The Openness of Data Platforms: A Research Agenda

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ABSTRACT

Data platforms are the keystone of the data economy. When opened up, data platforms allow data owners, data consumers and third parties to interact. Yet, openness may also harm business and societal interests. Literature on platform openness does not cover data platforms, and data economy scholars rarely study platform openness. Therefore, this paper develops a research agenda on the openness of data platforms. We explore how data platforms differ from conventional digital platforms (e.g., software platforms). From those differentiating characteristics, we identify areas for future work: (1) The specific characteristics of data require re-conceptualizing the object of platform openness; (2) New ways in which data platforms can be opened should be conceptualized; (3) As data platforms are tailored to specific industries, platform-to-platform openness should be a novel unit of analysis; (4) Because opening up data platforms create novel risks, new reasons to (not) open up data platforms should be studied.

CCS CONCEPTS

• Information systems→Database management systems • Applied computing→Enterprise computing→IT governance

KEYWORDS

Data platform; Data marketplace; Platform openness; Data ecosystem

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1 Introduction

Data platforms facilitate businesses to trade data [2,36,54,78]. While any digital platform creates data as a side-product of platform usage [89], the main offerings of data platforms revolve exclusively around data. Data platforms are essential enablers of a data economy in which businesses can freely exchange and monetize data. An archetypical example is the data marketplace, where data owners can sell their data to other businesses [54]. Another example is a data space, which provides an ecosystem for parties to share data [11].

Proponents of the data economy typically argue that data platforms should be fully open to third parties [see, e.g., 62]. By opening a data platform, data consumers and owners can freely exchange data or access third-party analytics or AI modules. However, complete openness is often not desirable. Data owners typically wish to retain control and sovereignty over their data [49,55]. Similarly, data consumers will require safeguards against low-quality or malicious third-party offerings. Hence, setting the appropriate level of openness of a data platform is a significant challenge for data platform providers.

The issue of platform openness has been studied extensively in digital platform literature in the information sciences discipline [26]. Here, platform openness is defined as allowing third parties to access platform resources [12:1851], either by going open source or making specific interfaces available [40,50]. Trade-offs and tensions regarding platform openness are studied in industries such as software [9] and gaming [20].

Yet, existing understandings of platform openness cannot simply be transferred to the newly emerging data economy domain. In this paper, we argue that data platforms fundamentally differ from digital platforms that have been studied to date. One example is the object of openness: while conventional platforms typically make software modules available to third parties, the object of openness for data platforms ranges from raw or aggregated data to full-fledged analytics solutions. These differentiating characteristics (explored in Section 3) imply that new research questions await, which are unique to the domain of platforms for the data economy. The central goal of the paper is thus to develop a research agenda on the openness of data platforms.

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Our research agenda aims to inspire interdisciplinary work on the intersection of digital platforms literature and data economy studies. For digital platforms scholars, our research agenda provides novel questions relating to openness in the newly emerging area of the data economy. This new setting challenges the assumptions of the existing discourse on platform openness. Although research agendas on data platforms exist [e.g., 11], these do not delve into the specific characteristics of data as an artefact [46]. For the data economy community, our research agenda calls for studies that go beyond often-studied questions of technology and pricing issues [2]. Ultimately, our premise is that we need both a deep understanding of the data economy and a conceptual basis of digital platform studies. Only by combining these disciplines, we can start to unravel the issue of the openness of data platforms.

2 Background

Digital platforms have become a mainstream research topic in the information sciences, a sociotechnical field which partly overlaps with information systems, media studies, and telecommunications. A commonality in these streams of literature is the recognition that the digital nature of platforms matters, which sets them apart from generic literature on platforms in business and economics [30]. Within the digital platforms literature, platform openness is a mainstream issue in older [27,95] and recent work [19].

Platform openness refers to reducing `restrictions on use, development and commercialization of a technology' [12:1851]. Platform openness is a continuum rather than a black-and-white issue [96]. Generally, openness is contrasted with retaining control [94], although some studies argue that the tension between openness and control can be resolved through governance [82,92]. Two main pathways to openness dominate the platform literature: giving up control (e.g., through open-source) and selectively granting access to platform technologies (e.g. through open interfaces) [40,50]. Most recent literature focuses on the latter scenario, where so-called boundary resources (such as application programming interfaces or software development kits) are made available to third parties [40].

In discussions of platform openness, scholars relate openness to three main outcomes: (1) economic outcomes: openness makes platforms valuable by creating network effects between user groups [32,67]; (2) innovation-related outcomes: openness allows third parties to innovate and thus make a platform `generative' [14]; (3) strategic outcomes: openness affects the competitive position of a platform provider [50]. Existing work on openness focuses on platforms for software development [9,39], gaming [20], Internet-of-Things [63] and payment [29,72].

3 What makes data platforms special?

Generally, data platforms inherit the characteristics of digital platforms. For example, the economic perspective on digital platforms stresses their multi-sidedness [73], whereas data platforms are indeed used by data owners, data consumers and third parties. Innovation scholars stress that platforms facilitate transactions and allow recombinant innovation [37], and data platforms do so by facilitating transactions between data consumers and owners while enabling third-party innovation. From a technical perspective, digital platforms are extensible systems [84], and data platforms can indeed be extended with additional features such as analytics [see 64].

However, data platforms differ from other digital platforms as their main offerings revolve around data. On any digital platform, users create traces of data that a platform owner can monetize [89] or use to improve the platform [43]. For data platforms, however, data is not a by-product of platform usage. Instead, data is the core value element being exchanged and built upon. Rather than passively leaving a data trail, data platforms empower owners to offer their data proactively [cf., 88].

Data as an artefact has specific characteristics. First, data can be de-contextualized, re-combined and re-contextualized [1]. Therefore, the openness of data platforms can be realized in new ways: the object of openness could range from raw datasets to readily usable data analytics modules. Second, thanks to new data-driven approaches such as privacy-preserving technologies, new mechanisms are emerging to realize the openness of platforms. Third, data requires context to be valuable to users. Therefore, data platforms will likely be tailored to specific industries. The resultant need for specialization reduces the strength of network effects and related winner-takes-all dynamics, implying that data platform fragmentation will likely continue in the future [60]. Fourth, making data-related resources accessible creates specific risks. These risks involve privacy (in the case of personal data) or confidentiality and sovereignty (in the case of business data). Table 1 summarizes the key differences between digital platforms and data platforms.

Table 1. Comparing digital and data platforms

	Digital platforms (e.g. software, gaming)	**Data platforms (e.g. data marketplaces)**
User groups	Developers Consumers	Data consumers Data owners Solution providers
Object of openness	Software/hardware modules	Data, aggregated data, trained models Data analytics modules
Ways to realize openness	Open source Open boundary resources	Data-driven mechanisms
Market consolidation	Strong network effects Dominant, cross-industry platforms	Moderate network effects Fragmentation and heterogeneity

Risks of opening up	Loss of control, revenues, reputation, integrity	Loss of data sovereignty, privacy violation, confidentiality

In the following sections, we develop a research agenda for each of the differentiating characteristics in Table 1: the object of openness (Section 4), mechanisms to realize openness (Section 5), market consolidation (Section 6) and risks of opening up (Section 6).

4 New objects of platform openness

In existing conceptualizations of platform openness, the object of openness typically entails platform modules (e.g. software and hardware modules that developers can build upon) [33]. For instance, platforms make available modules for authenticating users or conducting transactions. For data platforms, the object of openness could be similar [e.g. analytics modules, see 61]. However, the object of openness could also be specific to the data context, such as datasets (e.g. sales data of companies), data products (e.g. aggregated sales data) or data-driven insights (e.g. benchmarks against competitor sales data) [10]. These objects could be opened up to developers, as in conventional digital platforms, but also to intermediaries, data users and data providers. These data-specific objects of openness lead to new research questions:

- What data-related resources should data platforms make available when opening up (e.g. data, data products, data-driven insights, analytics modules)?
- Which user groups derive value from accessing data-related resources from data platforms (e.g. data providers, data users, intermediaries, developers)?

The open data literature mainly focuses on governments as data providers and businesses as data users [90], neglecting scenarios where businesses provide data. At the same time, in practice, some businesses already openly share some of their data with an open license and in a reusable format. To enhance the value of open business data, we propose the following question:

- (How) can businesses be incentivized to openly share their data for free under an open license and in an open format?

Here we argue that studying different levels of openness rather than studying openness as a 'black-or-white' concept of either being closed or open would be critical.

5 New mechanisms to realize platform openness

According to digital platform literature, openness is realized through two mechanisms: giving up control (e.g. open-source) or granting access to `boundary resources' (e.g. open interfaces) [40,50]. Boundary resources include application programming interfaces, software development kits and platform usage policies [28,39]. Boundary resources can be made accessible to any third party or created explicitly for a specific third party [34]. The assumption is that tension exists between openness and control: by making boundary resources available, platform owners intend to resource third parties and secure their core technologies [40].

Similar boundary resources may apply to data platforms, especially if analytics modules are the object of openness. However, for data-driven insights, new mechanisms are emerging. An example is collaborative computing, which enables multiple parties to compute insights without disclosing the underlying data. By leveraging privacy-enhancing technologies such as Multi-Party Computation (MPC), collaborative computing allows openness while safeguarding societal values of privacy, security, and sovereignty [4]. Similar mechanisms exist, for instance, where algorithms move to data rather than the other way around [87].

Interestingly, these new mechanisms to realize openness may break the traditional tension between openness and control: data can be made accessible without losing control over what data consumers do with the data. At the same time, the novelty of these mechanisms may have implications not accounted for by existing understandings, such as the inability to verify the computed insights that require an additional layer of trust [16]. These new mechanisms lead to new research questions:

- How can new mechanisms for realizing openness (e.g. privacy-enhancing technologies) break the tension between openness and control?
- What new tensions arise when applying data-specific mechanisms to realize platform openness?

6 New units of analysis

Existing literature on digital platforms and openness typically focuses on the openness towards complementary providers. Examples include the openness of a software platform to app developers [9] or the openness of a gaming platform to game creators [97]. The focus on openness to complementary providers is understandable, as most platforms exhibit strong network effects. Network effects imply winner-takes-all dynamics: only one or a few platforms that dominate the market survive. Hence, to understand why strong network effects affect a platform's survival, the question is how openness affects the participation of complementary providers.

Data platforms are different, in our view. Data requires context to be valuable to data consumers [1]. As data as an exchange commodity is thus highly context-dependent, a strong need for the specialization of data platforms arises [8]. Further, as data owners have concerns over data sovereignty, they will prefer data platforms confined to specific use cases [3].

In line with these assumptions on the need for specialization, we see that so-called data spaces are emerging that provide the facilities to data owners in specific verticals to exchange data. Use cases of data spaces are often deeply rooted in a specific industry

[66]. Most data marketplaces are similarly specialized. As data trading and exchange have to comply with local regulations, data marketplaces often focus on a specific nation (e.g. German Mobility Data Marketplace) or even a city (e.g. Amsterdam Data Exchange). Hence, we expect that the current fragmentation of the data platform industry will likely sustain in the future, resulting in costly lock-in effects and data discovery challenges [8].

At the same time, there is a strong push for cross-data platform interoperability [35]. Impactful solutions for societal challenges require cutting across industries and domains. For instance, self-care solutions require healthcare platforms (e.g., electronic patient records) and Internet-of-Things platforms (e.g., consumer wearables). New European regulations, such as the Data Act, empower consumers to mandate data platform providers to exchange their data with other platforms. Initiatives such as Gaia-X provide the standards and infrastructure to achieve platform-to-platform interoperability.

In sum, we see a trend toward specialization of data platforms to specific industries or geographical areas, which leads to an increasingly complex landscape of heterogeneous and fragmented data platforms. At the same time, there are strong forces to foster interoperability between platforms from a societal, regulatory and technical perspective. Hence, the openness *between* platforms requires scholarly attention, next to the openness to complementors or users.

Conceptually, multiple ways exist to realize openness between platforms. Meta-platforms can be introduced, constituting a higher-order platform that federates or forks other platforms [59]. Third parties may create `bridges' between platforms directly, for instance, through their applications [48]. Platforms could also foster interoperability by creating direct interconnections [60]. These conceptual issues lead to the following research questions:

- What is platform-to-platform openness in the context of data platforms?
- How do we distinguish meta-platforms, forking, and platform interoperability?

The area of platform-to-platform openness is largely uncharted. It is unclear what business models could be for meta-platforms and other complex platform constellations. Similarly, exploratory studies on platform-to-platform openness suggest that there may be very different reasons (not) to open up platforms to other platforms [60]. These uncertainties lead to the following questions:

- What are business models for meta-platforms?
- What are the reasons (not) to open up platforms to other platforms?

While the openness of platforms to users and developers is often defined in universal terms, platform providers typically take one-by-one decisions when opening up to other platforms [60]. This leads to the following questions of governance:

- How are new data platforms invited to participate in platform-to-platform openness?
- How many data platforms should ideally be included to reach optimum network effects?
- How can a consensus-based structure of governance be maintained? How can governance hierarchy and decentralization be balanced?
- How to divide roles and decision rights between platform integrators and platform participants?
- How can conflicts between data platform providers be managed and resolved?

Finally, platform-to-platform openness may affect the decisions of data owners to participate in the data economy. While disclosing data on one platform is already non-trivial for most data owners due to concerns over privacy or confidentiality, these concerns are likely amplified in a cross-platform setting [3]. Hence, the question arises:

- How does platform-to-platform openness affect data owners' and consumers' intentions to participate in data platforms?

7 New risks of platform openness

Literature on digital platforms discusses several drivers, trade-offs and implications of platform openness [77]. Reasons to open up platforms are increased flexibility [71], attractiveness for adopters [38], end-user adoption [95], efficiency [56], ability to charge license fees [68], ability to learn [93], long-term `evolvability' [83], legitimacy of market entry [52], and likelihood to reach critical mass [65]. Open platforms also benefit platform providers indirectly through potential network effects [67] and cross-side network effects [74,91]. Through openness, third parties are stimulated to join a platform [7,22,53] and share their knowledge [23]. Openness thus leads to higher external innovation [14,37,76], more complementors [6], diversity of complementors [83], co-creation by third parties [18]. Openness also creates strategic advantages, for instance, by promoting platform features that benefit the strategy of the platform provider [47] or winning the market quickly [65].

Various motives against openness exist too. High openness potentially removes incentives for complementors to innovate [13], for instance, because of coordination costs [24] or fear of competition [63]. Too high openness can also limit platform growth [58]. Other scholars generally question the impact of openness on platform participation [15]. Open platforms can attract low-quality complements that free-ride on the platform's reputation [21], threatening the platform's integrity [94]. Control mechanisms to mitigate low-quality complements are costly [92] and can reduce the motivations of third parties to contribute [42], thus reducing the benefits of openness.

Openness can also create financial disadvantages for platform sponsors. Openness creates costs from setting up open interfaces [41] and control mechanisms [44,92], especially as usage grows [5]. Open platforms can reduce revenues and profits if third parties directly compete with the platform provider [31,67].

Strategically, reduced openness can help lock in customers and create entry barriers [57,92]. Closed platforms also allow higher margins [31,95]. Open platforms are vulnerable to exploitation by competitors [51], e.g. through `forking' [50] or absorption into other platforms [41,69].

Whether openness is beneficial depends on the context of the platform provider: the for-profit status [92], maturity [14,92], market position [31], absorptive capacity [62] and market share [31]. The context of the market plays a role, too: availability of compatibility standards [86], the dominance of compatibility standards [14,95], the timing of opening up [85] and the degree of vertical integration [45]. Contextual factors interact; for instance, low market power and dominant standards justify high openness levels [52].

Studies show that the factors above motivate businesses to change platform openness. For instance, tensions between conflicting goals may be resolved by changing the governance regime of the platform [92], which can significantly impact third parties [25]. Businesses also tend to open up their platforms gradually over time [75,81].

For data platforms, novel risks of openness emerge, depending on the type of data being exchanged. For business data, openness creates new risks related to competitiveness. For instance, competitors could use business data to reverse engineer critical processes or break a competitive advantage [70]. For industrial data (e.g., from Internet-of-Things), similar risks of reverse engineering apply. Further, a new class of safety risks emerges when data platforms are linked to actuators and AI models. For personal data, openness implies risks for privacy and regulatory compliance. Even if anonymization is applied, risks exist of de-anonymization if sufficient data points are re-combined.

In general, new risks are difficult to foresee and anticipate because platform resources are generative: how third parties use them is difficult to predict [17]. The characteristics of data, as derived in Section 3, increase the unpredictability: Because data can be re-contextualized and re-combined in new ways, the qualitative risks that may emerge are principally uncertain until they materialize.

The new and unpredictable risks of opening up data platforms create new questions. These questions involve understanding the implications of openness as well as ways in which stakeholders can deal with these implications reflectively and responsibly:

- What are the novel (negative) implications of opening up data platforms?
- How can reflexivity in design help providers to resolve the negative implications of openness?

An open question is if the societal and external implications of platform openness play a role in the decisions of platform providers to (not) open up their platforms. As discussed in this section, existing literature mainly considers business motives in explaining openness decisions. One potential explanation could come from the theory on socio-political legitimacy, which explains why business actors take into account external pressures [79]. While legitimacy perceptions of platform users have been studied before [80], the role of broader societal concerns is hardly being studied.

- How do societal/external implications of platform openness (e.g. privacy, safety) affect platform openness decisions?
- Do negative implications of data platform openness affect the perceived legitimacy of data platform providers?
- What is the role of legitimacy tensions in deciding upon data platform openness?

8 Conclusions

The data economy brings a new generation of digital platforms, for which data is no longer a side product but the main dish. Data platforms are fundamentally different from conventional platforms due to the importance of context for data, the fragmentation of data platforms across industries, and the new business and societal risks that their openness creates. Therefore, we cannot simply transfer the insights from conventional platforms to understand the governance and openness of data platforms. Yet, visions of the data economy as a free market for data are only possible when data platforms are open.

In this paper, we laid down a research agenda, calling for more research in four main areas: (1) new objects of openness of data platforms should be studied, such that the specific characteristics of data as an artefact are covered; (2) new mechanisms to realize openness should be conceptualized, specifically privacy-enhancing technologies which may break the traditional tension between openness and control; (3) new units of analysis should be adopted in platform openness studies, specifically platform-to-platform openness; and (4) reasons to (not) open up platforms should be revisited, in light of the new risks that data platforms create when opened up.

Addressing these areas is crucial to gain insights into why, how and when providers open up their data platforms. These fundamental insights are also needed to build a basis for a new generation of platform studies in the emerging area of the data economy. Truly advancing these fundamental questions requires interdisciplinary work by (A) digital platform scholars that bring in the conceptual language and toolsets to theorize platform openness and (B) data economy scholars that bring in a deep understanding of the technologies and market structures of data platforms. Scholarly fora are needed that are open to such interdisciplinary and cumulative efforts, of which the inaugural workshop on the data economy hopefully sets an example.

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