

Thesis

Data Governance Maturity Model



Online Assessment tool:

https://docs.google.com/forms/d/1WgcpcvqpkGISSTrRenciAvpg0CRV3KrHj_B00nRMIJM

Website with ongoing PhD research:

<https://datagovernancematurity.wordpress.com/>

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Index

| | |
|---|----|
| Preface | 4 |
| Resume..... | 5 |
| Introduction | 7 |
| 1.1 Background..... | 7 |
| 1.2 Relevance | 7 |
| 1.3 Objective | 7 |
| 1.4 Research Question | 8 |
| 1.5 Research organisation..... | 9 |
| 1.6 Structure..... | 9 |
| 2. Data Governance (DG) & Maturity Model..... | 11 |
| 2.1 Definition data governance..... | 11 |
| 2.2 Definition maturity model..... | 15 |
| 2.3 Data Governance Maturity Model | 18 |
| 3. Method Empirical Research..... | 23 |
| 3.1 Research strategy..... | 23 |
| 3.2 Data Collection Method | 26 |
| 3.3 Reliability and Validity Data Collected | 29 |
| 3.4 Data Analysis | 31 |
| 4. Research Results | 33 |
| 4.1 Global description research | 33 |
| 4.2 Background research organization | 33 |
| 4.3 Results sub-question I | 36 |
| 4.4 Results subquestion II | 38 |
| 5. Discussion..... | 40 |
| 5.1 Interpretation of data..... | 40 |
| 5.2 Research evaluation | 41 |
| 6. Conclusions & Recommendations | 46 |
| 6.1 Conclusions..... | 46 |
| 6.2 Discussion | 47 |
| 6.3 Recommendations for Future Research | 47 |

| | |
|---|----|
| 7. Reflection | 48 |
| 7.1 Meaning research outcomes..... | 48 |
| 7.2 Processreflection..... | 48 |
| References | 49 |
| Appendix I Definition Dimensions Data Governance | 52 |
| Annex II Quality and design principles maturity models into BPM | 54 |
| Annex III Data Governance Maturity Model (DGMM)..... | 59 |
| Bijlage IV Interviewprotocol | 69 |
| Bijlage V DGMM Outcome Assessment..... | 75 |

Preface

This thesis is the final assignment of my master in Business Process Management & IT at the Open University in The Netherlands. I started this study with the motivation to deepen my knowledge of business and IT. In my bachelor of science in logistics management and IT and in my career so far this subject always fascinated me. This subject fascinated me so much that it has been possible to complete this study next to a full-time job and being the father of four children.

At the same time this thesis is the start of something new. I chose the subject to follow up on graduation. The subject is scientifically wasteland, which has loosened the pioneer in me to develop it. And the fundamental research of this thesis gives rise to further investigation.

This thesis was first established under the supervision of Prof. Rob Kusters, who I thank the most. On his instructions I discovered the world of scientific research and the immense space that exists therein. I also want to thank dr.ir. Werner Rutten for his work as second supervisor. I would also like to thank the respondents of the research organizations for their invaluable contribution to this research, here left anonymous due to commercial reasons.

And I want to thank my partner Annette who, in spite of our busy family life with four children, her job and her studies, every year left me the time and space to complete my studies.

Jan Rutger Merkus MSc

Resume

Relevance

This research aims to contribute to science by adding new knowledge about data governance and in particular a maturity model.

First of all, there is a need for this research in the research community. It indicates that there is still no clear definition of data governance (Begg, 2009, Otto, 2011). Further literature pointed out that, practical data governance maturity models exist but none all are scientifically sound.

Furthermore, there is the practical need for this study in both large organizations (Otto, 2011) as in small and medium businesses (Begg & Chaira, 2011). All kind of organizations lack both theoretical and practical knowledge. And data governance not only plays a role within organizations but also in the exchange of information between organizations (Kooper & Maes, 2011). Even when organizations offer their data in the cloud data governance plays an important role (Begg & Chaira, 2011).

Objective

Based on this, the objective of the literature review is to define a model to assess data governance based on organizational maturity to be able to give recommendations. The objective of the empirical research is designing a maturity model to assess data governance in practice.

Research Question

On basis of this objective the next research question is formulated:

How is data governance maturity assessed?

The answer is that the Data Governance Maturity Model provides a good take-off for assessing organizational maturity of data governance.

This answer is based on answers on research questions deducted from the main research question for literature research and for empirical research. These questions are answered as follows.

Data Governance

A definition of data governance is composed on the basis of literature. And experts have confirmed all dimensions of DGMM, what also confirms the definition of data governance.

Maturity Model

Based on analysis of the literature the design requirements and models of Huner et al (2009), Becker (2009) and Pöppelbuß (2011) are adopted as methods for the design of a maturity model for data governance. This method is based on literature about maturity models in the domains of data governance.

Data Governance Maturity Model (DGMM)

Based on the literature a maturity model is designed with relevant dimensions, levels, qualifications and criteria to grow in data governance. A translation was made from maturity assessment criteria from related domains to the dimensions of data governance.

Assessment of organizational maturity data governance

From results of empirical research can be derived that experts on the dimensions of data governance confirm that DGMM is relevant and valid as a measure to assess the organizational maturity of data governance. All dimensions were seen as relevant. All but one were considered relevant qualifications, although some qualifications are still unknown in the context of the research organization. All qualifications except one have been identified as growth opportunities in organizational maturity of data governance, although not always unanimous for each level of maturity.

Research evaluation

In evaluation of the investigation is concluded that with the research method used the DGMM entirely tested in practice. This by semi-structured interviews with experts within the same suitable research organization. The DGMM is thus relevant, credible and it is structured in a logical reasoning. On this basis is concluded that the DGMM has a high internal validity, reliability and credibility. But because the study is conducted in one organization the generalizability not so high, despite theoretical generalization from the literature. Further, the chosen research method returned new knowledge about data governance. Namely a definition of data governance and a maturity model as measuring instrument for practice.

Discussion

Only one qualification in the DGMM is not recognized as relevant. And there are only mentioned two new dimensions. Thus the question arises whether the DGMM is complete. This would qualify for further research to confirm or extend the DGMM.

Recommendations for future research

Based on the results of the above study, the following recommendations were formulated for further research. Experts have made recommendations to grow into organization maturity eligible for further investigation. A group discussion with experts is recommended for to increase the internal validity of the DGMM. Also repeating the survey for other organizations contributes to this. It is further recommended to conduct participatory research in which the researcher experiences practical situations. And in further research respondents could be informed about terms of data governance for preparation on the interviews. This would results in more relevant examples from practice. To increase the generalizability and reliability of the DGMM it is recommended to repeat the same examination in time, by another investigator and for other organizations. This contributes to the multi-case study for confirmation and generalization of the results of this study.

Introduction

1.1 Background

Data plays an increasingly important role in everyday life. Data is also increasingly in the spotlight with such a hype as *big* data. Thus increasing the importance of data quality. And data quality requires continuous maintenance in the form of data management (Dahlberg, 2011). Also, it is important that value of data is safeguarded being an assets. Both happens with data governance (Otto, 2011; Otto, 2013).

At the same time is data governance a little researched topic that requires further definition and validation (Begg & Caira, 2012). Organizations do not have measuring instruments to review the status of data governance (Otto, 2011). Therefore, additional qualitative and quantitative research is needed (Otto, 2013). Researchers think thereby to select the right governance model, depending on the type of organization (Kooper & Maes, 2011). And as requirements for data governance change over time as a result of changing organizations, it is necessary to deal with the maturity of organization (Otto, 2013).

1.2 Relevance

This research aims to contribute to science by adding new knowledge about data governance and in particular a maturity model.

First of all, there is a need for this research in the research community. It indicates that still no clear definition exists for data governance (Begg, 2009, Otto, 2011). Further literature pointed out that, while practical data governance maturity models exist, none are scientifically sound, i.e. not freely reproduceable, not empirically tested, etc.

Furthermore, there is the practical need for this study in both large organizations (Otto, 2011) as small and medium businesses (Begg & Chaira, 2011). All types of organizations lack both theoretical and practical knowledge. And data governance not only plays a role within organizations but also in the exchange of information between organizations (Kooper & Maes, 2011). Even when organizations offer their data in the cloud data governance plays an important role (Begg & Chaira, 2011).

1.3 Objective

Based on the relevance of the objective of this research is formulated as follows..

The objective of the literature review is to define a framework for assessing data governance based on organizational maturity (= maturity) and to give recommendations for organizational growth in data governance.

The objective of the empirical research is to test the maturity model for data governance into practice, with the following objectives:

- I. The design of a maturity model to assess the status of data governance within an organization. In the literature there is no references of scientific maturity models of data governance found.
- II. Give recommendations for valuable additions to the DGMM for organizations to grow in data governance. In literature there is no scientifically based research on this subject found and this research provides new knowledge.

1.4 Research Question

On the basis of this objective, the following research question arises. The main question is:

How is data governance maturity assessed?

To answer this main question it is divided into context and sub-questions for literature and questions for empirical research.

For the literature review, the following questions are asked:

Context questions:

1. What is the definition of data governance?
2. What is the definition of a maturity model for data governance?

Content questions

3. What are the relevant dimensions and levels of data governance maturity?
4. What are the relevant assessment criteria for data governance maturity?

For the empirical research the following sub-questions have been formulated:

- I. Exploratory research to validate that the organization maturity of data governance maturity can be assessed with the dimensions, levels and criteria from the literature in the form of the DGMM.

There are many practice-oriented models for data governance maturity known but never before a maturity model for data governance has been designed which is scientifically justified. Therefore, based on literature a DGMM is designed on the basis of relevant literature on data governance domains. For these domains statements are formulated in the form of assessment criteria which are to be tested in practice for validity and completeness.

The objective of sub-question is to explore whether the established DGMM suffices as measuring instrument or whether adjustments are needed to the model. The result of this investigation is whether the dimensions, levels and criteria in the DGMM make it possible to assess organizational maturity of data governance.

- II. Exploratory research to discover what are valuable additions to the DGMM for organizations to grow in data governance

The scientifically justified method for the design of a maturity model as established in the literature asks as third key component recommendations for growing into maturity. In the literature there are no recommendations for known data governance.

The objective of this sub-question is exploratory research to discover new knowledge in practice on the basis of the DGMM. The proposed answers are additions to the DGMM in the form of specific dimensions or qualifications to grow in organizational maturity in data governance as a subjects for further research.

1.5 Research organisation

The research organization has agreed on reporting the survey outcomes anonymously due to commercial reasons. Therefore, here are listed some characteristics of the research organization, without making able to trace the organization involved.

- The organization is an internationally organization operating in over 20 countries with subsidiaries across six continents.
- The organization produces new products and provides maintenance services.
- The clientele ranges from private to public customers of different nationalities.
- Business continuity is more important than profit.
- The organization has mainly grown through acquisitions of other companies to increase international market share and brand awareness.
- The organization is best to characterize as a network organisation in which affiliates are profit and cost centers.
- Quality requirements are imposed by the group in order to secure the brand.
- The following IT issues are organized at the holding level: IT infrastructure, network, ERP system and production applications. Other IT services are decentralized: accounting, applications, legacy systems, ICT services.
- For subsidiaries acquired the policy for automated exchange of data from distributed systems is based on interfacing rather than on systems integration.

1.6 Structure

The sub-questions of the main research question are detailed in the following chapters.

In chapter 2 are the questions answered in the literature. The chapter concludes with the results of the literature which is formed by the maturity model of data governance.

Chapter 3 describes the method of empirical research. Each part of the research design is described in the following sections: research strategy, data collection method, reliability and validity, data analysis. It concludes with an outlook to the expected results and conclusions of the investigation.

Chapter 4 presents the results of empirical research. First of all, a brief description of the data processing is given. Then follows the analysis of the summarized data about which model element is confirmed or which one needs improvement. In addition, other notable findings are included for complementation and missing items are discussed.

In chapter 5, in the discussion on the results portion conclusions are drawn in the first paragraph. At the end of this section conclusions and recommendations are given for future research. In the next section this research is assessed, followed by reflection and conclusions and recommendations for the method for further research.

In chapter 6, the main question of the problem is answered on the basis of the findings of the empirical research. This also follows the final verdict on the research method. And suggests recommendations for further research after discussing the claims.

Finally, in chapter 7 follows the reflection on the entire research and lessons learned.

2. Data Governance (DG) & Maturity Model

In each section of this chapter a context or sub-question is answered with the results of the literature review.

Research of scientific literature on Data Governance (DG) shows interest in this topic. Not only in recent years but still scientist are researching this topic.

The attention for DG is explained by its growing importance. According to Begg (2011) DG is of value for the survival of an organization. Organizations use DG to control the organization. Particularly in large companies know data quality problems through mergers and distributed systems for which DG is needed. Also Korhonen (2013) noted that data handling is inadequate and needs DG. Large, middle and small sizes organizations need quality data for their processes and due to administrative and legal obligations. The unilateral focus on data aspects need to change to a focus on organizational maturity in handling data [Huner et al (2009)].

The many interests of stakeholders from the business relevant in executing data quality management in the technical IT domain are translated by DG [Wende (2007)]. Also, data quality is important for compliance, customer policy and reporting or business processes [Otto (2011b)]. According to Gregory (2011a), DG is part of the framework for corporate governance, risk management and compliance (GRC) of Racz (2010). The goal of DG and GRC is adding value and reducing risk. Around data arise prejudice risks like loss or theft, privacy violation, violation of law, low data quality, but also liability.

2.1 Definition data governance

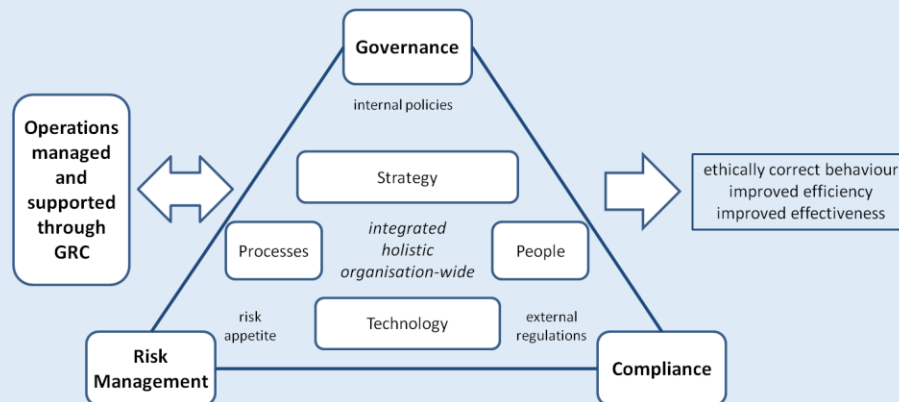
But what is DG? According to Begg (2011) the definition of data governance is still emerging. This is recently underlined by Otto (2013) indicating that a standard definition for DG does not exist in the science and practice. So it is necessary to further define DG.

2.1.1 Corporate Governance - Risk management – Compliance (CGRC)

To find the definition of DG it requires positioning among other organizational activities. Wende (2007) already stated that DG determines organization-wide guidelines and standards for data quality management. DG assures specific compliance with corporate strategy and laws about driving data. With DG organizations implement organization-wide responsibilities for data quality management (DQM) which include both professionals from the business and IT. Even Weber et al. (2009) recognized that DG combines business-driven IT technical perspectives. Because global presence requires harmonization of (master) data for business networking, customer management, decision making and business intelligence. This is done by Business and IT working together in DG for DQM. Gregory (2011a) confirms this: data governance also looks in his opinion at the interests of the owners and users of the data, the business. He shows the following interactions. DG is important for corporate governance, risk management and compliance (CGRC) because it ensures administrative information and self-control from CGRC to exploit the maximum value of DG. According to him, the first priorities are risk assessment, data audit and compliance gap analysis.

Vitolla (2014) states that recent holistic risk management has become part of corporate governance. IT Governance as part of many business activities is an integral part of corporate governance and thus falls within the scope of holistic risk management. Enterprise Risk Management (ERM) inevitably requires the existence of an effective IT Governance system. In the same way ERM also includes data governance. Moreover, DG deals with value of data and value means risk. Risk management is therefore applicable to DG. From the above we can conclude that DG is part of the greater whole of Corporate Governance (Enterprise) Risk Management and Compliance.

Racz (2010a) suggested that the definition of GRC is an integrated, holistic approach to enterprise-wide governance, risk and compliance. GRC ensures that organizations act ethically in accordance with his risk assessment, internal policies and external regulations. This by aligning strategy, processes, technology (product) and men (people). This increases efficiency and effectiveness. For this he set up the model for GRC as in Figure 1.



Figuur 1 - Frame of reference for integrated GRC [Racz(2010a)]

GRC distinguishes and controls the domains strategy, processes, people and technology in the GRC organization governance model. Gregory (2011a) supports this theory. According to him, people, processes and technology are core capabilities for data governance. Gregory elaborates the domain of people in the form of organizational vision and ownership of the business, processes in the form of the data life cycle and technology in the form of tools. In subsequent research Racz (2010b) has found that IT GRC is about Information Security, IT Compliance, IT and Data Governance, IT Risk Management and IT overhaul. IT GRC is hereby indirectly aligned with the organization operations. Therefore, the dimensions strategy, processes, technology and people are of interest for data governance.

2.1.2 Limitation

DG is limited, it is not about software tools but about the underlying data [Huner et al (2009)]. And there is a difference between information governance and data governance, the first involves interactions the second on assets [Koooper (2011)]. And DG partially overlaps with IT Governance and Data Quality, but not for the perspective, interest and understanding of data from the business stakeholders [Wende (2007)].

2.1.3 Data as Asset

Maes and Koooper stated that DG sees data as an enterprise asset [Koooper et al (2011)]. Others confirm this. According Otto, the formal goal of DG is to increase the value of data assets [Otto (2011a),(2011b)]. DG manages data assets and maximizes data value through quality control. And further, Otto (2011c): "DG is based on data as a company asset with value". According to him, the relationship between DG and data quality management is based on the value of data that, because of its value, needs to be managed and its quality needs to be monitored and secured.

Also Korhonen (2013) identifies data as an asset, to separate from other IT assets based on business value. Later Otto (2013) presents once again that DG is focused on maximizing the value of data assets in organizations. As part of DG data quality management looks at the quality of data in itself and it is a sub function of data management. But data management only includes planning, monitoring and provision of data assets. DG thus comprises the maximizing value of data as asset.

Interesting to note is that Otto (2013) proposed that the value of data is determined by the use thereof. This use is linked to the data quality, which is defined as fitness for use. Wende (2007) states that DG ensures that relevant, high-quality information products are delivered to users. Here, the use of data plays an evaluative role again. DG increases the value of data as asset by increasing data quality so that the use of it increases.

2.1.4 Organization, Domains and Accountabilities

Research shows that DG comprises organization, roles, and decision-making in order to control the value of data.

Wende (2007) states that DG helps companies with structuring and documenting data quality responsibilities. A DG model should consist of roles, accountabilities and responsibilities. She claims that such a model is company specific. Weber et al. (2009) state that DG specifies the framework authorities and responsibilities to encourage desirable behavior in the use of data. To promote this broad policy guidelines and standards are to be developed under DG organization that are consistent with the mission, strategy, values, norms and culture of the organization. So DG organizes policies, roles, responsibilities and authorities at the strategic level to better handle data.

According Khatri & Brown (2010) DG includes five interrelated decision-making domains: data principles, data quality, metadata, data access and data life cycle. According them DG determines who is authorized and who can be held responsible for organizational decision making about data assets.

Otto (2011b) builds on this and lets DG to answer 3 questions. The first is that decisions are taken in data management, data quality, data quality meetings, metadata, master data, authorization and data lifecycle. The second is what roles there are in the form of data stewards, data owners and data committees. The third question which authorizations and responsibilities are delegated according to the RACI method: Responsible, Accountable, Consulted and Informed.

In short, DG specifies who decide on dates for the tasks and duties are.

According to Otto (2011a), DG 3 has dimensions. The first dimension is the formal goal, namely increasing the value of data assets in which creating access rights is the functional purpose. The second dimension is organization structure in the form of decision-making position, organization, task allocation of roles and committees. The third dimension is roles and committees. In addition, DG takes place at a strategic and tactical level, centralized and often with metadata. Organizing DG is an assurance of data quality and securing data as assets, according Otto (2011c). He bases his findings on somewhat older work of Weil (2004), on the practice of commercial organizations and continue on their own work.

Otto (2013) argues that DG provides a decision framework for data management. It's about what decisions are made and by whom. DM is about making decisions and implementing them.

Korhonen (2013) confirms that DG controls the allocation of decision rights and responsibilities of data quality. There are several naming DG roles: executive sponsor, DG Council, Chief Steward, Business Data Steward, Technical Steward. Korhonen moreover relies on work by Wende (2007), Otto (2011) and Griffin.

In short, DG domains are data management, data principles, data quality, metadata, master data, data access and data life cycle. DG determines who is authorized and who is responsible for making decisions about data assets.

2.1.5 Definition Data Governance

Literature reads the following definitions for Data Governance:

- Otto (2011): a companywide framework for assigning decision-related rights and duties in order to be able to adequately handle data as a company asset.
- Gregory(2011): the business practice that defines and manages strategies for people, processes and technologies to ensure that valuable data assets are formally protected and managed throughout the organization.
- Korhonen(2013): an organizational approach to data and information management that formalizes a set of policies and procedures to encompass the full life cycle of data, from acquisition to use and to disposal.

None of the three definitions contain all the basic elements put forward by the scientific literature. Therefore it is advisable to tighten the definition of data governance. As described above, the following elements are relevant for DG:

- DG component is part of the larger whole of Corporate Governance (Enterprise) Risk Management and Compliance.
- The dimensions strategy, processes, technology and people are of interest for data governance.
- DG involves maximizing value of data as an asset.
- DG increases the value of data as asset by increasing data quality to increase its use.
- DG organized policies, roles, responsibilities and accountabilities at the strategic level to better handle data.
- DG domains are data management, data principles, data quality, metadata, data access and data lifecycle.
- DG determines who is authorized and who is responsible for decisions on data assets.

Therefore, based on literature, we propose the following definition for data governance:

**Data Governance is
from Corporate Governance, Risk Management and Compliance
determining the strategy for processes, people and technology
to maximize the value of data assets
by arranging organization, responsibilities and accountabilities
for the domains data management, data principles, data quality, metadata, master
data, data access and data lifecycle.**

2.2 Definition maturity model

2.2.1 Current state of knowledge

Literature study shows that currently no data governance maturity model (DGMM) exists. However, there are available all kinds of maturity models for data governance, but they are not all scientifically sound, i.e. not freely reproduceable, not empirically tested, etc.

Two currents seem to emerge in this domain. The Anglo-Saxon flow relies mainly on best practices for a data governance maturity model. These models are often drawn up by businesses IS and IS consulting firms, but have little or no scientific basis. For example, IBM models Data Flux, SAP, Gartner, Gregory et al. (2010, 2011, 2012).

The European Movement is trying to apply scientifically sound methodologies and to develop empirical research-based models, but limits itself to maturity models for data quality management [Otto (2013)]. Here, cooperation is established with the European Foundation for Quality Management (EFQM) Excellence Model. A DGMM is avoided because establishing Data Governance would be too dependent on internal and external contingency factors (Otto (2011c)). A maturity model would be too rigid because too many fixed criteria. However, Otto (2013) incorporates data governance as part of quality model EFQM. Otto claims that the selection of relevant criteria depends on the situation of an organization. And then it would be depending on the situation which dimensions or criteria are (always) valid and which are not. The EFQM Excellence Model is a quality model, a management model or even a strategic model for organizational management. The EFQM Excellence Model is indeed a non-normative

management model, but is also based on 9 fixed criteria. And with that rigidity is not a valid argument anymore. Moreover governance transcends quality and / or strategy. Governance, after all, is about governing an organization. The Governance, Risk Management and Compliance (GRC) model Razc (2011a) shows that organizations are controlled with strategy, people, processes and technology. The EFQM quality model, as a strategic model, could be part of that.

2.2.2 Maturity Models

According to Huner et al (2009) maturity models are intended to describe maturity of organizations, to assess them and to give directions on how to grow. Becker (2009) is in line with this and states that maturity models determine the status quo of an organization to make guidelines to improve. Also according Pöppelbuß (2011) are maturity models growth models for organizations. According him applications of maturity models are primarily descriptive if it is used as an assessment tool of the as-is situation, secondly it is prescriptive in providing guidelines for improving and thirdly comparative for benchmarking.

Huner et al (2009) have analyzed a lot of existing maturity models for their application in data governance relevant domains (BPM), in particular data quality management. He indicates that maturity model are usually validated in case studies.

According Huner et al (2009), Becker (2009) and Pöppelbuß (2011) is a maturity model a frame with maturity levels and dimensions, divided into qualifications. According Pöppelbuß (2011), organizational skills develop according a anticipated, desirable or logical growth path from one level to the next level, so called maturity levels .

A dimension according Pöppelbuß (2011) is a "central construct related to the application domain" that knows a specific 'granularity' which Pöppelbuß (2011) calls *qualities*. Otto (2011) calls them *qualifications*. This study opted for *qualifications* because the term quality can be confusing as a term. The degree of organization growth per qualification is determined by one or more assessment criteria per maturity level, according to Becker (2009). The basic design of an organizational maturity model is shown below in Table 1 Definition Maturity Model.

Table 1 Definition Maturity Model

| Dimensions | Qualifications | Maturity level 1 | Maturity level 2 | Maturity level 3 |
|-------------------|-----------------------|----------------------------------|----------------------------------|----------------------------------|
| Dimension A | Qualification A1 | assessment criteria A1 – level 1 | assessment criteria A1 – level 2 | assessment criteria A1 – level 3 |
| | Qualification A2 | assessment criteria A2 – level 1 | assessment criteria A2 – level 2 | assessment criteria A2 – level 3 |
| Dimension B | Qualification B1 | assessment criteria B1 – level 1 | assessment criteria B1 – level 2 | assessment criteria B1 – level 3 |

2.2.3 Developing a new Maturity Model

Because no existing scientifically justified model for data governance maturity is found in literature such a maturity model for data governance is developed in this study.

Although there are some practical oriented maturity models for data governance, by lack of scientific grounding we disregard them in this study and also because the models from practice do not meet the requirements of scientific model development methods, such as controllability or free reproduceability.

The DGMM is developed in accordance with a scientifically sound method. This design method is based on scientific literature on maturity models in business process management. Furthermore DGMM is based on existing science-based maturity models from domains that are derived from the definition of data governance prepared in section 2.1. The scientific grounding of the applied development method is justified in paragraph 2.2. The application for the DGMM follows in section 2.3.

2.2.4 Quality and design principles maturity models into BPM

According Pöppelbuß (2011) there are hundreds of maturity models of varying quality and design needs quality requirements. Becker (2009) also saw a need for a new form of maturity models, earlier versions need improvement. To this end, Becker (2009) has mapped the design process of maturity models. And research of Pöppelbuß (2011) mapped design principles by means of a checklist. Becker (2009) and Pöppelbuß (2011) embrace the method of Huner et al (2009) completing each other's methods. The quality and design principles that are mentioned in this literature are all gathered in Appendix II Quality and design principles maturity models in business process management (BPM).

2.2.5 Design method: Roadmap

To develop a scientific sound design method for the preparation of a maturity model for data governance this study uses the quality and design principles for maturity models of business process management from the literature of Huner et al (2009), Becker (2009) and Pöppelbuß (2011) .

The DGMM is designed according the maturity model like Becker (2009) defines (see Annex II), although mirrored diagonally with maturity levels horizontally and dimensions and qualifications listed vertically. The DGMM is also designed according to the roadmap of Becker (2009) in Appendix II. Step R2 of the roadmap of Becker (2009) has been refined to achieve a determination of all elements in the maturity model of Becker (2009). And the following design steps are determined based on the design principles of Pöppelbuß (2011).

- 1- As first design step in the development of the *basic* maturity model for data governance maturity all possible dimensions are collected from literature on maturity models from domains that are derived from the definition of data governance (design principle 1.2a, Pöppelbuß (2011)).
- 2- As a second design step in the preparation of the *base* maturity model the maturity levels are set. (design principle 1.2b, Pöppelbuß (2011)). In step R2 of the roadmap of Becker (2009) all maturity levels found in the literature about maturity models are collected from the domains of data governance. Then this list of maturity levels is transformed into a maturity level classification based on similarities in meaning.
- 3- As third step in the preparation of the *basic* maturity model all the qualifications that correspond to the dimensions found in step 1 are collected (design principle 1.2c, Pöppelbuß (2011)).
- 4- As fourth step in the preparation of the *descriptive* part of the maturity model the assessment criteria required to perform the assessment are collected (design principle 2.2b, Pöppelbuß (2011)). For that all assessment criteria found in literature about maturity models in domains of data governance are collected.
- 5- As fifth design step the long list of qualifications and assessment criteria are collected from step 3 and 4 and reduced to a maturity model that can be used as organization assessment instrument. The qualifications found are classified per dimension and as much as possible under similar headings on the basis of similarities in meaning.

The first list with assessment criteria are reduced according to the classification of the qualifications to a list of new operationalized assessment criteria. Here, the first assessment criteria for each maturity level and a new qualification are summarized or aggregated into new assessment criteria based on similarities in meaning.

During the design along with this plan, all quality and design principles of Huner et al (2009), Becker (2009) and Pöppelbuß (2011) from Appendix II are included as conditions, except the following:

- Due to the limited time available for the investigation, there is no iterative improvement in design principle as one of Becker (2009).
- For the same reason, there is also no incremental publication of the results.
- The third, prescriptive part according Pöppelbuß (2011) fails because no material is found in literature on maturity models in the domains of data governance nor elsewhere (!). Moreover, the assessment criteria of the subsequent maturity levels give, just like the maturity levels themselves, direction to advices on growth in organizational maturity.

2.3 Data Governance Maturity Model

This section describes the implementation of the development of the maturity model for data governance based on the developed design method from the previous section.

2.3.1 Step 1 Maturity Dimensions

As the first step, all domains are determined from the definition of data governance from paragraph 2.1:

- corporate governance, risk management en compliance.
- people, processes en technology
- data assets
- organization
- data management: data management, data principles management, data quality, meta data management, master data, data access management, data lifecycle management

Secondly all maturity models are collected that are found in literature that has been used for drawing up the definition of data governance. All dimensions of those maturity models are collected and classified under the same headings. During that collection a new dimension was discovered which was not to classify under any of the other dimensions; business alignment . And all data management-related dimensions were classified under the main heading of data management.

Table 2 *Maturity Models and Dimensions for DGMM* shows the literature on dimensions of data governance maturity models and the dimensions used therein. The definitions of the dimensions are derived from the same literature and are described in Appendix I. *Definition dimensions Data Governance*.

Table 2 Maturity Modells and Dimensions for DGMM

| | Smits | Batenburg | Car-cary | Otto | Gregory | Pöppe Ibuß | Racz | Pee | Cur-ley | Luft-man |
|--------------------|-------|-----------|----------|------|---------|------------|------|------|---------|----------|
| | 2014 | 2014 | 2013 | 2013 | 2011 | 2011 | 2009 | 2009 | 2008 | 2003 |
| Governance | V | V | | V | | | V | | | V |
| Risk management | | V | V | | V | | V | | | |
| Compliance | | V | | | | | V | | | |
| Processes | V | | | V | V | | V | V | | |
| People | V | | | V | V | V | V | V | V | V |
| Technology | | | | v | V | | V | V | | V |
| Data assets | | | | | | V | | | V | V |
| Business Alignment | | | | | | | | | V | V |
| Organisation | V | | | V | | | | | | |
| Data management | V | | | V | | | | | | |

V = Reference for dimension in article

2.3.2 Stap 2 Maturity Levels

Als tweede stap is de indeling van de volwassenheidsniveaus (maturity levels) voor het DGMM bepaald. Daartoe zijn op dezelfde manier als in de vorige paragraaf 2.3.1 alle maturity levels verzameld uit alle maturity models die zijn gevonden in de literatuur over de domeinen van data governance en gerubriceerd. De levels uit de literatuur zijn weergegeven in tabel 3 Literatuur maturity levels en dimensies.

The second step is the classification of maturity levels (maturity levels) for the DGMM. To this end, in the same way as in the previous section 2.3.1 all maturity levels are collected from all maturity models that have been found in the literature on the domains of data governance, and classified. The levels from the literature are shown in Table 3 *Literature maturity levels and dimensions*.

Table 3 Literature maturity levels and dimensions

| | | | | | |
|---------------------------|-----------------------|--------------------------|----------------------------|------------------------|---------------------------|
| Luftman(2003) | Without process | Beginning process | Established process | Improved process | Optimal process |
| Curley(2008) | Unmanaged | Basic | Intermediate | Advanced | Optimising |
| Gregory(2011a) | Aware | Reactive | Proactive | Managed | Optimal |
| Otto (2013) | Nothing has been done | Same approaches | Full deployment | Structured review | Systematic measurement |
| Rifae(2009) | Ad hoc | Repeatable | Defined | Managed | Optimized |
| Pee(2009) | Initial | Aware | Defined | Managed | Optimized |
| Carcary(2013) | Initial | Basic | Intermediate | Advanced | Optimising |
| Fath (2013) | - | Presence | Interaction | Transaction | Integration |
| Batenburg(2014) | Forming | Developing | Normalized | Established | Optimized |
| Chosen formulation | No process | Beginning process | Established process | Managed process | Optimizing process |

In order to achieve a usable format of maturity levels for the DGMM the following is determined on the basis of the literature on maturity models in this study. First, there is a distinction between situations without (1) and with (2-5) the presence of a maturity process. Then a distinction is made between a few (beginning) or far (advanced) advanced maturity level. This level of advancement determines also the average (established) maturity level. And the ultimate extent (optimized) of organization maturity is appointed to the last level. The maturity level classification thus created is used in the DGMM.

The dimension-selection and level-division results in the base DGMM as shown in Table 4.

Tabel 4 Basis Data Governance Maturity Model (DGMM)

| | No process | Beginning process | Established process | Managed process | Optimizing process |
|--------------------|-------------------|--------------------------|----------------------------|------------------------|---------------------------|
| Governance | | | | | |
| Risk management | | | | | |
| Compliance | | | | | |
| Processes | | | | | |
| People | | | | | |
| Technology | | | | | |
| Data assets | | | | | |
| Business Alignment | | | | | |
| Organization | | | | | |
| Data mangement | | | | | |

2.3.3 Step 3 Differentiating Dimensions: Qualifications

In step 3, all qualifications are literally and completely taken over from all maturity models that have been reported in the literature about maturity models in the domains of data governance (see Table 2 Maturity Models and Dimensions for DGMM). This list is the first roughly shaped DGMM. All qualifications together form a long list of 81 qualifications. These qualifications are classified according to the new classification of dimensions as specified in paragraph 2.3.1.

2.3.4 Step 4 Assessment Criteria

In step four, all with the qualifications associated assessment criteria are literally and entirely taken from the literature on maturity models in the areas of data governance (see Table 2 Maturity Models and Dimensions for DGMM) to the first roughly shaped DGMM. Together with the 81 qualifications from paragraph 2.3.3 the list of assessment criteria establishes a very large model. In practice, such a large model is unusable as a measuring instrument due to its size and duplicate entries. The model is due to the size shown in a separate annex *SamenstellingDataGovernanceMaturityModel_Nov2015.xls* in Excel format.

2.3.5 Step 5 Data Governance Maturity Model

In step 5 are, because of the frequent occurrence of qualifications with the same scope or meaning, similar qualifications classified unambiguously. The first list of 81 qualifications is therefore reduced to a new list of 29 qualifications. Also the qualifications accompanying list of assessment criteria are, according design step 5, brought back into line with the new 29 qualifications. Because of the reduction process reproducibility this is described in the separate annex *SamenstellingDataGovernanceMaturityModel_Nov2015.xls*. The end result of step 5 is the assessment model shown in Annex III Data Governance Maturity Model (DGMM).

2.3.6 Conceptueel model DGMM en operationalisatie

The results of the literature review are the following two things:

1. The model described in Table 5 Data Governance Maturity Model provides the conceptual model for this study.
2. Reference is made to the interview form in Annex III Data Governance Maturity Model (DGMM) for the operationalization of the DGMM. This describes the maturity model for data governance enclosing the qualifications for each dimension and operationalized assessment criteria.

Table 5 Data Governance Maturity Model

| Dimensions of Data Governance | Qualifications | Without process | Beginning process | Established process | Managed process | Optimizing process |
|--|---|-----------------|-------------------|---------------------|-----------------|--------------------|
| Governance, Risk management & Compliance | Structure | | | | | |
| | Authority | | | | | |
| | Controlling | | | | | |
| People | Capability | | | | | |
| | Policy | | | | | |
| | Culture | | | | | |
| Processen | Processes | | | | | |
| | Service and Product Portfolio | | | | | |
| | Planning & Monitoring | | | | | |
| Technology | Technology | | | | | |
| | Application Landscape | | | | | |
| | Data Storage & Distribution Architecture | | | | | |
| | Business Object Model & Corp. Data Dictionary | | | | | |
| Data assets | Value | | | | | |
| | Innovation | | | | | |
| | Assessments | | | | | |
| Business Alignment | Contribution to business | | | | | |
| | Relationship | | | | | |
| | Knowledge sharing | | | | | |
| Organisatie | Functions, roles, tasks and responsibilities | | | | | |
| | DG Goals, Objectives & Strategy | | | | | |
| | DG Tactics | | | | | |
| Data management | Data management | | | | | |
| | Data principles management | | | | | |
| | Data quality management | | | | | |
| | Meta data management | | | | | |
| | Master data management | | | | | |
| | Data access management | | | | | |
| | Data lifecycle management | | | | | |

3. Method Empirical Research

This chapter describes the empirical research method used to answer the sub-questions. The first paragraph describes the research strategy. The second paragraph describes the data collection method of which the review follows in the third paragraph. And The fourth paragraph describes the data analysis method.

3.1 Research strategy

3.1.1 Required data

To answer both sub-questions of the empirical research the research looks for specific information in practice.

Sub-question I will search for practical situations and experiences that lend them selves for an assessment based on the dimensions, levels and criteria from the DGMM. This is done in a way that the DGMM is tested to see if it satisfies as a model to assess organizational maturity or data governance .

To answer sub-question II additions to the DGMM are looked for, for example dimensions, Qualifications, maturity levels or criteria based on specific advice from the experts which are supported by practical examples.

3.1.2 Approach and Philosophy

The research is approached from theory to practice and therefore it has a deductive approach; DGMM it is tested as a conceptual model into practice. The way of thinking is in the direction of realism. From perceptions of several people we are trying to establishment an objective picture of reality.

3.1.3 Research method

To answer sub-questions and to achieve the objectives of this study, the methodology of a single, holistic case study of a real-life situation is chosen in an existing organization based on the following arguments.

The definition of a case study is "a method of doing research that uses empirical research of a contemporary phenomenon within the current context, which is using evidence of various kinds," Robson (2002: 178). First of all, this definition is consistent with realism as philosophy for this research; we look for the objective truth behind a phenomenon. This also applies for the approach of this study, which is deductive; the DGMM is being tested in practice. And by examining a case in practice, the subject is automatically a contemporary phenomenon. In this method the context of an organization is also relevant to exploratory research as thesis opportunities for growth in understanding. This conceptualization is used to supplement the lack of scientific knowledge about data governance. In addition, the method does not limit the technique of data collection for evidence, although interviews with experts are obvious to gather knowledge.

According to Yin (2003), a case study makes it possible to choose a holistic approach, all which is necessary because data governance occupies entire organisations. Herewith this subject is examined in its context, so that real-life characteristics are preserved. And the amount of

time available for this study does not make it possible to examine more than one organization-what has opted for a single case.

The disadvantage of using a case study is that it is an intensive method. Compared to other methods it costs much more to examine different cases. This limits the generalizability of the results.

Except a multi-case study among experts at several organisations, alternative methods are less suitable for this study. An experiment does not show the holistic nature and context of the organization. A survey limits the exploratory nature of the research by the closed nature of the responses and its quantitative nature. 'Action research' is not an option because the time for the investigation is limited. Typically ethnography is an inductive method, which is not suitable for deductive research. Archival research would still be possible depending on the organization to investigate, although the research deals with such new concepts that few archives on this topic are available.

For the time being with the time available is chosen for a single method of qualitative research. This is done to gain knowledge about this new subject as much as possible. In future research confirming the DGMM can happen in quantitative research, with a survey method in the form of questionnaires on the Internet. By inviting many respondents to apply the DGMM to their own situation arises knowledge about the usefulness of the criteria in the DGMM.

To properly carry out the case studies several respondents will be needed to get an objective view of the case and its context. Also required is that the respondents are grounded in (some of) the dimensions of data governance in order to contribute meaningful knowledge to the investigation.

3.1.4 Time horizon

Because organizational growth has a much longer time horizon than the duration of this study a cross-sectional study is adopted.

3.1.5 Access

The empirical study is conducted according to the case study method in a practical situation at a suitable organization. Several experts should be active in this organization. In the Netherlands there are many of these organisations. Therefore, some organization will be approached with a request to participate in the study. With positive response from several organisations, one organization will be selected to conduct the study.

The selection criterion is an estimate of the degree of maturity in data governance in order to test the DGMM as much as possible and discover if that's feasible. It is desirable to have access to the necessary data as much as possible, but this will also depend on the respondents.

A possible indicator whether organisations are working with this subject are vacancies in the area of master data management. Another is participation in interest groups in data management or in user groups of application software that support data governance and data governance. Because it is very difficult to find an organization that scores the highest of all maturity levels, an organization with a lower maturity score is also acceptable as long as it does not score level 1. It is important that the dimensions and qualifications are recognized or denied as a part of data governance. The maturity levels are already derived from literature and previously confirmed in other studies.

To achieve that organisations are interested to participate in the study, first the sponsor within the organisation is informed about the importance of the stud. Subsequently, the investigation of the workload will be shown. Not including introductions and reporting, the visit tae half a day for an interview with an expert. After completion of the investigation the organisation will receive a report with the findings of the research.

3.1.6 Ethical issues

Since research purposes do not sanctify the means, during the acquisition of generalized knowledge a great effort will be made during investigations to prevent damage to persons.

To achieve this the following research ethics will be observed during the investigation. Already with the study design and while gaining acces we attempt to do useful research.

When collecting data, the privacy rights of the respondents will be respected by requiring informed consent of the sponsor and the respondents. If deception might unfortunately occur this is feed back. Further, the well-being of the respondents will be observed during the execution of the investigation. An attempt is made to minimize the negative impact of the external researcher.

When processing and the collected data damage to the research organization and respondents is preented by working with anonymized data. The collected data will not be disclosed to third parties and not saved.

The analysis and reporting report generalized knowledge as much as possible. Over more, the personal data protection law is respected. Data are rendered anonymous so that the outcomes are not traceable to the research organization or to the respondents. The collected data will not be used against the interest of respondents or organization.

3.1.7 Samples

The choice of using a sample depends on the research questions and objectives. Given that the exploratory investigation is focused on knowledge creation is no point to look at the entire population, but to work with samples. It is not necessary to consult the population of an organization since all knowledge is spread over only a few workers with different roles. Therefore it is important to make a selection among the workers on the basis of their knowledge of one or more of the dimensions of data governance within the organization.

3.2 Data Collection Method

3.2.1 Secondary data sources

The literature study showed that is no scientific knowledge exists about data governance maturity models. Also, there are no recommendations for organizational growth in data governance known, not in the body of knowledge and not in practice as consultants keep this knowledge to themselves for commercial reasons. Therefore the use of secondary data sources is much less suitable for this research.

Because of the time available for the research the study is carried with a single organization. To get a good impression of this organization information is collected from various websites. This information serves to verify the suitability as research organization. To this end online job postings give insight in how organisation is active in one of the dimensions of data governance.

From the interests of the investigation to explore all aspects of the DGMM it is desirable that the organization where the research is conducted meet to the following requirements. These requirements are used in the selection of the research organization on the basis of secondary sources.

- Organization maturity in data governance on multiple dimensions of the DGMM, or even more dimensions to the extent relevant, to test the DGMM as much as possible.
- Availability of at least three experts with knowledge or data governance. An expert is someone who has built up expertise in a domain through research, experience and / or profession. The number of experts must be such that conclusions can be drawn about the validity of the DGMM. It assumes at least one expert per dimension of data governance. When two experts, or even three, bring examples of a dimension the validity of the research increases because the perceptions of two or three experts constitutes a more objective picture.

3.2.2 Primary Data Source

Research Technique: semi-structured interview

In the study design we chose a case study in the context of a research organization. Due to the limited time of the study we chose in the research strategy the cross-sectional study as time horizon. Because of this we also waive participatory observation as a technique for data collection. Instead, we opt for the technique or individual interviews of experts in the field of data governance.

As the type of interview a semi-structured interview is selected with the as DGMM subject. This on the basis of the following arguments.

First of all, the objective of the research is of exploratory nature for which a qualitative technique is the most suitable [Blumberg et al (2008)]. As a result, the possibility arises for the development of theory. Qualitative research is needed to learn to understand the reasons for decisions, attitudes and opinions of the respondents on the subject.

Second, the DGMM is itself a standardized questionnaire. To discuss all aspects of the DGMM possible DGMM is used as assessment tool and functions as a topic of conversation. This creates the opportunity to not only test the DGMM assessment tool as well as to discuss the dimensions, qualifications, maturity levels and criteria as separate themes. The latter aims for respondents to give the opportunity to share their insights and knowledge about the issues or complement the meaning of the elements in the DGMM. This will enrich existing knowledge. This approach requires the technique of a semi-structured interview.

A third argument is the controlled collection of the data. The DGMM contains many different aspects and themes. To investigate all these issues closely monitoring the progress of the investigation process is required. More over, it may happen that further explanation is required. Then personal contact with the respondents works much better than a questionnaire. Also, it is possible to request by at unanswered questions.

The disadvantage of this research technique is that the results are qualitative in nature and are not confirmed by quantitative research. This limits the generalizability of the results. The DGMM as standardized online questionnaire on the Internet can be used for research of quantitative nature to quantitatively validate the criteria of the DGMM in further research and in application in other organisations

Another major drawback is that there is no participatory observation done so that the answers of the respondents are not verified in the everyday work. In subsequent studies the effect of the introduction of one or more corrective measures could be examined to eliminate this disadvantage.

Interview

Based on information from secondary data sources a research organization is selected where the investigation could happen.

To not to burden the research organization and respondents too much but still cater for the advisability of test DGMM sufficiently thorough we chose to reserve a hour for an interview per respondent. It is expected that distortion by decreasing willingness to participate may happen. For the sake of preserving context of the organization the interviews will be held at the location of the organization. To carry out the investigation a quiet environment on location in the organization is requested to conduct the interviews.

To increase the credibility of the research we chose to interview each respondent separately. The main reason is that maximum attention to the contribution of the respondent is achieved in a one-on-one conversation. The respondent will feel freer to discuss the issues. The conversational form of one-on-one interview is also important to register as many non-verbal cues of the respondent.

In Addition, the following measures are taken to protect the internal validity. When selecting participants for the semi-structured interviews attention will be given to what extent participants:

- Have been active in the organization for a longer time so that their history counts in the judgment
- Experience no positive or negative effect or research experience in their functioning
- Are confronted with the same DGMM in order not to have differences in readings by abnormalities of the measuring instrument
- Intend (not) to leave the organization in the short term
- Undergo interviews reasonably simultaneously to filter out effects of organizational developments in research

Prior to the interview to each respondent is explicitly asked to consent to the use of the data. This by signing an information form by respondent and researcher. Only after obtaining the consent the interview continues.

To leave no confusion in conceptualization we chose not to send the respondents detailed information in advance. Thus, the very first responses to the measured themes is observed which may be useful in adjusting the design and in repetition of the studies.

To introduce the topic data governance and this research an information sheet is drawn for respondents and other interested parties as shown in Annex IV Interview Protocol. At the beginning of the interview, the purpose and usefulness of the research is explained on the basis of this information sheet.

In the interview the DGMM functions as a starting point. Data is collected for each DGMM element (level, dimension, or qualifying criterion). This by asking question and answer per DGMM element that make it possible to draw conclusions about the importance of and the relationship between DGMM elements (part question I). Also a question per DGMM element is asked to identify additions to the DGMM to grow in data governance (Part II question). The next two questions are operationalized per DGMM element:

A. This is Important and why?

This question is asked with the aim to find out practical experiences substantiating the DGMM element. This is necessary in order to confirm the importance of the DGMM element, and the importance of the DGMM as a whole, to reject it or modify the DGMM-off element.

Further, an attempt is made to find out backgrounds or argument of the Importance of the DGMM element. This is necessary in order to gain insight in support of the element of the DGMM and the DGMM as a whole.

B. How to improve this element and why?

This question is asked to identify insights for recommendations for organizational growth in data governance.

Discovered insights have to be incorporated into theoretical models which are to be enshrined in the literature, which serve as recommendations for further research.

The collection of data is done with the operationalized questions about each element as shown in the interview form as part of Annex IV *interview protocol*.

Per qualification is asked for critical incidents as specific experiences which are useful for the investigation. Further more, it is also asked to illustrate certain statements with documents for reasons of triangulation. Afterwards the collected data is fed back to the respondent for verification and addition, with or without additional documents.

The interviews will be held according a standard method described in the following interview protocol.

1. As a first step, the consent form is signed and discussed.
2. As second step follows processing of the interview and the DGMM and the under lying themes are introduced on the basis of the information sheet in annex IV interview protocol.
3. As third the questions from the interview form as shown in the attachment interview protocol are imposed on the respondent. While answering the questions the DGMM and the under lying themes are discussed. The resulting answers are recorded on the interview form. And the discussions and debates of the themes are noted.
4. As fourth the continuation of the investigation is explained, the respondent is thanked for his/her contribution and agreed is how to feed back the collected data.

The survey data will be anonymized after the interview by registering context information of the organization separately from interview data and not disclosing the key between them.

3.3 Reliability and Validity Data Collected

The reliability of the collected data will be judged on the criteria of Yin (2008): reliability, internal validity and external validity or generalizability. In addition also for credibility and logical reasoning volgens Saunders M et al (2013).

Reliability

Qualitative research is done and conclusions are drawn on the basis of knowledge, insights and opinions of various experts to achieve better reliability. Opportunity is given to free expression of ideas and insights. At the same time the investigation is limited to the research of three experts in one organization. The disadvantage is that the scope of the investigation is limited. The depth of the investigation is served by the qualitative approach to empirical research. There is opportunity for reflection and applying nuances and new insights to the DGMM. In Addition, each section examines and discusses what can provide a richer picture. The disadvantage is that the draft is limited to three experts. The reliability of the data collected has been improved by the respondents reducing bias by interviewing more than one respondent.

Further research of this study could increase the reliability of the results further, i.e. when another researcher repeats this research and thus reduces observer bias. In this study, observational bias is reduced displaying quotations literally and taking a neutral stance during the interviews.

internal validity

A high degree of internal validity will be achieved with the deepening of topics and apply various angles.

A potential threat to the internal validity is limited expertise of the respondent, respondents bias, because it is used too much from a single expert to control all dimensions or DGMM. The same applies to the everpresent limitations of the discretion of the investigator, the researchers bias.

generalizationability

The external validity or generalizability is increased by approaching governance experts in various dimensions or data.

To reduce the contrast in generalizability with survey samples, the case study of a specific case is carried out with several respondents in an organization. As a result, an organisation situation is examined from the point of view of different persons.

The outcomes of the study are also generalizable because of an association with existing theory. The new theory of DGMM is based on existing theory in the literature. This theory will be tested in practice. For this the connection between existing and new theory is proofed and evidence arises for generalizability of the results of the investigation.

Because of the time available the research is conducted at only one organization, which limits the generalizability of the results. This gives rise to carry out the same investigation for several organisations. In subsequent studies, the generalization can also be improved by online quantitative research with DGMM as questionnaire for which many respondents can be invited to participate in the study.

Another disadvantage of this form of investigation is that it is a snapshot in time putting the generalizability under pressure. This can be remedied by repeating the examination later on. The research is carried out in the context of a Dutch company that, although it operates internationally. Possible outcomes are not entirely valid for a non-private, non-Dutch or non-Western culture. This could be improved by further research within a public authority in another country or another culture.

Credibility

The credibility of the research increases by one-on-one interviews with respondents where they can express themselves freely. This is much less possible in other types of interviews like in a phone call, a group or by filling out an online questionnaire.

The disadvantage of the choice for an individual interview opposed to a group of experts is that it is not possible to react to each other and discuss topics in order to arrive at correspondence on concept formation. Future research could take the form of a group interview.

Another disadvantage is the difference in experience of the respondents. Not every respondent shall be an expert in every field. Thereby consistency in DGMM be underestimated. Further research can raise this disadvantage by consulting more experts.

As the researcher himself is an expert of the dimensions of data governance the risk of misunderstanding about the activities of the respondents, the researchers bias, is reduced. The study therefore can better focus on how data governance is designed in the research organization.

By understanding and knowledge the trust of respondents will easily grow which facilitates some deeper penetration into the soil of the processes. However, there is a risk that both researcher and respondent plunge too quickly and too deep into the art as they are both working in the field. The risk is that aspects of the discipline, which are seen as obviously for professionals, are overlooked.

Logical reasoning

For the logical reasoning and assumptions to withstand the test of criticism as much as possible, the following measures have been taken:

- The study population was made up of various experts.
- For the analysis of the data a deductive method of analysis is used according Yin (2008).
- The (provisional) conclusions will be fed back to the experts interviewed to obtain their feedback.

3.4 Data Analysis

Because the survey and the collected data are qualitative in nature, qualitative data analysis is chosen. The approach of the empirical research is deductive what makes that the primary approach to qualitative analysis is also deductive. But during the investigation, it is well possible that there will be found new themes during the discussion of the DGMM. These new themes are explored with the inductive approach.

Each DGMM element is test according the following steps [Yin (2008)]:

1. Design propositions on theoretical basis (already happened in literature review resulting in the DGMM model)
2. Collecting data in case study using semi-structured interview
3. Compare collected data and make theoretical assumption and draw conclusions
4. If necessary, adjust theoretical assumption.

With this method, it is to be expected that the dimensions, qualifications, levels and criteria of the DGMM are adapted or supplemented as a result of the outcome of the interviews. Or otherwise, the validity of parts of the DGMM is confirmed.

Because the DGMM gives the interview categorized structure we did not chose for the technique or transcribing and coding interview recordings. Instead analyzing the given answers for each DGMM element is chosen. Based on the responses from the three interviews conclusions are drawn per DGMM element about its validity or that it deserves a feature adaptation. The same is done for consistency within the DGMM.

If at least one expert confirms a DGMM element and supports it by a practical example the DGMM element is considered confirmed. A difference between a denial or confirmation of a DGMM element consists out of that one expert can and the other expert can not make practical example.

When an expert needs explanation of a DGMM element caused by defective explanation or lack of expertise, the confirmation of this element DGMM is not seen as fully recognized in the evaluation and confirmation is not counted. Based on the notes on the new themes DGMM is adjusted (sub-question I) or additions are listed on the DGMM (sub-question II) as recommendations for further research.

4. Research Results

In this chapter the results of the empirical research are given. The research in which the DGMM has been tested in practice to prove its design is adequate as an assessment tool for determining organizational maturity or data governance.

4.1 Global description research

The research data consist of responses to the operationalized questions in the DGMM in Appendix III. These responses consist of arguments and reasons, but mainly from relevant examples which happen repeatedly within the research organization. Further advice and remarkable statements from the experts were noted during the interviews as quotes. Also the score of the assessment is included.

In addition, information is collected about the research organisation which forms the context of the research. This context is important to better interpret the resulting research data.

4.2 Background research organization

Data Governance within the research organization

How Data Governance is setup in the research organization can be characterized as follows.

- At the time of the investigation the examined organization is engaged engaged in organizing data management, data quality and data governance across the organization for two years. Back then an expert in the dimensions of DG was engaged and at the moment there are plans to expand the team with several members more, like data stewards. For this there is a first inventory of the status of the organization in the field of data management and data governance. This is done by capturing and documenting the existing Business Objects and the Corporate Data Dictionary. Next there is a data management and data governance strategy formulated. And the organisation has started to realize 26 individual plans to improve data and its organization.
- The strategy give attention mainly to the following topics:
 - o Connectivity and synchronization
 - Integration issues between departments
 - Shaping ERP system by compiling global data
 - Growing into adulthood for 'maintained' and 'monitored' interfaces
 - o Community
 - o Ownership for data quality delegated to departments
 - o Drafting Data definitions for serving Business Intelligence (BI) reporting
- Capturing and sharing of data between different companies is organized at group level. There'd rather interfaces between systems than made to work in one system. At the moment there is mostly manually information exchanged with structured text files (CSV). There are no automatic interfaces yet. Documentation of systems and data is captured at the source
- A central reporting point for Data Governance, Data Management and Data Quality questions and issues via the intranet is used.

- A project was started to select a technical application for performing for Data Governance, Data Management and Data Quality.
- A number of qualifications are addressed strategically. Another number of qualifications are addressed case by case or in parts. For most qualifications is a planning but the final maturity stage will be reached much later, and only for a number of relevant qualifications.
- There is a lot of product information which is not available in digital form. The organisation is working to digitize non-digital documentation-which data can be accessed digitally.
- "*Standardised product data forms data assets of strategic value for the company and these are independent of operating systems or correct tooling.*" This citation reflects the design of the ICT division, all which is split into an Information Technology and Information Management department.

The presence of a data management maturity model, the presence of experts with knowledge of the dimensions of data governance and effective implementation of data governance enable the organization to test the DGMM. It should be noted, however, that the organization is not at the highest level of maturity, which has somewhat limited the validity of the claims.

Respondents

Three respondents are interviewed, all experts and working in multiple dimensions of data governance.

The first respondent holds the position of Master Data Manager. He has experience with data management in several organisations in the Netherlands and abroad. He holds a masters degree in information management and is familiar with maturity models. He himself introduced a maturity model for master data management in the past and continued to use it. During the interview was noticed that very recent developments in literature included in the DGMM were not included in the maturity model used in the research organization, being 2 years old. For example, the fifth maturity level 'Optimizing' was new. Same happened for the dimension Governance, Risk Management and Compliance (GRC). Both level and dimension were referred to as relevant.

The second respondent holds the position of Application & Information Architect. He holds a bachelor's degree in engineering and has many practical experience in ICT built up in its own organization and with other organizations in the Netherlands as a consultant.

The third respondent is the manager of the Business Intelligence department (BI). She holds a master's degree in management and years of experience within the organization. Being responsible for the Business Intelligence department (BI) she is interested in good data governance.

Respondents are expert in the dimensions of data governance displayed in Table 6 Coverage *dimensions of data governance by experts.*

Tabel 6 Coverage dimensions of data governance by experts

| Dimensions of Data Governance | Expert 1 | Expert 2 | Experts 3 |
|--|----------|----------|-----------|
| Governance, Risk management & Compliance | v | | v |
| People | v | v | v |
| Processen | v | v | v |
| Technology | v | v | |
| Data assets | | v | v |
| Business Alignment | v | v | v |
| Organisatie | v | | v |
| Data management | v | v | |

The three respondents interviewed are all experts in multiple dimensions of data governance and together they have knowledge of all dimensions. The education level and work experience of the respondents in the relevant dimension were more than sufficient which is relevant for determining multiple examples of all DGMM elements. There are striking similarities observed between the individual reported examples and description of the organization. That made it possible to examine the whole DGMM and assess its relevance. With separate interviews the respondents bias was reduced. This provides a high reliability of the results.

Context research organisation

During the interviews and visits at the research organization the following notable quotations related data governance are observed. The quotes are usually related to the practical context of the examined organization.

- Quote 1: "For data governance responsibilities for data are distributed over the organization."
- Quote 2: "Data Governance is about aligning the management of data."
- Quote 3: "Often is (functional) management oriented towards applications, while it is better to align it with data. For example the responsibility for client data that's stored in multiple applications."
- Quote 4: "Previously DG was based on the business information model, nowadays it is based on the business model which better reflects the perception of the business."
- Quote 5: "Business Intelligence (BI) as an interested party is a driver for Data Governance."
- Quote 6: "Meta data management follows the same trend as master data management and is important for Business Intelligence (BI) as the basis of Key Performance Indicator (KPI) reports."
- Quote 7: "Information and knowledge from projects is not transferred consciously and disappears because projects are inherently finite."
- 8 quote: "The effectiveness of innovation is measured in the area of the data assets in savings or production costs"
- Quote 9: "Data assets are not assessed because no problems have occurred so far."
- Quote 10 "Governance, Risk Management and Compliance returns especially into compliance"

These ratios are an indication That data governance is setup within the research organization.

Organization Assessment with DGMM

During the interviews, all DGMM elements are discussed. But due to time constraints not all DGMM elements separately collected relevant examples. Nevertheless, for at least one each qualification a sample was noted, sometimes several.

There was a substantiated estimate for each classification of the maturity level of the organization. And there's a planning for the realization of the next stages of maturity, unless it wasn't considered relevant for every qualification.

Applying the DGMM at the time of the interviews actually created an organizational assessment of organizational maturity of data governance. This is done as a practice test for application of the model as DGMM organizational assessment tool. The results of this assessment can be found in Annex V *DGMM Outcome Assessment*.

The result of the assessment is that the research organization scored for data governance maturity level for all dimensions predominantly level two, except dimensioning GRC-which scored mostly level 3. Respondents acknowledged the score and confirmed the outcome.

Therefore DGMM can be used in practice as a measuring tool to assess organizational maturity data governance.

4.3 Results sub-question I

The first exploratory subquestion investigates how the DGMM can be tested as a measuring instrument for assessing organizational maturity in data governance. To that end is asked whether a DGMM element (a) is relevant and why and (b) how to improve and why. Summary of the research shows the following results.

Confirmation of the DGMM:

- All levels, dimensions, qualifications and criteria are acknowledged by one or more experts from their own maturity model for master data management and confirmed on the basis of practical examples.
- The fifth organizational maturity level 'Optimized' from the DGMM is seen as a new addition to the own maturity model of the research organization, which had four maturity levels. And this fifth level was seen as valid and relevant.
- The Governance, Risk Management and Compliance dimension was seen as highly relevant in practice, mainly the Compliance aspect:
 - o The organization is ISO certified and meeting international quality standards
 - o The organization and its subsidiaries comply with financial reporting requirements in different countries
 - o Holding subsidiaries comply to rules for production that are imposed by the governments of the various countries
 - o Subsidiaries keep customer-specific requirements, like the safety demands of several at customers

- A central system for all subsidiaries is planned to enable checking the quality and compliance of parts
- Risk Management and Governance of data and master data management are not completed within the research organization according to the respondents.
- The research organization's scores in the assessment are an overall maturity level 2, but for some dimensions level 4. For most of the qualifications a project is planned for the short and long term to increase its maturity levels. Also some qualifications score only level 1. And for some it is wondered whether that subject is ever being developed as qualifications.
- By effectively assessing the research organization on the basis of the DGMM a rating of the level of maturity of data governance results which is confirmed by the respondents.

Amendments to the DGMM:

The research organisation recommends to remove the following elements from the DGMM or change them.

Qualification:

- DG product portfolio can be removed. This because it is not advisable to leave prioritization of work to (internal) customers of DG. And because it is not certain whether insight and transparency into the DG dimension is present. Possibly this qualification is recognized by other organisations.

Assessment criteria:

- Job rotation, this does not occur in the research organization and the experts have no experience with it at other organisations
- Sponsorship by the business is replaced by ownership of the business. This is more contemporary language of the same ie involvement.
- In dimensioning GRC the qualification can be completed with EDP auditing. EDP auditing occurs in the context of the audit of internal control.

Unknown or undisclosed research organization

All dimensions and qualifications of the DGMM model were confirmed with examples from practice by one or more of the respondents. Some qualifications were considered not used, but none of the elements were unanimously considered irrelevant. Table 7 *Confirmed Qualifications* shows which respondents confirmed the qualification.

Tabel 7 Confirmed Qualifications

| Dimensions of Data Governance | Qualifications | Expert 1 | Expert 2 | Expert 3 |
|--|---|----------|----------|----------|
| Governance, Risk management & Compliance | Structure | v | v* | v |
| | Authority | v | v* | v |
| | Controlling | -* | v* | v |
| People | Capability | v | v | v |
| | Policy | v | v | v |
| | Culture | - | - | v |
| Processen | Processes | v | - | v |
| | Service and Product Portfolio | - | - | v |
| | Planning & Monitoring | v | v | v |
| Technology | Technology | v | v | v* |
| | Application Landscape | v | v | v |
| | Data Storage & Distribution Architecture | v | v | v |
| | Business Object Model & Corp. Data Dictionary | v | v | v |
| Data assets | Value | -* | v | v |
| | Innovation | -* | v | v |
| | Assessments | v* | -* | v |
| Business Alignment | Ownership by business | v | v | v |
| | Relationship | v | v | v |
| | Knowledge sharing | v | v | v |
| Organisatie | Functions, roles, tasks and responsibilities | v | v | v |
| | DG Goals, Objectives & Strategy | v | v* | - |
| | DG Tactics | v | v | v |
| Data management | Data management | v | v | v |
| | Data principles management | v | v | -* |
| | Data quality management | v | v | v |
| | Meta data management | v | v | v |
| | Master data management | v | v | v |
| | Data access management | v | v | v* |
| | Data lifecycle management | - | v | -* |

v = conformation, - = denial, grijs = no expertise (zie table 6)

For this DGMM element further explanation was necessary for the expert. By inadequate explanation or by lack of expertise this DGMM element can not fully be taken into account in the assessment

4.4 Results subquestion II

The second exploratory subquestion is to detect additions to the DGMM for further research. For the following elements DGMM was recommended by an expert to further Investigate whether these can be added to the DGMM model.

New dimensions:

- Connectivity and synchronization: concerns integration issues between business units or with other organisaties
- Community: concerns communication with stakeholders on data governance

New Qualifications:

- Drafting data definitions, for example for Business Intelligence (BI) reporting
- Data Harmonization (deduplication)
- Data Profiling
- Degree of (de) centralization
- Key Performance Indicator (KPI) according Service Level Agreement (SLA), for example Corrections

These dimensions and qualifications are not derived from the literature but arise in the practice of data management. These elements can be confirmed in further research in an inductive way.

5. Discussion

This chapter describes the conclusions and findings of the research.

5.1 Interpretation of data

The research data of chapter 2 and 4 are interpreted in this paragraph.

5.1.1 Conclusions literature review

The DGMM is derived from the definition of data governance. And experts have confirmed all dimensions of the DGMM. This also confirms the definition of data governance. There is a nuance: in this research data concerns explicitly digital data.

5.1.2 Conclusions research findings context

The following conclusions can be drawn from the findings of the context of the research organization.

Within the research organization, there are indications that data governance is setup, All which is supported by several at quotes. There are also experts who collectively possess knowledge of all aspects of data governance. And the DGMM is used as a measuring instrument for the assessment of organization maturity of data governance. Nevertheless, the assessment indicates that the research organization is not yet fully mature in data governance. It may well be concluded that the research organization is suitable for testing the DGMM in practice.

5.1.3 Conclusions subquestion I

To answer subquestions I, the following conclusions are drawn out of the research results as summarized in paragraph 4.3:

- The relevance and validity of the DGMM elements separately and DGMM as a whole in the empirical study can be seen in Table 7. All dimensions were confirmed on the basis of examples from practice. All but one of the DGMM qualifications were relevant to the organization, namely product portfolio processes. But this qualification is recognized by other organisations.
- Some of the DGMM criteria are lyrically edited on the advice of the respondents
- GRC has been confirmed as the basis for data governance, especially compliance is seen as a relevant part of DG. This is because there are many requirements for companies and their services and products, both by governments and by customers. This conclusion is important because before Racz (2010a, 2010b) GRC was not previously involved in data governance, even not within the research organization, but it turns out to be important.
- In particular, the dimensions data value and people are not at all known dimensions of data governance within the research organization, but are considered relevant. With more information about the dimensions during the interview, The importance is acknowledged. At the same time the need for explanation shows that a respondent is not an expert in the relevant dimension, which is factored into the survey results.

- Recent developments in the literature are listed in DGMM and considered relevant and valid as the fifth level 'Optimizing process'.
- The assessment showed a clear score, which was confirmed by the respondents and in which the situation of the organization was recognized. From this review of the DGMM as a measurement instrument can be concluded that it is possible to indicate organization maturity or data governance with DGMM in the studied organization.

From the results of empirical research can be concluded that experts in the dimensions of data governance confirm that the DGMM is relevant and valid, after adjustment, as a measure to assess the organizational maturity of data governance.

All dimensions were seen as relevant. All but one were considered relevant qualifications, although some are still unknown in the context of the research organization. All qualifications except one have been identified as growth opportunities in organizational maturity of data governance although not always unanimous for each level of maturity.

5.1.4 Conclusions subquestion II

To answer subquestion II, there are two new dimensions to grow in organisation maturity of data governance organization recommended by one expert, that qualify for further research. These recommendations relate to two new dimensions:

- Connectivity and synchronization: concerns integration issues between business units or with other organisations
- Community: groups of communication with stakeholders on data governance

5.2 Research evaluation

To evaluate the research follows a Strengths-Weaknesses analysis of which conclusions and recommendations are made for further research.

5.2.1 Beoordeling Methode Empirisch Onderzoek

The case study with as aim exploratory research of qualitative nature as chosen method for this empirical research is rated as follows.

- + To explore the scientific unknown concepts the right method is chosen because the case study has delivered much knowledge about data governance and the DGMM.
- + The choice of qualitative research above quantitative resulted in the discovery of new knowledge about data governance.
- + Using the chosen research method has yielded a high internal validity and reliability of the results.
- + By working with the case study of method Yin (2008.2013), theory of literature is tested in practice what results in confirmation of the theoretical model and so reliable research.
- The generalizability of the research method can be improved, although measures have been taken to this improve this like theoretical generalization according Yin (2008), through support with literature and interviews with several at experts.
- Because of the limited time the research was carried out in one organization-which limits the generalizability of the results, although there are several experts consulted

who confirmed each other's ideas, practical situations and the theory of literature. Also Yin (2008) recommends multi-case study over a single case study.

The conclusion is that the chosen research method of exploratory research of qualitative nature in the form of a case study was just to enable knowledge discovery on the unknown subject of data governance. The method results in research with high internal validity, although the generalizability could be better.

Recommendation is to replicate the same research in another organization so that a multi-case study is carried out.

5.2.2 Data collection method

The data collection method is evaluated as follows.

- + As primary data collection method the semi-structured interview is chosen. This research technique proved highly suitable for exploratory research because the DGMM with its operationalized questions forms a semi-structured questionnaire.
- + the choice of the individual interviewing of experts has delivered so much information that DGMM could be tested and be a basis for the definition of data governance based on facts and real-life situations and critical incidents. This provides a high degree of internal validity.
- + Through the use of the DGMM as questionnaire all components of the DGMM, and the internal cohesion between them, are examined as propositions in all three interviews. All parts of the entire model are discussed three times. Because of this there was plenty of time for testing the many propositions in the model and theories about data governance. Respondents had the opportunity to contribute their own ideas and discuss new ideas.
- + The research organization complied with the requirements so it was a suitable research organization and more over internationally active in more than 20 countries on six continents.
- + Repeating the interviews according predetermined steps had a positive effect because nothing was missed during the interviews, and the conversation line was clear line for those involved.
- + Making survey data anonymous by using a signature form has helped the respondents to speak freely.
- ± The choice to confront respondents only with knowledge about data governance and the information sheet during the interview has resulted that some explanation about data governance was needed during interviews. The aim was to not to create confusion about understanding. In retrospect this purpose worked. Examples from practice were brought forward spontaneously Instead that there had been preparation.
- Because of the limited time participatory research is not opted for so that results of the interviews are not experienced by the researcher.

Aanbeveling is participatief onderzoek uit te voeren zodat de onderzoeker zelf de praktijksituaties ervaart. Verder zou in verder onderzoek de respondenten tevoren ingelicht kunnen worden over begrippen van data governance om zich voor te kunnen bereiden op interviews. Mogelijk dat er dan meer relevante praktijkvoorbeelden worden aangedragen. Verder wordt aanbevolen om het onderzoek te repliceren door een andere onderzoeker zodat de onderzoeksresultaten meer generaliseerbaar en betrouwbaarder worden

The conclusion is that the used data collection method of semi-structured interview with experts within the same appropriate research organization has produced a high degree of internal validity, reliability and credibility of the data.

It is recommended to carry out participatory research so that the researcher experiences the practical situations himself. In further research respondents could be informed in advance about terms of data governance to prepare for interviews. Maybe that more relevant examples are contributed.

It is also recommended to replicate the study by another researcher so that the research results become more generalizable and more reliable.

5.2.3 Assessment Data collection method

The data analysis method is assessed as follows.

- + Using the method of analysis for case studies of Yin (2003, 2008, 2013) a high internal validity is achieved because for each theoretically grounded DGMM element is determined in practice whether it is confirmed or rejected. This promotes the logical reasoning, especially because the analytical method is provable and reproducible.
- + With the two operationalized questions for relevance and improvement of each DGMM element is reliably determined the relevance and validity of the whole DGMM.
- This method does not ask specifically for the missing. Completeness of the model is determined separately from the method chosen for subquestion II.

From this it is concluded that use of this data analysis method yields a model in which each DGMM element and the DGMM as a whole is supported substantially. This shows that the DGMM is relevant and credible, and it is structured in logical reasoning.

5.2.4 Assessment Data processing and analysis

The data processing and analysis are assessed as follows.

- + The DGMM was founded in empirical research for all individual components and consistency of its parts.
- + The propositions of the DGMM which are derived from the literature are substantiated on the basis of data from empirical research. These are collected and analyzed by the method of Yin(2008).
- + There is ample room for improvement of the DGMM or recommendations for further research.

It is concluded that the data processing of the empirical study is designed such that the theoretical propositions of the elements of the DGMM and their relationships are confirmed. This confirmation is done on the basis of data obtained from empirical research, which are collected and analyzed according to the method of Yin (2008).

5.2.5 Assessment Research data

The research data are assessed as follows.

- + The research organization has such a knowledge of data governance maturity that it was possible to test the DGMM. Many dimensions were actually completed or plans for realization are present.
- + There are only a few improvements and recommendations for the DGMM. That means that the DGMM sufficiently covers the content of data governance to determine its organizational maturity levels. More over, for each qualifying practice cases are found within the organization that underpin the model. The few practice situations that are contradictory with the DGMM are recorded as improvements or as a recommendation for further research.
- The study should be repeated in order to determine if trends over time can be measured by the DGMM, all which increases the reliability of the DGMM.
- The study was conducted by a single researcher with the risk of observer bias. In this study, observational bias is reduced by noting quotes and a neutral stance during the interviews.
- There was no group discussion with experts in order to discover more nuances or to enrich the conceptualization.

The conclusion is that the DGMM is tested substantive enough in practice to determine that the measuring instrument DGMM has a high internal validity.

To win on internal validity, we recommend a group discussion with experts. It is also recommended to further investigate the recommendations for two new dimensions.

5.2.6 Reflection

Reflecting on the research the following is stated.

- + The research yielded new scientific knowledge about data governance in the form of a definition and a maturity model for data governance.
- + DGMM is a measuring instrument for measuring data governance maturity of organisations in practice.
- The research organization is limited in organizational maturity of data governance and the experts limited in their knowledge and expertise thereof. New and unfamiliar concepts or data governance that do not belong to their own expertise will only be recognized after explanation as theory and in practice. Because the research initially relied upon confirmation by experts with knowledge of the relevant dimension, the influencing effect of respondents on the research results is minimized.
- Incomprehension of a respondent for a DGMM element as dimension, qualification or criteria supplies sometimes 'not relevant'.

- Because the theme DG is new certain themes that are still relevant can be irreproachable.
- Further research is needed to confirm the results of this study and to generalize it.

The conclusion is that new knowledge about data governance is found in the form of a definition and a maturity model as practicable measuring instrument. This new knowledge requires clarification and explanation to recognize it in practice.

Recommendation is to replicate the same research at other organisations to confirm the findings and generalize it.

6. Conclusions & Recommendations

This section answers the research question of the study. The earlier drawn conclusions are summarized in the first paragraph, followed in the second paragraph by a discussion on those conclusions. In the last paragraph follows the recommendations for further research.

6.1 Conclusions

Based on the objective of the study the problem was formulated for which the main question is:

How is data governance maturity assessed?

The answer is that the Data Governance Maturity Model offers a good impetus for assessing organizational maturity of data governance. This response is based on answers to both contextual and subquestions for literature and answers to questions for empirical research. The answers are as follows.

Data Governance

On the basis of literature the definition of data governance is composed. And experts have confirmed all dimensions of DGMM. This also confirms the definition of data governance.

Maturity Model

Based on analysis of the literature, requirements and models are Huner et al (2009), Becker (2009) and Pöppelbuß (2011) are adopted as a method for the preparation of a maturity model for data governance. This method is based on literature about maturity models in the areas of data governance.

Data Governance Maturity Model

Based on literature a maturity model is built with relevant dimensions, levels, qualifications and criteria on how to grow in data governance. A translation was made on criteria from related domains to the dimensions of data governance.

Assessment of organizational maturity data governance

From results of empirical research can be derived confirm that experts on the dimensions of data governance confirm that the DGMM is relevant and valid as a measure to assess the organizational maturity of data governance. All dimensions were seen as relevant. All but one were considered relevant qualifications, although some were still unknown in the context of the research organization. All qualifications except one have been identified as growth opportunities in organizational maturity of data governance although not always unanimous for each level of maturity.

Recommendations for organizational growth in data governance

There are two new dimensions to grow into maturity in data governance organization recommended by experts that qualify for further research.

Research evaluation

From evaluation of the investigation is concluded that with the research method used the DGMM is substantially and entirely tested in practice. This in the form of semi-structured interviews with experts within the same, suitable research organization. Herewith the DGMM is relevant, credible and it is structured in logical reasoning. On this basis, it is concluded that the DGMM has a high internal validity, reliability and credibility. But because the study is conducted in one organization the generalizability not so high, despite theoretical generalization from the literature. Further the chosen research method returned new knowledge about data governance. Namely a definition and a maturity model as useable measure for practice.

6.2 Discussion

From the DGMM only one qualification is not recognized as relevant. And there are only two new dimensions mentioned. Thus the question arises whether the DGMM is complete. This would qualify for further research to confirm or extend the DGMM.

6.3 Recommendations for Future Research

Based on the results of the above study, the following recommendations for further research are formulated. The experts have given recommendations to grow in organizational maturity which qualify for Further investigation.

To increase the internal validity of the DGMM a group discussion with experts is recommended. Also repeating the survey at other organisations contributes to this. Further is recommended to do participatory research in which the researcher experiences the practical situations. And in further research respondents could be informed about terms of data governance in advance to prepare for interviews. It is expected that that will be trigger more relevant examples.

To increase the generalizability and reliability of the DGMM it is recommended to repeat the same examination intime, by another investigator and at other organisations. This forms a multi-case study to confirm the results of this study and generalize it.

7. Reflection

7.1 Meaning research outcomes

First It is special to the ascertain that his research yielded a validated instrument that proves useful in practice. More about, there is new knowledge created in a young field that's still developing to add to literature.

At the same time during the investigation occurred that scientific knowledge is still lacking in the practice of the Investigated dimensions. Within this part of the field there is a lot of work on the basis of skills, rules of thumb and methods formed in practice. That means that there is still much to research scientifically.

During the research process the limitation of thesis research was revealed. There was limited time available for empirical study what limited the scope of the investigation. Especially the generalizability would be enhanced if the investigation is extended to other organisations.

7.2 Processreflection

The following learning experiences are gained in the research project.

- When looking for a research organization a high demand for knowledge about data governance occurred. Thereby was noticed that there is little knowledge about DG. At the same time during the study was notices that scientific research takes time. However, there is a clear need for further research.
- The implementation of the empirical study took a few months because it coincided with the summer holiday period so that the availability of the experts and the researcher was limited. Therefore it is advisable to plan empirical research outside the holidays.
- My own intention was to set up a wider research. Inexperience in research was the cause of this. Only on direction of the supervisor it became clear how to carry out the final research in correspondance with scheduled time and planned size.
- Studying publications during the study helped a lot in the design of the study. Through several choices in research methods, each research gets results in a different way. Recognising this opened up the possibility of applying different research methods and techniques in this research. This improved the quality of the research. From this we can learn that adding structure with known methods improves the quality of research.

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Appendix I Definition Dimensions Data Governance

| | Definitie | Bron |
|--|---|--|
| Governance | Governance involves how the board and management are structured and what are their roles and responsibilities. Governance also means that appropriate procedures are established and communicated. In addition, these policies and procedures are to ensure that these are followed. | Batenburg (p45,2014) |
| Risk management | Risk management aims to mitigate and minimize the impact of risks. There is always a tradeoff between risk and chance. It is important how these risks are identified, analyzed, evaluated and treated, in short: managed. | Batenburg (p45,2014) |
| Compliance | Compliance indicates that an organization operates in accordance with existing laws, regulations, protocols, standards and specifications. This is guaranteed during the design of controls. | Batenburg (p45,2014) |
| Governance, Risk management & Compliance (GRC) | GRC is an integrated, holistic approach of enterprise-wide governance, risk and compliance. It ensures that an organization is acting ethically and in accordance with its risk flavor, internal policies and external regulations through alignment in strategy, processes, technology and people, thereby enhancing efficiency and efficacy. In itself is GRC not new. As individual cases, governance, risk management and compliance were always fundamental concerns of the business and its leaders. What is new is the growing perception of GRC as an integrated set of concepts that, when applied holistically, can add significant value and deliver competitive advantage. | Racz(p8.2010 a), Gregory (2010a) Batenburg (2014) |
| Process, People & Technology | Process, People and Technology are the areas of interest (Key Process Area's), both within data quality management and data governance. See also definition GRC above. | Pee(2009), Batenburg (p46,2014) Pöppelbuß (2011), Otto(2013) |
| Asset Value | (Used) Data are a valuable business asset that needs careful protection and the value should actively be managed and / or "governed" (= controlled). | Gregory(2011), Otto(2013) |

| | | |
|--------------------|---|------------------------------|
| Business Alignment | Alignment between user organization and IT. | Luftman (2003), Curley(2008) |
| DG Organisation | <p>DG organization has two dimensions:</p> <ul style="list-style-type: none"> - DG goals include formal (business and IT) and functional goals. - DG structure is determined by locus of control (functional and hierarchical) form and roles & commissions | Otto(2011a) |

Annex II Quality and design principles maturity models into BPM

In scientific literature, the following quality and design principles of maturity models in business process management (BPM) found.

Huner et al (2009) suggest the following **quality requirements** on a maturity model:

1. A maturity model is not only an assessment tool but offers usefull guidelines to achieve a higher maturity level.
2. Vagueness in the investigated dimension must be resolved by use of assessable parts.
3. As growth model, the model should also be applicable in starting situations, level 0.
4. Different maturity dimensions have to be distinguished, (CMMI distinguished only the dimension).
5. An informed assessment should include clear, measurable guidelines and tools.
6. A self-assessment should be supported.

Huner et al (2009) describe the following components of a maturity model:

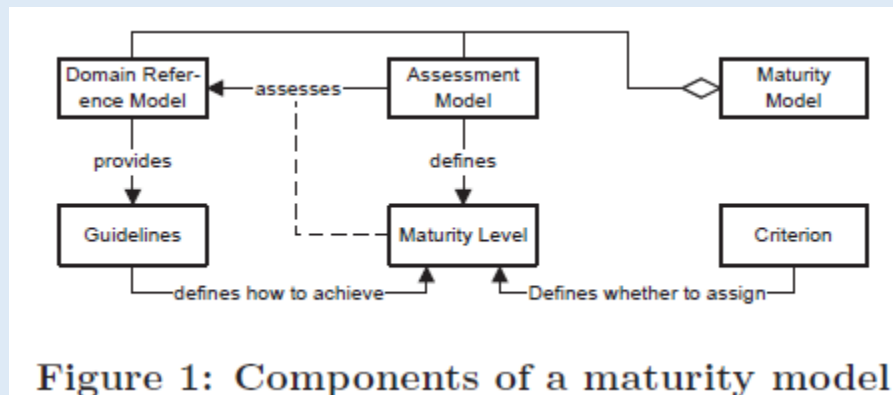
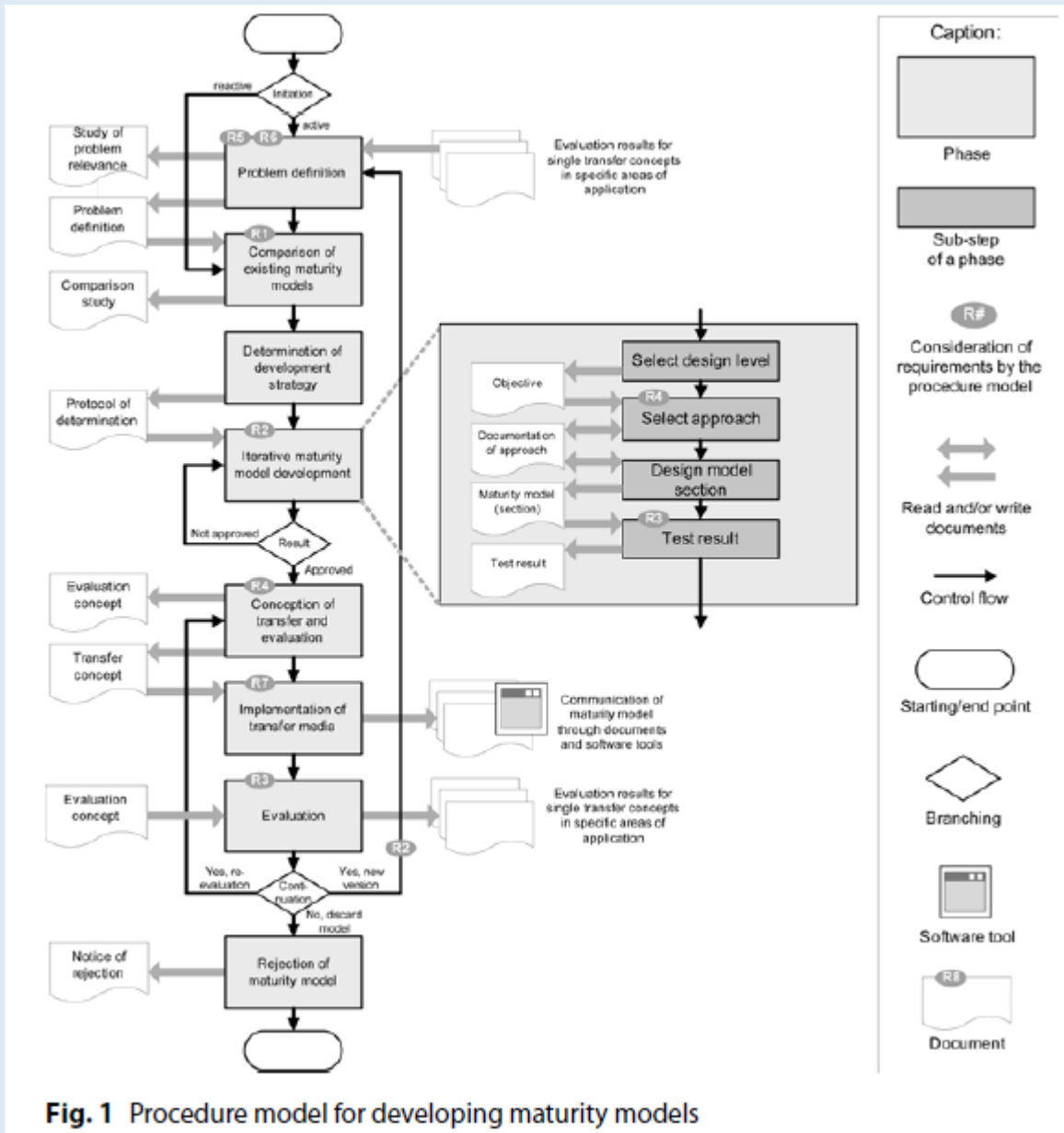


Figure 1: Components of a maturity model

Becker (2009) provides the following design principles :

1. That iterative improvements happen step by step.
2. Improvements are evaluated.
3. Improving happens according different scientific methods.
4. Improvements are innovative and relevant.
5. The domain, application conditions and benefits to achieve are determined in advance.
6. Presentation of results are targeted towards users.
7. All steps in the model, stakeholders, methods and results should be described in detail.

Becker (2009) gives the following procedure for the preparation of a maturity model



Explanation

- R1 - The model must be relevant compared to its predecessors
- R8 - The design method is based on a comparison of previous methods
- R2 - Iterative method, the design with the highest level of abstraction determines the specific architecture, multi-dimensional architectures are customary
- R4 - Methods for compiling assessment criteria are determined for each dimension, eg based on success factors.
- R3 – In evaluation completeness, consistency and adequacy are to be testing.

- R4 - documentation can be created for publication, but also useful software tools to carry out discriminatory tests in experiments
- R7 - The model implementation must be described, like the self-assessment tools
- R3 – An evaluation demonstrates the utility of the MM in e.g. a case study or through web-based forms that validation of the model can be done by many users
- Optionally, the models usefulness can be rejected by too many negative results
- The model must be updated to changing circumstances.

The preparation of a maturity model synthesis follows steps:

1. Problem definition
2. Comparison of existing Maturity Models
3. Determination of development strategy
4. Iterative development MM
5. Publication and evaluations: software tool

Becker (2009) describes his resulting maturity model in the next figure.

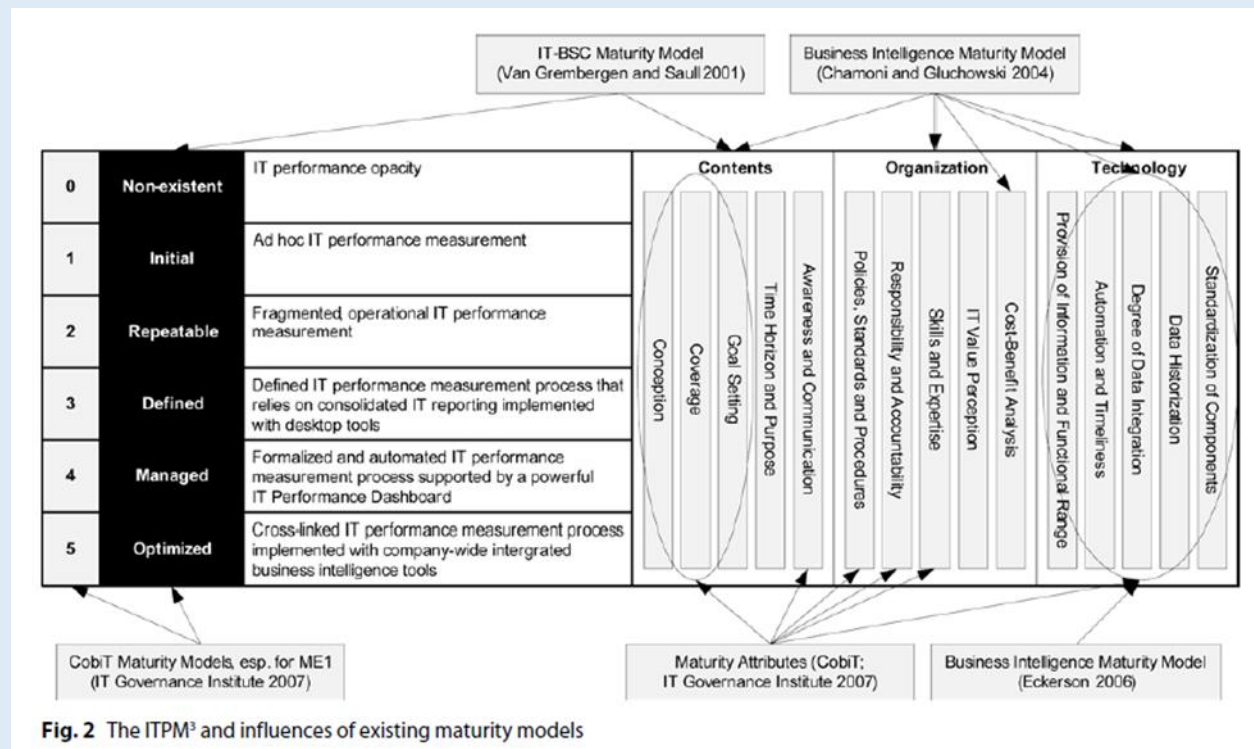


Figure 28

Pöppelbuß (2011) gives the following design principles.

| Group | Design Principles | |
|------------------|-------------------|--|
| (1) BASIC | 1.1 | Basic information a) Application domain and prerequisites for applicability b) Purpose of use c) Target group d) Class of entities under investigation e) Differentiation from related maturity models f) Design process and extent of empirical validation |
| | 1.2 | Definition of central constructs related to maturity and maturation a) Maturity and dimensions of maturity b) Maturity levels and maturation paths c) Available levels of granularity of maturation d) Underpinning theoretical foundations with respect to evolution and change |
| | 1.3 | Definition of central constructs related to the application domain |
| | 1.4 | Target group-oriented documentation |
| (2) DESCRIPTIVE | 2.1 | Intersubjectively verifiable criteria for each maturity level and level of granularity |
| | 2.2 | Target group-oriented assessment methodology a) Procedure model b) Advice on the assessment of criteria c) Advice on the adaptation and configuration of criteria d) Expert knowledge from previous application |
| (3) PRESCRIPTIVE | 3.1 | Improvement measures for each maturity level and level of granularity |
| | 3.2 | Decision calculus for selecting improvement measures a) Explication of relevant objectives b) Explication of relevant factors of influence c) Distinction between an external reporting and an internal improvement perspective |
| | 3.3 | Target group-oriented decision methodology a) Procedure model b) Advice on the assessment of variables c) Advice on the concretization and adaption of the improvement measures d) Advice on the adaptation and configuration of the decision calculus e) Expert knowledge from previous application |

Table 1. A framework of general design principles for maturity models

Figure 29

- 1.2 The path to maturity should be described with therein the change that needs to happen. High level steps are for external stakeholders, low-level steps for internal stakeholders.
- 1.3 Constructs and activities should be defined by their relationship to the domain
- 1.4 The relationship between construct and activities must also be described, possibly in groups.
- 2.1 criteria are interrelated, precise and distinguishing between levels
- 2.2 Advised is how to assess and how to apply criteria
- 3.1 Prescriptively best practices for improvement of action are given

- 3.2 Prescriptively a weighting model is given to decide which are alternative priorities in maturation.
- 3.3 A procedure model should be in place which stipulates the sequence of improvement steps. And existence of previous applications are also requested.

Pöppelbuß (2011) additionally suggests the following quality standards :

1. Maturity models combine state descriptions, which are models for distinct maturity levels and activities, and which are methods for assessment, indicating need for action and the selection or improvement measures.
2. Maturity models consist of maturity levels (level) indicators, dimensions, qualities (= qualifications (Otto, 2011)) ordered in dimensions, descriptions, process areas, activities per process area and a description of each activity.
3. Domain reference models and assessment models are different from each other.
4. A maturity model should be valid, reliable, cost-efficient, underpinned empirically, have software tool support, implement standardization, possess flexibility / adaptation, possibility of benchmarking, make certification possible, reveal potential improvements and prove relation between model adoption and performance.
5. Design principles for form and function include design principles for
 - basic model (domain model)
 - descriptive model (assessment tool)
 - prescriptive model (improvement guidelines)

Otto (2013) mentions that:

- A maturity model consists of a domain model and assessment tool.

Annex III Data Governance Maturity Model (DGMM)

Elaborated DGMM frameworkk

The DGMM consist out of the frameworkas shown hereunder in table 1 Data Governance Maturity Model. For the research of the DGMM are for each cell the following questions asked :

- A. Is this of interest and why ?
- B. How can this better and why ?

The operationalized questions are given hereunder in a table per dimension.

table 1 Data Governance Maturity Model

| Dimensies van Data Governance | Kwalificaties | Without process | Beginning process | Established process | Managed process | Optimizing process |
|--|---|-----------------|-------------------|---------------------|-----------------|--------------------|
| Governance, Risk management & Compliance | Structure | | | | | |
| | Authority | | | | | |
| | Controlling | | | | | |
| People | Capability | | | | | |
| | Policy | | | | | |
| | Culture | | | | | |
| Processen | Processes | | | | | |
| | Service and Product Portfolio | | | | | |
| | Planning & Monitoring | | | | | |
| Technology | Technology | | | | | |
| | Application Landscape | | | | | |
| | Data Storage & Distribution Architecture | | | | | |
| | Business Object Model & Corp. Data Dictionary | | | | | |
| Data assets | Value | | | | | |
| | Innovation | | | | | |
| | Assessments | | | | | |
| Business Alignment | Contribution to business | | | | | |
| | Relationship | | | | | |
| | Knowledge sharing | | | | | |
| Organisatie | Functions, roles, tasks and responsibilities | | | | | |
| | DG Goals, Objectives & Strategy | | | | | |
| | DG Tactics | | | | | |
| Data management | Data management | | | | | |
| | Data principles management | | | | | |
| | Data quality management | | | | | |
| | Meta data management | | | | | |
| | Master data management | | | | | |
| | Data access management | | | | | |
| Data lifecycle management | | | | | | |

Table 2 Dimension Governance, Risk Management & Compliance (GRC)

| Qualification | No process | Beginning process | Established process | Managed process | Optimizing process |
|---------------|--|---|--|--|---|
| Structure | No Governance, Risk management & Compliance process in place | Little attempt to standardize Governance, Risk management & Compliance processes | Similar Governance, Risk management & Compliance processes are standardized across parts of the organisation | Similar Governance, Risk management & Compliance processes are reviewed across the organisation | Similar Governance, Risk management & Compliance processes are standardized across the organisation |
| Authority | Ad-hoc authority, no DG officer, no steering committee | DG officer is appointed, without any power, steering committee meets informally when needed | DG officer reports directly to the board and has the power, formal steering committee meets regularly | DG officer has authority to enact changes & users do not oppose, steering committee has proven to be effective | DG officer works closely with the board, users share the power in a balanced way, steering committee includes external partners |
| Controlling | No GRC control process or results analysis, ad hoc reporting | GRC controls are requirements, results reactively reviewed, internal reporting on paper | GRC Controls cause review policies, results analysis process in place, external automated reporting | Users feel safe with GRC control process, organisation wide results analysis, external audits are conducted | users trust GRC control process, results analysis integrated with R&D, stakeholders are alerted with automated system |

Tabel 3 Dimension People

| Qualification | No process | Beginning process | Established process | Managed process | Optimizing process |
|---------------|--|---|--|---|--|
| Capability | Unmanaged | Technology Supplier & Utility provider | Technical expert | Strategic Business partner | Strategic core competency |
| Policy | No retention program, poor recruiting, no internal opportunities | DG hiring focused on technical skills, Training & job rotation occasionally at unit level | Technology and business focus; retention program, Training & job rotation for unit management | Formal program for hiring and retaining, Advanced training & job rotation across enterprise | Effective program for hiring and retaining, Advanced training & job rotation with partners |
| Culture | Organization and its people are not aware of the need to formally manage DG, Changes discouraged | Management is aware of the need for formal DG, Changes encouraged at unit level | Management is aware of its role in encouraging DG, basic DG strategy is in place, Individual DG roles are defined, Incentive systems are in place, Change programs at unit level | Common strategy and standardized approaches towards DG, incorporated into the organizational strategy, Organizational standards, Change programs at corporate level | Culture of DG is institutionalized, Change programs with partners |

Tabel 4 Dimension Processes

| Qualification | No process | Beginning process | Established process | Managed process | Optimizing process |
|-------------------------------|--|---|---|---|---|
| Processes | No formal processes to capture, share and reuse organizational DG issues | DG processes critical for performing routine task are documented and mapped | Processes for DG are formalized, metrics are used to measure the increase in productivity due to DG | Quantitative measurement of DG processes (i.e., use of metrics) | DG processes constantly reviewed and improved, easily adapt new business requirements and integral part of organization |
| Service and Product Portfolio | No DG service & product portfolio in place | DG Portfolio of critical services & products in place | DG Portfolio covers basic services&products | DG Service&product portfolio is being monitored | DG service & product portfolio is being shared & improved |
| Planning & Monitoring | No DG planning & monitoring | DG planning & monitoring attempts | Integral DG planning & monitoring | DG planning & monitoring proces is managed | DG planning & monitoring process is integrated & shared with stakeholders |

Tabel 5 Dimension Technologie

| Qualification | No process | Beginning process | Established process | Managed process | Optimizing process |
|---|--|---|--|--|--|
| Technology | No specific DG technology or infrastructure in place | Pilot DG projects are initiated (not necessarily by management) | Basic DG Infrastructure in place, some enterprise level DG projects are put in place | Enterprise-wide DG systems are in place and usage at a reasonable level. | Existing DG infrastructure is continually improved |
| Application Landscape | No formal planning or documentation | Attempts for planning & documentation at unit level | Formalized planning & documentation for basic elements at organizational level | Controlled & audited process of planning & documentation | Automated planning & documentation process, reviewed with partners |
| Data Storage & Distribution Architecture | No formal planning or documentation | Attempts for planning & documentation at unit level | Formalized planning & documentation for basic elements at organizational level | Controlled & audited process of planning & documentation | Automated planning & documentation process, reviewed with partners |
| Business Object Model & Corporate Data Dictionary | No formal planning or documentation | Attempts for planning & documentation at unit level | Formalized planning & documentation for basic elements at organizational level | Controlled & audited process of planning & documentation | Automated planning & documentation process, reviewed with partners |

Tabel 6 Dimension Data Assets

| Qualification | No process | Beginning process | Established process | Managed process | Optimizing process |
|---------------|--|--|--|---|---|
| Value | No or ad hoc practices | Total Cost of Ownership | Simple ROI & DG Business Case Discipline | Options/Portfolio management | Optimized Value (Investment Return) |
| Innovation | None | Rare; effectiveness not measured | Rare; starting to measure effectiveness | Rare; frequently measure effectiveness | Practices and measures well established |
| Assessments | No assessments, investments measured rarely, if ever | Only when there is a problem, technical cost measured, metrics rarely reviewed | Assessments becoming routine occurrence, reviews, act on technical ROI metrics | Routinely assess and act on findings, also measure customer value | Routinely assessments, act on, and measure results, balanced scorecard, includes partners |

Tabel 7 Dimension Business Alignment

| Qualification | No process | Beginning process | Established process | Managed process | Optimizing process |
|--------------------------|---|---|--|---|---|
| Contribution to business | No sponsoring, considered costs of doing business | Often have a senior sponsor or DG champion, becoming an asset, enables business processes | "DG and business | Contribution to business | No sponsoring, considered costs of doing business |
| Relationship | DG takes all the risks & IT receives no rewards, Conflict and mistrust, use only as needed, communication business to IT only and formal, relationship is not managed | DG takes most risks with little reward, relationship managed on an ad hoc basis & agreement with units, communication one-way & somewhat informal | DG and Business start sharing risks&rewards & relationship processes exist but not always followed, DG becoming a valued service provider & enterprisewide agreements & knowledge transfer facilitated, communication two-way & formal | Risks, rewards always shared & relationship processes exist and are complied with, long-term partnership & enterprise wide & trust & confidence achieved, communication two-way & somewhat informal | Managers incented to take risks & relationship processes are continuously improved, partner & trusted vendor or DG services & relationship with other partners, communication two-way & informal & flexible |
| Knowledge sharing | Casual conversation and meetings, no benchmarking | Some structured sharing emerging, newsletters, reports, group e-mail, sometimes benchmark informally | Structured around key processes, training, departmental meetings, May benchmark formally, seldom act | Formal methods, sharing at all levels, Routinely benchmark, usually act | Formal sharing with partners, learning monitored, Routinely benchmark, act on, and measure results |

Tabel 8 Dimension Organization

| Qualification | No process | Beginning process | Established process | Managed process | Optimizing process |
|--------------------------|---|---|--|---|---|
| Contribution to business | No sponsoring, considered costs of doing business | Often have a senior sponsor or DG champion, becoming an asset, enables business processes | DG and business | No sponsoring, considered costs of doing business | Often have a senior sponsor or DG champion, becoming an asset, enables business processes |
| Relationship | DG takes all the risks & IT receives no rewards, Conflict and mistrust, use only as needed, communication business to IT only and formal, relationship is not managed | DG takes most risks with little reward, relationship managed on an ad hoc basis & agreement with units, communication one-way & somewhat informal | DG and Business start sharing risks&rewards & relationship processes exist but not always followed, DG becoming a valued service provider & enterprisewide agreements & knowledge transfer facilitated, communication two-way & formal | Risks, rewards always shared & relationship processes exist and are complied with, long-term partnership & enterprise wide & trust & confidence achieved, communication two-way & somewhat informal | Managers incented to take risks & relationship processes are continuously improved, partner & trusted vendor or DG services & relationship with other partners, communication two-way & informal & flexible |
| Knowledge sharing | Casual conversation and meetings, no benchmarking | Some structured sharing emerging, newsletters, reports, group e-mail, sometimes benchmark informally | Structured around key processes, training, departmental meetings, May benchmark formally, seldom act | Formal methods, sharing at all levels, Routinely benchmark, usually act | Formal sharing with partners, learning monitored, Routinely benchmark, act on, and measure results |

Tabel 9 Dimension Data Management

| Qualification | No process | Beginning process | Established process | Managed process | Optimizing process |
|----------------------------|------------|-------------------|---------------------|-----------------|--------------------|
| Data management | No process | Beginning process | Established process | Managed process | Optimizing process |
| Data principles management | No process | Beginning process | Established process | Managed process | Optimizing process |
| Data quality management | No process | Beginning process | Established process | Managed process | Optimizing process |
| Meta data management | No process | Beginning process | Established process | Managed process | Optimizing process |
| Master data management | No process | Beginning process | Established process | Managed process | Optimizing process |
| Data access management | No process | Beginning process | Established process | Managed process | Optimizing process |
| Data lifecycle management | No process | Beginning process | Established process | Managed process | Optimizing process |

For the assessment questionnaire, see the online software tool:

<https://datagovernancematurity.wordpress.com/>

Direct Access:

https://docs.google.com/forms/d/1WgcpcvqpkGISSTrRencjAvpg0CRV3KrHj_B00nRMIJM

Bijlage IV Interviewprotocol

The following components are part of the interview protocol

- Consent form
- Information Sheet Data Governance Maturity Model
- Interview Form: See Annex III Data Governance Maturity Model

Consent Form

Research: Data Governance Maturity Model

Researcher: Jan Merkus, graduation in Business Process Management, Open Universiteit the Netherlands

- | | Paraph | |
|---|--------------------------|--------------------------|
| | yes | no |
| 1. I hereby confirm that I have read and understood the information sheet for this research, and that I have had the opportunity to ask questions. | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. I understand that my participation is voluntary and that I can terminate it at any time without giving any reason. | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. I am aware that, although every effort will be made to ensure the eep the confidentiality of the information I give, this can only be guaranteed within the limits of the law. | <input type="checkbox"/> | <input type="checkbox"/> |

Tick box

- | | | |
|--|--------------------------|--------------------------|
| 4. I agree to participate in the study | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. I give permission to use anonymous quotes in publications | <input type="checkbox"/> | <input type="checkbox"/> |

Name participant:

Date:

Signature:

Jan Merkus, researcher:

Date:

Signature:

Information Sheet

Data Governance Maturity Model

Introduction

Data plays an increasingly important role in everyday life. Data is also of increasing interest given the hype around big data. This increases the importance of data quality. And data quality requires maintenance in the form of data management. Along with ensuring the quality, shouldering the value of data as an asset is to be safeguarded, which both takes place under data governance (DG).

Relevance

Research of the scientific literature on DG shows the interest of this topic. Not only in recent years but even now scientific research on this topic is carried out.

The attention for DG can be explained by its growing importance. DG is of value for the survival of an organization. Organisations use DG to control the organization. In larger companies data quality issues happen through mergers and distributed systems which requires DG. It was noted that their data quality was handled inadequately with required DG also. And large and small organisations need data with quality for their processes and due to administrative and legal obligations. The unilateral focus on data aspects must change to organizational maturity in dealing with data.

The many interests of stakeholders from the business are translated by DG in conducting data quality management in technical IT domain. And data quality is important for compliance, customer policy, reporting and business processes. DG also makes part of the framework of corporate governance, risk management and compliance (GRC). The goal of DG and GRC is adding value and reducing risk. Around data prejudice risks arise like loss and theft, privacy violation, violation of law, low data quality, but also liability.

Definition Data Governance

Literature study has come to the following definition of data governance:

**Data Governance is
from Corporate Governance, Risk Management and Compliance
determining the strategy for processes, people and technology
to maximize the value of data assets
by arranging organization, responsibilities and accountabilities
for the domains data management, data principles, data quality, metadata, master data, data
access and data lifecycle.**

Definition dimensions

Tabel 1 Definition dimensions Data Governance

| | Definitie |
|--|--|
| Governance | Governance involves how the board and management are structured and what are their roles and responsibilities. Governance also means that appropriate procedures are established and communicated. In addition, these policies and procedures are to ensure that these are followed. |
| Risk management | Risk management aims to mitigate and minimize the impact of risks. There is always a tradeoff between risk and chance. It is important how these risks are identified, analyzed, evaluated and treated, in short: managed. |
| Compliance | Compliance indicates that an organization operates in accordance with existing laws, regulations, protocols, standards and specifications. This is guaranteed during the design of controls. |
| Governance, Risk management & Compliance (GRC) | GRC is an integrated, holistic approach of enterprise-wide governance, risk and compliance. It ensures that an organization is acting ethically and in accordance with its ris flavor, internal policies and external regulations through alignment in strategy, processes, technology and people, thereby enhancing efficiency and efficacy. In itself is GRC not new. As individual cases, governance, risk management and compliance were always fundamental concerns of the business and its leaders. What is new is the growing perception of GRC as an integrated set of concepts that, when applied holistically, can add significant value and deliver competitive advantage. |
| Process, People & Technology | Process, People and Technology are the areas of interest (Key Process Area's), both within data quality management and data governance. See also definition GRC above. |

| | |
|--------------------|--|
| Asset Value | (Used) Data are a valuable business asset that needs careful protection and the value should actively be managed and / or "governed" (= controlled). |
| Business Alignment | Alignment between user organization and IT. |
| Organization | DG organization has two dimensions: <ul style="list-style-type: none"> - DG goals include formal (business and IT) and functional goals. - DG structure is determined by locus of control (functional and hierarchical) form and roles & commissions |

Data Governance Maturity Model

Tabel 2 Basis Data Governance Maturity Model (DGMM)

| | Without process | Beginning process | Established process | Managed process | Optimizing process |
|---|-----------------|-------------------|---------------------|-----------------|--------------------|
| Governance, Risk management, Compliance (GRC) | | | | | |
| Processes | | | | | |
| People | | | | | |
| Technology | | | | | |
| Asset Value | | | | | |
| Business Alignment | | | | | |
| DG Organization | | | | | |
| Data Management | | | | | |

Interview Form

To answer the research question it is translated into the following sub-questions.

Sub-questions:

- I. Exploratory research to determine whether the organization maturity of data governance can be assessed with the dimensions, levels and criteria from literature in the form of the DGMM and if any changes or additions are needed.
- II. Exploratory research to discover valuable recommendations for organisations to grow in data governance.

The translation of the sub-questions in operationalized question is as follows. Respondents are asked in interviews to determine on the basis of relevant situations in practice for each DGMM element or for cohesion within the DGMM whether:

- A. Is it important and why ?**
- B. How to improve it and why ?**

Bijlage V DGMM Outcome Assessment

Table 1 Assessment Score

| Dimension | Qualifications | No process | Beginning process | Established process | Managed process | Optimizing process |
|--|---|------------------------------------|------------------------------------|------------------------------------|-------------------------|-------------------------|
| Corporate Governance, Risk management & Compliance (GRC) | Structure | <input type="radio"/> 1 | | <input checked="" type="radio"/> 2 | | |
| | Authority | <input type="radio"/> 1 | | <input checked="" type="radio"/> 2 | | |
| | Controlling / EDP auditing | | <input type="radio"/> 1 | | | |
| People | Capability | | <input checked="" type="radio"/> 2 | | <input type="radio"/> 1 | |
| | Policy | | <input checked="" type="radio"/> 3 | | | |
| | Culture | <input type="radio"/> 1 | <input checked="" type="radio"/> 2 | <input type="radio"/> 1 | | |
| Processes | Processes | <input type="radio"/> 1 | <input checked="" type="radio"/> 2 | | | |
| | Planning & Monitoring | <input type="radio"/> 1 | <input type="radio"/> 1 | | <input type="radio"/> 1 | |
| Technology | Technology | | <input checked="" type="radio"/> 2 | <input type="radio"/> 1 | | |
| | Application Landscape | | <input type="radio"/> 1 | <input type="radio"/> 1 | <input type="radio"/> 1 | |
| | Data Storage & Distribution Architecture | | <input checked="" type="radio"/> 2 | <input type="radio"/> 1 | | |
| | Business Object Model & Corporate Data Dictionary | | <input checked="" type="radio"/> 2 | | <input type="radio"/> 1 | |
| Data Assets | Value | <input type="radio"/> 1 | <input type="radio"/> 1 | | | <input type="radio"/> 1 |
| | Innovation | <input type="radio"/> 1 | | <input type="radio"/> 1 | <input type="radio"/> 1 | |
| | Assessments | | <input checked="" type="radio"/> 3 | | | |
| Business alignment | Ownership by business | <input type="radio"/> 1 | <input checked="" type="radio"/> 2 | | | |
| | Relationship | | <input checked="" type="radio"/> 3 | | | |
| | Knowledge sharing | <input type="radio"/> 1 | <input checked="" type="radio"/> 2 | | | |
| Data Governance (DG) Organization | Functions, roles, tasks and responsibilities | | <input checked="" type="radio"/> 3 | | | |
| | DG Goals, Objectives & Strategy | | <input checked="" type="radio"/> 2 | <input type="radio"/> 1 | | |
| | DG Tactics | | <input checked="" type="radio"/> 3 | | | |
| Data management | Data management | | <input checked="" type="radio"/> 2 | <input type="radio"/> 1 | | |
| | Data principles management | <input type="radio"/> 1 | <input checked="" type="radio"/> 2 | | | |
| | Data quality management | <input type="radio"/> 1 | <input checked="" type="radio"/> 2 | | | |
| | Meta data management | | <input checked="" type="radio"/> 2 | | <input type="radio"/> 1 | |
| | Master data management | | <input type="radio"/> 1 | <input checked="" type="radio"/> 2 | | |
| | Data access management | | <input type="radio"/> 1 | <input checked="" type="radio"/> 2 | | |
| | Data lifecycle management | <input checked="" type="radio"/> 2 | <input type="radio"/> 1 | | | |

This table give which level is scored during the three interviews of this research.

Other research data

Other research data can be requested from the author : janmerkus@gmail.com