Building Continents of Knowledge in Oceans of Data: The Future of Co-Created eHealth
A. Ugon et al. (Eds.)

doi:10.3233/978-1-61499-852-5-241

eHealth-Platforms - The Case of Europe

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Abstract. Platform approaches to improve interorganisational integration and eHealth innovation have gained a lot of attention. A variety of platform projects have been established in Europe. However, a systematic view is missing. Based on a multiple source analysis, this paper collects existing European eHealth-platforms and systematizes them with regard to their functional adjustment. We contribute by proving a functional cluster of platforms. The paper describes classification dimensions and identifies two general classes of platforms in the healthcare sector.

Keywords. eHealth, platforms, eHealth digital infrastructures, platform theory

1. Introduction

The eHealth infrastructures in the European countries differ in their objectives and maturity [1]. Although they differ, within eHealth infrastructures we observe a predominant role of eHealth-platforms. eHealth-platforms are implemented to meet different challenges like market failures of eHealth business models [2,3], a decreasing number of specialists in rural areas or a continuous increase in the number of elderly people, who need care in their home environment [4]. These different objectives lead to a heterogeneous functional design of platforms.

We question whether there are specific functional clusters in different types of eHealth infrastructures. Based on a multi-source-analysis, we identify current eHealth-platforms in Europe and give an overview of their functional adjustment. We contribute with a systematized understanding of existing platforms and thereby introduce a piece of the puzzle within eHealth-platform design theory.

2. Platform Theories in the Healthcare Sector

Since the early 2000s, platform theory has gained a lot of attention in the field of information systems research (ISR) [5,6]. Platforms are typically seen as intermediaries that support the transaction between different user groups [7]. As there are mainly two user groups, platforms are seen as an enabler for two-sided markets in ISR and economics [6]. In these markets, four different roles exist: the platform provider and platform sponsor who establish the platform, the supply-side user who provides complements and the demand-side user who consumes the complements provided by the supply-side user. The platform mediates the transaction between the supply-side and demand-side users [7].

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From an architectural perspective, platforms are "a set of stable components that supports variety and evolvability in a system by constraining the linkages among the other components" [8]. The stable components form the core of the platform. Evolvability is an important characteristic of platforms which addresses the adaptation to unanticipated changes within the environment [8]. This view comprises the independence of components that exist around the platform. These components are named complements [7]. The platform facilitates the complements and their creation.

Based on the foundational theories of information systems, platforms have the potential to overcome existing obstacles with eHealth technology like innovation barriers, missing diffusion and sticking organisational interoperability efforts [9,3]. In the following, we term platforms in the healthcare sector as eHealth-platforms because they enable electronic healthcare services and/or interorganisational integration based on electronic services within the healthcare sector. eHealth-platforms are at least open to medical professionals and organizations that want to ease interorganisational information exchange (openness to demand-side users [7]).

3. Methods

When analysing European eHealth-platforms, an important challenge is to gather a set of platforms which represent the European landscape of eHealth-platforms. In Europe, different national and regional actors initiate eHealth-platforms. Therefore, a literature review of scientific papers alone will not necessarily create such a set. According to the different sectors of the organizational environment model by DAFT ET AL., we identified four elements that are relevant drivers of eHealth-platforms: national governmental initiatives, scientific initiatives, international initiatives (e.g. initiatives of the EU-commission) and commercial initiatives [10]. Hence, we used the following sources:

1. *Governmental Website*: The websites of ministries and national eHealth centres have been searched. We searched separately for the terms "eHealth", "e-health", "telemedicine", "telehealth", "platform" and "ecosystem".
2. *Scientific Literature*: For the literature review we used a conventional literature review method [11]. We used Thomson Reuters Web of Science as a database with the following search string "(e-Health OR ehealth OR health OR telehealth OR telemedicine) AND (ecosystem OR network OR platform OR system)". After reviewing the abstracts, we included literature which describes existing platforms. Purely conceptual papers have been excluded.
3. *Funding Database*: We searched in CORDIS database (http://cordis.europa.eu) of the EU for signed projects. We used the search terms mentioned in source 1.
4. *References*: We searched for references to other platforms in the descriptions of previously identified platforms.

In order to remove non-active platforms from the study, we screened their websites for actual reports and news which had been published since March 2016. For the comparison of the different platforms, we used the classification method by NICKERSON ET AL. [12]. The method starts with defining one or more meta-characteristics for the classification. We identified the business cases of platforms as the central meta-characteristic. We used the conceptual-empirical approach articulated in the framework [12]. The initial dimensions that represent the business cases are "topic" and "function". "Topic"

considers whether a platform specifically focuses on a certain aspect of eHealth. "Function" describes the role of an eHealth-platform in a special healthcare environment. Following the definition of these dimensions and characteristics, the textual descriptions of the platforms have been analysed and characteristics for each dimension have been revised. After the final iteration, these characteristics have been used to build functional clusters.

4. Results

In total, 23 eHealth-platforms were identified (see table 1). All initiators refer to their project with the term 'platform': However, there are differences in the understanding of these platforms. Firstly, there are projects like EFA and openEHR, which are a standard for creating centralized (platform-based) systems. Secondly, there are concrete instances of platforms with running electronic services, which mediate the transactions between supply- and demand-side users, e. g. Kanta or ELGA. They are called 'Two-sided Service Platforms'. Some of these platforms also facilitate the creation of new eHealth applications by third-party providers (e. g. CCS Telehealth Ostsachsen, OpenTele). Thirdly, the last set of platforms can be understood as data sharing platforms, which collect technologies to facilitate electronic communication in the healthcare sector. In table 1, each platform is either assigned an 'S' for specification standard for platforms, a 'TSP' for two-sided service platform or a 'DSP' for data sharing platform.

In table 2, we map the identified platforms within the dimension of the classification scheme. Following the classification method in [12], each platform is assigned one characteristic of each dimension. Therefore, the assignment of characteristic represents the principal focus of a platform.

The dimension **topic** has six characteristics:

- *'Ambient Assisted Living' (AAL)* describes technologies which empower peoples' capabilities by means of a digital environment.
- *'Electronic Health Records (EHR)'* is an interorganisational medical record of patients, which is controlled by health service provider.
- *'Personal Health Records (PHR)'* is also an interorganisational medical record but controlled by the patient.
- *'Holistic'* matches platforms which try to unify different medical services within one platform.
- *'Interoperability/ Infrastructure'* describes platforms which enable data exchange.
- *'Telemedicine'* describes platforms which enable the provision of medical services over distance.

The dimension **function** has three characteristics:

- *'Application Development'* represents the ability to develop new applications based on the platform. It characterises the design of a platform that allows integrating new eHealth solutions into an existing ecosystem of actors.
- *'Data exchange'* represents the ability to share data between different organisations. These platforms are pure enablers for communication and only allow the use of a common infrastructure.
- *'Data exchange and storage'* extends the class of information sharing by adding abilities to store and manage data on the platforms.

Table 1. Identified eHealth-platforms, Src. – Source of Platform acc. to section 3, Types explained in Sec. 4.

Src	#	eHealth-platform	Type	Website	Country
1	1	CCS Telehealth Ostsachsen	TSP	http://www.telehealth-ostsachsen.de/	Germany
	2	E-veseliba	TSP	https://www.eveseliba.gov.lv/	Latvia
	3	EFA	S	http://www.fallakte.de/	Germany
	4	ELGA	TSP	https://www.gesundheit.gv.at	Austria
	5	epa-291a	S	https://www.epa291a.de	Germany
	6	HSCN	DSP	https://digital.nhs.uk/health-social-care-network	UK
	7	Kanta	TSP	http://www.kanta.fi/en/	Finland
	8	Kjernejournal	TSP	https://helsenorge.no/kjernejournal	Norway
	9	MedCom	TSP	http://medcom.dk/	Denmark
	10	Samedi	TSP	https://www.samedi.de/	Germany
	11	Spine	DSP	https://digital.nhs.uk/spine	UK
	12	Summary Care Record	TSP	https://digital.nhs.uk/summary-care-records	UK
	13	sundhed.dk	TSP	https://www.sundhed.dk/	Denmark
	14	Telerad MV	DSP	http://www.telerad-mv.de/	Germany
	15	Wdt. Teleradiologieverbund	DSP	http://www.medecon-telemedizin.de/	Germany
	16	Telematikinfrastruktur	DSP	http://www.gematik.de/	Germany
2	17	eHealth-Plattform	TSP	https://www.ehealth.fgov.be	Belgium
	18	Net4Care	TSP	http://net4care.org/	Denmark
	19	openEHR	S	http://www.openehr.org/	UK
	20	OpenTele	TSP	http://opentele.org/	Denmark
	21	Reseau Sante Wallon	TSP	https://www.reseausantewallon.be	Belgium
3	22	UNCAP	TSP	http://www.uncap.eu/	Italy
4	23	Danish Health Data Network	DSP	http://medcom.dk/medcom-in-english/other-stuff/the-danish-healthcare-data-network-sdn	Denmark

5. Discussion

After having identified eHealth-platforms, we observed a variety of different understandings. The term "platform" is used for specifications as well as for concrete infrastructural components. However, the understanding does not always align with platforms in the sense of the existing platform theory. In particular, CUSUMANO states "standards are not platforms" [13]. In Europe, eHealth-platforms strongly focus on providing data exchange, mainly through concrete instances of infrastructural components. A set of platforms implement data storage mechanisms. These establish central repositories for sharing of medical information. Hence, they are functioning as a central documentation and information exchange infrastructure in the corresponding care region. At the same time, a second set of platforms (1, 18, 20, 22) does not only focus on a different function (application development) but also on completely different topics (AAL and telemedicine). It seems as if two different classes of eHealth-platforms are developing: First, *platforms for healthcare information exchange* and, second*, two-sided platforms for the development of innovative telemedicine and homecare services*. In sources 1. and 2. we identified a majority of platforms. Therefore, we recommend these sources and the selected method setting for similar research projects. The classification method by NICKERSON ET AL. involves a loss of information because only one characteristic is allowed per dimension. On the other hand, the reduction of information makes the heart of the platform tangible, which outweighs the information loss. The identified platforms and their classification

will help to create a larger theory for platform artefacts in the healthcare sector. In future research, we will use the results as a basis to create archetypes of eHealth-platforms. This will be done by further analysing the architectures, platform ecosystems and effects that occur in these ecosystems.

Table 2. Taxonomy clustering eHealth-platforms.

		Topic					
		AAL	EHR	Holistic	Inter-operability / Infra-structure	PHR	Tele-medicine
Function	Application development	22					1, 18, 20
	Data exchange		3, 5	13	6, 9, 11, 14, 15, 16, 17, 23	4	
	Data exchange & storage		12, 19	2, 7	10	8, 21	

Acknowledgement

This work is based on the diploma thesis of Hanno Herrmann.

References

[1] A.Moen,W.O.Hackl,J.Hofdijk,L.V.Gemert-Pijnen,E.Ammenwerth,P.Nykänen and A.Hoerbst, eHealth in Europe – Status and Challenges, IMIA Yearbook (2013), 59–63, ISSN 0943-4747.
[2] K.A. Stroetmann, J. Artmann and V. Stroetmann, Developing national eHealth infrastructures – results and lessons from Europe, AMIA Annual Symposium Proceedings (2011), 1347–1354, ISSN 1942-597X.
[3] M. Benedict and H. Schlieter, Revise your eHealth-Platform! – Design Principles for a Descriptive Case Study, in: AMCIS 2017 Proceedings, 2017.
[4] E. Etchemendy, R.M. Baños, C. Botella, D. Castilla, M. Alcañiz, P. Rasal and L. Farfallini, An e-health-platform for the elderly population: The butler system, Computers & Education 56(1) (2011), 275–279, ISSN 0360-1315. doi:10.1016/j.compedu.2010.07.022.
[5] J. West, How open is open enough?: Melding proprietary and open source platform strategies, Open Source Software Development 32(7) (2003), 1259–1285, ISSN 0048-7333. doi:10.1016/S0048-7333(03)00052-0.
[6] J.-C. Rochet and J. Tirole, Platform competition in two-sided markets, Journal of the European Economic Association (2003), 990–1029.
[7] T.R. Eisenmann, G. Parker and M.W. Van Alstyne, Opening Platforms: How, When and Why?, SSRNElectronic Journal (2008), ISSN 1556-5068. doi:10.2139/ssrn.1264012.
[8] C.Y. Baldwin and C.J. Woodard, The Architecture of Platforms: A Unified View, SSRN Electronic Journal (2008), ISSN 1556-5068. doi:10.2139/ssrn.1265155.
[9] C. Kuenne and R. Agarwal, Online Innovation Intermediaries as a Critical Bridge between Patients and Healthcare Organizations, Wirtschaftsinformatik Proceedings 2015 (2015).
[10] R. Daft, Organization Theory and Design, Cengage Learning, 2006. ISBN 978-0-324-40542-2.
[11] J. vom Brocke, A. Simons, K. Riemer, B. Niehaves, R. Plattfaut and A. Cleven, Standing on the Shoulders of Giants: Challenges and Recommendations of Literature Search in Information Systems Research, Communications of the Association for Information Systems 37(1) (2015), ISSN 1529-3181.
[12] R.C. Nickerson, U. Varshney and J. Muntermann, A method for taxonomy development and its application in information systems, European Journal of Information Systems 22(3) (2013), 336–359, ISSN 0960-085X, 1476-9344. doi:10.1057/ejis.2012.26.
[13] M. Cusumano, The evolution of platform thinking, Communications of the ACM 53(1) (2010), 32, ISSN 00010782. doi:10.1145/1629175.1629189.