





Benefits of the Enterprise Data Governance in Industry: A Qualitative Research

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Abstract: Data governance policies and procedures (DGPP) ensure proactive and efficient data management within the Enterprise context. Thus, DGPP corporate projects may result in positive impacts – we name benefits – to these companies. However, we found few studies reporting these benefits in-developing countries. Another gap is no evidence of a DGPP benefits model. Given this context, we first created a DGPP benefits model (DGB-M) via a Systematic Literature Review; we planned and conducted case studies at four different Brazilian industry sectors: agribusiness, fertilizers, automotive, and logistics. As main results, we have: (i) The DGB-M itself; (ii) evidence that 62% of the processes described by DGB-M were implemented by these four cases; (iii) evidence that 68% of the DGB-M benefits expected were achieved by these cases; and (iv) cases lessons learned. These results are highly relevant to forecast the benefits and challenges of future DGPP projects.


1 INTRODUCTION


Contemporary organizations are fast adopting Data Governance (DG) policies and procedures (DGPP) given data is a fundamental company asset, which supports from daily operations and up to strategy decisions. Enterprise data is been considered one of the most critical assets of a company (Yebeles and Zorrilla, 2019). Data is a vital backbone that may be scaffolded by the DG and its DGPP, towards proactive and efficient data management (Dasgupta, Gill, & Hussain, 2019).


DGPP are implemented via frameworks, in which the expected results are positive impact – what we name benefits – to these organizations (Haider & Haider, 2013). However, were found a gap given that few studies investigated the benefits right after the adoption of these DGPP. Even further, we found no consolidate model to bound DGPP and their expected benefits.


Anyhow, towards the adoption of these frameworks, companies are expected to face many challenges, such as partial framework adoptions, based usually on customers' priorities and requirements. As a natural consequence, frameworks should consider partial adoptions as a possible result, thus it should also consider what to prioritize the implementation of DGPP (Otto, 2011a). Within this context, the main goal of this study is to analyze four DGPP projects occurred in Brazil as well as its benefits. To achieve the research's main goals, we created the DG Benefits Model (DGB-M).

Thus, there are two mains objectives: (1) describe the DG processes implemented by Brazilian organizations and the benefits obtained, and (2) analyze the benefits obtained with partially or fully implementation of DG processes.

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2 THE DATA GOVERNANCE BENEFITS MODEL (DGB-M)

The DGB-M emerged as a result of a systematic literature review (SLR). We first describe the SLR base concepts and the SLR methodology. We then collected all the DG Frameworks from the SLR results. Then, we clustered the SLR results into two main groups: DGPP and DG benefits. DGPP and DG benefits are detailed in Subsection 2.3.

2.1 SLR Base Concepts and Method

A base concept is the DG itself, which might be defined as a system of accountabilities and decision rights for processes related to information within an organization (DGI, 2015). Two other base concepts used by this SLR are Data Governance Office (DGO) and data stewardship. DGO is defined as a group of people that provide general support to various fields of information and data-driven tasks within the corporate operations. Data stewards is a person that specializes in the data fields. He/she follows after data policies, practice oversight, and process (Thammaboosadee and Dumthanasarn, 2019; Rosenbaum 2010).

DG is the main subject of the Data Management Association (DAMA, 2009), an organization that promotes best practices of information and data management across the Globe. DAMA is most known by its framework, the Data Management Body of Knowledge (DMBoK). The DMBoK provides an overview of data management through the definition of standards, terminologies, and best practices.

Based on these concepts, this SLR was carried out as described by Kitchenham *et al.* (2009). The study addressed the following research questions: (1) Which DG frameworks are available in the scientific literature? (2) What are the benefits of DG processes and practices? In sum, we consolidate DG processes and practices and their expected benefits into a model we named DGB-M as seen in Figure 1. This SLR included English researches only published between 2005 and 2019 found at the IEE, ACM, and SCOPUS databases. We limited researches to academic journals and conferences in the information systems (IS) field only that we peer/expert reviewed. The SLR was finished on Feb. 2020. Our final list of 31 articles found the frameworks described as follows.

2.2 DG Frameworks

In addition to the DMBoK framework, other DG frameworks to meet specific contexts have been reported. Some of them are enhancements of DMBoK such as (Aisyah & Ruldeviyani, 2018). The SLR identified sixteen studies reporting DG frameworks. We grouped them by context as follows: Big Data, Cloud, Public Sector, and Other Sectors.

2.2.1 Big Data Governance Frameworks

A big data governance framework for healthcare data was reported regarding health information yet useful for industries non-healthcare industries. For instance, it can be used to analyze the risk factors in advance, preventing prevent issues and problems, and actuate at these frameworks' limitations level (Al-Badi, Tarhini and Khan, 2018; Li *et al.*, 2019).

2.2.2 Cloud Data Governance Frameworks

Monolithic Enterprise Applications have been transformed integrated, thus they are been connect into what has been named Enterprise Service Ecosystems. These ecosystems modularize business rules and expose these rules as services. These services at then hosted via Cloud Infrastructure, and event Internet of Things devices should be thus subjected to a Cloud Data Governance Framework. A framework proposed by (Shrivastava and Pal, 2017) spans across various Data Centers and Cloud Infrastructure resources for instance. A common agreement among these studies is that the gap regarding Cloud Data Governance Framework still is an open question.

2.2.3 Data Governance Framework in the Public Sector

In in-development countries, personal data privacy is the role and responsibility of government agencies. As the first sample, there is a legal gap in Thailand government data (Thammaboosadee and Dumthanasarn, 2019) proposed a new framework for Thailand open government data. Another emerging problem in in-developing countries Public Sector is the large data amount. Aisyah and Ruldeviyani (2018) reported that Indonesia Insurance Institute requires much data from their users. They also reported data governance and management structure based on the guidance of DMBoK to accommodate these challenges.

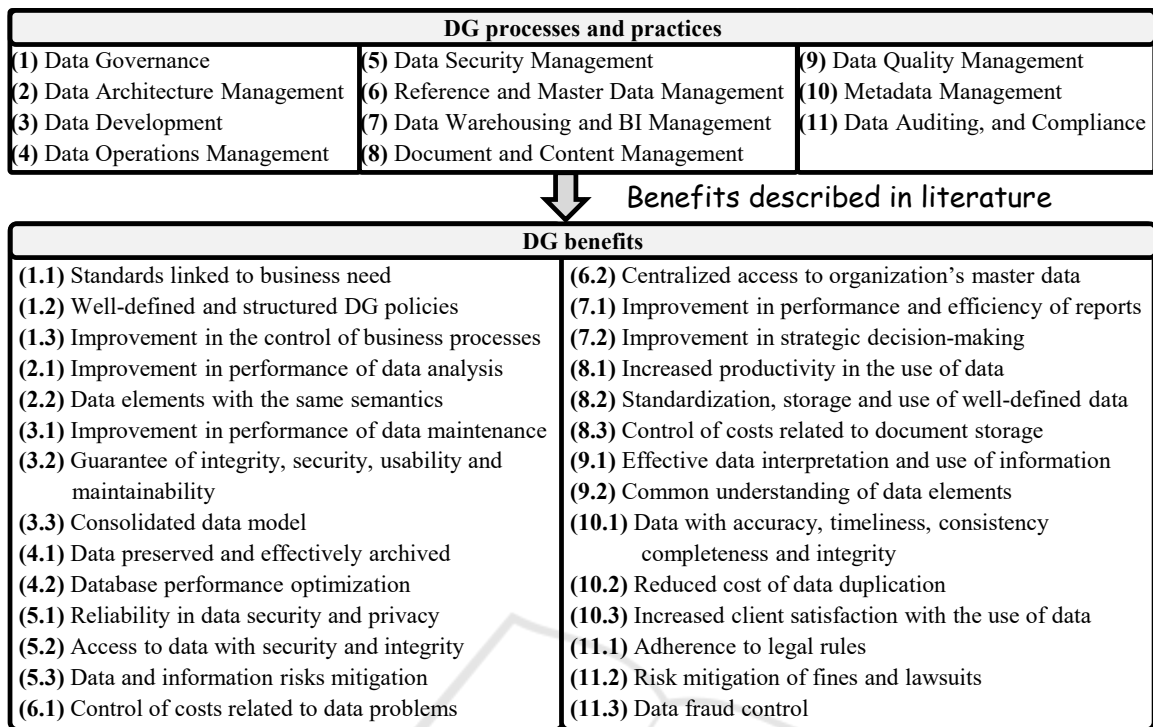


Figure 1: The Data Governance Benefits Model (DGB-M).

2.2.4 Other Frameworks

There have been reported other frameworks for DG general context, such as: DG maturity (Haider & Haider, 2013); DG frameworks unification (Liaw, *et al.*, 2014); Framework for data governance which can be used to focus on DG relevant issues, (Khatri, and Brown, 2010); and literature and practice topics complementation (Otto, 2011a).

There have been reported also DG-specific context frameworks, such as elderly citizens (Dahlberg, 2014), new-generations platforms (Yebeles & Zorrilla, 2019), and more. Finally, it has been reported frameworks intended to implement the Enterprise Information Management maturity model, such as Gartner® DG (Newman & Logan, 2008).

2.3 DGPP and DG Benefits

As seen, we identified and classified the DG frameworks. At the next SLR step, we found that the 10 key processes advocated by the DMBOK (numbered them from 1 to 10, on Figure 1 first box) and also the DGPP process number 11 was added based on Mosley *et al.* (2009) report. We also found 28 DGPP as described in Figure 1 second box.

3 CASE STUDY METHOD

The case study is an exploratory and qualitative research method (Yin, 2015). The four case studies at Brazilian organizations described the DGPP and analyse the resulting benefits via the DGB-M. The research design and case protocol are described as follows. The case data were collected in the 2nd semester of 2020.

3.1 Research Design

This research design was: First (1) we performed the SLR; then (2) we then defined the research method and conducted the field research (presented in this section); finally we (3) presented the results in Sections 4 (single cases) and 5 (cross-cases), followed by discussions, as seen on Figure 2.

3.2 Cases Selection Criteria

The case selection criteria were based on Yin (2015): First, the research could have comprehensive access to the entire project, including its processes, participants, and documentation. Second, selected cases that refer to different periods in time. Third, cases that came from different industries.

Phases	Techniques	Outcomes
Literature review	<ul style="list-style-type: none"> • Systematic literature review 	<ul style="list-style-type: none"> • DG processes and frameworks • Benefits of DG processes
Research method	<ul style="list-style-type: none"> • Multiple case study • Data acquisition: - through interviews and documents - two professional per case • Data processing: - SLR for literature articles - content analysis for interviews 	<ul style="list-style-type: none"> • Four cases • Two interviews per case • Project’s documents
Results and discussion	<ul style="list-style-type: none"> • Descriptive statistic • Triangulation of data 	<ul style="list-style-type: none"> • Comparison between benefits described and achieve

Figure 2: Research phases.

We finally select four organizations that met the criteria as shown in Table 1. The first organization comes from the agribusiness industry, thus we shall name it AGRO, and it has implemented DGPP on: master data for customers, suppliers, and bill of materials.

Table 1: Enterprise characteristics.

Characteristics	Enterprise			
	AGRO	AUTO	LOGI	FERT
Employees	7,500	10,000	5,000	17,000
Annual revenue (US\$ millions)	700	2,100	600	3,000
IT team	25	50	42	100

The second organization is the automotive industry, thus from now on refer as AUTO, has implemented the GDPP to its bill of material master data. The third organization is a logistics industry, thus from now on refer as LOGI, has implemented DGPP to on the following data: customers, suppliers, and bill of materials. Finally, a fertilizer company, thus from now on refer as FERT, has implemented the DGPP to its bill of material master data.

3.3 Data Acquisition

We adopted individual interviews as an instrument for data collection due to the qualitative nature of the research (Yin, 2015). We adopted the semi-structured interview (Selltiz, Wrigthman & Cook, 1987), given it has a pre-establish script that makes it easier to compare information among participants. The interview script had both open and closed questions. The answer regarded projects that were already closed between 2016 and 2019.

We interviewed different groups of people with different perspectives: staff, project managers, and data analysts. First, we conducted interviews with eight professionals from a multinational consulting company that operates in Brazil. These eight staffs

were members of the DG implementation projects at the mentioned companies. We then interviewed two project-managers that were in charge of these project implementations. And finally, a data analyst who has supported DG processes and practices. We also collected project data.

3.4 Data Processing

Data treatment and analysis were performed using the semantic content analysis technique (Neuendorf, 2001), according to the following steps: (1) the interviews were recorded based on participant consent; (2) we generated the transcribed; (3) the data was classified according to the previously explained categories; and (4) The final list of benefits was then double-checked back with the participants.

3.5 Research Limitations

The main research limitations are as follows:

- (1) Data analysis technique. The data collected in the interviews were analyzed using the content analysis technique. The interpretation of this data was made by the author, which attributes subjectivity to the results.
- (2) Results generalization. All interviewees belong to a single consulting service company, which does not allow generalization of the research results to other companies and contexts.

4 WITHIN-CASE ANALYSIS

The final within-case analysis is as shown in Table 2. Light-gray lines are special cases as follows. Zeroed lines: the process was not implemented by the current project. Line with 100(%): both processes 4 and 7 are were already implemented by earlier projects.

Table 2: The DGPP per Sector.

Processes	Enterprise (%)			
	AGRO	AUTO	LOGI	FERT
1 Data governance	75	65	75	75
2 Data architecture	88	75	68	50
3 Data development	50	7	73	65
4 Data operations	100	100	100	100
5 Data security	50	75	50	0
6 Reference and master data management	100	58	100	100
7 Data warehousing and BI management	100	100	100	100
8 Document and content management	63	0	58	50
9 Data quality management	0	0	0	0
10 Metadata management	100	78	68	85
11 Data auditing	63	65	20	20
Total implemented processes (%)	74	54	64	56

4.1 AGRO Case

The AGRO DG project finished by the fall of 2015 after a 22 months project. The project budget was circa US\$ 700,000 distributed as follows: 20% to executives - partners, directors, and managers; 20% to senior consultants; and 60% to junior consultants and trainees. The project was implemented in the headquarter office and it was sponsored by the Supply Department. The departments involved in the project were engineering, accounting, supplies, and Information Technology (IT). The project team had five employees from the interviewed consulting company. The PMBOK and the SCRUM methodologies supported the project management methodologies, while the DMBOK was used as a reference for DGPP.

4.2 AUTO Case

The AUTO DG project finished by the fall of 2016 after 17 months. The project team had five employees. The project budget was circa US\$ 875,000 distributed as follows: 37% to executives - partners, directors, and managers; 30% to senior consultants; and 33% to junior consultants and trainees. The project was implemented in a branch office and it was sponsored by the Accounting Department. The departments involved in the project were accounting, supplies, and IT. The project management was supported by the SCRUM methodology, and DMBOK was used as a reference for DG processes. The AUTO company implemented 54% only of DGPP, due to the specific

characteristics, such as the one company with the lowest productivity rate.

4.3 LOGI Case

The LOGI DG finished by the fall of 2016 after a 12 months project. The project team had six employees. The project budget was circa US\$ 500,000 distributed as follows: 7% with executives - partners, directors, and managers; 44% to senior consultants; and 49% to junior consultants and trainees. The project was implemented in both a headquarter office and branch offices. The departments involved in the project billing, warehousing, supplies, and IT. The project used SCRUM as the project management methodology, while the DMBOK was used as a reference for DGPP. As seen in Table 2, circa 62% of DGPP identified by DGB-M were implement. Given these projects was the first one of this kind, supported by a consulting company, the results were considered satisfactory.

4.4 FERT Case

The FERT DG project finished in 2019 after a 9 months project. The project budget was circa US\$ 350,000, distributed as follows: 10% with executives partners, directors, and managers; 40% to senior consultants; and 50% to junior consultants and trainees. The project was implemented in the head office and was sponsored by the Finance Department. The departments involved in the project were in the areas of finance, and IT. The project used SCRUM as the project management methodology, while the DMBOK was used as a reference for DGPP.

5 CROSS-CASE ANALYSIS

This section analyses the interrelation among cases.

5.1 DGPP Costs

As a relevant outcome, the cost to implement 1% of DGPP per sector was, from lowest to higher: FERT: US\$ 6,292; LOGI: US\$ 7,813 AGRO: US\$ US\$ 9,507; AUTO: US\$ 16,355. The higher AUTO project is indeed a relevant subject to analyze. This project had high management costs. While in the other companies the projects spent an average of 12.3% with it, AUTO spent 37.0%. Even a longer project (AGRO) and the same size team project (FERT) had much lower costs. Except for AUTO, other projects had a US\$ 7,871

average cost for the implementation of 1% DGPP, which was in line with the 2015-2019 consulting company historical database.

5.2 DGPP Benefits

Table 3 presents the DGPP benefits according to the DGB-M model. This information was acquired with the project team members, from both the consulting company and the customer side. The final benefits and percentages were agreed upon among the participants.

For instance, The Metadata Management process at AGRO was fully implemented (100%) but it resulted in 38% only of the benefits expected benefits. On the opposite, 7% only of the Data Development process in AUTO generated a gain of 33% of the expected benefits. Indeed, AUTO was the case that had the highest relation (1.25 as seen in Table 3) DGPP vs benefits, yet it had the highest costs as seem.

Table 3: DGPP projects Benefits.

Processes	Enterprise			
	AGRO	AUTO	LOGI	FERT
1 Data governance	70	88	88	70
2 Data architecture	100	100	83	50
3 Data development	50	33	88	60
5 Data security	50	75	100	0
6 Reference and master data management	100	75	83	90
8 Document and content management	100	0	67	50
10 Metadata management	38	83	83	80
11 Data auditing	83	83	33	15
Average	74	67	78	53
Benefit / proc. implemented	1,01	1,25	1,22	0,95

To make it simpler to cross analyze cases, we have created Figure 3 where it is possible to identify a *directly proportional relationship* between the DGPP and benefits. In fact, 78% of the processes (i.e., 25/32 of the implemented DGPP) are in the #4 quadrant. This quadrant has a higher implementation degree versus higher benefits. As expected, there was a certain exception for this rule. AGRO processes 8 and 10 and for LOGI Process 5, detailed as follows:

AGRO GDPP two exceptions: processes 8 and 10. In the first process, the perception of benefits was total (100%), even without the implementation of all processes described in the literature. However, AGRO intended to improve this process after project implementation. In process 10, the benefits achieved were low (below 50%), this is because sometimes the benefits related to data quality are perceived only later after the implementation of the project.

LOGI exception: Process 5. With only 50% of the implementation of this process, the client had a perception of having obtained 100% of the benefits. This happened because LOGI had a deficient DG maturity level, and with the implementation of part of the DG processes, the benefits obtained are expressive and generate significant value for the organization.

Finally, it is possible to state that the average GDPP was 62% and the average benefits were 68%. These values were considered in line with the other projects managed by the same consulting company.

6 DISCUSSION

In complement to the cross-analysis section, this section discusses the customer motivations, challenges and lessons learned behind these DG projects.

6.1 Motivation for DG Projects

Cost-saving and process standardization were the main motivation behind these four cases.

AGRO specific motivation was to improve their decision-making process as well as enhance their data quality. AUTO specific motivation was to avoid losing tax benefits due to their inconsistent data. In fact, Brazil has one of the most complex tax systems in the world, which thus elevates costs, the number of employees their overheads. LOGI specific motivation was their Enterprise Resource Planning System new release, which was intended to centralize and organize their resources and data.

6.2 Challenges to Carry Out the Projects

As expected, all research participants reported challenges. Resistance to changes is a common issue among the four cases, such as the difficulty of obtaining knowledge from people who owned it. Stakeholders also expected maximum return with minimum changes, which indeed is most probably not prone to occur. Bellow, we present specific challenges for each sector:

AGRO. Employees' turnover made it difficult to obtain stakeholders' involvement. This required more effort from the consulting service company professionals in managing change and gaining business knowledge.

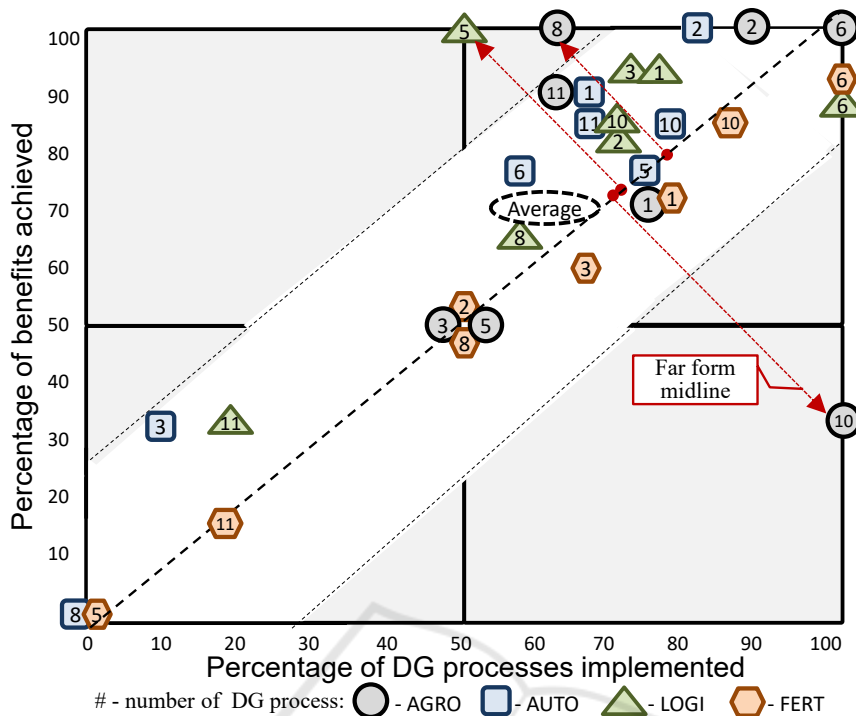


Figure 3: The degree of DGPP implementation and its related benefits.

AUTO. The enterprise size results in a higher number of processes and challenges across the enterprise to the addressed. The problem to obtain knowledge when considering many departments highly increase these challenges.

LOGI. Managing stakeholders. There was reported a lack of alignment and interest among stakeholders, especially between the project sponsors and other stakeholders. Besides, there were difficulties to identify the data owners.

6.3 Lessons Learned

According to the research participants, these were the main lesson learned:

- (1) **Clear Identification of Project Stakeholders**, such as a formal project board with decision making power, and a formal and empowered sponsor. Additionally, it is mandatory to have well-prepared staff in the data registration processes. If the company has local branches, make a physical visit to each of them to identify both stakeholders and data owners.
- (2) **Change Management Process**. Relevante tasks are formalized the changes will occur and thus create DG policy, especially for large

organizations, and implement data standardization process whenever when required.

- (3) **Make Technologies and Infrastructure Available to the Project**, given there are fundamental assets on which these projects rely, such as the ERP for LOGI project.

7 CONCLUSIONS

This was exploratory and qualitative research, that proposed a model, named DGB-M, for investigating the DGPP benefits at four different sectors: agribusiness, fertilizers, automotive, and logistics. As result, we found that on average 62% of the process was implemented and 68% of the benefits were achieved.

Even these processes were implemented partially they added value to these organizations, given many in-developing countries still lack DGPP projects, this research is highly relevant to identify the key-process DGPP, in which we created the DGB-M model. We also validated the DGB-M process and benefits, thus contributing to enhancing the success rate of future similar projects. Additional material such as DGPP costs, benefits, challenges, and other lessons learned we also collect from this research. For

future researches, the DGB-M can be extended to contexts, such as companies that actuate at these reported sectors and in in-developing countries.

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