Data Governance in an university context : Proposal for a maturity model

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ABSTRACT. As data production continues to surge, the challenge of data governance becomes increasingly relevant across all organizations. Although extensively explored within business contexts, primarily for its economic benefits in data management, this topic has garnered less attention within university settings. This study introduces a maturity model specifically designed for universities. It aims to identify and analyze data governance mechanisms and assess stakeholder engagement and organizational involvement. Developed within the context of ACT projects at the University of Bordeaux, this model is designed to be adaptable to other university environments.

KEYWORDS: maturity model, data governance, higher education

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1. Introduction

In a very rapid data production context[1], the issue of data governance permeates all organizations. While this issue has been primarily studied in business contexts (Jimenez et al., 2019) where optimal data management primarily serves economic objectives, it has been less studied in university contexts. However, the lack of governance indiscriminately exposes organizations to numerous regulatory, security, and logistical risks that hinder good data management and raise questions about their reliability and legitimacy (Verdier, 2015; Al-Ruithe, Benkhelifa, and Hameed, 2016; Kremser and Brunauer, 2019); Borgman and Brand (2022) have called this an "invisible tax" on an organization's efficiency. Anglo-Saxon universities have embraced this topic by incorporating data governance into their operations for at least ten years (Jim and Chang, 2018).

In France, initiatives aimed at implementing data governance are quite confidential[2]. Additionally, the means of expression of university governance in France, which is much more decentralized than their Anglo-Saxons counterparts (Melançon, Pinède, and Verdi, 2024), add difficulty to an already complicated situation. Indeed, implementing data governance is complex and raises various questions. Prior to the necessity of resolving these issues is the need to identify them. This article is part of an action research project, the GouD[3] project which aims to propose a maturity model to provide universities with a tool that helps them, on the one hand, to identify and analyze data governance mechanisms, and on the other hand, to assess the level of involvement of the university personnel and the university itself. Although adapted to a specific context, namely the *ACT* projects of the University of Bordeaux, it is intended to be adaptable to other university contexts.

Objetivo

2. Data governance in an university context

In our previous works (Melançon et Pinède, 2023 ; Verdi, 2023a), we defined data governance as the exercise of authority and control over data management by the means of a system of standards and procedures (Plotkin, 2013). This data governance aims for optimal use of data, most specifically through a general policy of open data (Gegenhuber et al., 2023), in order to guide the organization's decisions (Janssen, 2020). In that case, governance must ensure the respect of the conformity

O que é governança de dados

[1] https://www.statista.com/statistics/871513/worldwide-data-created/

[2] The only visible example in France is the case of Nice Côte d'Azur University (AMUE, 2022).

[3] GouD is a project of the ACT (*Augmented university for Campus and world Transition*) program of the University of Bordeaux which carries out prospective work on data governance and examines the state of the art on governance issues to identify the particularities of the French university context and ultimately propose a governance model specific to *ESRI* (*enseignement supérieur, recherche et innovation*) establishments.

of its principles (Loshin, 2008), which is encompassed in the term "compliance" (Fu et al., 2011). This system of rules and principles, integrated into a global long-term strategy (Weber, Otto and Österle, 2009; Waller, 2020), induces the creation of a common culture on data where data are valued and perceived as bearers of value for university stakeholders. Its emergence is largely linked to the data literacy[4] disseminated within the university. Data literacy includes both theoretical and technical knowledge but also includes a training aspect (Verdi, 2023b). It is essential to governance by allowing the "enculturation" of actors which, beyond simple acculturation, promotes the mechanism for achieving change and leads to a more natural acceptance of the governance principles (Herskovits, 1952). Therefore, data literacy and data governance cannot be separated and are "two important building blocks in the knowledge base of information professionals involved in supporting data-intensive research, and both address data quality and research data management" (Koltay, 2016).

Governance encompasses or is encompassed in many modalities. Firstly, data management: unlike governance which establishes the principles, rules and values as well as the responsabilities to the actors integrated in the governance, data management aims to implement them effectively (Khatri and Brown, 2010; Alhassan, Sammon and Daly, 2018; Rafal and Girard, 2023). Data management is often confused in the literature with data stewardship, which is also presented as the operational facet of the governance (Plotkin, 2013). In both cases, whether it is data management or data stewardship, the objective pursued is the same: ensuring data quality management (Wende and Otto, 2007). This includes the conformity of their completeness, their consistency, their precision, their relevance, their interpretability, their reusability or even how quickly they can be obtained (Pinino, Lee and Yang, 2002; Cheong and Chang, 2007; Brous, Janssen, & Herder, 2016). This data quality management, beyond ensuring data quality, must take into account data security to avoid any leak or loss (which could harm the actors' privacy), which requires staff accreditation (Benfeldt, Persson and Madsen, 2020) and the establishment of a set of short and long-term protection procedures. The difficulty here lies in finding balance between data access and control so as not to hinder the proper running of the governance (Rafal and Girard, 2023).

To ensure the proper running of the governance, several typologies of actors must be integrated. We were able to list (1) data trustees who are responsible for the compliance with governance rules to guarantee data integrity and usefulness; (2) data owners who create datasets and can be both internal personnel (e.g.: professors) and external personnel to the university (e.g.: in an institution like *INSEE*[5]); (3) data users who use datasets and who are not necessarily the intended recipients; 4) data stewards or data managers who are disciplinary experts giving advice on different aspects related to data management (Teperek et al., 2018). It is important to note that

[4] In the original version, we used the French term 'culture des données', which could be translated as "data culture".

[5] *INSEE* is the acronym for *Institut national de la statistique et des études économiques (*National Institute of Statistics and Economic Studies*).*

not all people in roles (1) and (2) can be included in the governance for practical reasons: designating representatives might be a simpler solution to collect their input.

In the French academic world, these roles are not necessarily constituted as such and an actor can carry out several of these functions alone, as in the case of a data protection officer (DPO). Nevertheless, this conceptualization is useful for delimiting a first scope of study. With the approval of the governing bodies, these actors can then form a board, with or without decision-making power. In North American universities, the same governance model, adapted from DMBOK[6], is visible: it is vertical, led primarily by the provost (whom we could compare in France to the role of *Directeur Général des Services*) who takes part, or even constitutes a data governance board or council, integrating actors from all university departments[7] who develop and oversee the implementation of the data governance mechanisms. Unlike this top-down approach which transforms governance into a supervisory body, we highlighted in Melançon and Pinède (2023) that the "non-invasive" approach of Seiner (2014) putting governance at the service of projects seemed more suitable to the French context. Within the framework of the University of Bordeaux, this implementation begins precisely with a set of initiatives limited to the ecosystem of *ACT* projects which we will now present

Qual modelo de governança?

3. The context of Bordeaux : ACT project

Started in 2021, the Augmented university for Campus and world Transition (*ACT*) project is an *ANR* project[8] with the mission "to develop, test, validate and disseminate new ways of addressing major environmental, social and economic transition problems thanks to the transformation of university campuses into a vast living laboratory"[9]. It includes more than 24 projects, integrated into living labs, linked to transition issues (ecological, economic and digital) where a large number of actors interact and in which data production serves different aims.

We can name as an example the "PRISME" project manipulating student health data, the "Datacampus" project working on campus mobility data, or even the "Forêt urbaine" project analyzing data from urban forest responses to climate change. Regarding the "Datalab" project, started in 2023, it develops, on the scale of *ACT* projects: data strategy actions, data governance and development of data practices (Blanchard, 2023). The desire to establish data governance is nevertheless older: it

[6] DMBOK is published by DAMA International and describes data governance mechanisms in a business setting.

[7] We can see this model in many North American universities such as East Carolina, Madison, Maine, San Francisco or Villanova, but also in a similar fashion in Toronto (Canada) and Londons (United Kingdom) universities.

[8] *ANR* stands for *Agence Nationale de la Recherche*, which is the French National Research Agency which funds research projects.

[9] https://www.u-bordeaux.fr/universite/notre-strategie/projets-institutionnels/act-pour-un-campus-experimental

officially emerged with the creation of a COPIL[10] "*Gouvernance des données et des documents d'activité publics de l'établissement*" (GDDP)[11] in 2017 under the leadership of the University Archives Department : the latter produced an internal context note on data governance in 2021 and an article by Anne Pletinckx, keeper of the University Archives (Pletinckx, 2022), both of which offer a description of the characteristics of data governance and which underline the premises of an interest for the subject within the University of Bordeaux.

Data governance is currently at an embryonic stage, having recently begun the pursuit of initiatives such as Data Management Plans (DMPs), the constitution in December 2023 of a group welcoming internal and external actors at the University of Bordeaux contributing to the definition of the data governance principles, and recently with the creation in February 2024 of the *3D* service (Data, decision-making, datalab) responsible for leading data governance and the dissemination of a data culture within the university. As an action research project based on an empirical and inductive approach, *GouD* uses all of the aforementioned *ACT* projects as a field of experimentation. The maturity model, resulting from our literature synthesis but also from *ACT* projects field analysis, is part of a long-term analysis of the development of data governance.

4. The maturity model

The objectives pursued by our maturity model are as follows: to clarify the general characteristics of data governance and to be able to analyze them through the lens of three facets. For each facet, components will be described and sources allowing their analysis will be presented. All of this aims to assist in the implementation of data governance or to improve an existing one. Our maturity model should therefore allow for an assessment of an ongoing situation, at different stages, and anticipate its evolution.

Modelo de maturidade

According to the literature, a maturity model serves as a diagnostic tool (Kohlegger, Maier & Thalmann, 2009) that has been tested in a specific context (Wilkinson, 2014) and includes two potential perspectives: a lifecycle or a potential performance (McBride, 2010). It can be elaborated according to a descriptive, prescriptive, or comparative model (Poeppelbuss et Roeglinger, 2011) and incorporates maturity levels for a set of items such as processes, roles, or an organization. These levels represent an anticipated, desired, or typical evolution path (Becker, 2009). Our model aims to assess the maturity level of the data governance implemented within the *ACT* projects at the University of Bordeaux. In this regard, it must include in its analysis all actors interacting with data used within the university: the *ACT* project participants, as well as those from the service departments (e.g., the university archives department), and even external partners (e.g.: Bordeaux Metropolis). The aforementioned concepts (e.g., data management,

[10] *Copil* stands for *comité de pilotage* (steering committee).

[11] "Governance of the establishment's data and public activity documents".

data quality, data literacy, etc.) are restructured here to propose a framework adapted to a French context.

Data governance maturity is poorly defined in the literature, with the exception of Marchildon et al. (2018) and Gupta and Cannon (2020). According to these authors, data governance maturity refers to the design and the implementation extent of processes and policies aimed at optimizing the management of data over their lifecycle : namely the detection, production, collection, use, share, storage, archive and destruction of data. To be measurable, it requires the analysis of two criteria: the existence or not of a variable (e.g. human resources) and the capacity of the university to be able to identify this variable (e.g. data used in a laboratory). Like any maturity model, ours includes levels that explain formalization, generalization and adherence to governance principles. In the literature, there are generally five levels and their titles differ depending on the sources (Soares, 2013; Seiner, 2014; Merkus, 2015; Lee et al., 2019). Carretero et al. (2016) mention a level 0 which is a total absence of initiatives. We chose six maturity levels: level 0 (non-existent), level 1 (emerging), level 2 (in development), level 3 (local implementation), level 4 (global implementation) and level 5 (mature). These levels are divided into three facets: data, actors and organization. Their selection was made from the (scientific and professional) literature describing the characteristics of data governance but also from other facets highlighted by the authors (such as people, standards or even technologies) as well as the difficulties encountered in the development of governance. These last two points, although not originally integrated into a maturity analysis logic, nevertheless helped us refine our proposal.

Several authors and reports have contributed to listing the potential obstacles and challenges to overcome in order to be able to build and establish data governance (DAMA International, 2009; Benfeldt, 2017; Mahanti, 2021; Okoro, 2021). The issues quoted are (1) a lack of a common understanding on data governance scope, (2) a logistics issue with regard to the implementation and compliance of the data governance implementation, (3) conflicts between actors and/or services due to power struggle, scope of action or even competing visions on data and their processing, (4) resistance to change resulting from a rejection of the data governance rules and principles, (5) absence of skills and resources (material, financial or human) to address the needs of data governance. In point (5), the absence is due either to a non-specialization of the actors, or to an inability to define them and in extenso to hire competent people, or to a disinvestment in this problem by people with decision-making power, particularly those in charge of the university budget. These points are transversal and must be deduced from the analysis of each component of our maturity model, especially non-adherence to the principles of governance.

The first facet deals with data. There are three subfacets: (1) data capital, that is to say all existing data and the means available to identify and manage them, (2) the rules and principles governing this management and (3) the training courses offered to establish a common data culture.

Table 1: the data facet

Subfacets	components	component description
Data capital	Collected data	Data used in different projects or contexts. The characteristics of a dataset must be documented exhaustively, which include its formats, metadata, etc.
	Measurement tools	Tools allowing to list and monitor data flows (e.g.: a data management plan, a dashboard or a data catalog).
	Resources	The characteristics of human (tasks and roles), structural (e.g. servers, software, dedicated spaces) and financial resources.
Rules and principles	Data lifecycle	Rules and principles governing the entire data lifecycle, namely the identification, collection, production, storage, archiving and destruction of data (e.g. integrated into a decision tree). If made mandatory, the softwares and technologies chosen must be specified and described here. Due to the large number of tasks that this component involves, they can be treated separately (as part of an audit for example).
	Data quality	The set of rules and principles used to ensure the relevance, completeness, conformity, integrity, freshness and consistency of data (e.g. FAIR principles, metadata standards, etc.).
	Data security	All hardware and cyber protections as well as data access management.
	Documentation	All documents which list data management rules and principles.
Training course	Types of training	The course of training (e.g.: timing, activities, etc.) and the subjects they address (e.g.: open science).
	Target audiences	The types of audiences (e.g.: students, university administrations, etc.) and the reasons for this targeting (e.g.: improvement of skills, development of knowledge, etc.).
	Trainers	The trainers'profile (e.g.: is she/he an internal/external actor, what is the nature of her/his position, etc.) and the reason for their recruitment (e.g.: skills only possessed by them, historical partnership with the university, etc.).

The second facet deals with the actors. Its objective is to highlight the human role by taking into consideration the autonomy of the actors and their ability to accept or not change. Their respective roles, their working methods, their collaborative modes as well as the extent of their data culture must be described here. This is therefore an investigation covering both the actual practices and the imaginations of the actors.

Table 2: the actors' facet

Subfacets	components	components description
Typologies	Data trustees	Actors responsible for the compliance of data processing principles and rules.
	Data owners	Actors in charge of data production.
	Data users	Actors using the data made available by the university.
	Data managers or data stewards	Actors advising and supervising data management.
Uses	Contexts and objectives	The description of data production and processing contexts as well as the objectives that the data serve.
	Processing	The description of data processing over its entire lifecycle (e.g.: which actor processes which data, according to what time period, what materials, for which objective, etc.).
	Compliance	The governance capability to integrate different regulatory frameworks (e.g.: GDPR), to open a dialogue with other bodies that have also developed rules (e.g.: ethics committee, health committee, etc.) and to ensure the compliance with established rules.
Collaborations	Collaborative modes	How actors collaborate with each other (e.g.: their methodologies, their respective knowledge and imaginations).
Data culture	Level of training	Actors' skills and knowledge on data and their ecosystem of which data governance is a part.
	Imaginations	The actors' visions and imaginations on data and their ecosystem of which data governance is a part.

The third facet deals with organization and refers to the development and supervision of data governance. It lists all the elements to take into consideration to guarantee its sustainability. It contains (1) the strategy which aims to establish and make known the vision of data governance upheld by the university, (2) the form of the data governance and (3) the collaborations maintained between internal and external actors to the university.

Table 3: the organization facet

Subfacets	components	components description
Strategy	Strategic vision	The governance values and overall objectives and the way in which they are perceived by the university personnel.
	Communication	Characteristics of the communication strategies (e.g. the actors responsible for them, communication actions temporality, subjects addressed, etc.) and their reception by the university actors (e.g. adherence, rejection, etc.).
Form / Design	Governance coordination	The way in which governance is coordinated (centralization, decentralization or subsidiarity) and the reasons that led to this choice.
	Assignement of responsabilities	Refers to the mechanisms for assigning responsabilites to actors in order to address a specific function of the data governance.
Collaborations	Internal collaborations	Internal actors at the university (e.g.: university departments) and the way in which they collaborate (e.g.: permanent or temporary advisory role, etc.)
	External collaborations	External actors to the university and the way in which they collaborate (e. g : the metropolis)

Característica do modelo

In the same way as the governance mechanisms described by Abraham et al. (2019), our maturity model is intended to be interactionist: each facet has an influence on the others and none is prevalent. All must be developed so that data governance reaches an acceptable maturity level, chosen accordingly to the needs and objectives of the university.

The analysis of the previous items shoud allow us to identify a level of maturity for each of the facets at a given moment. Indeed, internal changes (budgetary, material, logistical and human) take place over time, most specifically staff turnover, to which other external changes are added such as the evolution of regulations. The level of maturity measured is therefore not definitive and must be analyzed again.

In the table displayed below, the boxes must not be read independently due to the fact that the components of one facet directly influence those of another facet. For example, without communication, actors' imagination of data governance will not change. Thus, the levels are not homogeneous: one facet could for example be at a level 2 while another will be at a level 0. The overall analysis of the maturity level is appreciative, depending on the university specific contexts.

Table 5 : Maturity levels for each facet

Levels / facets	Data	Actors	Organization
Level 0 Non-existent	Data are not identified or processed according to unified principles and rules. No data training is offered at this level.	Actors are not identified. Their data culture is too poorly developed for them to have a clear vision of what data governance means.	Governance is neither defined nor implemented.
Level 1 Emerging	A desire to identify and manage data according to unified principles and rules is emerging. Data training is not yet offered to university pesonnel.	Very few actors as well as their collaborative modes and their use of data are identified. They do not fully understand what data governance means.	The need for data governance is emerging. No communications strategy has yet been developed.
Level 2 In development	Some data are identified. Acculturation to data involves external training depending on the opportunities encountered by the actors.	Some actors as well as their collaborative modes and their use of data are identified. They are beginning to understand what governance means.	Data governance is being developed. Some communication actions are potentially undertaken to discuss this topic.
Level 3 Local implementation	Only a part of the data is identified and is managed according to the principles and rules of the data governance. Data training is occasionally offered by the data governance to support the university personnel.	A minority of actors as well as their collaborative modes and their use of data are identified. Their data culture is developed and allows them to understand what governance means.	Data governance is implemented at a local level, supported by a communication strategy which provides documentation detailing its principles and objectives.

Level 4 Global implementation	The majority of data is identified. These are managed according to the principles and rules of data governance. Training is regularly offered by the data governance to support the university personnel.	The majority of actors as well as their collaborative modes and their use of data are identified. Their data culture is developed and allows them to understand what governance means.	Governance is implemented at a global level and communication strategies are now undertaken on a constant basis. However, data governance still encounters some issues in its implementation.
Level 5 Mature	All data are identified and managed according to the principles and rules of the data governance. Data training is constantly offered by the data governance to meet the needs of the university personnel.	All actors as well as their collaborative modes and use of data are identified. They understand and adhere to the principles and rules of the data governance.	Data governance is implemented across all the university and its comitology is extended to its partners. It is robust and agile, able to adapt to new contexts.

As specified in the introduction, one of the greatest difficulties lies in the identification of data governance components, in particular when this term is not used: either because it does not reflect the actors' wish for global strategy, or because it is simply abandoned for another more representative of the activities undertaken such as open science. However, data initiatives can be the basis for data governance and must in this sense be the subject of analysis. This is the case in France with the "ateliers de la donnée" [12] which describe themselves "as the entry point related to research teams on any type of need relating to data"[13] and whose network design facilitates collaboration and the establishment of a common vision on data. Based on the literature and our field feedback, we propose here three main sources for analysis which would enhance our maturity model.

On the one hand, the information sources which list the principles and rules on data processing. These are embodied in many formats. Here we can list the charters, standards and internal regulations, decision trees, meeting minutes, web contents as well as any additional source which allow to identify the rules in application within the university and the underlying logics which dictate data management. Attending

[12] Which can be translated as "data workshops

[13] https://www.ouvrirlascience.fr/wp-content/uploads/2021/10/2021.10.11_AMI_Ateliers-de-la-donne%CC%81e.pdf

their development provides an additional opportunity to analyze the evolution of thoughts and interactions between actors.

We specifically recommend the study of Data Management Plans (DMPs). Through datasets description, they offer a complete overview of the university capital. In addition, they also allow us to identify the projects participants and their respective responsabilities. Although dedicated to research data, they can nevertheless be adapted for other data types and cover a broader set of resources. Their development also allow us to question the actors to obtain more specific details on their working methods and their interactions. Although being an information source, the singularity of DMPs' characteristics make them, in our opinion, an element of analysis dissociated from other information sources.

Sugestão de Questionário

On the other hand, the inquiry sources deduced from the actors which can be carried out either with questionnaires or with interviews. For example, Marchildon et al. (2018) proposed a multiple-choice questionnaire consisting of 11 items and 72 questions allowing each aspect of an existing governance to be analyzed. If questionnaires allow immediate quantitative analyses, the interviews offer an in-depth look at little developed points in the aforementioned information sources. This is particularly the case for the actors' data culture which can only emerge through this type of inquiry. This data culture, beyond skills, knowledge and representations, induces specific practices, particularly within the framework of a discipline or a long established service.

Detecting these practices and constraints is essential here to adapt governance to local practices and prevent it from being perceived as an inconsistent duplicate or as an additional workload by the university personnel. Knowing who must be interviewed is another difficulty, especially without knowing the previous initiatives carried out in the university. In our case, the actors linked to the *ACT* projects on the one hand and the actors linked to the formation of the data governance of the University of Bordeaux on the other hand have been identified early in the process. But we keep in mind that other actors with an interest in governance and who have not yet come forward may have put in place some data initiatives, requiring for us to conduct new interviews. These three sources of analysis can be used for all facets but some will give more precise answers than others, which is why we recommend the most appropriate below.

Table 5: recommended sources for each facet

Facets	Subfacets	Information sources	Data management plans	Inquiry sources
Data	Capital	limited	✓	optional
	Rules and principles	✓	✓	optional
	Training courses	✓	not relevant	✓
Actors	Typologies	✓	✓	✓
	Uses	✓	✓	optional
	Collaborative modes	✓	✓	✓
	Data culture	limited	barely relevant	✓
Organization	Strategy	✓	not relevant	✓
	Form / Design	✓	not relevant	✓
	Collaborations	✓	not relevant	✓

5.Conclusion

Building up and sustaining data governance is a long and complex process, particularly in a university context. At a time when data management is of crucial importance, it becomes necessary to master its ins and outs. The purpose of the synthesis of the literature was to propose a characterization of governance and here calls for validation. The maturity model presented is currently being tested in the context of ACT. Reading information sources, including DMPs, and conducting interviews throughout 2024 should allow us to describe the data governance characteristics at the University of Bordeaux and to measure its maturity level. This could lead to an evolution of the facets and their components in order to better understand the particularities of data governance in a university context. This will be the subject of future publications.

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