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DESIGNING DATA GOVERNANCE MECHANISMS FOR DATA MARKETPLACE META-PLATFORMS

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Abstract Data Marketplace Meta-platforms (DMMPs) federate the fragmented set of data marketplaces and are expected to become a pivotal instrument to realize a single European Data Market in 2030. However, one critical hindrance to foster the adoption of business data sharing via DMMPs is data providers' risk of losing control over data. Generally, the literature on inter-organizational data sharing has highlighted that data governance mechanisms can help data providers to retain control over their data. Nevertheless, data governance mechanisms in the DMMP context are yet to be explored. Therefore, this research aims to design data governance mechanisms for business data sharing in DMMPs by employing the Design Science Research (DSR) approach. This study contributes to the literature by identifying root causes and consequences of losing control over data and defining prescriptive knowledge regarding design requirements, design principles, and a framework for designing data governance mechanisms within the novel setting of meta-platforms.

Keywords: data governance, data sharing, data exchange, data markets, data marketplaces, federated platform, platform federation, meta-platforms, design science research (DSR)

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1 Introduction

Data marketplaces are increasingly recognized as a pivotal instrument for accomplishing the EU vision to create a single European Data Market in 2030 (European Commission, 2020). A data marketplace is a multi-sided platform that matches data providers and data buyers; that facilitates data sharing and transactions via features provided by data marketplace owners and third-party providers (TPPs) (Fruhwirth, Rachinger, & Prlja, 2020; Koutroumpis, Leiponen, & Thomas, 2020; Spiekermann, 2019). Data marketplaces' core aim is to facilitate business data sharing among companies (Agahari, 2020). Thereby, business data become a trading commodity. Nevertheless, considerable heterogeneity of data marketplace initiatives exists and causes fragmentation. The fragmentation causes multiple aspects of data marketplaces (e.g., business models, governance arrangements, and technical standards) to diverge uncontrollably, leading to a decrease of trust in data marketplaces as a whole (TRUSTS, 2019). For potential data buyers, for instance, the fragmentation triggers difficulties in data discovery processes. Data buyers also suffer from vendor lock-in (i.e., unable to switch to other data marketplace providers due to high switching costs). In general, the fragmentation has slowed down the platforms' commercialization due to a lack of users (i.e., data providers and buyers) (Basaure, Vesselkov, & Töyli, 2020).

Nascimbeni (2020) refers to meta-platforms as a promising solution to tackle fragmentation. A meta-platform is a platform of platforms that coordinates and integrates different platforms' resources and solutions. (Billhardt et al., 2020; Burkhardt, Frey, Hiller, Neff, & Lasi, 2019; Savković, Schweigkofler, Savković, Riedl, & Matt, 2020). Meta-platforms are centralized efforts to organize collective actions by enforcing common policies, standards, and infrastructures (Chia, Keogh, Leorke, & Nicoll, 2020; Floetgen et al., 2021). Meta-platforms functionalities include *one-stop-shop* via standardized portals, information dissemination & aggregation, and the establishment of shared services (Floetgen et al., 2021; Hoffmann, Rupp, & Sander, 2020). Meta-platforms enable the increase of demand-side users (e.g., data providers and data sellers) to discover data, avoid switching costs and demonstrate legal compliance (Basaure et al., 2020).

However, a critical hindrance to foster the adoption of business data sharing via data marketplaces is data providers' risk of losing control over data (Richter & Slowinski, 2019; Spiekermann, 2019). Losing control over data triggers many consequences for data providers. For instance, competitors may benefit from their data in unanticipated ways (Gelhaar & Otto, 2020; Richter & Slowinski, 2019). Moreover, it also brings privacy risks (Schomakers, Lidynia, & Ziefle, 2020) and triggers data providers' reputational damage. In our exact context, i.e., Data Marketplace Meta-Platforms (DMMPs), we argue that data providers also possess the same risk. DMMPs inherit unresolved data control problems in data marketplaces. Even more, the nature of DMMPs where data flows from a data marketplaces to others (and vice versa) may increase the risk.

The literature on inter-organizational data sharing has highlighted that data governance can potentially help data providers to retain control over their data (van den Broek & van Veenstra, 2015). We define data governance as the activities of exercising control (i.e., defining what, who, and how) over data ownership, access, and data usage decisions to minimize the risks associated with data sharing (De Prieëlle, De Reuver, & Rezaei, 2020; Lis & Otto, 2020; Nokkala, Salmela, & Toivonen, 2019). Examples of data governance mechanisms are defining data ownership and access, formal contract selling, user consent, or data stewards. These mechanisms are beneficial to overcome the barrier of losing control over data (Günther, Rezazade Mehrizi, Huysman, & Feldberg, 2017; Lee, Zhu, & Jeffery, 2017; Suver, Thorogood, Doerr, Wilbanks, & Knoppers, 2020). Nevertheless, data governance mechanisms in the DMMP context are yet to be explored. Based on the previous elaboration, the objective of this study is ***to design data governance mechanisms for business data sharing via DMMPs to reduce data providers' risk of losing control over data.***

2 Research Design

This study will employ the Design Science Research (DSR) approach. The DSR aims to develop innovative Information System (IS) artifacts to solve real-world problems (Hevner, 2007). The DSR approach is appropriate because it allows the creation of innovative artifacts (i.e., data governance mechanisms) that could reduce data providers' risk of losing control over data. The creation of artifacts and also it implementations can lead to knowledge creation. Based on the study of Peffers,

Tuunanen, and Niehaves (2018) that defines DSR genres, we position our DSR study under the classification of the *Design Science Research Methodology (DSRM)*. The DSRM is a well-adopted methodology in DSR. The DSRM focuses on artifact development, and its evaluation is outcome-oriented and practical. It should aim for generalizability and reasoned arguments on why the designed artifacts could work (Peffers et al., 2018). Building from the DSRM (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007), we will explain the relationship between research phases, questions, and instruments. The research will be conducted within five phases (see Figure 1).

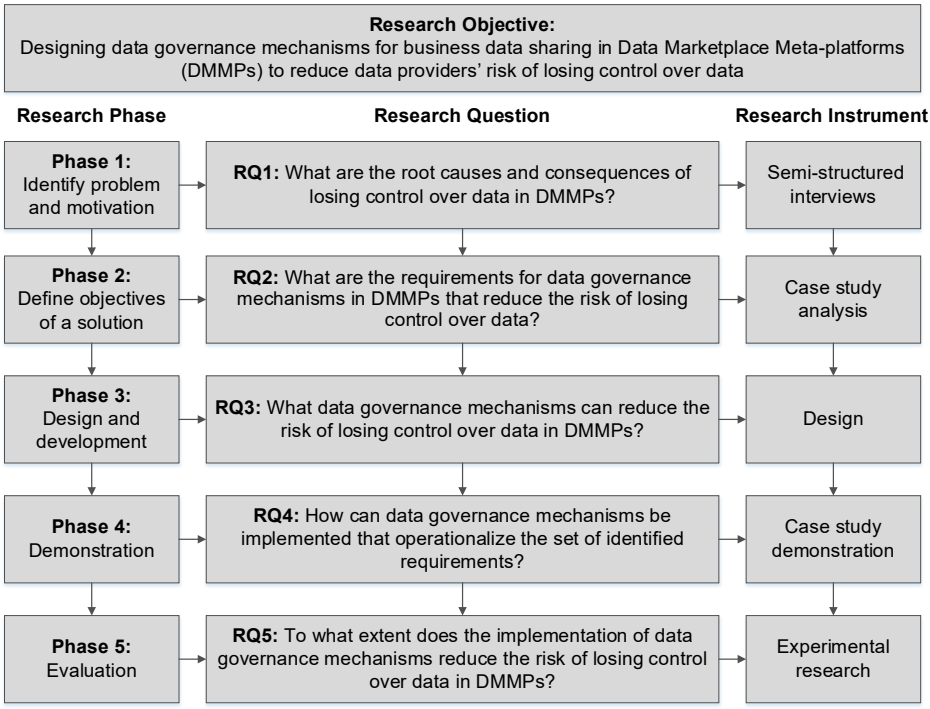

Figure 1: Research design

We will begin the research by identifying the root causes and consequences of losing control over data in the context of DMMPs. These factors will be the foundation when defining requirements in the later stage. We will conduct an exploratory study to answer the RQ1. An exploratory study is suitable because not much is known about this phenomenon (Sekaran & Bougie, 2016). Our exploratory study will

employ the qualitative approach using semi-structured interviews as a primary data collecting method. Semi-structured interviews will be guided by the preliminary literature review result we conducted in the introduction section. Next, the second phase of our DSR study defines requirements for designing data governance mechanisms in DMMPs. Requirements here refer to the detailed descriptions of what users want from the designed solution (Dym, Little, & Orwin, 2014). We will use a single case study to derive data governance requirements. We will select the TRUSTS project[1] since that project aims to develop a DMMP. We will use several procedures, such as interviews, document analysis, and observation, to collect the data. We are aware that it will be challenging to come up with one final design. Therefore, we will create business data sharing scenarios via DMMPs to scope our research.

Once we have defined the requirements, we will answer the RQ3 by designing the artifacts. We will produce two major artifact types in this phase, namely 1) design principles and 2) a framework. First, we will construct design principles, which refer to "core principles and concepts to guide design" (Vaishnavi et al., 2004, p. 16). Design principles inform the designers to develop instances from artifacts that belong to a similar class (Gregor, Kruse, & Seidel, 2020). Second, we will develop a framework to design data governance mechanisms. The framework here can be described as "real or conceptual guides to serve as support…" (Vaishnavi et al., 2004, p. 16). DMMPs owners can use the framework to develop data governance mechanisms. The design principles will be used as input to create this framework. The framework includes the guideline to decide and select which mechanisms will be appropriate; to operationalize the mechanisms in a specific context.

In phase 4, we will apply the designed framework to build data governance mechanisms. Phase 4 will be beneficial to demonstrate data governance mechanisms in practices. We will use a case study (i.e., the TRUSTS project) to operationalize our solution. We will follow the frameworks from Phase 3 to develop an instantiation. In the final phase, we will evaluate whether demonstrable data governance mechanisms can achieve the goal or not. We will evaluate our data governance mechanisms using a summative evaluation. The summative evaluation aims to test whether our designed artifact creates the desired impact or not. Summative

[1] https://www.trusts-data.eu/ accessed on March 02, 2021

evaluation is often conducted after the artifact has been developed (i.e., *ex-post* evaluation) (Sonnenberg & Vom Brocke, 2012; Venable, Pries-Heje, & Baskerville, 2016). We will conduct an experiment to test our designed artifacts (e.g., quasi-experiments).

3 Theoretical framework

The section below discusses relevant theories that will be used to develop data governance mechanisms.

Data governance theory – data governance can help organizations to retain control over their data (van den Broek & van Veenstra, 2015). Data governance mechanisms such as defining data ownership and access, RACI chart, formal contract selling, user consent, governance mode, and data stewards can be used as instruments to retain control over data (Günther et al., 2017; Lee et al., 2017; Suver et al., 2020). We will build upon these works and will explore which mechanisms are appropriate for our novel settings.

Platform control theory – platform control can be described as platform owner's attempts to influence complementors (e.g., application developers) to behave according to the platform's objectives (Goldbach, Benlian, & Buxmann, 2018; Tiwana, 2013). There are two categories of platform control mechanisms: a) formal and b) informal control. The formal control can be further subdivided into input, behavior, and output control. In contrast, informal control can be subcategorized into self- and clan control. Previous studies show how platform controls affect digital platforms. For example, Goldbach et al. (2018) discover that enforcing self-control to third-party developers positively influences the quality of the application and their continuance intention to participate in an ecosystem. In addition, Zheng, Xu, and Lin (2019) reveal that formal control (e.g., seller reputation) and social control (e.g., number of fans and members), in the context of the crowdsourcing platform, are decreasing the likelihood of opportunistic behavior by the seller.

Coordination theory – coordination is the act of managing dependencies amongst activities to accomplish a goal. The coordination consists of four components: the *goals, activities, actors,* and *dependencies*. The common coordination processes associated with those components include: a) defining goals, b) plotting goals to activities, c)

defining actors and assigning them to relevant activities, and d) managing dependencies (Malone & Crowston, 1990, 1994). Though studies that draw the connection between coordination and control are limited (Ko, Lee, Keil, & Xia, 2019), some researchers have started investigating this matter. For example, in the project management context, Remus, Wiener, Mähring, Saunders, and Cram (2015) inform that control-focus on coordination can be achieved by "empowerment, guidance, facilitation, and trust" (p. 5). Ko et al. (2019) explore the different impacts of formal control (i.e., outcome and process control) on coordination and explain how coordination mediates these formal controls. The coordination theory will be beneficial to complement the previous platform control theory. For instance, if we want to employ the clan control that requires interactions between complementors, we need to define what appropriate activities should be proposed, which dependencies may occur, and how to assemble those dependencies.

Accountability theory − Vance, Lowry, and Eggett (2015) have synthesized the definition of *accountability*: "a process in which a person has a potential obligation to explain his/her actions to another party who has the right to pass judgment on those actions and to administer potential positive or negative consequences in response to them" (p. 347). Accountability theory suggests numerous mechanisms that increase accountability perceptions. These are: *a) identifiability*, *b) expectation of evaluation, c) awareness of monitoring,* and *d) social presence.* Various studies have revealed the relationship between accountability and control. For example, accountability theory can be used to increase accountability perception, and in consequence, decrease the attention to violate the data access policy (Vance, Lowry, & Eggett, 2013; Vance et al., 2015). Yaokumah, Walker, and Kumah (2019) explain how Security Education, Training, and Awareness programs (SETA) can improve employee security behavior, mediated by employee accountability. A study conducted by Y. Zheng, Huang, Lee, and Bao (2017) shows that extra-role behaviors (derived from social control and accountability theory) positively influence such bright internet policy adaptions. In general, individuals with a high accountability perception are more likely to develop cognitive awareness. Accordingly, it will lead to the conformity of expected actions, pro-social behaviors, and decrease risk behaviors (Zhang, Wei, & Zeng, 2020).

The summary of the context, relevant theories, and DSR can be seen in Figure 2. It describes the idea of having kernel and provides justificatory knowledge for prescriptive knowledge (Kuechler & Vaishnavi, 2008). We will use multiple theories to gather justificatory knowledge. Finally, we will also use those theories to derive criteria on the utility of the artifact (Niehaves & Ortbach, 2016).

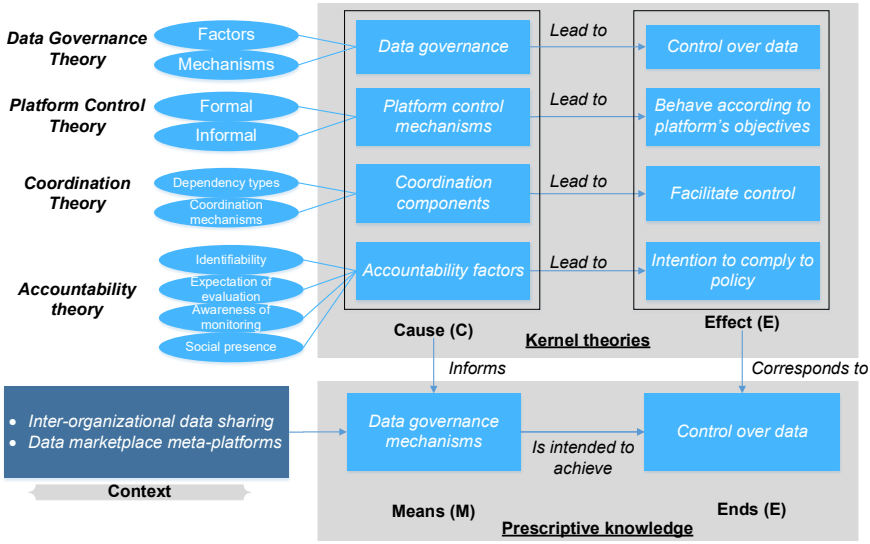

Figure 2: The role of theories in the DSR study

4 Preliminary results

A Systematic Literature Review (SLR) study for business data sharing via data marketplace has been conducted. This study is currently under review at an international conference. This study helps to set the stage and position our proposed research in data marketplace literature. Therefore, we will use it as an input for the literature section. After reviewing numerous articles, we found no comprehensive overview of data marketplace research available in the literature. Consequently, we have no clear understanding of what is known about data marketplaces, and we are unable to spot neglected research topics that may contribute to advancing data marketplaces towards commercialization. This study provides an overview of the state of the art of data marketplace research. We employ the SLR approach and structure our analysis using the Service-Technology-Organization-Finance (STOF) model. We studied 135 articles from the Scopus database and found that the extant

data marketplace literature is primarily dominated by technical research, such as discussions about *computational pricing* and *architecture*. To move past the first stage of the platform's lifecycle, i.e., platform design, to the second stage, i.e., platform adoption, we call for empirical research in non-technological areas, such as *value networks* and *organizational arrangement*. The findings, therefore, in line with our goal (i.e., contribute to a non-technical topic and incorporate empirical data) because the proposed research will design data governance mechanisms that likely discuss the interaction between actors and required arrangements in DMMPs.

Moreover, we conducted an initial workshop with TRUSTS internal participants on 22 October 2020 to explore potential value creations and perceived adoption barriers of DMMPs. In total, 15 participants from different organizations attended the workshop. The former objective is relevant to this study because it strengthens the argument we elaborate in the introduction section, i.e., related to the benefit of DMMPs towards resolving the fragmentation. The latter objective is also beneficial to give additional insights for exploring the root causes and impacts of losing control over data. On the one hand, potential value creations of DMMPs include 1) traffic forwarding and commissioned brokerage services, 2) the increase of dataset/data source numbers within the federation, 3) gradual harmonization of technology stack through coordination and common standards, and 5) provision of non-differentiating capabilities (e.g., billing) as shared services. On the other hand, perceived adoption barriers of DMMPs include 1) unclear and unproven value propositions, 2) unclear and unproven network-effects and added value from small-size and domain-specific data marketplaces, 3) unexplored economics of various data marketplace setups with a federation (e.g., revenue sharing mechanisms), 4) increased complexity and cost for technology integration, and 5) fear of losing data marketplaces' Unique Selling Proposition (USP).

In addition, we also developed a business model taxonomy for data marketplaces. The developed taxonomy is relevant because we need to know what kind of data marketplaces a DMMP platform will federate or interoperable with. The study is also beneficial in the literature review section of the dissertation. In this study, we argued that data marketplaces are vastly different so that a taxonomy can be used to classify data marketplaces. Existing data government arrangements that the DMMP federates or interoperable with may be incompatible. For instance, a data marketplace may focus on automotive data while the other focuses on healthcare

data. The degree of sensitivity of these data types are different, and in consequence, it may impact the definition of data access right. We employed a DSR approach and a standard taxonomy development method by Nickerson, Varshney, and Muntermann (2013) to develop the taxonomy. Four meta-dimensions, 17 business model dimensions, and 59 business model characteristics have been identified in the final taxonomy.

5 Future development and expected contributions

The future development of this research is to execute the plan provided in section 2. These are: 1) identifying root causes and impacts of losing control over data, 2) identifying requirements for data governance mechanisms, 3) creating a framework for designing data governance mechanisms, 4) demonstrating data governance mechanisms, and 5) evaluating the usefulness of the developed mechanisms.

This study contributes to science by identifying root causes and impacts of losing control over data in DMMPs, thus serving as a basis for designing solutions. We also contribute to defining prescriptive knowledge regarding: a) design requirements, b) design principles, and c) a framework for designing data governance mechanisms in DMMPs. Societally, DMMPs' owners may benefit from this research by applying data governance mechanisms to reduce data providers' risk of losing control over data. Data providers will feel safe and trust the ecosystem because of their positive perception. Consequently, data providers' adoption of DMMPs may increase, potentially leading to more value generation through business data sharing and use.

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