Aug 10th, 12:00 AM

Towards a Framework for Enterprise & Platform Ecosystem Data Governance

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Completed Research

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Abstract

Platform ecosystems offer great potential for enterprises by sharing data. However, the convergence of different data from multiple data sources results in large efforts to use this data in a valuable way. Data governance for platform ecosystems has the potential to tackle this problem. However, the data governance of individual enterprises differs significantly from the data governance for platform ecosystems. In this paper a systematic literature review was used to identify the differences between enterprise data governance and data governance for platform ecosystems. On this basis, a conceptual framework that demonstrates the design elements that need to be added to an enterprise data governance in order to be able to function as a platform ecosystem was created. Therefore, a framework for enterprise data governance was extended with 24 factors of platform ecosystem data governance.

Keywords

Data Governance, Platform Ecosystem, Interenterprise, Data Sharing, Data Quality, Data Ecosystem.

Introduction

As the importance of data for the success of an enterprise is constantly growing, the careful and coordinated handling of data is crucial (Brüning et al. 2017). The data governance of an enterprise is therefore focused on the appropriate handling of data to be able to make use of the information resulting from the data in the best possible way (Brüning et al. 2017). Besides an internal data governance, Judah and White (2020) suggest that enterprises also need an interorganizational data governance to achieve their goals in sharing data with other enterprises. Platform ecosystems offer enormous potential for sharing data, by leveraging data from multiple enterprises (Prieelle et al. 2020). Gelhaar et al. (2020) stated, that nowadays, "involvement in ecosystems is no longer a choice, but rather a necessity for companies to unlock the benefits of data sharing". Schreieck et al. (2018) also highlight that more and more established enterprises are implementing platform ecosystems to collaborate and share data with other organizations. Platform ecosystems consist of a stable core respectively the platform, that interacts with a dynamic and heterogeneous set of corresponding components and parties that either provide, extend, and use the platform (Kretschmer et al. 2022, Uludag et al. 2016). The ability of platforms to create flexible ecosystems and not just stable relationships between long-term business partners complicates the handling of shared data in a platform ecosystem (Cheong and Chang 2007, Kravets and Zimmermann 2012). However, in the context of data sharing between companies in platform ecosystems, data governance research is still in its infancy (Prieelle et al. 2020). The reason for this is, among other things, that the data governance of entire platform ecosystems differs significantly from that of individual enterprises because the parties of platform ecosystems form an interorganizational network and therefore have no formal authority above themselves (van den Broek and van Veenstra 2018). Until today, there is no literature that gives a clear answer how data governance for platform ecosystems differs from enterprise data governance and which factors should

be included in both data governance approaches. Based on this problem definition, this paper aims to answer the following two research questions:

RQ1: "What are the differences and relations between enterprise and platform ecosystem data governance?"

RQ2: "How could a comprehensive framework for data governance look like?"

By answering these two questions, this work should show which elements of data governance can exist both within the enterprise and data governance in platform ecosystems, and which elements must additionally be included. This should help enterprises that already have a platform ecosystem or are planning to set up a platform ecosystem to adjust their data governance. Since there could not be found a comprehensive framework for enterprise and platform ecosystem data governance, this paper will further address this issue in research question 2.

The structure of the paper is as follows. First, the basic terms for understanding are explained. Then, the research methodology is presented to provide a transparent view of our approach. This is followed by the findings of the literature analysis which includes the data governance factors for platform ecosystems, the intersection between enterprise and platform ecosystem data governance factors and the conceptual framework for enterprise and platform ecosystem data governance. In the end, after a short summary of the results, the limitations and implications of this paper are pointed out.

Theoretical Background

In order to create a consistent understanding of the terms platforms, platform ecosystems, data governance and their interdependencies respectively the data governance in platform ecosystems, these topics are described in more detail in this chapter.

Platforms & Platform Ecosystems

Uludag et al. (2016) did a state-of-the-art analysis on literature and research streams concerning platforms and ecosystems which is why the following definitions are mostly described based on their research. They describe a platform as the stable core of a digital, multi-sided market. A platform provider makes the platform available to end users (Uludag et al. 2016). From a technical perspective, a platform is an extensible code base to which third-party modules can be added (Prieelle et al. 2020). A platform is therefore the technological infrastructure to develop an ecosystem of users and providers (Guggenberger et al. 2020). In this sense, platforms enable unrelated organizations to offer and exchange services, products, and information (Scholten and Scholten 2010). Summarized by Uludag et al. (2016), platforms and ecosystems can together be described as platform ecosystems which are composed of a stable core respectively the platform, the applications developed for it, the actors that provide, extend, and use the platform and applications, and the interactions as well as their impacts. In this context, data ecosystems can be considered as a specific subset of platform ecosystems, where the core value proposition is enabled by data sharing (Prieelle et al. 2020). Here, the summarized definition for data ecosystems by Oliveira and Lóscio (2018) that resulted from related state-of-the-art publications about data ecosystems provides a detailed description: A data ecosystem is "[…] a set of networks composed by autonomous actors that directly or indirectly consume, produce or provide data […]. Each actor performs one or more roles and is connected to other actors through relationships, in such a way that actors collaboration and competition promotes data ecosystem self-regulation."

Data Governance

Corporate governance of a company manages the assets, main processes and resources of a company (Brüning et al. 2017). Due to the importance that data has for enterprises, data is now considered to be one of the key assets of a company (Brüning et al. 2017). Therefore, it is required to also define a specific data governance that sets the regulatory framework for handling them (Brüning et al. 2017). Simply defined, data governance implicates the way data is handled in a company or across companies to make decisions through data while minimizing data-related risks (Otto 2011). Data governance is becoming increasingly important in organizations, due in part to the annual amount of data generated globally, which has

increased tenfold in the last seven years (Abraham et al. 2019). The growing volumes of data from various sources lead to data inconsistencies that need to be identified and addressed before decisions are made based on incorrect data (Abraham et al. 2019). Despite the growing importance of data governance, the current view on this topic is mixed and there is no consistent definition on the term data governance (Otto 2011). Abraham et al. (2019) conducted a literature review on this topic and were able to identify 145 publications. No unified definition of data governance was found in the 145 publications. Therefore, Abraham et al. (2019) analyzed all definitions of data governance in the identified publications and searched for common characteristics and features. The analysis resulted in the following summarized definition of data governance: "Data governance specifies a cross-functional framework for managing data as a strategic enterprise asset. In doing so, data governance specifies decision rights and accountabilities for an organization's decision-making about its data. Furthermore, data governance formalizes data policies, standards, and procedures and monitors compliance."

Data Governance in Platform Ecosystems

While organizations can easily control their data and employees, platform owners are facing multiple parties contributing and using data (Smedlund and Faghankhani 2015). Designing data governance can help to tackle this complexity (Lee et al. 2018b). In this context, data governance for platform ecosystems has to decide how to partition the rights between the owner and its users, to counteract possible tensions between all participants (Lee et al. 2018b, Lis and Otto 2021). The role of data governance in platform ecosystems in this context is to create a collaborative environment that enables data sharing between organizations (Lis and Otto 2021). Accordingly, Van den Broek and Van Veenstra (2018) define data governance in platform ecosystems as follows: “Arranged institutions and structures to ensure that individuals behave in line with the collective goals, conflicts between individuals are prevented or resolved, and the effective and fair use of collective resources within the inter-organizational collaboration.”

Research Methodology

In this chapter, the research methodology used in this paper is described in detail. Figure 1 gives an overview of the methodology.

In step 1 a literature search to identify relevant literature in the context of data governance for a single enterprise and of a platform ecosystem was conducted. Therefore the methods of Webster and Watson (2002) and vom Brocke et al. (2009) were used. Vom Brocke et al. (2009) provide a general approach, from formulating the problem to presenting the results of the literature review. Further they require a strict documentation and presentation of the entire search process for scientific papers to ensure reusability. The AIS Electronic Library, IEEE Xplore Digital Library, and Google Scholar databases were used for the literature search.

Electronic searches of titles, abstracts, and keywords were conducted using the following search term: [“Data Governance” AND ((“platform” OR “ecosystem”) OR (“interorganizational” OR “interenterprise”) OR (“model” OR “framework” OR “concept” OR “elements” OR “factors”))]. The search was conducted from 2000 onwards, but relevant hits were found only from 2016 ongoing. This is consistent with the statement of Abraham et al. (2019) that publications have increased substantially since 2016.

According to the search query performed, these searches resulted in a total of 205 publications. After the duplicates were excluded, the abstracts of all publications could be reviewed for thematic relevance. After analyzing the abstract, keywords or, if necessary, the full article, 14 relevant publications remained for our research focus. In addition to the database search, Webster and Watson (2002) recommend performing a forward and backward search. This was done in a final step which increased the number of final publications to 17. Using the qualitative content analysis proposed by Mayring (2010), the 17 papers were analyzed and a count of ten meta papers were identified in step 2. These ten meta papers reference the remaining seven papers. In step 3 the ten publications were read in full and coded according to the thematic synthesis process of Cruzes and Dybå (2011). For the coding process regarding the platform ecosystem data governance factors, the wording of the listed categories from the cited authors could be adopted. In this process the four-eye-principle as proposed by Peffers et al. (2012) was used. Only issues explicitly mentioned by the respective authors were considered.

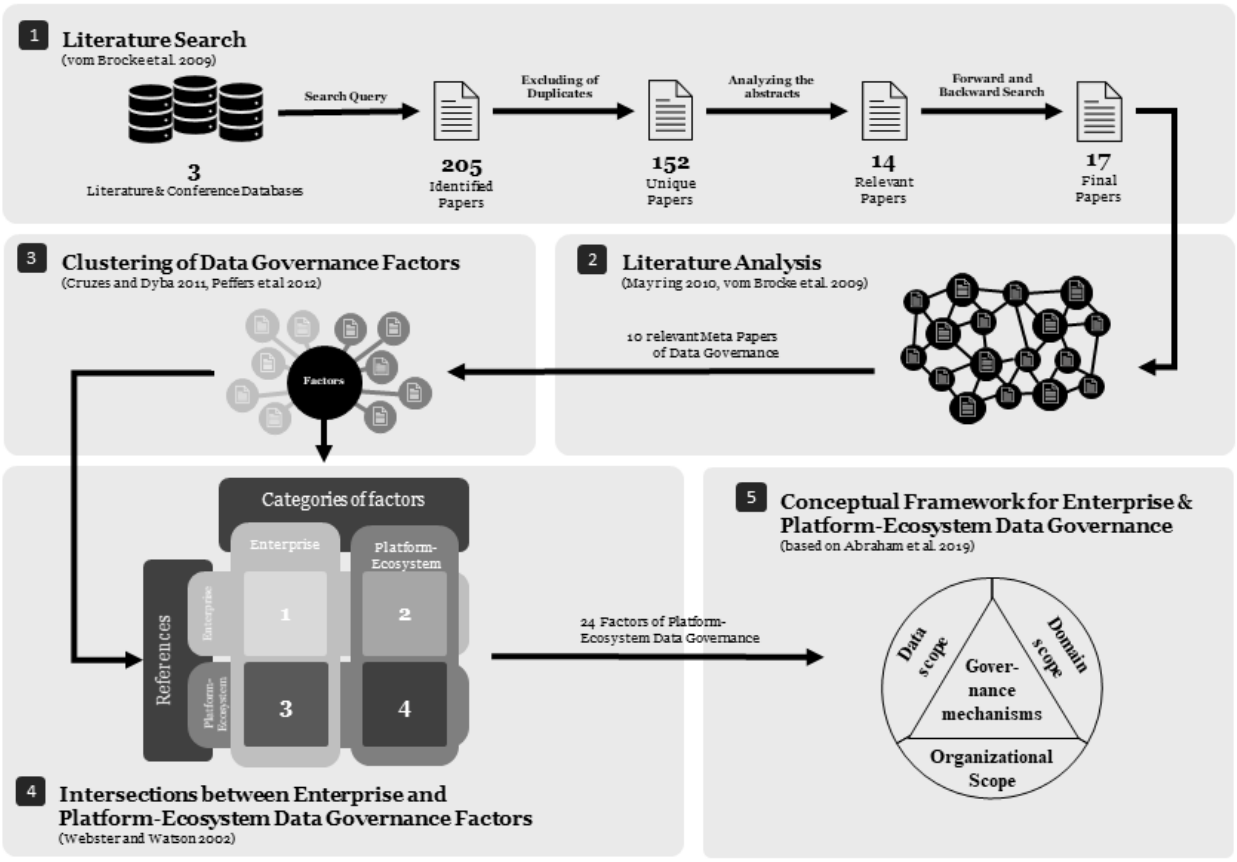

Figure 1. Overview of the Methodology

Webster and Watson (2002) recommend the use of a concept-centered organizational framework when conducting a literature review, which allows the comparison of the different data governance factors for enterprises and those for platform ecosystems. Therefore, in step 4, the categorized factors were contrasted to show their intersections within a concept matrix. As a result, 20 data governance factors for platform ecosystems could be identified that are not included in the enterprise data governance factors, to which, in step 5, 4 more factors could be added. Afterwards, the conceptual framework of Abraham et al. (2019) was extended to include the platform ecosystem data governance factors. This was done by creating a conceptual framework that includes the enterprise data governance factors and the platform ecosystem data governance factors. A complete list of all papers and a documentation of the coding process is available from the authors upon request.

Findings

Through the literature review 16 major factors of enterprise data governance and 24 major factors of platform ecosystem data governance were identified. These have been divided into categorized factors which are explained in detail below.

Enterprise Data Governance Factors

All concepts and their elements in the identified papers were analyzed, looking for common features to get an overview of which design elements compose an enterprise data governance. The conceptual framework of Abraham et al. (2019) is used as the basis for all design elements, because during the clustering of factors it was observed that the framework contains almost all design elements that are addressed in the other publications. This can also be seen in the concept matrix in table 1. The framework is divided into six dimensions. Governance mechanisms are the core dimension of the framework and include structural, procedural, and relational mechanisms. Another dimension is organizational scope, which differentiates

between inter-organizational and intra-organizational scope. The data scope dimension refers to the amount of data that an organization must manage. A difference is made here between big data and traditional data such as master data or transaction data. Further, Abraham et al. (2019) describes the domain scope as being about decisions about data to which data governance mechanisms are applied. Decisions include data quality, data security, data architecture, data lifecycle, metadata, and data storage and infrastructure. The last two dimensions are divided into factors that influence or precede the other dimensions (antecedents) and factors or effects that data governance has.

Platform Ecosystem Data Governance Factors

Data layer – Under the data layer, the following dimensions by Lee et al. (2017a) were categorized: Decision rights, data ownership and data usage. These dimensions each contain individual characteristics and factors. *Decision rights* define the decision-making authority for data-related resources, such as setting data standards or usage conditions. *Data ownership* is associated with privileges to exercise control over data access or use. A distinction is made as to whether data ownership resides with an individual, organizational, or shared entity. More closely, the data ownership dimension also includes other factors: *definition criteria* refers to the legal environment that might affect the ownership and use of data in platform ecosystems. *Contribution estimation* is a mechanism for measuring user contribution to value creation through the provision of data. This is necessary to support revenue sharing, promote high quality resources, and suppress low quality resources from platform ecosystems. The *data use case* factor overlaps within the data ownership and data Usage dimensions. Under data use case, the purpose for which data has been collected is defined and, accordingly, what it may be used for (Jaekel 2020, Lee et al. 2017a). The Data Usage dimension also includes the factors *Conformance*, *Monitoring* and *Data Provenance*. Conformance and monitoring show and safeguard exactly where data comes from and what has been or may be done with it (Lee et al. 2018a). This can prevent data leakage, as it becomes clear exactly which data originates from sensitive data sets (Lee et al. 2018a). Further, the contribution of users should be measured to reward value generation (Lee et al. 2018a). Data provenance is a means to make the genesis of data transparent to all groups involved. Since metadata is a fundamental element to ensure transparency and visibility of data usage, standardization of metadata for tracking information about data in platform ecosystems should be considered.

Governance layer – This Dimension indicates how the governance was set up. Lis and Otto (2021) include the *Governance Structure*, which considers the variants for the control and incentives of a platform ecosystem. This includes the market, which is characterized by strict compliance with contractual conditions on property rights with low trust. Further, a so-called Hierarchy represents the opposite extreme of a market structure. It is characterized by the enforcement of control by administrative authority. The structure network was introduced to form its own hybrid arrangement environment between the two extreme forms of market and hierarchy. A bazaar is an alternative structure introduced with the rise of the open-source movement. Unlike market or hierarchy structures, bazaar governance is characterized by open licenses that do not require formal contracts or some basis of trust to enable collaboration. Further, the Governance Layer also includes the *configuration* dimension, which describes that the data governance can be managed in a centralized or decentralized manner. In centralized governance, all control and responsibility lies with the platform owner; in decentralized, responsibility is shared with the platform users (Lee et al. 2018b). For decision making between the two, Lee et al. (2018b) established contingency factors, as well as advantages and disadvantages. Last, the governance layer includes the *mechanism* dimension, which differentiates between formal and relational manifestations of governance. It enables the implementation of control mechanisms that are influencing the behavior and dynamics of cooperation, e.g. through incentives, rewards, or punishments.

Interaction layer – Lis and Otto (2021) use this layer to define the *purpose* that a platform ecosystem is intended to fulfill. They differentiate between control, collaboration, value generation and solving conflicts. The interaction layer also considers the *phase* dimension, which relates to the life cycle of a partnership within a platform ecosystem. Here, a difference is made between collaboration before the partnership, partnership creation, partnership program delivery, and partnership succession or termination.

Platform provider structure – According to Uludag et al. (2016), this concerns the structure of the platform provider organization as well as the general characteristics. This includes factors such as the *number of employees*, *age*, *size*, and *type* (i.e., incumbent or start-up) of a platform provider.

Decision rights partitioning – mentioned here by Uludag et al. (2016) are *strategic and implementation decision rights*; depending on the decision, these items can be managed individually centrally or decentrally.

Business domain – These include factors that are determined by what is to be achieved with the platform (Uludag et al. 2016). The *market structure*, *business plan*, *strategy*, *pricing*, *incentives for development* and *support for development* are mentioned (Uludag et al. 2016).

Control domain – Also from the analysis framework of Uludag et al. (2016), necessary control measures could be derived. These are: *gatekeeping*, *regulatory activities*, *process control*, *output control*, *social control*, and *sanctional control*. Here, each point requires an individual decision on how much these are controlled.

Overview of Enterprise and Platform Ecosystem Data Governance

To get an overview of the extent to which there are overlaps, similarities and differences between the enterprise data governance and platform ecosystem data governance, a concept matrix was set up in table 1 with the categorized factors presented in the chapter "Findings".

	Categories of factors / References (Meta Papers)	Enterprise Data Governance					Platform Ecosystem Data Governance						
		Impacts	Governance Mechanisms	Domain Scope	Organizational Scope	Data Scope	Data Layer	Governance Layer	Interaction Layer	Platform provider structure	Decision rights partitioning	Business Domain	Control Domain
Enterprise Data Governance	(Abraham et al. 2019)	●	●	●	●	●	◔	○	○	○	○	○	○
	(Alhassan et al. 2016)	○	○	◑	○	○	◔	○	○	○	○	○	○
	(Behringer and Hizli 2021)	○	◔	◔	○	○	◔	○	○	○	○	○	○
	(Brous et al. 2016)	○	◕	◕	◑	○	◔	○	○	○	○	○	○
	(Brüning et al. 2017)	○	○	◑	○	○	○	○	○	○	○	○	○
Platform Ecosystem Data Governance	(Lee et al. 2017a)	○	◔	◕	◑	○	●	●	●	○	◔	○	○
	(Lee et al. 2017b)	○	◔	◑	◑	○	●	●	●	○	◔	○	○
	(Lis and Otto 2021)	○	◕	◔	●	○	◔	●	●	○	◑	◔	○
	(Uludag et al. 2016)	○	◕	◔	◑	○	◔	◔	○	●	●	●	●
	(van den Broek and van Veenstra 2018)	○	○	◑	◑	◑	○	◔	○	○	◔	◔	○

Table 1. Intersections between enterprise and platform ecosystem data governance factors

Along the x-axis, categorized factors from the enterprise data governance are listed first, followed by those from the platform ecosystem data governance. Along the y-axis, references for the enterprise data governance are listed first, followed by those for the platform ecosystem data governance. The overlapping areas provide the following information: area 1 and 4 show which categorized factors are found in the

literature of the same governance practice they are origin from. Area 2 and 3 show which factors are found in the literature of the respective other governance practice.

The results are illustrated with harvey-balls. A full black ball represents a strong match between the governance factors and the corresponding reference, which means that all factors are addressed in the corresponding reference. A white ball expresses that the factors are not mentioned in the corresponding reference at all.

In area 3 it can be seen that the governance mechanisms, domain scope and organizational scope overlap in large extent. Only impacts and data scope do not seem to be considered. For the impacts, however, this is due to the fact that they were not the primary subject of research in the other papers, and for the data scope it is due to the fact that it represents a trivial listing of various types of data. From this we deduce and hypothesize that elements of the enterprise data governance can be adopted in a model for the data governance for platform ecosystems. This is also confirmed by the framework of Abraham et al. (2019), which also differentiates between intra- and inter-organizational in its organizational scope, but otherwise focuses on a comprehensive picture of enterprise data governance.

Conceptual Framework for Enterprise & Platform Ecosystem Data Governance

With the finding that the platform ecosystem data governance builds on the enterprise data governance and that the framework of Abraham et al. (2019) considers all factors of the enterprise data governance, this framework will be extended by iterating through the different dimensions presented by Abraham et al. (2019) and assigning the already presented domains of the platform ecosystem data governance to them. The resulting framework can be seen in figure 2. The gray shaded areas symbolize the factors that are additionally relevant for platform ecosystems.

Influencing factors – In this model, the antecedents were renamed to influencing factors. These are defined by the fact that they precede or predict data governance practices and thus include, for example, other governance practices. The rationale for the renaming is based on Basole (2009), who highlights the ability of an ecosystem to continuously adapt and evolve as one of its main characteristics. Thus, these factors cannot be considered as something that has an impact on data governance only at the beginning of the evolution. To these influencing factors, which are now defined by the fact that they impact the data governance factors from the outside, the platform provider structure and the business domain were added. The factors were attributed from the business domain to the influencing factors, as, for example, user contributions need to be monitored for development incentives (Lee et al. 2018a). Also all factors listed in governance and interaction layer except for the mechanism dimension were added because they are already considered in the governance mechanisms proposed by (Abraham et al. 2019).

Domain scope – The data decision domain by Lis and Otto (2021) was completed with the defined data layer. Underlying mechanisms from the data layer will be added to the governance mechanisms.

Data scope – Here, also only one additional point could be determined: user data. These not only serve to allocate data; without them, but a platform also loses massively in value (Jaekel 2020).

Governance mechanisms – Here, all mechanisms from the control domain and the data usage domain, as well as the underlying mechanisms of the data layer (monitoring and conformance) could be derived – all these mechanisms have been added to the procedural mechanisms.

In the area of structural mechanisms, the platform players (all persons interacting with the platform) and the decision makers (Lee et al. 2018a) were added. The platform players break down into further roles and are added us under "roles and responsibilities" (Lee et al. 2018a). From these different roles, the different property rights individual, organizational, and shared then emerge (Lis and Otto 2021). The decision makers are added by the fact that the decision-making power no longer has to lie exclusively in the hands of the platform operator, as in the case of an enterprise data governance, but can also lie in the hands of platform users through, for example, a decentralized co-configuration (Lee et al. 2018a).

Consequences - A major risk arises from the openness of a platform: openly available or shared data offers great potential for data misuse and privacy breaches (Lee et al. 2018a) and there is also a greater risk for data leaks (Lee et al. 2018b).

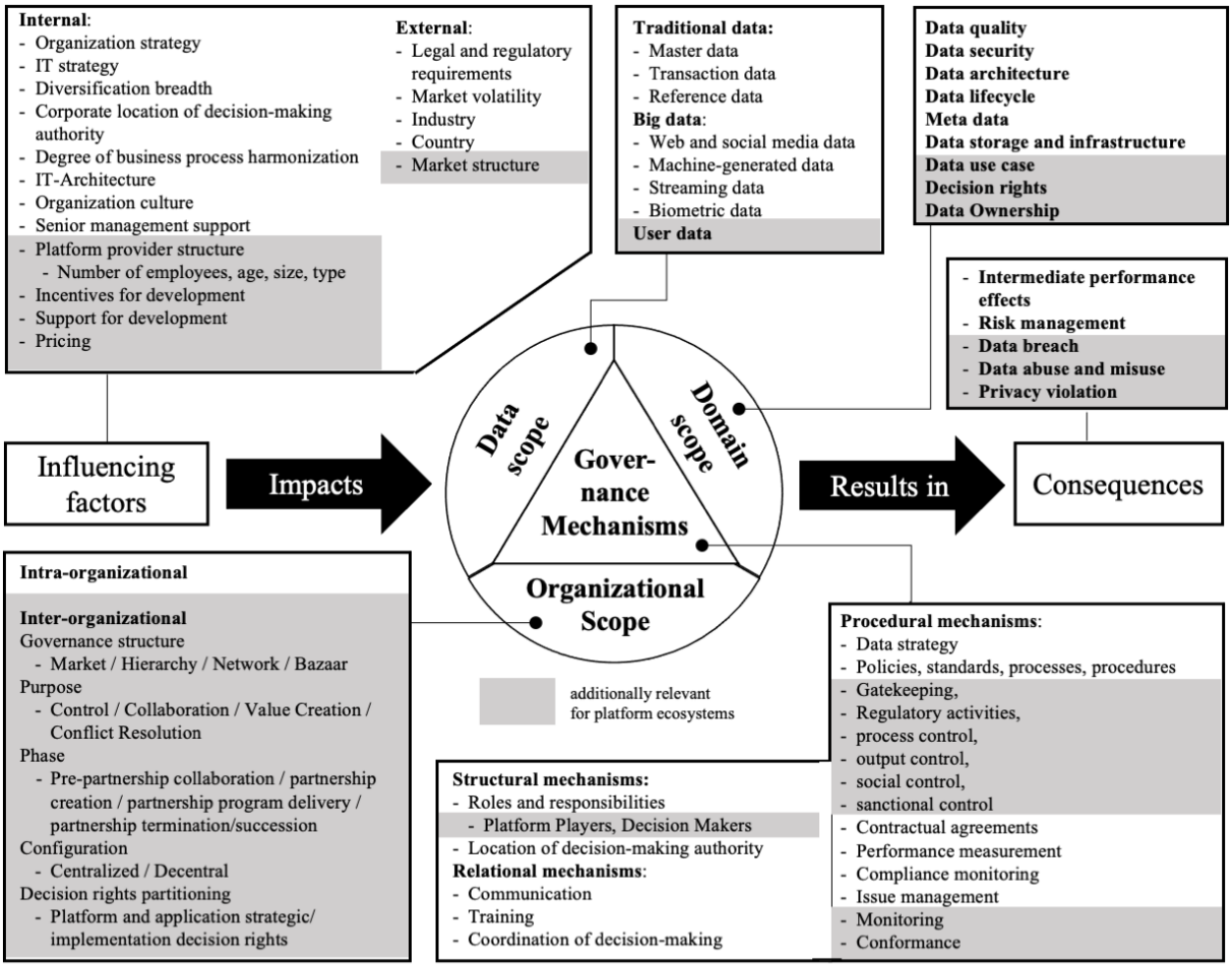

Figure 2. Conceptual framework for enterprise & platform ecosystem data governance based on Abraham et al. (2019)

Conclusion

Summary

This research identified five categories of factors for enterprise data governance and seven of platform ecosystem data governance by literature research. With a concept matrix (see table 1) four areas with overlaps of factors between data governance for enterprises and data governance for platform ecosystems and their respected literature were formed. By doing so, the concept matrix showed which factors an enterprise data governance is lacking to become a platform ecosystem data governance. On this basis, it was possible to answer RQ1 and it was shown that the concept of an enterprise data governance can be used as the basis for the data governance of a platform ecosystem.

Based on this finding and to answer our second research question (RQ2), this research extended the framework introduced by Abraham et al. (2019). Therefore, the model was extended with 24 additionally identified factors for data governance in platform ecosystems. As a result, the conceptual framework in figure 2 shows a comprehensive model that combines the two perspectives of enterprise and platform ecosystem data governance. It illustrates differences and similarities of the two data governance concepts.

Limitations

Table 1 shows clearly that there is little common understanding of the subject. On one hand, the visualized gaps show where more research is needed, which is on the other hand a limitation of this research. With further research, the model should also be further developed as well as evaluated. Another limitation of this research is that the individual aspects hide large subject areas whose interdependencies are not discernible e.g., in a decentralized approach such as a bazaar, the issue of data quality can be omitted if the responsibility for it lies entirely in the hands of the individual users of the platform (Lee et al. 2018a).

Because the scope and focus of the work was not based on consequences associated with a platform ecosystem, there is a need to supplement this area of the model with further research. There is also research needed on the topic of impacts, since this year the EU Data Governance Act came into force, as well as regarding other types of information system ecosystems like they have been introduced by Guggenberger et al. (2020). Further, the model cannot show which changes would impact which governance mechanisms. Because the scope and focus of the work was not based on consequences associated with a platform ecosystem, there is a need to supplement this area of the model with further research.

Implications

Summed up, this work provides practitioners as well as researchers an overview of how the two introduced data governance disciplines are related, of what factors they consist and in which areas further research is needed.

The practitioners should evaluate if the model is understandable, implementable and useful. It would also be interesting to explore in which cases the benefits of using this framework in a real-world scenario are promising research opportunities. Therefore, and before being used in a practical environment, the researchers should evaluate the model within a case study with data producers, data consumers and data ecosystem providers. Further, it was difficult to add the factors to the framework of Abraham et al. (2019) due to lack of exact description and definition of the different areas. For example, we could not include points like technical interoperability, semantics and data integration challenges into the model, like they are addressed by Otto and Oesterle (2015) – although these are relevant, they were also not addressed by the identified literature. Thus, it should be evaluated whether the used framework is a good basis or a new model should be built from scratch. And due to the fact that data governance as well as data ecosystems and especially the combination of them are still considered as an under-research topics (Lis and Otto 2021), future research will probably impact this framework.

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