More Than One Way to Solve the Healthcare Innovation Crisis With Digital Platforms. Various Forms of Platform Openness Impacting Primary Healthcare

Gijs van der Wielen, Mats van Hattum, Lars Mosterd, Mark de Reuver & Marijn Janssen
Delft University of Technology, Faculty Technology Policy and Management, Department Engineering Systems and Services, Delft, The Netherland.
E-mail: g.h.vanderwielen@tudelft.nl, mtvanhattum@outlook.com, larsmosterd@gmail.com, g.a.dereuver@tudelft.nl, m.f.w.h.a.janssen@tudelft.nl

Abstract Whereas open digital platforms drive innovation in industries, platforms in primary healthcare are mostly closed. Policy-makers have been looking for ways to open up primary healthcare platforms to stimulate collaboration and innovation and need to do so even more due to the ongoing COVID-19 crisis. Yet, there is not one way of opening up platforms in primary healthcare, just as it is unclear how different ways of openness can lead to more innovation. This paper analyzes the opportunities and challenges in realizing platform openness while examining alternative forms of openness. To answer this, we (1) conceptualize different forms of platform openness (sponsor-provider-platform-user openness), (2) examine how these forms of openness can resolve barriers to innovation, and (3) examine what challenges need to be overcome to realize that form of openness in practice, such as complexity in roles, regulations, and ICT infrastructure. The findings are relevant to structure further research on how platform openness leads to more innovations in healthcare.

Keywords: digital platform platform opennes platform ecosystem innovation healthcare.

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1 Introduction

The COVID-19 crisis has painfully exposed that existing digital platforms fall short in supporting caregivers and patients. When caregivers needed comprehensive and accurate data to diagnose, treat, and identify risk groups, they faced low reliability and information availability (EHRIntelligence, 2020a). Even when patient files were digitalized, caregivers often could not access them due to legal constraints and a lack of openness between heterogeneous platforms (Lenert and McSwain, 2020). These issues also hinder innovation in the healthcare domain. In response, governments are urged to issue temporary emergency laws to improve information exchange between healthcare platforms, like in The Netherlands (Rijksoverheid.nl, 2020) and the U.S. (Anderson, Belcher and Parker, 2020; EHRIntelligence, 2020b). However, these recent events highlight a significant systemic problem: caregivers experience digital platforms as a burden rather than an enabler for innovation and effective healthcare.

A digital platform is an "extensible codebase of a software-based system that provides core functionality shared by the modules that interoperate with it, and the interfaces through which they interoperate" (Tiwana, Konsynski, & Bush, 2010, p. 675). In healthcare, digital platforms facilitate numerous tasks, including patient-caregiver communication, administrative jobs, and tracking treatments. Various platforms exist in most countries, supplied by multiple parties and IT-departments with complex organizational arrangements (WHO, 2020; Frontoni et al., 2019). Most platforms are highly complex, resulting from years of expansion in information systems, participants, and arrangements (Bygstad and Hanseth, 2018), and offer varying functionalities (Darmon, Sauvant, Staccini and Letrilliart, 2014). Further, most digital platforms in healthcare are organized as closed silos (Bannister, 2001; OECD, 2011), meaning third parties cannot create add-on functionalities. Both scholars and practitioners have stated that, in general, openness in information technology in healthcare, like sharing patient data and add-on functionalities, is limited for technical and non-technical reasons (OECD, 2011). Reasons for this lack of openness include the fragmentation of systems, users, and software suppliers (Bygstad, Hanseth and Le, 2015; Furstenau et al., 2018), and the challenge to deal with non-interoperable legacy systems (Scott Kruse, Karem, Shifflett, Vegi, Ravi and Brooks, 2018; Hermes, Riasanow, Clemons, Böhm and Krcmar, 2020). Also, healthcare-related data's sensitive nature complicates system openness and

information exchange across healthcare platforms (Grisot, 2018). While standards that allow openness are increasingly available (e.g., by shared data transferring protocols such as the interoperability standard HL7FHIR or openEHR), these standards are scarcely adopted in existing systems and platforms (Dixon, Rahurkar and Apathy, 2020; Schreiweis, Pobiruchin, Strotbaum, Suleder, Wiesner and Bergh, 2019). In other industries, digital platforms have largely opened up, driving innovation and information exchange (De Reuver, Sørensen and Basole, 2018). Open platforms are assumed to increase innovation (Boudreau, 2010) and transform business models (Tilson, Lyytinen, & Sørensen, 2010). Therefore, governments may enforce platform openness, similarly as in banking (Schreieck, Wiesche, Kude, Krcmar, 2019). In this article, we explore whether open digital platforms could similarly transform the healthcare industry, allowing (1) third parties to create innovative add-ons to platforms and (2) easier exchange of data to ultimately improve decision making and patient self-management (Joiner and Lusch, 2016). What the openness of digital platforms in healthcare entails is not clear yet. In general, platform openness is the extent to which external parties can use, extend, or commercialize a platform (Benlian et al., 2015; Boudreau and Hagiu, 2009). Platforms can become open to different degrees (West, 2003), towards different roles (Eisenmann et al., 2009), and on different levels (Ondrus et al., 2015). How these levels and forms of openness translate into the specific context of primary healthcare is yet unclear. Furthermore, it is unclear how different forms of platform openness can resolve barriers to innovation and how the forms of openness are realistic to achieve in practice. This paper analyzes the opportunities and challenges in realizing platform openness. Our purpose is to go beyond simplistic representations of platform openness projected on a simplified application domain and develop a comprehensive conceptualization of platform openness and combine this with a representational delineation of the primary care sector. To answer this question, we (1) conceptualize different forms of platform openness in primary healthcare, (2) examine how these forms of openness can resolve barriers to innovation, and (3) examine what challenges need to be overcome to realize that form of openness in practice. The paper is grounded in desk research and interview data gathered in the primary healthcare domain in The Netherlands. The primary care domain concerns all professional care patients can consult without a prescription to the hospital. This domain of care yields tremendous amounts of patient information and is highly dependent on information exchange between

caregivers. The Dutch system provides a suitable setting for several reasons. First, platforms in this domain in the Netherlands already have a mature ICT-infrastructure and well-developed health and information systems relative to other EU countries (Tavares, 2018). All primary caregivers rely on digital platforms. Studying a situation with an advanced platform infrastructure is useful for its findings can yield outcomes applicable to other (unobserved) countries. Moreover, previous studies show that changes in information systems in healthcare have significant consequences for the involved stakeholders, roles, and responsibilities (Grisot et al., 2018). Therefore, it is interesting to study the primary care domain in the Netherlands, which is rich in terms of stakeholders, both public and private, that collectively define how the primary care domain and its platforms are organized. This paper contributes to understanding healthcare innovation through a lens of platform concepts, specifically for primary healthcare. In this way, the paper complements existing insights of platform-driven innovation in healthcare in other domains such as elderly care (Nikayin et al., 2013) and primary prevention (Nikayin et al., 2014). The paper also contributes to digital platform literature by contextualizing the antecedents and consequences of platformization in the specific domain of digital healthcare, thus answering calls from scholars for domain-specific contextualizations of platform concepts (De Reuver et al., 2018).

2 Theoretical background

Digital platforms, openness, and innovation are all well-studied topics in scientific research and closely relate to each other. Furthermore, they are often intertwined with each other and the context they are embedded (De Reuver et al., 2018). To develop a structured overview of healthcare challenges that may be solved by openness, we need to be clear on interpreting some of the key concepts.

2.1 Platform openness

Fundamental to our definition of digital platforms is that platforms host core functionality shared by modules that interoperate with the platform through interfaces. Inherent in this definition is that platforms' functionality can be extended with new services and products coupled to the platform. Related to this definition, many researchers in the fields of information and innovation management have considered digital platforms as modular structures, consisting of a stable core and a variable periphery (e.g., Baldwin and Woodward, 2009). In a more general sense,

platforms can be considered a socio-technical aggregation of technical components (soft- and hardware) combined with organizational arrangements (Tilson, Sorensen and Lyytinen, 2012). It is essential to consider this latter definition because it denotes that technological and organizational arrangements govern platforms openness, and their add-on modules. With this definition, we do not neglect the concept of modularity, but we focus on the interoperability between technology from one or more suppliers.

Platform openness concerns the extent to which external parties can use, develop services, or commercialize a platform (Benlian et al., 2015; Boudreau and Hagiu, 2009). Openness exists in different ways and to different degrees. How a platform is open has significant consequences for the functionality and development of the platform. First, it is important to understand that platform openness is no binary choice but a continuum (West, 2003). Platforms exert different degrees of openness in opening other parts of their platform (Boudreau, 2010) or to which parties (Eisenmann et al., 2009; Ondrus et al., 2015). To understand how platforms in the domain of primary healthcare can be opened, we must be clear in describing the ways platforms can be open or closed. To do so, we use a conceptualization based on Ondrus et al. (2015). They identify different levels of openness, based on Eisenmann et al. (2009), who argue that openness definitions should distinguish the roles in a platform ecosystem. By adding a technology level, a clear separation between actors and technology is made (Ondrus et al., 2015). This results in four levels of openness in a platform ecosystem: (1) sponsor level openness, (2) provider level openness, (3) technology level openness, (4a) demand-side user-level openness, and (4b) supply-side user-level openness. In our conceptualization, we expand on the definition of technology-level openness and refer to it with the concept of platform-to-platform openness.

2.1.1 Level 1: sponsor openness

Platform sponsors exercise property rights over a platform (Eisenmann et al., 2009). Thereby, they can be considered the 'owner' of a platform that can make strategic choices related to technology and governance. With openness on the sponsor level, Eisenmann et al. (2009) refer to the ownership structure. They implicate that a platform is open on the sponsor level when property rights are shared among different actors. Vice versa, a platform is closed on the sponsor level when a single

actor holds property rights. In the absence of a specific definition, we define sponsor level openness as follows: the extent to which multiple actors share the property rights of a platform. This definition incorporates the idea from West (2003), who states that openness is not a binary variable but can be viewed on a continuous scale.

2.1.2 Level 2: provider openness

A platform provider serves as the primary point of contact for the end-users and can be seen as the actor operating the platform (Eisenmann et al., 2009). In a similar fashion as with the sponsor level, Eisenmann et al. (2009) see a platform as open on the provider level when multiple actors provide it. Ondrus et al. (2015) takes a slightly different approach. They see a situation where other actors use the same platform technology as a platform open on the provider level. In this view, an array of horizontally collaborating firms with specific roles and responsibilities could collaborate to provide an inter-industry platform. For this research, we adopt the latter approach. The following definition for provider openness is used: the extent to which multiple actors can use a platform's technology.

2.1.3 Level 3: platform-to-platform openness

Openness on the technology level defines how interoperable a platform is with other platforms and related technologies – through the use of gateways or APIs (Ondrus et al., 2015). However, we see the interoperability of two platforms not only as a technical matter. In addition to technological interoperability, like standardization of interfaces, organizational arrangements must be made for two platforms to be interoperable. Hence, we refer to the interoperability between platforms with the concept of platform-to-platform openness. This view acknowledges that a platform is a socio-technical construct (Tilson, Sorensen, and Lyytinen, 2012). For this research, we use the following definition: the extent to which a platform is interoperable with other platforms (Mosterd, Sobota, van de Kaa, Ding and de Reuver, 2021). An important characteristic of platform level openness is that they both keep on existing if two platforms open up towards each other. Hence, integration is not seen as a form of platform-to-platform openness. Furthermore, this definition incorporates the idea that one should talk about the degree of openness (West, 2003) in two distinct ways: (1) a platform can be partly interoperable with another platform (e.g., only data, but no services can be shared between the

platforms), and (2) a platform can be closed to one platform but open to another. Alternatively, instead of becoming interoperable via a direct gateway, two platforms can also become interoperable via a meta-platform.

2.1.4 Level 4: user openness

The final level of openness relates to the users of a platform. Ondrus et al. (2015, p. 263) state that openness on the user level is concerned with "making the platform accessible in indiscriminate ways to new users." Within user openness, a distinction can be made between demand- and supply-side user openness. In line with Ondrus et al. (2015), we define user openness as the extent to which users from other platforms and/or users not yet part of a platform can join the platform.

2.2 Platform openness and innovation

Platformization -i.e., "a shift from individual products/services to platforms as intermediaries for transactions and for organizing value-creation processes" (Nambisan, Siegel and Kennedy, 2018)- of the digital primary healthcare landscape will change how value is created and how innovation takes place within the domain. Traditionally, innovation took place within the boundaries of organizations or their linear supply chain. With platforms, innovations come from different actors that build their business (partly) around the platform, creating value for end-users (Gawer, 2014). Due to platforms' possibility to leverage a range of value-creating entities, platforms have become powerful stimulants of innovation in many industries (Gawer, 2009; Boudreau, 2010; Cennamo and Santaló, 2019) (a trend that has not yet taken off for healthcare (Hermes et al., 2020)). An example of platforms' innovation capacity is Apple's iOS or Google's Android, which allow Apple and Google to outsource large parts of their R&D by accessing and harnessing a possibly unlimited external pool of resources and capabilities. Moreover, digital platforms allow for generativity, meaning that the functionality of innovations can go beyond the original scope of the platform (Zittrain, 2008; Wareham et al., 2014). Allowing others to contribute to the service or product offerings may thus benefit the platforms' innovation capacity. For platforms to capitalize on this external pool of contributors requires platforms to be open, allowing others access to or control parts of the platform. Besides the given benefits of open collaboration in platforms, openness also poses threats to the platform. Openness can harm the platform's

revenues when a complementor competes with the platform (or its offerings) itself (Eisenmann, 2009). Platform openness can also lower switching costs as products or services become available across different platforms, thereby harming the platform's possibility of locking in users (West, 2003). Another threat is when low-quality external offerings harm a platform's integrity (Wessel et al., 2017). More recently, Karhu et al. (2018) have articulated the threat of forking, a hostile strategy when a third-party exploits an open platform by copying, reverse engineering, or harming the platform. Case in point, platform owners, need to balance openness, granting autonomy to contributors versus restraining contributors' access and power.

3 Method

To attain an in-depth understanding, we took an iterative approach, going back and forth between data collection and analysis, see Figure 1. Although we did not follow the method fully, our iterative approach was inspired by grounded theory principles (Corbin and Strauss, 1990). Two data sources were used:

Desk research - Initial understanding of the domain and its historical development was attained through grey literature (e.g. Idenburg and Dekkers (2018), Idenburg and Phillipens (2018), Kuijpers and Bakas (2017), Bus et al. (2019) and Van Gelder and Zebregs (2015)) and websites (e.g. https://www.nictiz.nl/and https://www.vzvz.nl/).

Discussions with field experts - Kuechler and Vaishnavi (2012) incorporate 'tacit theory' as input to information systems design efforts. This refers to "insights or evidence/experience-based justification for pursuing a novel design" (Kuechler and Vaishnavi, 2012, p. 404). Experts' insights are an useful source for understanding the problem. These insights were gathered through conversations with experts who all worked at companies that develop information systems for first-line care providers.

Analysis approach

Desk research information was presented during a presentation. These concepts were shown to domain experts, who all are experienced in different levels of openness. After each discussion with a domain experts, the information from the slides was iterated until domain experts had no suggestions for further adjustments.

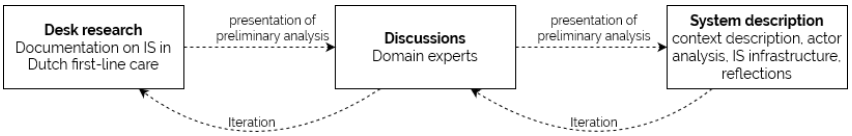

Figure 1: Overview of the approach, inspired by grounded theory

9 expert interviews were held, with software suppliers (6), with consultants (2), with network provider (1), in different roles like Managers Business Development, Product Owners (2), Head of Products, Architect, Directors (2) and Consultants (2).

4 Analysis

What are the consequences of openness to platforms in primary healthcare in The Netherlands? What threats and opportunities arise in these different levels of openness? This section explores and discusses expectations on the impact of platform openness in primary healthcare for the different levels of openness. Figure 2 shows an overview of possibilities for platform openness at different levels in Dutch primary healthcare. The figure visualizes data flows between different levels, for instance platform and 3rd party developers.

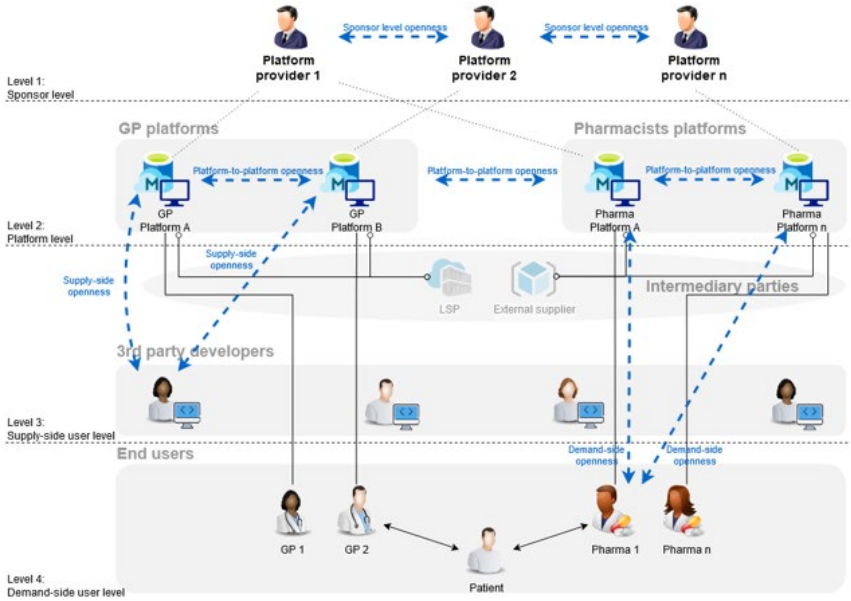

Figure 2: Possibilities for platform openness at different levels in Dutch primary healthcare

4.1 Openness on the sponsor-level

We discussed earlier that multiple sponsors compete for the same user group, for example with nine parties providing their own platform for general practitioners. While openness between these competitors is unlikely, openness is more likely to arise between sponsors that target different types of users, for instance co-opetition or collaboration (see Ondrus et al., 2015) between sponsors of general practitioners and physiotherapists.

Opportunities

Co-opetition between different sponsors can be an interesting strategy for sponsors when they can together reach a set of users that is larger than they each of the platform could on its own (Ondrus et al., 2015). Thus, for the sponsors, this strategy provides the opportunity to expand its user base. Such co-opetition could also present opportunities for users on the demand-side. Combining data gathered on the side of the physiotherapists enables caregivers to be better informed, having the combined database information at their disposal. Furthermore, it could lead to more holistic patient care in which a patient well-being is approached from a combination

of disciplines (phycological, physical and social) (Zamanzadeh et al., 2015). This could also attract new customers to the platform.

Challenges

Ondrus et al. (2015) state the potential of a larger user group as a prerequisite to successful co-opetition between platform sponsors. However, in primary care, there are additional challenges with regard to privacy-preservation and data infrastructure. To what degree are sponsors allowed to combine data from the affiliated platforms? And on the data-level, is it possible to combine the data that is collected in the platforms?

4.2 Openness on the platform-to-platform level

The platform-level can be considered closely related to the sponsor-level, albeit more focused on the interoperability of the actual platforms rather than a strategic collaboration between sponsors.

Opportunities

This openness is expected to yield opportunities. First, it will enhance the opportunity to transfer patient information across different platform providers. This enhanced interoperability will hugely impact a unified experience both for the patient and for the caregiver. It will allow caregivers to see data of a patient also when it is stored in a different platform. Thus, also increasing the amount of information upon which a caregiver can diagnose and treat a patient. Second, to compete on the platform's quality rather than on the quality lock-in mechanisms and the established installed user-base. In the current situation, a platform with a large user base has the advantage that these users have access to the same pool of patient data (namely that in the platform's database). When this data becomes transferrable between platforms, this diminishes the advantage of a large pool of users and consequently requires platforms to compete on their platform's quality. A third advantage lies in the opportunity for big data analysis and the application of machine learning to improve understanding of healthcare diagnosis. When data is accessible and readable in a similar manner across platforms, this can open opportunities for analyzing the pool of data. Advancements in machine learning, together with platform openness,

can give caregivers the opportunity of making more data-driven decisions. And it can help them strengthen their focus on the patient rather than on the administrative burden of requesting information from other databases. Fourth, a shared interoperability standard among platforms may reduce the development costs. Open processes for developing standards can be led to more effective feedback, higher quality products and consequently a higher rate of innovation, as was also repeatedly pointed out by domain experts. One of the ways to achieving openness on the platform level is through a meta-platform. Domain experts consider this option preferable, especially if it entails that one meta-platform could host all the necessary functionality within the primary care domain that now exists in all individual platforms. This way, there remains only one platform that hosts the necessary functions, to which the platforms can plug into and can innovate and compete on additional functionalities and the user experience.

Challenges

A challenge for achieving platform-to-platform openness is setting standards for the format for how data is stored and transferred between the servers of the different platform providers. How to achieve these interoperability standards is a challenge that has yet to be solved within the industry. For a single platform to open up in this way, it is unlikely to be successful as the platform itself will only reap the benefits of enhanced openness if parties open up. Previous studies on platform openness discuss how openness can be achieved. Either interoperability standards can be set de jure, that is, adherence is imposed by law. Second, a platform may face increasing pressure from competing platforms or users that demand open standards to avoid user lock-in (Eisenmann, Parker & Van Alstyne, 2009). A common challenge with platform interoperability is the need to coordinate collaboration in defining and updating standards. Change in standards can be slow or low quality because the platforms' ecosystem needs to consider the platforms with the (s)lowest capabilities. This argument was also mentioned repeatedly by domain experts in primary healthcare in The Netherlands as one of the main barriers to achieve interoperability. Also, decision-making processes are typically slow because they require different platforms to arrive at a shared solution. This same argument was also applied to the meta-platform situation, where all platforms need to adhere to the rules and standards of the meta-platform. In the later situation, additionally, there need to be

governance mechanisms in place to align all affiliated platforms with the meta-platform.

4.3 Openness on the supply-side user level

This type of openness allows third-party developers to build complementary offerings that extend the functionality of the platform. These complementary services, or applications, can be developed for users in caregivers and patients.

Opportunities

One effect of this type of openness is that it significantly reduces the barrier to entry for third-party developers to develop complementary services for the primary healthcare domain. Currently, a developer would either have to develop its digital platform (and compete with established platforms for users). They should go to great lengths to add a piece of software to an established platform. Opening up would lead to a significant reduction in the effort and costs to enter the market and reach an established pool of end-users. Second, it enables platform owners to outsource parts of their R&D. Not only can this reduce costs, but it will also give access to a possibly unlimited pool of knowledge and innovations. While the platform can still provide the core functionality, new services may emerge in its ecosystem. These new services may contribute to more proactive healthcare, higher patient engagement, and better-informed care, for instance, by making use of the power of data analytics. These developments can benefit both caregivers and patients.

Challenges

To successfully enable and stimulate supply-side user openness, platforms in this domain must carefully consider both technical and governance factors. One of the technical challenges is that platforms need to consider how they choose to open their architecture. For instance, the platform's architecture's complexity can affect the willingness of third-party developers to contribute to a platform (Cennamo et al., 2018). Perhaps a more prominent discussion is the governance of healthcare platforms. This question of governance involves questions of how to deal with sensitive patient data stored at the side of the platform owners and how to govern the relationship, control, and financial arrangements between the platform provider

and the complementors. One of the crucial questions to answer is how to design boundary resources that mediate the relationship between the platform provider and the complementor (Hein et al., 2019). How platforms choose to design their boundary resources can significantly affect how they can attract and retain complementors and consequently strengthen their platforms to become more attractive to caregivers and patients.

5 Discussion and Conclusions

Far too often, discussions on using platform openness to stimulate innovation in healthcare are overly simplistic and even unrealistic, suggesting that one integrative platform or open APIs are the only possible solutions. This paper examines alternative ways to open up platforms and stimulate innovation. Especially within the primary healthcare domain, with its complexity in roles, regulations, and ICT infrastructure and where it is notoriously difficult to implement changes, we strongly recommend considering platform openness in its entirety and learn to understand what (combination of) approaches to platform openness can help to boost innovation to make primary care more efficient. Our study shows opportunities to enhance innovation-opportunities at different levels of the platform ecosystem. See Table 1 for an overview of challenges and opportunities of different forms of platform openness.

Table: 1: Overview of challenges and opportunities of different forms of platform openness

	Challenges	Opportunities
Sponsor-level openness	Requires integration of data sources, requires privacy-preservation regulation and architecture.	Access to larger set of users, better informed caregivers, open opportunities for holistic care.
Platform-to-platform openness	Requires standardization efforts of multiple platform providers, slows down the innovation of the platforms.	Greater access to information, greater competition between platforms, less lock-in / winner-takes-all, more data for (machine) learning, lower development costs, in case of meta-platform, the necessary functions and patient data is managed centrally for all patients and caregivers.
Supply-side openness	Requires thought on the platform architecture, governance/access rules, requires boundary resources to regulate access to the platform.	Lower barriers to entry for developers, outsource innovation to developers.

Firstly, opening up platforms towards other platforms, either within or outside of the primary care domain, can lead to better-informed caregivers and can make room for a more holistic approach to patient care. Platform-to-platform openness gives sponsors from different care-disciplines access to a larger pool of users that they would have on their own. It is yet unclear what governance methods can manage the relationship between the sponsors and at the same time ensure adherence to policies and regulations in healthcare. Secondly, openness can be achieved through gateways, APIs or a meta-platform. All three options are expected to enhance the rate of innovation and also ensure better access to information by caregivers. Until now, platform sponsors have shown to be unwilling to open up towards other platforms because of risk of losing market share. Another barrier is that agreement on the terms and technological requirements for platform interoperability is notoriously slow in healthcare. Platforms either strategically fail to comply or do not have the technological means or knowledge to do so, making interoperability a difficult strategy to pursue. Thirdly, supply-side user openness (i.e., opening up the platform to users) has a high potential of boosting innovation by third-party developers. Currently this opportunity has not yet been seized for the lack of suitable platform architectures, governance and boundary resources. Those are required to ensure the quality and security of patient information but also the relationship, control, and financial arrangements between the platform provider and the complementors. These findings not only widen the range of opportunities to stimulate innovation, but they also provide excellent suggestions for further research. By bringing together the complicated and extensive primary care domain and research on (open) digital platforms, we have created a solid foundation to discuss openness and innovation in primary care platforms. This analysis will be the starting point of the further research to explore new ways of openness in primary healthcare. More in detail insights are possible by using design science research in this domain.

References

Anderson, E., Belcher, N., and Parker, G. (2020). Will the coronavirus spark an overdue platform revolution in health care? MIT Management: Sloan School. Accessed: 5-5-2020 through: https://mitsloan.mit.edu/ideas-made-to-matter/will-coronavirus-spark-overdue-platform-revolution-health-care.

Bannister, F. (2001). Dismantling the siloes: extracting new value from IT investments in public administration. Information Systems Journal, 11(1), 65-84.

Benlian, A., Hilkert, D., and Hess, T. (2015). How open is this platform? The meaning and measurement of platform openness from the complementors' perspective. Journal of Information Technology, 30(3):209–228.

Boudreau, K. J. (2010). Open platform strategies and innovation: Granting access vs. devolving control. Management Science, 56(10):1849–1872.

Boudreau, K. J. and Hagiu, A. (2009). Platform rules: Multi-sided platforms as regulators. Platforms, markets and innovation, 1:163–191.

Burcharth, A., Knudsen, M. and Søndergaard, H. (2014). Neither invented nor shared here: The impact and management of attitudes for the adoption of open innovation practices. Technovation, 34: 149-161.

Bus, B., Van Gelder, E., Gondelach, S., Van Holland, R., Mallie, M., Meijboom, G., Van Pelt, V., Settels, M., Van der Stigchel, B., Tesink, W., and Vos, J. (2019). Visie op samenhang in de zorginfrastructuren in Nederland: Op weg naar naadloze samenwerking in de zorg.

Bygstad, B., Hanseth, O., and Le, D. T. (2015). From IT Silos to Integrated Solutions. A Study in E-Health Complexity. In ECIS 2015, pages 0–15.

Bystad, B., Hanseth, O. (2018). Transforming digital infrastructures through platformization. In 26th European Conference on Information Systems: Beyond Digitization - Facets of Socio-Technical Change, ECIS 2018.

Corbin, J. M. and Strauss, A. (1990). Grounded theory research: Procedures, canons, and evaluative criteria. Qualitative Sociology, 13(1):3–21.

Darmon, D., Sauvant, R., Staccini, P., & Letrilliart, L. (2014). Which functionalities are available in the electronic health record systems used by French general practitioners? An assessment study of 15 systems. International journal of medical informatics, 83(1), 37-46.

Deloitte (2020). Open Banking around the world: Towards a cross-industry data sharing ecosystem. https://www2.deloitte.com/global/en/pages/financial-services/articles/open-banking-around-the-world.html. Accessed: 20-08-2020

De Reuver, M., Sørensen, C., & Basole, R. C. (2018). The digital platform: a research agenda. Journal of Information Technology, 33(2), 124-135.

Dixon, B. E., Rahurkar, S., & Apathy, N. C. (2020). Interoperability and health information exchange for public health. In Public health Informatics and information systems (pp. 307-324). Springer, Cham.

EHRIntelligence (2020a). Health Information Exchange Sees Participation Surge Amid COVID-19. https://ehrintelligence.com/news/health-information-exchange-sees-participation-surge-amid-covid-19. Accessed: 19-08-2020.

EHRIntelligence (2020b). COVID-19 Accelerating Interoperability, Data Exchange, Analytics. https://ehrintelligence.com/features/covid-19-accelerating-interoperability-data-exchange-analytics. Accessed: 19-08-2020.

Eisenmann, T. R., Parker, G., and Van Alstyne, M. (2009). Opening platforms: How, when and why? Platforms, Markets and Innovation, pages 131–162.

Frontoni, E., Mancini, A., Baldi, M., Paolanti, M., Moccia, S., Zingaretti, P., Landro, V. & Misericordia, P. (2019). Sharing health data among general practitioners: The Nu. Sa. project. International journal of medical informatics, 129, 267-274.

Grisot, M., Vassilakopoulou, P., and Aanestad, M. (2018). Dealing with tensions in technology enabled healthcare innovation: two cases from the Norwegian healthcare sector. In Controversies in Healthcare Innovation, pages 109–132. Springer.)

Hein, A., Weking, J., Schreieck, M., Wiesche, M., Böhm, M. Krcmar, H. (2019). Value co-creation practices in business-to-business platform ecosystems.

Hermes, S., Riasanow, T., Clemons, E. K., Böhm, M., & Krcmar, H. (2020). The digital transformation of the healthcare industry: exploring the rise of emerging platform ecosystems and their influence on the role of patients. Business Research, 1-37.

Idenburg, P. J. and Dekkers, V. (2018). Zorg Enablers: Technologische ontwikkelingen in de zorg. Be-Bright, Zeewolde.

Idenburg, P. J. and Phillipens, M. (2018). Diagnose transformatie: Een toolkit voor grensverleggers in

de zorg. BeBright, Zeewolde, NL.

Karhu, K., Gustafsson, R., and Lyytinen, K. (2018). Exploiting and defending open digital platforms with boundary resources: Android's five platform forks. Information Systems Research, 29(2):479–497. Electronic Markets, 29:503– 518.

Kuechler, B. and Vaishnavi, V. (2008). On theory development in design science research. European Journal of Information Systems, 17(5):489–504.

Kuijpers, A. and Bakas, A. (2017). Digitalisering van de Zorg. Bakas Books bv, Amsterdam, NL.

Lenert, L., McSwain, B.Y. (2020). Balancing health privacy, health information exchange, and research in the context of the COVID-19 pandemic. Journal of the American Medical Informatics Association, 27(6): 963–966.

Mosterd, L., Sobota, V. C., van de Kaa, G., Ding, A. Y., & de Reuver, M. (2021). Context dependent trade-offs around platform-to-platform openness: The case of the Internet of Things. Technovation, 108, 102331.

OECD (2011). OECD-NSF Workshop: Building a Smarter Health and Wellness Future. Accessed: 14-10-2020, through: https://www.oecd.org/sti/ieconomy/48915787.pdf

Ondrus, J., Gannamaneni, A., and Lyytinen, K. (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):260–275.

Rijksoverheid.nl (2020). Belangrijkste huisartsinformatie tijdelijk te raadplegen. Accessed: 24-4-2020 through: https://www.rijksoverheid.nl/ministeries/ministerie-van-volksgezondheid-welzijn-en-sport/nieuws/2020/04/08/belangrijkste-huisartsinformatie-tijdelijk-te-raadplegen.

Schreieck, M., Wiesche, M., Kude, T., & Krcmar, H. (2019). Shifting to the cloud–how SAP's partners cope with the change. In Proceedings of the 52nd Hawaii International Conference on System Sciences.

Schreiweis, B., Pobiruchin, M., Strotbaum, V., Suleder, J., Wiesner, M., & Bergh, B. (2019). Barriers and facilitators to the implementation of eHealth services: Systematic literature analysis. Journal of medical Internet research, 21(11), e14197.

Scott Kruse, C., Karem, P., Shifflett, K., Vegi, L., Ravi, K., & Brooks, M. (2018). Evaluating barriers to adopting telemedicine worldwide: A systematic review. Journal of telemedicine and telecare, 24(1), 4-12.

Spena, T. R., & Cristina, M. (2019). Practising innovation in the healthcare ecosystem: the agency of third-party actors. Journal of Business & Industrial Marketing.

Tilson, D., Lyytinen, K., and Sørensen, C. (2010). Digital infrastructures: The missing IS research agenda. Information Systems Research, 21(4):748–759.

Tilson, D., Sorensen, C., and Lyytinen, K. (2012). Change and control paradoxes in mobile infrastructure innovation: the Android and iOS mobile operating systems cases. In 2012 45th Hawaii International Conference on System Sciences (pp. 1324-1333). IEEE.

Tiwana, A. (2014). Platform Ecosystems: Aligning Architecture, Governance, and Strategy. Elsevier, Waltham.

Tiwana, A., Konsynski, B., and Bush, A. A. (2010). Research commentary—platform evolution: Coevolution of platform architecture, governance, and environmental dynamics. Information systems research, 21(4):675–687.

Van Gelder, E. and Zebregs, Y. (2015). Visie op het zorglandschap: Een duurzaam landschap voor zorg en welzijn. Technical report.

Wareham, J., Fox, P. B., & Cano Giner, J. L. (2014). Technology ecosystem governance. Organization science, 25(4), 1195-1215.

West, J. (2003). How open is open enough? Melding proprietary and open source platform strategies. Research Policy, 32(7):1259–1285.

World Health Organization (2020). The New European Policy for Health – Health 2020 – A European policy framework and strategy for the 21st century. World Health Organization, Regional Office for Europe.

Zachariadis, M., & Ozcan, P. (2017). The API economy and digital transformation in financial services: the case of open banking.
Zittrain, J. (2008). The future of the internet–and how to stop it. Yale University Press.