Open ecosystem platforms for assistants and IoT-devices: a look into corporate practice

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Abstract: Platforms are becoming an increasingly important part of today's and future innovations. However, from a privacy and security, as well as from a societal perspective, closed proprietary platforms, the currently dominant form, possess certain potentially problematic features. This is why many call for open ecosystem approaches that so far have had only limited success on the market. In order to design an open ecosystem platform in a way that is attractive to companies, we therefore analyze the role platforms and related aspects play in companies' strategies. This is achieved through an analysis of the annual corporate reports of large companies. Results show that platforms are a common topic in all industry sectors, with closed proprietary approaches prevailing. This illustrates that open ecosystem approaches are still hardly considered by the big industry players and more efforts are needed to make them economically attractive.

Keywords: open ecosystem; platform; Internet of Things; IoT; smart assistants; assistance systems; content analysis

1 Introduction

It is expected that the Internet of Things (IoT) and smart assistance systems (supported by artificial intelligence technologies) will fundamentally shape our future way of life. So called platforms already serve as the basis for many of the high-technology products and services of today such as smartphones and social networks, and are expected to gain even more in importance for future innovations connected to the Internet of Things and smart assistance systems [Bu16b] [Gu13]. In May 2017, as we are writing this article, Alphabet, Amazon, Apple, Facebook and Microsoft are the world's five most valuable listed firms. Significant parts of their business (for some of them virtually their whole business) are based on platforms [Th17]. Because of this importance of platforms, we think that it is necessary to examine some of their special features as they also have implications for security and privacy as well as for business models in a platform context. This is fundamental if we want to develop platform based applications and services that are secure and privacy friendly and at the same time successful enough on the market to actually reach and be beneficial for users.

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As closed, proprietary platforms controlled by one big player can include some problematic features in terms of privacy, security, innovation and other societal aspects (see chapter 2) many initiatives promote the development of open platforms or the creation of open ecosystems for platforms. Examples of the Internet of Things, smart services and smart assistants are Big-IoT (`big-iot.eu`), SmartOrchestra (`smartorchestra.de`), OpenIoT (`openiot.eu`) and our project ENTOURAGE (`entourage-project.de`). Many of these initiatives put a great emphasis on developing open standards, powerful architectures and flexible interfaces. While these are certainly necessary for the technical functionality of the open platform, they are not sufficient for its broad success. For this they need to attract and retain users on all sides of the platform – end users as well as providers of services, hardware and software – through the right incentives. Moreover, the platform as a whole is required to somehow cover the costs for the party or the parties that developed it and that bear the costs of its operation. This shows that we need to look at the incentive structures and business models for privacy friendly and secure open platforms if we want to make them successful. So besides technical, we also have to consider economic and legal aspects if we want to promote open platform ecosystems. As we have already given a broad overview of the fundamental economic and legal challenges in a recent paper [KGH16], this paper is now focusing on the economics of open platforms.

2   The call for open ecosystems

A platform can be defined as a set of technological building blocks and complementary assets that companies, entrepreneurs and individuals can use and consume to develop complementary products, technologies and services [Mu13]. The non-technical aspects of platforms are especially notable for this paper. Platforms create two- or multi-sided markets that coordinate the demand of distinct groups of actors who need each other in some form [Ev03]. Such platforms can be categorized as proprietary or open. Simply put, open platforms allow free entry on all sides of the market (for developers and users), while proprietary platforms restrict this entry in some form and are controlled by one or several sponsoring institutions [We03] [Ha09]. While firms usually prefer proprietary platform strategies, as they provide better barriers to imitation and better margins, this strategy may only be available to market leaders [We03], and from a societal point of view, closed platforms are often seen critical [Bu16b]. Platform markets are often a "winner-takes-all markets"[Ei08]. With open platforms this is not problematic, as new players can always enter the platform market. However, operators of successful proprietary platforms often possess a high power over the market [Th17]. This happens because of the fact that the structural barriers to enter the market for competing platforms can be very high. A reason for this is that due to indirect network effects a platform has to reach a critical mass of users before it is really attractive. To reach this critical mass, high initial investments, for example into marketing, are required. Moreover, the initial technical development costs for the software platform and architecture can also be significant, while the marginal costs upscaling of the technical infrastructure for already successful platforms may be negligible. Proprietary platforms are therefore also watched closely by antitrust agencies [Th17] [Bu16a] [VB15].

Aspects of privacy and data sovereignty contribute even further to the critical perspective on dominant proprietary platforms. Business models of platforms are often based (at least partly) on the economic utilization of the data that is generated through the platform. And with an increasing number of connected IoT-devices there will be much more data and it will become even more valuable [Th17]. Data is often personal data that can be used for advertising purposes or to improve algorithms. Currently, the discussion about the owner-ship and the exact value of this data is still ongoing. Moreover, this data might be stored outside of the jurisdiction of the users [Bu16b].

If only one or very few attractive platforms exist in a specific application area, these plat-forms also control the vast amount of data that is generated by their users. For a society, this raises the question of how to deal with the fact that single institutions possess de-tailed personal information about large parts of the population and the not only economic power resulting from it [KZ16]. Therefore, we can observe a call for open platforms, inter-operability between platforms in an ecosystem, or at least the portability of data from one platform to another which would facilitate the switching between platforms for users and the so called multi-homing (simultaneous use of competing platforms [Ei08]) [Bu16b]. This is regarded as a way to lower the dominance of single operators of proprietary plat-forms, which brings challenges as described above, and furthermore as a way to promote innovation [Th17] [PV10] [PVJ17]. However, in spite of all calls and initiatives for open platforms, it seems as if proprietary, more or less closed platforms regularly seem to dom-inate the markets. Social networks and smartphone operating systems can serve as two examples. In the case of the Internet of Things and smart assistance systems we can ob-serve a gradual opening of platforms from big players like Amazon and Google [Pr17], but these platforms nevertheless remain under their strict control and can't be called open ecosystems. Therefore, we need to better understand the position of the industry in order be able to design a successful open platform ecosystem and motivate companies to par-ticipate in the ecosystem to reach a critical mass of providers which makes it attractive to users.

3   Analysis of corporate reporting on open platforms and ecosystems

In the following section we carry out an analysis of the annual corporate reports of the 25 largest German companies by turnover in the year 2015/2016[Fo17] (excluding three wholesale and retail companies). We chose the method of a combined quantitative and qualitative content analysis of published corporate reports to gather insights into the busi-ness strategy of the most important German companies. Content analysis is performed to make replicable and valid inferences from texts (or other meaningful matter) to the con-texts of their use [Kr04]. Already today platform markets are significant drivers for eco-nomic success and will continue growing in significance in the future (see above). A com-pany's business strategy – as reflected in the corporate report – should therefore somehow address platforms. Moreover, with important stakeholders like antitrust agencies calling for an opening up of closed proprietary platforms, open platforms and ecosystems are also relevant aspects to consider in the strategy. Finally, we also wanted to capture if and how companies include smart assistants as promising technology related to platforms in their

strategy. These points give us valuable insights for our research project ENTROURAGE to design an open platform ecosystem for smart assistance systems that also matches companies' economic requirements.

The analysis of corporate reports to gain insights into firms' strategies is an established method in business science. The report can serve as "keyhole through which one can observe the evolution of a corporate strategy" [PGM95], p 303. For example, it has been applied to observe firms' Green IT strategies [DJW17], and general IT strategies [PGM95]. Firms communicate with their stakeholders through the reports. To their shareholders and potential future investors they want to appear as economically successful. Platform aspects and smart assistants are issues that can be relevant for (future) economic success and could therefore be included in the reports. For other stakeholders like politicians, antitrust agencies, and non-governmental interest groups, different aspects of the corporate performance might be more important than just economic success. For the field of interest of this paper these aspects are open platforms and a fair platform economy. As stakeholders might use their power to influence the firm towards their preferred policy goals and because this can affect corporate success, firms might want to signal to these stakeholders through their reports that and how they already consider open platforms and a fair platform economy. Therefore, we think that our methodology of a content analysis of corporate reports is suitable.

As part of the quantitative analysis we initially defined the following subjects for the investigation: *smart assistants, digital platforms (open approach), digital platforms (closed approach), Internet of Things, digitalization*. We then automatically searched the corporate reports for predefined keywords that indicate a coverage of the related subject. In a subsequent qualitative content analysis, the previously identified contents are then evaluated in detail. Since the concept of open platforms and ecosystems is currently in an early adoption stage [Ro03], we assume that the necessary effort to establish these technologies is relatively high and in turn is reflected in the corporate reports as part of the corporate strategy.
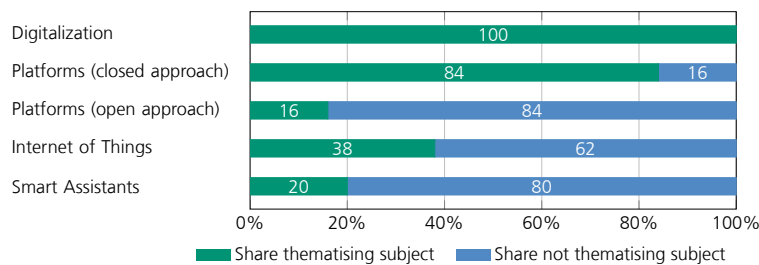

Fig. 1: Industry sectors of sample companies

We chose 25 largest German companies by worldwide turnover [Fo17] in the year 2015/16. Their cumulated turnover is 1,744 billion US Dollars, which corresponds to approximately 27 percent of the total turnover of German companies in 2015 [St16], showing that this sample already captures a significant part of all German companies. Furthermore, large companies are able to master high investments for new technologies and potentially co-

operate with many other small or medium sized companies as technology leaders thereby having a great impact on the total market.

As shown in Fig. 1 the companies can be assigned to the following six main industry sectors: "automotive", "electric utility", "insurance/financial services", "chemical/pharmaceuticals/heath", "infrastructure"and "conglomerate company". Due to this fairly high number of heterogeneous industries we achieve a cross-sector analysis of the main industry branches. With 20 percent ($n = 5$), the industry sectors "automotive" and "insurance/financial services" hold the largest share of the investigated companies followed by "infrastructure" with 16 percent ($n = 4$). The industry sectors "electric utility", "conglomerate company" and "chemical/pharmaceuticals/health" are equally represented at 12 percent ($n = 3$). 8 percent ($n = 2$) that belong to an industry sector that only once was found are aggregated and presented in the category "other".

As shown in Fig. 2, all sample companies address the ongoing trend towards digitalization in their corporate reports, covering almost all business divisions and procedures. This result is also reflected in numerous studies[Vo10]. With a high share of 84 percent, we observe a high diffusion of closed platform concepts in all industry sectors. Within the sectors "automotive", "conglomerate company" and "chemical/pharmaceuticals/health" all companies follow this trend. The platforms in question are used in a wide range of areas, such as company internal processes (e.g. production monitoring), customer services or solutions to improve a product or service by utilizing information from other systems (e.g. hazard recognition for driving assistance systems).

Only 16 percent of the companies follow an open platform approach. In this case the most represented industry sectors are "automotive", "chemical/pharmaceuticals/health" and "infrastructure". The area of application is primarily a platform for the cooperation of companies (e.g. joint research and development platforms, platforms for connecting IoT devices). Accordingly, all of the identified industry sectors in this context feature a high share of cross-company business activity. 8 percent of platform approaches don't fully match our definition of an open platform but pursue the compatibility to other systems via application programming interfaces (APIs). The high diffusion of closed platform concepts for end users indicates that the companies in the sample pursue a maximization of the market penetration with a lasting commitment of the customers to the company brand.
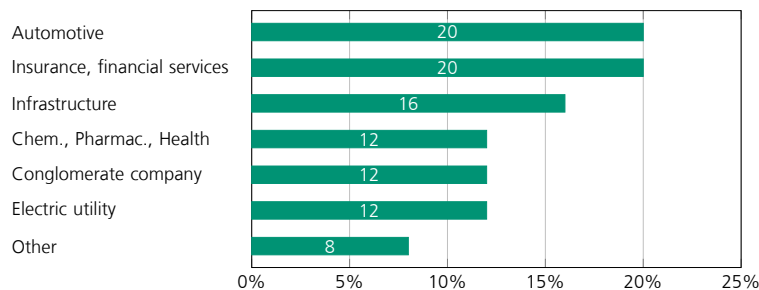

Fig. 2: Distribution of the subjects/technologies

The IoT is thematised in 38 percent of the companies in the sample. It has been found in all investigated industry sectors except "chemical/pharmaceuticals/health". With a share of 67 percent the conglomerate companies in particular thematise this subject in their corporate reports followed by the industry sectors "automotive" and "infrastructure" with a share of 50 percent each. A closer examination of the corporate reports showed the use of the Internet of Things in the field of connected products for users (e.g. smart home appliances) and Industry 4.0 (e.g. monitoring and controlling of industrial facilities). Smart Assistants were mentioned in 20 percent of the reports, limited to the industry sectors "automotive", "infrastructure" and "other" with 4 out of 5 in the mobility sector.

4   Conclusion

Currently, most successful platforms are closed, proprietary ones, which is seen critical from various sides. Both the strong role of platforms as such and the dominance of closed proprietary platforms has significant consequences for security and privacy, as well as for the economy, and finally, society as a whole. Therefore, we have first summed up the discussion about open platform ecosystems. It became clear that there is a strong case for the promotion of open platforms. Nevertheless, closed proprietary platforms prevail, even though there are plenty of initiatives for open platform ecosystems and although some of the big players are gradually opening up their closed platforms for third party developers (while, however, still keeping them under close control).

It is simply not enough to develop a technical architecture for an open platform ecosystem. Technical development and standardization efforts have to be complemented by measures to make the ecosystems economically attractive to companies. To identify the incentive structures that make such ecosystems attractive for companies we first analyzed how companies integrate the aspects of (open) platforms, Internet of Things, smart assistants and digitalization into their corporate strategy. Using the findings of this analysis we hope to be able to improve the design of the open ecosystem ENTOURAGE, which we currently develop as partners in a research project.

Our analysis of corporate reports showed that the companies are addressing the ongoing trend of digitalization in various business divisions. When looking at the use of platforms, we found closed platform concepts prevailing in every business sector considered. Open platforms approaches were only found in a small share of the companies considered and are mainly related to the area of cross-company cooperation such as research and development platforms. The dominance of closed proprietary platform approaches supports our initial hypothesis. This illustrates that open ecosystem approaches are still hardly considered by the big industry players and more efforts are needed to make them economically attractive. Further research into this topic is therefore required.

With a share of approximately one third of the companies investigated, the Internet of Things was a less common topic in the corporate reports which primarily relates to the interconnection of existing products and industrial facilities. Unexpectedly, there were no findings in the context of recent market developments and trends such as wearables or new

smart devices. When it comes to smart assistants, the coverage of this topic is the smallest and mainly limited to mobility services such as public transport or shared fleet business models. This indicates that the underlying technologies are still in an early adoption stage and are likely to expand to other areas of application within the next few years. An increasing number of smart devices is a complementary development that has a mutually reinforcing effect.

Analyzing the pubic corporate reports certainly gives only a limited window into the real strategy of companies. The reports are highly formalized and companies have to report a great number of financially related information. The aspects that are relevant for us could therefore be marginalized. In a next step we are therefore also considering other material of the companies, such as press releases, speeches and the websites. As we have shown, the analysis of corporate reports to gain insight into non-financial behaviour and strategy of companies is nevertheless an established tool in economic science. This is why we think that our approach is well suited in this phase of our research project. One could argue as well that by focussing on the largest companies alone we overlook other important stakeholders for the ecosystem. Although the companies in our sample certainly play a leading role in the German economy and represent large parts of it, they are certainly only one – but significant – part of the companies important for the success of an open ecosystem. Other important stakeholders are innovative start-ups and research projects in the areas of the Internet of Things, smart assistants and so on. These are not captured in the present paper, but subject of an ongoing qualitative analysis consisting of short interviews with semi-structured questionnaires. This way we will be able to cover both – big financially strong industry leaders and innovative start-ups. All in all, we think that our research documented in this paper can serve as a starting point in building an open ecosystem for secure and privacy friendly assistance systems in the Internet of Things that is economically viable and, thus, actually used.

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