

# Data Governance Capabilities Model: Empirical Validation for Perceived Usefulness and Perceived Ease of Use in Three Case Studies of Large Organisations

Jan R. Merkus<sup>a</sup>, Remko W. Helms<sup>b</sup> and Rob J. Kusters<sup>c</sup>  
Faculty of Beta Sciences, Open Universiteit, Valkenburgerweg 177, Heerlen, The Netherlands

Keywords: Data Governance, Capabilities Models, Empirical Validation, TAM Evaluation, Metaplan.

Abstract: A Data Governance Capabilities (DGC) model for measuring the status quo of Data Governance (DG) in an organisation has been validated in practice. After DG experts gained experience with the operationalised DGC model, we evaluated its perceived usefulness (PU) and perceived ease of use (PEOU) in case studies of three large organisations in the Netherlands. PU and PEOU are evaluated positively, but a moderator and knowledgeable participants remain necessary to make a meaningful contribution.

## 1 INTRODUCTION


Data Governance (DG) is relevant for Corporate Governance because data is seen as one of the most valuable assets (Hugo, 2024; Addagada, 2023). Recent research identifies DG as relevant for corporate financial reporting, economic performance, or the facilitation of corporate takeovers, and a positive influence of DG on corporate governance (Addagada, 2023). Additionally, DG is promising in successfully maximising value from data (Schmuck, 2024).


An organisation's ability to govern data can be determined by its data governance capabilities (DGC) to execute certain data governance activities (Merkus et al., 2021). Capabilities are defined as “*the collective abilities of an organisation to carry out business processes that contribute to its performance*” (Brennan et al., 2018; Merkus et al., 2020). Governance, and hence DG, can be measured in terms of capabilities (Rosemann & De Bruin, 2005; Otto et al., 2022). When doing so, a DGC reference model can be useful in determining which DGCs are relevant. A DGC reference model is a model from which one can, depending on the organisation, select relevant DGCs, e.g. to determine its DG status quo for further improvement (Merkus, 2023).


However, we could not find a validated DGC reference model, so we developed one consisting of 34 DGCs. Recently, we presented an empirical validation of these 34 different DGCs, forming a DGC (reference) model (Merkus et al., 2023). Each of the DGCs in the model was empirically validated in practice by DG activities occurring in large organisations. In this study, we design an approach to use the DGC model in practice to validate its usefulness and ease of use in its entirety. Consequently, the resulting research question is as follows:

***To what extent is the DGC model useful and easy to use in practice when used to determine the status quo of Data Governance in large organisations?***

This research's theoretical relevance is adding an empirically validated DGC reference model to the literature. Its practical relevance is providing large organisations with a set of DGCs to improve their DG. The remainder of this paper is outlined as follows. First, an overview of related work is presented. Next, our research approach is described. Third, the research results and analysis are presented. Finally, the results are discussed, followed by the conclusions, limitations and future research.

<sup>a</sup>  <https://orcid.org/0000-0003-2216-7816>

<sup>b</sup>  <https://orcid.org/0000-0002-3707-4201>

<sup>c</sup>  <https://orcid.org/0000-0003-4069-5655>

## 2 RELATED WORK

This section reviews the current state of the literature on DGC research and establishes the motivation for this research. DGCs describe an organisation’s ability to execute data governance activities (Merkus et al., 2021). DGCs can be used to develop and execute DG in an organisation. Furthermore, DGCs are the basis of DG maturity models. With these DGCs, an organisation can determine its DG status quo (Merkus et al., 2023). When this DG status quo is known, a DG future state can be set, DG capabilities can be developed accordingly, and benchmarks with other organisations can be made (Pöppelbuss et al., 2011).

Previous studies discussed other DGC and DG maturity models (Rifaie, 2009; Rivera,2017; Permana,2018; Dasgupta, 2019; Heredia, 2019; Olaitan,2019; Merkus et al, 2021). These studies introduced DG models with different sets of DGCs in specific business sectors, yet only two were empirically validated in one large organisation. Recent research on DGC and DG maturity models focuses on different application areas and other types of organisations, like government or specific business sectors, and on ways to implement DG maturity models within organisations (Abeykoon,2023; Alsa, 2023; Mouhib, 2023; Hugo, 2024).

One notable contribution on DGCs presents a more comprehensive framework for implementing DG, which consists of 18 DG requirements and a TOGAF reference architecture describing the architecture of an Industry 4.0 DG system. This DG framework has been validated theoretically in a “fictitious” power grid operating company but not yet in practice (Zorrilla & Yebenes,2022). In addition, the authors recommend further review and empirical testing, which is currently a gap (Bento, 2022). So, although some DGC frameworks have been presented, researchers disagree on the set of DGCs, and the empirical validation of a comprehensive DGC model including all known DGCs has not yet taken place but is recommended.

Recently, we presented our research on DGCs, revealing 34 DGCs from literature, each of which we validated in practice by DG expert’s arguments, (see Table 1) (Merkus et al., 2023, Merkus et al., 2021). We validated these individual DGCs in the practice of 19 large organisations using DG expert interviews, resulting in a comprehensive DGC model for generic application (Merkus et al., 2023). We created this set of 34 DGCs ourselves because we did not find a reference set of DGCs for determining the status quo of DG, let alone one that was empirically validated.

However, our comprehensive DGC model has not yet been validated in practice, only its parts, a gap in

the literature. Consequently, our research aims to rigorously validate the most comprehensive DGC model so far as a reference model for its usefulness and ease of use in determining the status quo of DG.

Table 1: Empirically validated DGCs.

| Generic Capability Groups            | Data Governance Capabilities               | # DG sub-capabilities | # Experts arguments |
|--------------------------------------|--|-----------------------|---------------------|
| Leadership                           | Establish Leadership                       | 1                     | 3                   |
|                                      | Establish & manage culture                 | 4                     | 15                  |
| Culture                              | Establish & manage awareness               | 4                     | 15                  |
|                                      | Establish & manage Train                   | 8                     | 36                  |
| Communication                        | Establish & manage Communicate             | 13                    | 44                  |
|                                      | Specify data value                         | 19                    | 53                  |
| Strategy                             | Set goals & objectives                     | 6                     | 20                  |
|                                      | Make business case                         | 1                     | 3                   |
|                                      | Formulate data strategy                    | 4                     | 13                  |
|                                      | Align with the business                    | 14                    | 44                  |
|                                      | Establish roles & responsibilities         | 13                    | 53                  |
|                                      | Establish policies, principles, procedures | 11                    | 51                  |
| Governance & Control                 | Establish performance management           | 3                     | 15                  |
|                                      | Establish Monitoring                       | 1                     | 4                   |
|                                      | Establish KPI's                            | 1                     | 2                   |
|                                      | Establish decision-making authority        | 10                    | 35                  |
|                                      | Establish data stewardship                 | 5                     | 28                  |
|                                      | Establish committees                       | 1                     | 4                   |
|                                      | Establish Auditing                         | 7                     | 23                  |
|                                      | Establish accountability                   | 1                     | 3                   |
|                                      | Manage risk                                | 8                     | 36                  |
|                                      | Manage processes & lifecycle               | 14                    | 43                  |
| Organisation, Management & Processes | Manage organisation                        | 7                     | 23                  |
|                                      | Manage metadata                            | 3                     | 8                   |
|                                      | Manage issues                              | 1                     | 4                   |
| Information Technology               | Manage data                                | 20                    | 74                  |
|                                      | Setup security & privacy                   | 11                    | 45                  |
|                                      | Setup IT                                   | 8                     | 24                  |
|                                      | Setup DG tools                             | 1                     | 1                   |
| Human Resrcs                         | Organize people                            | 9                     | 23                  |
| Value Chain                          | Contract data-sharing agreements           | 7                     | 34                  |
|                                      | Align & integrate data                     | 5                     | 21                  |
| Legislation                          | Comply with regulations                    | 9                     | 36                  |
| Environment                          | Establish environmental response           | 1                     | 4                   |
| <b>Total</b>                         |  | <b>231</b>            | <b>840</b>          |

## 3 RESEARCH METHOD

This study aims to validate the whole DGC model for its usefulness and ease of use in determining the status quo of DG in three large organisations that differ in the type of organisation and business sector.

We select an evaluative strategy (Venable, 2014). More specifically, we choose the human risk and effectiveness strategy with formative evaluations early in the process and a summative evaluation focusing on evaluating the effectiveness of the artefact in this research in multiple naturalistic case studies (Venable, 2014). These case studies explore the DGC model holistically as it applies to the entire organisation. The reasons for selecting this evaluation strategy are that (1) the design risk is user-oriented, (2) it is cheap to evaluate with real users in their organisation, (3) the utility of the DGC model should be long-lasting in practical situations.

Our research method is based on how to refine and evaluate artefacts in design science research with groups of experienced participants (Tremblay, Hevner&Blend, 2010). Therefore, our research is divided into three distinct phases, elaborated in the

remainder of this section. Phase 1 involves designing an approach to let participants use the DGC model in practice to gain experience with it. When people gain experience with the DGC model, they may be better able to evaluate it. Phase 2 is about building that experience with the DGM model in case organisations to make its evaluation possible. Phase 3 evaluates the DGC model's usefulness and ease of use to answer the research question. We end this session with, we describe our measures for improving the research validity and reliability.

### 3.1 Phase 1 Designing an Approach to Use the DGC Model

Phase 1 aims to design an approach for determining the DG status quo at an organisation using the DGC model. We selected seven steps to improve the research construct validity (see Table 2) (Tremblay, Hevner & Blend,2010).

Table 2: Steps to use the DGC model in practice.

| # | Step                     | Description  |
|---|--------------------------|--|
| 1 | Selecting participants   | A key informant seeks DG experts within the sponsor's organisations as participants.   |
| 2 | Informing participants   | A moderator explains the purpose and process of determining the DG status quo to the participants only during the interviews.  |
| 3 | Collecting DG practices  | A moderator individually interviews the participants to determine their view on DG in the organisation and existing DG practices using the operationalised DGC Model as a checklist.                         |
| 4 | Analyse DG practices     | In an analysis with the key informant, a moderator identifies key differences from the interviews, which are used to prepare the group meeting.  |
| 5 | Intermediately reporting | All DG practices resulting from using the DGC model are presented in an intermediate report to the participants.   |
| 6 | Group meeting            | In a group meeting with all participants, the individual practical use results from the interviews are discussed with participants. This involves trying to obtain consensus in the questionnaire responses. |
| 7 | Final reporting          | The result of the group meeting is reported, including possible differences in outcome.  |

We made the following choices in our approach to obtain proper use of the DGC model in an organisation. We support organisations using the to them unknown DGC model with a moderator knowledgeable in DG. The moderator gives a proper introduction at the beginning and guidance during the interview.

We need a sponsor for each participating organisation to approve and enable the research.

We require an organisation's key informant to organise contacts between the moderator and participants employed by the organisation. This contact is only needed to arrange the interviews with suitable candidates and provide the moderator with context about the organisation despite the key informant's organisational bias.

We try to assemble participants with professional experience in DG or data roles within that organisation. They hold a position in DG or the data field and have the ability and willingness to exchange abstract ideas. Collectively, they have the information

to judge the status quo (Bagheri,2019). We select a group of DG experts within an organisation to correct the filters and biases of individuals in their roles or positions and to obtain a richer picture and variation in interpretations (Heemstra et al., 1996). To qualify as an expert and contribute to how to set up data management, participants must have more than five years of experience in data governance or data management at the B- or C-level. Typical DG or data positions include Chief Data or Information Officers, other Data (Governance) Board members, Data officers, Privacy or Security Officers, Data or Enterprise architects or Information or BI managers and experienced data specialists e.g. data stewards.

The DGC model is used as a checklist to arrive at a consensus for each DGC (Heemstra et al.,1996). The advantage of this choice is that all DGCs are presented and discussed with all the participants. Previous experience with checklists shows that their advantages outweigh the disadvantages if the checklist is manageable (Heemstra et al.,1996). We operationalise the checklist in the form of a maturity scale based on the results of our previous research (Merkus, 2023). With the resulting questionnaire, a user can determine the organisational maturity.

We choose individual online interviews collecting DG practices so that the moderator can clear up ambiguities while answering evaluation questions by immediately providing the necessary explanations. DG practices are real DG activities happening in the organization in practice demonstrating the ability to execute these DG activities.

All DG activities, as the results of the interviews, are presented graphically and on a sheet to all participants of their own organisation in a group meeting. The purpose here is to learn from each other's contributions, to obtain feedback on the individual interview results for further refinement, and to reach a consensus on the status quo of DG. For each DGC, the group tries to meet mutual understanding amongst participants on the underlying DGC activities happening in practice. Consequently, the group concludes on the status quo for each DGC or expresses the differences in insights. The results of the group meetings are presented to the participants, representing the organisation's DG status quo.

With this approach, we aim to obtain access to knowledgeable participants who have used the DGC model and, therefore, evaluate it properly in practice.

### 3.2 Phase 2 Building Experience in Using the DGC Model

In phase 2, the approach developed in phase 1 is executed within the context of a number of large organisations. The purpose is to execute phase 1 for building the necessary experience with the DGC model among DG experts so that they can be asked to evaluate it. In our research, one of the authors executes the moderator role, having knowledge of DG.

We select three large organisations for the multiple case study to be able to compare the results between them. We aim to achieve this by comparing the results in cross-analysis to ascertain a broad-based opinion (Yin, 2014). Furthermore, with literal replication in three organisations, we aim to achieve saturation in the answers to the interview questions. Here, saturation refers to the degree of similarity between the answers. When similar answers are mentioned across two or all three organisations, a shared perspective or consensus can be achieved, this strengthens credibility.

We select organisations that are suitable for our study and meet the following criteria: (1) Sufficient size (>1,000 employees) and consequential complexity reflecting the need for governance awareness in such large organisations (Merkus,2023). (2) DG is being implemented in the organisation. (3) The organisation employs DG experts. (4) Operating in different business sectors from different types of organisations so that we find general and broader arguments that are not business sector specific. By formulating these requirements, we aim to facilitate the acquisition of experience in using the DGC model.

We apply purposive sampling because "*studying information-rich cases yields insights and in-depth understanding*", according to Patton, which occurs before the data is gathered (Suri,2011; Yazan,2015).

Additionally, to ensure the validity of the participant's experiences in using the DGC model, the moderator observes whether the participants make a meaningful contribution to this study through thoughtful participation. This is achieved by recording observations in a log by only recording factual observations and not the researcher's own interpretations. Afterwards, the observations are analysed, and conclusions about the participants' contributions are drawn. These conclusions may confirm whether a participant's experience with the DGC model is meaningful for our research, i.e. will the participant be able to reflect meaningfully on using the DGC model. If a participant did not make a meaningful contribution, he will be excluded from phase 3 and, therefore, from further analysis.

### 3.3 Phase 3 Evaluating the DGC Model

In phase 3, the purpose is to evaluate the DGC model in practice. Having gained experience with the DGC model within the context of their organisation in phase 2. The participants are now interviewed using a questionnaire about the perceived usefulness and perceived ease of use of the DGC model. More specifically, we collected the respondent's opinions based on their experience with the model and their underlying arguments for their opinion. Where perceived usefulness is '*the degree to which an individual believes that using a particular system would enhance his or her job performance*', and perceived ease of use is '*the degree to which an individual believes that using a particular system would be free of physical and mental effort*' (Davis, 1991).

The questionnaire for evaluating our DGC model consists of the Technical Acceptance Model (TAM) questionnaire, initially developed to ascertain a new technology's *perceived* usefulness (PU) and *perceived* ease of use (PEOU) and later improved (Davis, 1991; Turner,2008). The improved TAM questionnaire was selected because it can be used for qualitative research on the acceptance and use of new technologies in semi-structured interviews (i.e. Singh,2019). Like Singh, we use it to interview a small number of respondents to understand the reasoning behind its usability and ease of use (Davis,1991; Singh, 2019).

So, we adapted the four questions from Turner's improved TAM questionnaire to measure the usefulness and ease of use of the DGC model (Turner, 2008). We followed Turner's advice by replacing "*the technology*" with "*the DGC model to determine the status quo of DG*" and formulating the statements into questions (Turner, 2008). This resulted in four questions for usefulness and four for ease of use. Furthermore, we chose the original five-point Likert scale because we agree that a five-point scale is sufficient for our evaluation (Turner, 2008). The original Likert scale values *Strongly Approve - Approve - Undecided - Disapprove - Strongly Disapprove* (Likert,1932). In addition to the standard series of four TAM questions, we added question number five to both series to ask respondents about their underlying arguments (Singh,2019). Finally, we added an extra question on whether respondents would use the tool again and why, as an extra question to understand their reasoning why to reuse the DGC model again. With the resulting questionnaire, we can evaluate the usefulness and useability of the DGC model in semi-structured interviews of the respondents within the practice of their case organisations, (see Table 3).



Table 3: Operationalised TAM questionnaire for the semi-structured evaluation interviews.

| Questionnaire for perceived usefulness & perceived ease of use  |
|---|
| <p>Questions on the perceived usefulness of the DGC model</p> <ol style="list-style-type: none"> <li>1. Does the DGC model help you determine the status quo of DG more quickly?</li> <li>2. Does the DGC model make you more productive in determining the status quo of DG?</li> <li>3. Does the DGC model increase your effectiveness in determining the status quo of DG?</li> <li>4. Do you find the DGC model useful to determine the status quo of DG?</li> <li>5. Why is the DGC model (not) useful to you? And why?</li> </ol>               |
| <p>Questions about the perceived ease of use of the DGC model</p> <ol style="list-style-type: none"> <li>1. Do you find it easy to learn to use the DGC model quickly to determine the status quo of DG?</li> <li>2. Do you find it easy to use the DGC model to determine the status quo of DG?</li> <li>3. Do you find the DGC model easy to learn to use to determine the status quo of DG?</li> <li>4. Do you find the DGC model easy to use to determine the status quo of DG?</li> <li>5. Why is the DGC model easy to use? And why?</li> </ol> |
| <p>Questions about reusing the DGC model</p> <ol style="list-style-type: none"> <li>1. Will you continue to use the DGC model? And why?</li> </ol>  |

We take measures to preserve the resulting research data for further analysis and verification. We record the online evaluation interviews, transcribe the recordings, ask participants for their agreement on the content of the transcripts, and delete the recordings to assure the anonymity of the case organisation and the participants.

Our data analysis aims to answer the research question by evaluating the usefulness and ease of use of the DGC model in practice so that we understand the underlying reasoning why the DGC model is useful and easy to use. The research data we need to analyse are the respondents' potential arguments from the semi-structured interviews resulting from phase three.

The method to reveal the arguments for evaluation and, consequently, the result of our evaluation is elaborated as follows. First, we extract potential arguments from the respondent's interviews by applying in-vivo coding to identify the respondent's potential arguments and register them on a list (Saldana, 2013, p.91). Second, we apply axial coding to classify the potential arguments to find the arguments for evaluation (Saunders, 2012, p.185). This is carried out using Metaplan for the card sorting technique (Howard, 1994; Harboe et al., 2015; Merkus et al., 2020). To achieve a more stable and higher conceptual quality of card sorting, we execute the card sorting in a group of three peers, all DG researchers (Paul, 2008). (3) Finally, the researcher reports the identified arguments to conclude the evaluation of phase 3. This additional categorisation of arguments further improves the research result's validity.

### 3.4 Research Quality

Below, we assess the quality of our research method to ensure its validity and reliability by highlighting the measures we applied (Saunders, 2012)

To improve the validity of the survey data, the construct validity, we allowed participants to gain experience with the DGC model with the guidance of a moderator. For this we operationalised the 34 DGCs in a questionnaire as a checklist. We also repeated the survey in three appropriate organisations, conducted careful interviews with predefined questionnaires and collected survey data from all three organisations to compare results. In addition, during the evaluation phase 3, we used the well-known, improved TAM questionnaire and the original Likert scale for collecting research data.

To improve the rigour of our reasoning in validating the DGC model, the internal validity, we applied categorisation by applying the referenced Metaplan technique of card sorting to find arguments on which to base our conclusion ((Howard, 1994). In addition, we perform the card sorting with the authors, all three being DGC researchers, in one physical room simultaneously to eliminate the researcher's bias and apply peer scrutiny.

Although the generalisability or external validity of qualitative research is limited, our research outcomes are determined by arguments given by precisely selected respondents in precisely selected organisations and, therefore, might most likely apply to similar case organisations. We replicate our research in multiple organisations to obtain arguments from similar contexts to achieve congruence in our findings with reality. According to the concept of purposive sampling, we will achieve better insights and obtain more precise results with just a few organisations, and consequently, in less time. This is because we know the DGCs from our previous research to select a suitable case organisation. In addition, the requirements to select a case organisation are detailed in our approach are strict enough to replicate our research (Meriam (1993); Yin (2004); Yazan (2015)).

Our qualitative research has a sufficient degree of reliability because we detail our approach so that others can easily replicate and check our research.

To ethically protect participants and respondents, we assure them that their answers are anonymised and that the survey data are not traced back to them or their organisation. We do this by asking their explicit permission for the anonymous processing of their answers and allowing them to check the answers afterwards. Furthermore, before each interview, we ask each participant and respondent for their informed consent. Given our limited time, resources, and suitable case organisations willing to participate, our design is as valid, reliable, and ethical as possible.

## 4 RESULTS

This section firstly reflects on how we conducted our research in three large case organisations. Secondly, we present the results obtained from experiences with the practical use of the DGC model in Phase 2. Thirdly, we present the evaluation outcome of Phase 3. Finally, we analyse the arguments obtained in the evaluation in a cross-case analysis.

### 4.1 Three Case Studies of Large Organisations

We conducted this research using the method described in the previous section. In Phase 1, we designed the approach we executed in Phase 2 as follows. For step 1, we selected 3 case organisations for our research with more than 5.000 employees from different business sectors in the Netherlands to obtain a significant contrast between them (see Table 4). The three key informants recruited 16 participants from all three organisations. Each participant is an employed DG expert with a specific DG role. Participants have roles like chief data officer, data architect, enterprise architect, data manager, BI manager, and privacy officer. We also included a data steward and a data governance specialist with over seven years of experience with DG because of their lived-through experience with DG. The three case organisations have a corporate data strategy in place, demonstrating the presence of sufficient DG complexity in these organisations to be suitable for this research. The interviews were held online to facilitate on-screen use of the questionnaires and reduce travel time and expenses. One of the authors played the role of the moderator.

Table 4: Case organisations.

| Business sector        | Consumers  | Employees | DG Experts |
|------------------------|------------|-----------|------------|
| Private Medical        | 300.000    | 6.000     | 5          |
| Quasi-Public Utilities | 2.500.000  | 7.000     | 6          |
| Public Service         | 18.000.000 | 17.750    | 5          |

### 4.2 Practical Use Results

For step 2, the moderator explained the questionnaire process at the start of the interview and guided the participants while explaining the questions. Each participant appeared to recognise all DGCs, and no new DGCs were suggested. For step 3, the moderator noted the DG practices mentioned by the participants during the interviews, keeping scrupulous bookkeeping of all research results available at the author. For step 4, the moderator presented the key differences between the participants and discussed these with the key informant to prepare the group

meetings. For step 5, all organisational DG practices were reported in a large table together with the maturity scores displayed in a radar chart (see Figure 1). For step 6, we held three group meetings, one for each organisation with its employees. The moderator had the groups reach a consensus on the status quo of DG for all DGCs. For step 7, the group meeting results are reported to the participants and the sponsor.

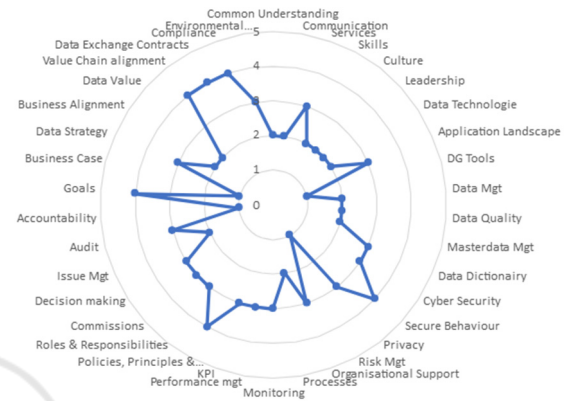


Figure 1: Group meeting outcome from the measurement with the operationalised DGC checklist for organisation 3 plotted in a radar chart.

Additionally, according to the additional step in the research method, the researcher observed the thoughtful contributions of the participants during the interviews and group meetings. The conclusion was that all participants made a meaningful contribution to the research, but some were absent during the group meetings due to other priorities or changing employers. Consequently, these three participants were excluded from further participation in this research.

### 4.3 Evaluation Results

In phase 3, we interviewed the remaining 13 DG experts as respondents to our research with the applied TAM list as a questionnaire in online sessions. The answers to the questionnaire were recorded using automatic transcription. Afterwards, we collected potential arguments from the transcripts using en vivo coding and kept the administration (Saunders, 2012). The result of the en vivo coding is 167 different potential arguments, which we recorded on a list for further cross-case analysis.

### 4.4 Evaluation Analysis

The aim of the evaluation analysis is to understand the potential arguments resulting from phase 3 for the

usefulness and ease of use of the DGC model so that we understand the underlying reasoning why the DGC model is useful and easy to use. To arrive at such an understanding, the 167 potential arguments were printed on cards and physically categorised in axial coding by card sorting using the Metaplan technique with three peers in a physical setting of two and a half hours.

The card sorting of the 167 potential arguments resulted as intended in the following arguments. 26 potential arguments are categorised as out of scope and thus seen as irrelevant. 113 of the remaining 141 potential arguments are categorised as arguments for PU, PEOU and *Intention to continue using (ITCU)*, while 28 are categorised as conditions.

113 potential arguments are categorised as arguments, (see table 5). Although the TAM questionnaire was classified by PU, PEOU and ITCU classification, respondents sometimes answered the questions with potential arguments for the other classes. Nevertheless, potential arguments and discovered arguments during card sorting were classified into the intended classes. E.g. the argument *Reporting needs improvement* moved from the PU class to the PEOU class.

Table 5: Arguments.

| Argument categories                | Org       |           |           |           | Total |
|------------------------------------|-----------|-----------|-----------|-----------|-------|
|                                    | 1         | 2         | 3         |           |       |
| <b>perceived usefulness</b>        | <b>11</b> | <b>28</b> | <b>17</b> | <b>56</b> |       |
| Enables further steps              | 4         | 6         | 10        | 20        |       |
| Provides insight                   | 5         | 8         | 1         | 14        |       |
| Brings structure                   | 2         | 7         | 3         | 12        |       |
| Aligns knowledge                   |           | 7         | 3         | 10        |       |
| <b>perceived ease of use</b>       | <b>15</b> | <b>18</b> | <b>9</b>  | <b>42</b> |       |
| Works quickly                      | 10        | 4         | 2         | 16        |       |
| Simplifies measurement             | 5         | 5         | 3         | 13        |       |
| Difficult to understand            |           | 7         | 1         | 8         |       |
| Reporting needs improvement        |           | 2         | 3         | 5         |       |
| <b>intention to continue using</b> | <b>5</b>  | <b>5</b>  | <b>5</b>  | <b>15</b> |       |
| It monitors developments           | 5         | 1         | 3         | 9         |       |
| It measures                        |           | 1         | 1         | 2         |       |
| Use to adapt own model             |           | 1         |           | 1         |       |
| Too complex                        |           | 2         | 1         | 3         |       |

We found the following arguments.

PU is positively supported by arguments *Enables further steps*, *Provides insight*, *Brings structure* and *Aligns knowledge*. This indicates that the DGC model is perceived as useful with 56 potential arguments and without any other negative arguments or potential arguments.

PEOU is positively supported by the arguments *Works quickly* and *Simplifies measurement* supported with 29 potential arguments, but for some the DGC model is *Difficult to understand* and *Reporting*

*needs improvement* which is supported by 13 potential arguments. This indicates that most perceived the DGC model easy to use, but some find it complex.

ITCU the DGC model is positively supported by arguments like *It monitors developments*, *It measures*, *Use to adapt own model* with 12 potential arguments, but negatively supported by the argument *Too complex* with 3 potential arguments. In addition, all thirteen respondents answered to reuse the DGC model, three of them only some missing DGCs that are not yet part of their model. This means that we found one argument supported in Organisation 2 and Organisation 3 that does not support the intention to use the DGC model but not in Organisation 1.

Although we did not specifically ask for them, we categorised not less than 28 potential arguments as conditions (see Table 6).

Table 6: Conditions.

| Condition categories       | Org |    |   | Total |
|----------------------------|-----|----|---|-------|
|                            | 1   | 2  | 3 |       |
| Moderator                  |     | 12 | 4 | 16    |
| Knowledgeable participants |     | 2  | 5 | 7     |
| Moderator preparation      | 1   |    | 4 | 5     |

We found the following conditions: *Moderator*, *Moderator preparation* and *Knowledgeable participants*.

Although the nine positive arguments are supported by 97 potential arguments, three negative arguments supported by 16 potential arguments were found together with three conditions supported by 28 potential arguments. First, this indicates the necessity of a moderator and knowledgeable participants. Second, this confirms our choice to apply a knowledgeable moderator and search for DG Experts as participants when designing our research method. Third, some respondents mentioned potential arguments supporting the negative arguments and conditions, each in up to two organisations. So, using the DGC model can be complicated if DG knowledge lags and use requires proper support.

## 5 CONCLUSIONS

This section concludes our research and its relevance, discusses the results and analysis, and elaborates on limitations and further research of our study.

### 5.1 Conclusions

Regarding the research question, we conclude the following concerning the DGC model:

The whole set of 34 DGCs has been validated in practice as a comprehensive DGC model to measure the status quo of DG in large organisations. From our evaluation, we conclude that the DGC model is perceived as useful and easy to use. However, we also see some complex issues in two of the three organisations. PU is evaluated positively without negative arguments. PEOU is also evaluated positively with two positive arguments from all three organisations, but also with two negative arguments from two organisations. Similarly, ITCU is supported by three positive arguments in three organisations, but a negative argument was also discovered in two organisations. Even more, three conditions are found; a moderator is needed to prepare and guide the process so that knowledgeable participants can make meaningful contributions. All negative arguments and conditions are related to the complexity of the model, which should be looked at in further research.

Looking at the results of all participating organisations, we can conclude that each argument occurs in at least two organisations. Given the large overlap in arguments between organisations, we suspect that adding a fourth organisation would not change the outcomes much. The results have already been confirmed in more than one organisation.

Another result of this research is the approach in Phase 1 to use the DGC model in practice to measure DG in case organisations.

During our research, none of the sixteen DG experts added new DGCs. So, no one was aware of DGCs other than those that comprise the DGC model, which supports the comprehensiveness of our DGC model.

## 5.2 Relevance

The outcomes of this research are relevant in two ways. The theoretical relevance is that the comprehensive DGC model is validated in practice in multiple organisations, and our qualitative evaluation method proved useful. The practical relevance is that organisations obtain a comprehensive measure and approach to assess their DG status quo and to benchmark across organisations. This can be useful in improving the value of data as one of an organisation's most valuable assets.

## 5.3 Discussion

Discussing the DGC model evaluation outcomes, we see the following discussion points.

To date, no such comprehensive and validated capability model for measuring DG status quo exists in literature.

Looking at the discovered conditions, we see that a knowledgeable moderator and knowledgeable participants are required to use the DGC model. In addition, an argument about the complexity of the *intention to continue using* the DGC model was discovered. We could conclude from this that knowledge transfer seems to be a concern that needs attention when using the DGC model. This points to further research for improving our approach with more knowledge transfer.

The average Likert score for PU is 4.1 on a scale of 5, and for PEOU, it is 3.7. Although this is a qualitative study, this indicates that respondents perceive PU as positive. PEOU is also perceived as positive, albeit slightly less positive than PU. So, both PU and PEOU are rated positively on average, indicating that the DGC model is also perceived positively on average.

## 5.4 Limitations

Given the limitations of our study, we have identified some shortcomings when conducting research which may need further research. Concerning data collection (1) One of the authors was the moderator; a researcher's bias must be considered, (2) Respondants were recruited by the key informant, who could influence their selection, (3) Only Dutch organisations have been selected for the case studies, and (4) The organisations operated in only three different business sectors. Concerning data analysis only three DG researchers conducted this research.

However, given the limitations, our approach proved valuable in evaluating the DGC model. When replicated rigorously in other organisations using the scrupulous described method, the DG status quo can be measured in a useful and easy-to-use manner over time and benchmarked with other organisations.

## 5.5 Further Research

Further research is recommended for some of the outcomes of this study.

To improve the use of the DGC model, further research may address the concern of transferring knowledge of DG or the DGC model as part of the approach to improve the PEOU and ITCU.

Seen this research's limitations and for validating the results with other data sets, we recommend replication of our research (1) by other researchers, (2) in the same organisation with other respondents, (3) in other countries or cultures, and (4) in other business sectors. For validating the data analysis, we recommend replication by different DG researchers.

In addition, certain DGCs seem to be required for others to develop. A logical order could indicate a



guide on implementing DG. This idea is supported in other maturity model research (Van Steenberg et al., 2007). A critical path of developing DG capabilities can be determined as a guide for organisations to improve DG.

During the practical use of the DGC model, many experts suggested a higher-level classification for more convenient use of the model and understandable reporting. Some suggested the categories of the applied generic capability reference model from the underlying literature, designed for that purpose and to enable measuring and benchmarking governance (Merkus et al., 2021).

Finally, apply our research method in evaluating other artefacts in DSR research, e.g. new x governance capability models using the same reference framework as the DGC model, where x is any organisational area to govern.

## FUNDING

This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## ACKNOWLEDGEMENT

Special thanks go to the anonymous respondents, without whom this study could not have succeeded.

## REFERENCES

- Abeykoon, B. B. D. S., & Sirisena, A. B. (2023). A Bibliometric Analysis of Data Governance Research: Trends, Collaborations, and Future Directions. In: *South Asian Journal of Business Insights*, 3(1), 70–92.
- Addagada, T. (2023). Corporate Data Governance, an evolutionary framework, and its influence on financial performance. In: *Global Journal of Business and Integral Security*.
- Alsaad, A. (2023). Governmental Data Governance Frameworks: A Systematic Literature Review. 2023 In: *International Conference on Computing, Electronics & Communications Engineering (ICCECE)*, 150–156.
- Abraham, R., Schneider, J., & vom Brocke, J. (2023). A taxonomy of data governance decision domains in data marketplaces. In: *Electronic Markets*, 33(1).
- Bagheri, S. (2019). Design of a reference model-based approach to support business-IT alignment improvement in co-creation value networks. Doctoral dissertation. Technische Universiteit Eindhoven.
- Becker, J., Knackstedt, R., & Pöppelbuß, J. (2009). Developing Maturity Models for IT Management – A Procedure Model and its Application. In: *Business & Information Systems Engineering*, 1(3), 213–222.
- Bento, P., Neto, M., & Corte-Real, N. (2022). How data governance frameworks can leverage data-driven decision making: A sustainable approach for data governance in organisations. In: *Iberian Conference on Information Systems and Technologies, CISTI, 2022-January*.
- Brennan, R., Attard, J., & Helfert, M. (2018). Management of data value chains, a value monitoring capability maturity model. In: *ICEIS 2018 - Proceedings of the 20th International Conference on Enterprise Information Systems*, 2(January), 573–584.
- Dasgupta, A., Gill, A., & Hussain, F. (2019). A conceptual framework for data governance in IoT-enabled digital IS ecosystems. In: *Proceedings of the 8th International Conference on Data Science, Technology and Applications (DATA, 2019)*, Data, 209–216.
- Davis, F. D. (1991). User acceptance of information systems: the technology acceptance model (TAM). In: *International Journal Man-Machine Studies*, 38, 475–487.
- Dijkstra, J. (2022). Toward an IoT Analytics capability framework for business value creation. Master's thesis, Open Universiteit, The Netherlands.
- Heemstra, F. J., & Kusters, R. J. (1996). Dealing with risk: A practical approach. In: *Journal of Information Technology*, 11(4), 333–346.
- Heredia-Vizcaino, D., & Nieto, W. (2019). A Governing Framework for Data-Driven Small Organizations in Colombia. In: *New Knowledge in Information Systems and Technologies*, Springer, WorldCIST'19 2019. *Advances in Intelligent Systems and Computing*. Vol. 930, Issue 1, pp. 622–629.
- Harboe, G., & Huang, E. M. (2015). Real-world affinity diagramming practices: Bridging the paper-digital gap. In: *Conference on Human Factors in Computing Systems*. In: *Proceedings of the 33rd annual ACM conference on human factors in computing systems* (pp. 95-104).
- Howard, M. S. (1994). Quality of Group Decision Support Systems: A comparison between GDSS and traditional group approaches for decision tasks. Doctoral dissertation: Technische Universiteit Eindhoven.
- Hugo Ribeiro Machado, V., Barata, J., & Rupino Da Cunha, P. (2024). A Maturity Model for Data Governance in Decentralized Business Operations: Architecture and Assessment Archetypes. In: *International Conference on Information Systems Development 2024*.
- Mouhib, S., Anoun, H., Ridouani, M., & Hassouni, L. (2023). Global Big Data Maturity Model and its Corresponding Assessment Framework Results. In: *International Journal of Applied Mathematics*, 53(1).
- Likert, R. (1932). A Technique for the Measurement of Attitudes. In: *Archives of Psychology*, 22, 5–55.
- Merkus, J. R., Helms, R. W., & Kusters, R. J. (2021). Data Governance Capabilities; Maturity Model design with Generic Capabilities Reference Model. In: *Proceedings of the 13th International Joint Conference on*

- Knowledge Discovery, Knowledge Engineering and Knowledge Management (IC3K), 102–109.
- Merkus, J. R., Helms, R. W., & Kusters, R. J. (2023). Data Governance Capabilities; Empirical Validation In Case Studies Of Large Real-Life Organisations. In: proceedings of the 36TH Bled E-Conference, 35–48.
- Merriam, S. B. (1998). Qualitative Research and Case Study Applications in Education. Revised and Expanded from “Case Study Research in Education.”. In: Quality Research and Case Study Applications in Education, (pp. 26–43) San Francisco.
- Mouhib, S., Anoun, H., Ridouani, M., & Hassouni, L. (2023). Global Big Data Maturity Model and its Corresponding Assessment Framework Results. In: International Journal of Applied Mathematics, 53(1).
- Olaitan, O., Herselman, M., & Wayi, N. (2019). A Data Governance Maturity Evaluation Model for government departments of the Eastern Cape province. In: South Africa. South African Journal of Information Management, 21(1), 1–12.
- Otto, B., Hompel ten, M., & Wrobel, S. (2022). Designing Data Spaces; the ecosystem approach to competitive advantage. Springer.
- Paul, C. L. (2008). A modified Delphi approach to a new card sorting methodology. Journal of Usability Studies, 4(1), 24.
- Permana, R. I., & Suroso, J. S. (2018). Data Governance Maturity Assessment at PT. XYZ. Case Study: Data Management Division. In Proceedings of 2018 International Conference on Information Management and Technology (ICIMTech 2018), 15–20.
- Pöppelbuß, J., & Röglinger, M. (2011). What makes a useful maturity model? A framework of general design principles for maturity models and its demonstration in business process management. Ecis, Paper28.
- Rifaie, M., Alhadj, R., & Ridley, M. (2009). Data governance strategy : A key issue in building enterprise data warehouse. IiWAS2009, 587–591.
- Rivera, S., Loarte, N., Raymundo, C., & Dominguez, F. (2017). Data Governance Maturity Model for Micro Financial Organizations in Peru. In Proceedings of the 19th International Conference on Enterprise Information Systems (ICEIS 2017), 203–214.
- Rosemann, M., & Bruin, T. de. (2005). Towards a Business Process Mangement Maturity Model. ECIS 2005 Proceedings of the Thirteenth European Conference on Information Systems, May, 26–28.
- Saldaña, J. (2013). The Coding Manual for Qualitative Researchers (Second Edition, Vol. 1).
- Saunders, M. N. K., Lewis, P., & Thornhill, A. (2012). Research Methods for Business Students (6th ed.). Pearson Education Limited.
- Schmuck, M., & Georgescu, M. (2024). Enabling Data Value Creation with Data Governance: A Success Measurement Model. CS & IT Conference Proceedings, Vol. 14, Nr 8.
- Shenton, A. K. (2004). Strategies for ensuring trustworthiness in qualitative research projects. Education for Information, 22(2), 63–75.
- Singh, S., & Srivastava, P. (2019). Social media for outbound leisure travel: a framework based on technology acceptance model (TAM). Journal of Tourism Futures, 5(1), 43–61.
- Steenbergen, M. van, Berg, M. van den, & Brinkkemper, S. (2007). A balanced approach to developing the enterprise architecture practice. ICEIS 2007, Lecture Notes in Business Information Processing, 12 LNBP, 240–253.
- Stoiber, C., Stöter, M., Engebrecht, L., Schönig, S., & Häckel, B. (2023). Keeping Your Maturity Assessment Alive: A Method for the Continuous Tracking and Assessment of Organizational Capabilities and Maturity. Business and Information Systems Engineering.
- Suri, H. (2011). Purposeful sampling in qualitative research synthesis. Qualitative Research Journal, 11(2), 63–75.
- Tremblay Monica Chiarini, Hevner Alan R., & Berndt Donald J. (2010). Focus Groups for Artifact Refinement and Evaluation in Design Research. *Communications of the Association for Information Systems*, 26(27), 327–337.
- Turner, M., Kitchenham, B., Budgen, D., & Brereton, P. (2008). Lessons Learnt Undertaking a Large-scale Systematic Literature Review.
- Venable, J., Pries-Heje, J., & Baskerville, R. (2014). FEDS: A Framework for Evaluation in Design Science Research. European Journal of Information Systems, 25(1), 77–89.
- Ijmker, S. (2022). Verbetermaatregelen opstellen en prioriteren om IT-project portfolio's op koers te houden — Open Universiteit research portal.
- Yazan, B. (2015). Three Approaches to Case Study Methods in Education: Yin, Merriam, and Stake. In The Qualitative Report (Vol. 20, Issue 2, pp. 134–152).
- Yin, R. K. (2014). Case study research: design and methods (5th ed.). SAGE Publications, Inc.
- Zorrilla, M., & Yebenes, J. (2021). A reference framework for the implementation of Data Governance Systems for Industry 4.0. Computer Standards & Interfaces, 81, 103595.