore, as consumers, we tend to benefit from these big digital platforms.

Successful platforms have the characteristic that they grow very fast and that, in the end, often one winner remains. After a platform has become the market leader, it is very difficult to compete for organizations that started later. IBM still dominates the computer mainframe market after 60 years. Intel and Microsoft are still dominant in the processor market and the software market for personal computers. It seems that Google, Amazon, and Facebook will dominate, respectively, search, shopping, and social

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media for years to come. A rule of thumb is that successful platforms can be “eclipsed” but not “displaced” (Barwise 2018; Barwise and Watkins 2018). For example, Kodak had a market share of 85% in camera sales and 90% in film sales. It was not the direct competition, but the shift to digitization that caused the decline of Kodak. The traditional camera business was eclipsed by digital cameras which in turn were eclipsed by smartphones.

Why do successful platforms evolve into monopolistic platforms where the winner takes it all? There are several reasons for this (Shapiro and Varian 1999; Stummer et al. 2018). First of all, the traditional economy of scale applies. Digital products and services tend to require huge fixed costs and low marginal costs. For example, it is very costly to develop machine-learning techniques that scale well. However, applying the learned model to a new batch of customers is cheap. Note that the marginal transaction costs for Airbnb and Uber are close to zero. If there are losses, these are caused by fixed costs. Second, there are often so-called “network effects”. The more people or organizations join, the more valuable the platform becomes. If only one of your friends is on Facebook, then the platform is less valuable than when almost all of your friends are on Facebook. Offering just one room in Amsterdam makes Airbnb less valuable, however, when thousands of rooms are offered by Airbnb the value increases. Also, machine learning techniques work better when there are more data. Hence, as the platform usage increases, automatically the quality of the platform increases. Next to these network effects, technology companies use a range of strategies to lock-in users (e.g., not trying to reducing switching costs).

Data Protection is Just One Element The success of the big digital platforms has triggered quite some concerns. The EU General Data Protection Regulation (GDPR) is the most important change in regulating data privacy in the last 20 years and was set off by concerns about the rise of the big digital platforms. Mark Zuckerberg, the chief executive of Facebook, was scrutinized by members of the European Parliament because of privacy breaches in May 2018. For a long time, the leading American technology firms were not hindered by regulators and politicians. However, this has changed recently. Not long ago, US president Trump accused Facebook, Google, and even his preferred communications outlet, Twitter, of a bias against conservative opinions. This fueled antitrust investigations against Facebook, Google, Apple, and Amazon. Hence, big digital platforms have been put under scrutiny for very different reasons (Bercovici 2019; Day and Gu 2019). Some of these arguments against big digital platforms are rather artificial. However, there are clear negative side-effects.

Figure 1 highlights four potential problems caused by successful digital platforms. First of all, there is the

problem that competition becomes difficult as soon as there is a clear market leader (“the winner takes it all”) and dominance may stifle innovation. Second, the platform may collect lots of confidential data. For example, the Facebook – Cambridge Analytica data scandal in 2018 revealed that the personal data of millions of people’s Facebook profiles were used for political advertising purposes. There are also more subtle uses of user data by the platform, e.g., recommending things your friends buy. Often it is unclear where the ethical and legal boundaries are. The third problem shown in Fig. 1 is a possible bias in the rankings created by the platform. This may range from filtering out certain opinions (e.g., for political purposes) to ranking products in an unfair manner. In such cases algorithms are manipulated to provide a different outcome, giving advantage to a third party (possibly the platform itself). For example, Google was accused of promoting its own comparison shopping service in search results. Amazon is both a digital platform and a supplier of products (smartphones, televisions, speakers, TV-series, diapers, etc.), which automatically leads to conflicting interests. The fourth problem is that large digital platforms tend to integrate the market horizontally, sometimes even vertically, utilizing their user base as an asset. Moreover, the profits generated by a dominant platform may be exploited to subsidize expansion in other sectors. For example, Google uses its profits from search engine marketing to invest in many other services and products. As a result, competition in upcoming markets becomes difficult.

The focus in Europe seems to be on the second problem in Fig. 1 (i.e., privacy and confidentiality). The GDPR is a prime example of this. However, one could argue that complex regulations such as the GDPR only strengthen the positions of large tech companies (that have strong legal support and ways of handling advanced technological challenges). Moreover, is privacy the biggest problem we are facing? The search-engine market-share of Google is estimated to be 92.6% (July 2019). The second largest search engine (Bing) has only 2.5%. Amazon is selling 84% of all e-books purchased (Day and Gu 2019). However, companies are allowed to possess such complete market dominance according to the current interpretations of antitrust laws in most countries. The dominance of a platform in one sector may also jeopardize competition in other sectors (fourth problem in Fig. 1). Hence, a monopoly in one sector can easily lead to additional monopolies in other sectors.

Transportation as a Platform The significance of digital platforms is underestimated because they appear to be virtual (“in the cloud”). However, these platforms do not only influence the digital world. For example, retail shops in city centers are struggling to survive. The platform

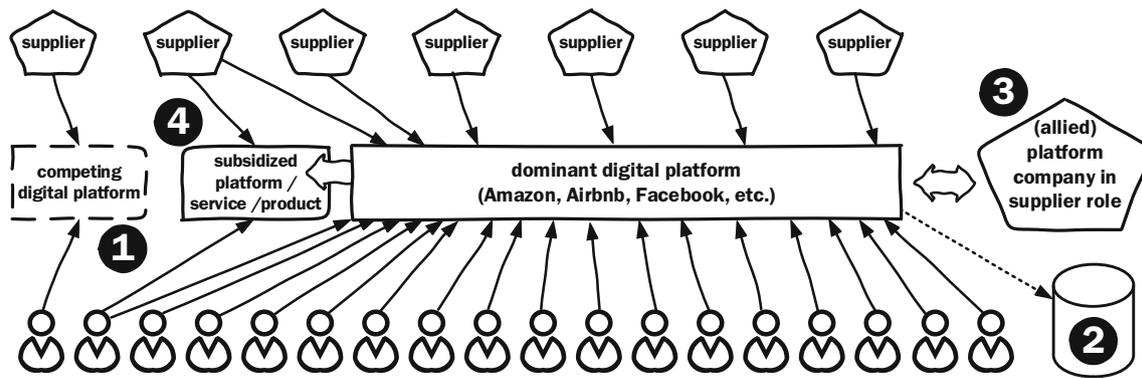


Fig. 1 Four possible problems of big digital platforms: (1) no real competition is possible because of the scale needed, (2) confidential data is collected and used to obtain competitive advantages or additional revenue, (3) the platform may be biased (e.g., because the

supplier role and platform role are combined), and (4) the profits and user base generated by the dominant platform are used to expand horizontally or vertically

economy will increasingly impact the physical world. For example, we anticipate that platforms will more and more affect transportation and the use of public spaces. Autonomous self-driving cars may exist only in a transitional phase. To make best use of the scarce space, autonomy may be counterproductive (autonomous self-driving cars driving at different speeds all looking for parking spots in a city will not solve the challenges cities are facing). Roads could become part of a digital platform with standard interfaces and services. Platform companies could bid to be able to manage all the roads in a particular city or region. This is comparable to today's 5G spectrum auctions where companies can bid for frequencies. For example, in June 2019, the 5G auction in Germany raised €6.6 billion from four telecom operators. Frequencies can be compared to roads and other public spaces, and may be auctioned in the future. Viewing the roads as a digital platform would allow for a much better use of public space (matching supply and demand and optimizing the throughput) and a range of new services. However, such developments will also trigger a range of questions, both of a technological and a regulatory nature.

Relevance for BISE The remarkable expansion of big digital platforms is changing the way we analyze, design, implement, and manage information systems. Hence, this is highly relevant for the BISE audience, but only a few publications exist on the topic (Hinze et al. 2019). Moreover, digital platforms based on network effects are difficult to replicate, e.g., in a laboratory. This makes it difficult to explore features or mechanisms that are not already implemented by the platforms. It is even difficult to conduct surveys based solely on hypothetical questions and intentions without framing the participants. An opportunity may be provided by open data. For example, in de Reuver et al. (2018) the authors state that “data-driven” approaches can assist research on digital platforms due to the

increasing availability of openly accessible data. Forcing organizations to provide anonymized open data may help to address the negative side effects mentioned.

It is also interesting to see the role platforms play in our research. We store our code on GitHub or SourceForge and publish our papers via the platforms of Springer and Elsevier. For machine learning, we build upon ecosystems such as Python (with libraries such as Scikit-Learn), R, RapidMiner, Knime, and TensorFlow. However, these are very different from the transaction-oriented digital platforms mentioned before (Amazon, Alibaba, Airbnb, Uber, and Baidu). Also, Google, Amazon, Apple, and Facebook are heavily investing in machine learning (in particular deep learning). They do this because of the importance of machine learning for the effectiveness of their platforms. However, by pinching talent from universities, they may also threaten the training of the next generation of academics (Procaccia 2019). This shows that the impact of big digital platforms is multifaceted and cannot be left to politicians. Hence, we encourage BISE researchers to actively engage in debates on the governance of these platforms.

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