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Digital Government Value Logic – Model Konceptualny i Benchmarkingowy

Tytuł rozprawy w języku angielskim:
Digital Government Value Logic – Conceptual and Benchmarking Model

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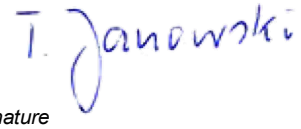

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Abstract (ENG)

Digital Government (DG) can be described and analyzed from several perspectives, which generally fall into two categories. The first is the process logic, which highlights technology-enabled operations of public administration. The second is the system logic, which highlights the nexus of technology-enabled interactions between DG organizational, technological, social, political, etc., components. Some conceptualizations, e.g., the DG value chain or DG value activity system, integrate these perspectives through the logic of public value generation, which itself rationalizes any DG development effort.

The problem addressed in the thesis is that, among internationally recognized country-level DG benchmarking (DGB) projects by the European Commission, the United Nations, the World Bank, etc., none explicitly adopts a value-generation perspective. By and large, they provide static, context-free snapshots of arbitrarily selected aspects of the countries' DG operation. Thus, on their own, they have limited capacity to provide reliable, actionable feedback to the countries they survey. Also, the academic debate on the deficiencies of DGB instruments, their development paths, and DGB-informed policy and management decisions largely omits the fundamental question of how to align DGB with the value-generation imperative.

Given that DG plays a key and increasing role in today's public policy and governance, there is a merited need for country-level DGB instruments that implement the value-generation perspective, directed less toward providing new rankings and more toward helping countries identify their DG weaknesses, address them, and pursue deliberate DG development goals and trajectories.

To undertake such a challenge, this thesis proposes a DG Value Logic (DGVL) model – an original conceptual design to encompass the issues of DG public value generation. From the DGVL perspective, DG is conceived as a system of conceptual components that interact within various value-generation processes, e.g., providing legal foundations for public sector technology adoption, improving public services through better data processing models, increasing the use of such services, and improving democracy through digital participation mechanisms. Given the explicit orientation on measurement and evaluation, DGVL may provide a comprehensive base for developing innovative value-oriented DGB instruments.

To this end, the thesis pursues four objectives: 1) to present DGVL as a platform for integrating ideas already present but scattered in the DG literature; 2) to position

DGVL as a substantive extension of the current DGB approaches; 3) to provide a methodological guide and toolset for designing and implementing DGVL-based benchmarking instruments; and 4) to demonstrate the validity and feasibility of this approach and its capacity to address substantial issues of DG operation.

These objectives were realized through a research and development process comprising: 1) literature-based knowledge synthesis, leading to the formulation of a set of postulates for developing value-oriented DGB instruments; 2) formalization of DGVL as a conceptual model and methodological guidelines addressing these postulates; 3) development of a DGVL-based benchmarking instrument (DGVLB) and its realization and demonstration in the context of the DG in selected countries of the European Union. The DGVLB instrument is, in principle, adaptable to other contexts as well. These actions were complemented with an evaluation survey conducted among a group of leading international DG experts.

This thesis may contribute to both DG research and DG practice. Regarding research, it integrates concepts such as DG system and process perspectives, introduces the value generation language as a consistent way to address DG issues, and others previously scattered across different streams of DG research, thereby formalizing DG as a value-generating system. Regarding practice, the thesis provides a conceptual and methodological basis for designing innovative, value-oriented DGB instruments. By design, such instruments leverage data from existing instruments to conduct reliable evaluations and inform better management and policy decisions.

Abstrakt (PL)

Rząd cyfrowy (DG) jest opisywany z różnych perspektyw, które można, ogólnie, przyporządkować do jednej z dwu kategorii. Pierwszą z nich jest logika procesu, która na plan pierwszy wysuwa działania administracji publicznej realizowane w oparciu o technologię. Drugą jest logika systemu, która z kolei opisuje sieć opartych o technologię interakcji pomiędzy różnymi komponentami DG – organizacyjnymi, technicznymi, społecznymi, politycznymi, itd. Pewne konceptualizacje rządu cyfrowego, np. łańcuch wartości czy system wartości działań DG, łączą te dwie kategorie, postulując ogólną logikę tworzenia wartości (publicznej), co skądinąd stanowić powinno cel każdego projektu w ramach rządu cyfrowego.

Problemem, który podejmuje niniejsza rozprawa jest to, że spośród uznanych międzynarodowych instrumentów służących benchmarkingowi rządu cyfrowego (DGB), tworzonych przez takie instytucje jak Komisja Europejska, Organizacja Narodów Zjednoczonych, Bank Światowy, itp., żaden nie jest bezpośrednio oparty o logikę generowania wartości. W efekcie, to, co instrumenty te dostarczają, to statyczne, pozbawione kontekstu „migawki" arbitralnie dobieranych aspektów funkcjonowania rządu cyfrowego w poszczególnych państwach. Tak więc, same w sobie instrumenty te mają ograniczoną zdolność dostarczania wiarygodnej i użytecznej informacji diagnostycznej państwom, które badają. Co więcej, akademicka debata na temat ułomności instrumentów DGB, ich ścieżek rozwoju oraz wpływu benchmarkingu na decyzje polityczne i menedżerskie, zasadniczo pomija fundamentalną kwestię, jak dostosować modele DGB do logiki generowania wartości.

Wziąwszy pod uwagę to, że rząd cyfrowy odgrywa coraz bardziej istotną rolę we współczesnym modelu rządzenia i działalności sektora publicznego, istnieje uzasadniona potrzeba dostępności instrumentów DGB na poziomie państw, które konstruowane byłyby w oparciu o logikę generowania wartości. Instrumenty takie w mniejszym stopniu służyć miałyby tworzeniu kolejnych rankingów państw, a w większym pomagać państwom w identyfikowaniu słabych elementów ich rządów cyfrowych, podejmowaniu właściwych działań w celu ich ulepszenia oraz wspieraniu realizacji racjonalnych ścieżek rozwoju rządu cyfrowego.

Podejmując takie wyzwanie, rozprawa ta proponuje model logiki wartości rządu cyfrowego (DGVL), który jest oryginalną konceptualizacją obejmującą różne aspekty generowania wartości przez rząd cyfrowy. Z perspektywy DGVL rząd cyfrowy rozumiany jest jako system złożony z „konceptualnych" komponentów, które oddziałują ze sobą w ramach procesów generowania wartości, np. budowanie

podstaw prawnych dla rozwoju technologii w sektorze publicznym, poprawa jakości cyfrowych usług w oparciu o ulepszony model przetwarzania danych, zwiększenie wykorzystania takich usług, wspieranie demokracji poprzez mechanizmy partycypacji cyfrowej, itp. Wziąwszy pod uwagę ukierunkowanie DGVL na pomiar i ewaluację, model ten może stanowić wszechstronną bazę dla budowy innowacyjnych instrumentów DGB, zorientowanych na procesy generowania wartości.

W tej rozprawie przyjęte zostały następujące cele: 1) przedstawienie DGVL w kategoriach platformy integracji koncepcji i wątków tematycznych dotychczas rozproszonych pomiędzy różnymi nurtami badań nad rządem cyfrowym; 2) wykazanie, że DGVL stanowi merytoryczne rozwinięcie obecnie dominujących modeli DGB; 3) dostarczenie metodologicznego przewodnika i opracowanie zestawu narzędzi służących projektowaniu i wdrażaniu nowych instrumentów pomiarowych w oparciu o DGVL; 4) wykazanie zasadności i wykonalności podejścia opartego o DGVL, a także jego potencjału w zakresie identyfikowania istotnych problemów rządu cyfrowego.

Powyższe cele zostały zrealizowane poprzez proces badawczo-rozwojowy obejmujący następujące elementy: 1) oparta o literaturę synteza wiedzy, której efektem było sformułowanie zestawu postulatów dotyczących tworzenia nowych instrumentów DGB; 2) formalizacja DGVL jako modelu konceptualnego i podejścia metodologicznego mających realizować te postulaty; 3) zaprojektowanie instrumentu benchmarkingowego opartego o DGVL (DGVLB) oraz jego realizacja i wdrożenie w kontekście rządu cyfrowego wybranych krajów Unii Europejskiej. DGVBL jako instrument referencyjny jest możliwy do wdrożenia również w innych kontekstach. Powyższe działania zostały uzupełnione ankietą ewaluacyjną przeprowadzoną wśród czołowych międzynarodowych ekspertów w tematyce rządu cyfrowego.

Niniejsza praca może przynieść korzyści zarówno w sferze badawczej, jak i praktycznej. W wymiarze badawczym praca integruje zagadnienia takie jak systemowe i procesowe opisy rządu cyfrowego, język generowania wartości jako spójny sposób opisywania problemów rządu cyfrowego i inne wcześniej rozproszone w różnych nurtach badań DG – w efekcie formalizując rząd cyfrowy jako system generowania wartości. W wymiarze praktycznym praca dostarcza konceptualną i metodologiczną bazę dla tworzenia innowacyjnych instrumentów benchmarkingowych ukierunkowanych na procesy generowania wartości. Instrumenty takie z założenia wykorzystują dane już dostępne i modelują ich użycie w sposób pozwalający na rzetelną ewaluację rządu cyfrowego, a tym samym wspierają podejmowanie racjonalnych decyzji politycznych i menedżerskich.

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Acronyms

AI	Artificial Intelligence
B-SGI	Sustainable Governance Indicators (by the Bertelsmann Foundation)
DEA	Data Envelopment Analysis
DG	Digital Government
DGB	Digital Government benchmarking
DGVC	Digital Government Value Chain
DGVL	Digital Government Value Logic (conceptual/methodological model)
DGVLB	DGVL Benchmark (DGVL-based benchmarking model)
DESI	Digital Economy and Society Index (by the European Commission)
DMU	Decision-Making Unit (of DEA)
EU	European Union
EU-EGB	E-Government Benchmark (by the European Commission)
FCA	Formal Concept Analysis
GG	Good Governance
ICT	Information and Communication Technologies
NRI	Networked Readiness Index (by World Economic Forum)
OECD	Organisation for Economic Co-operation and Development
OECD-DGI	Digital Government Index (by OECD)
SDG	Sustainable Development Goals
TOPSIS	Technique for Order Preference by Similarity to Ideal Solution
UN-HCI	Human Capital Index (of UN-EGS)
UN-OSI	Online Service Index (of UN-EGS)
UN-EGDI	E-Government Development Index (of UN-EGS)
UN-EPI	E-Participation Index (of UN-EGS)
UN-EGS	E-Government Survey (by the United Nations)
UN-TII	Telecommunication Infrastructure Index (of UN-EGS)
WB-GTMI	GovTech Maturity Index (by the World Bank)
WGI	Worldwide Governance Indicators (by the World Bank)
WU-IDGR	International Digital Government Ranking (by Waseda University)

1. Introduction

This chapter provides a general overview of the thesis, comprising thematic background, the problem to be addressed, the approach to address it, the aim and objectives, the results, contributions to research and practice, and the structure. The chapter consists of seven corresponding sections: background (Section 1.1), problem (Section 1.2), approach (Section 1.3), aim and objectives (Section 1.4), results (Section 1.5), contributions (Section 1.6), and structure (Section 1.7).

1.1. Background

Among multiple definitions of Digital Government (DG), this study mainly subscribes to the one by the Organisation for Economic Co-operation and Development (OECD): "The use of digital technologies, as an integrated part of governments' modernisation strategies, to create public value" (OECD, 2014, p. 6).

As appositely noted, "Digital government, as a field of study, has evolved to address the complex challenges at the intersection of technology, governance, and society" (M. Janssen et al., 2025, p. 1). Indeed, one must note the diversity of interests within the DG research community, as confirmed by a meta-analysis of the contents published in Government Information Quarterly, the leading journal in the field (ibid). What is more, at the level of institutionalized practice, DG is assumed to "involve rethinking organizations and processes, and changing behavior so that public services are delivered more efficiently to people" (European Commission, 2022a), thus going beyond the technical facilitation of the public sector's routines.

The constantly extended scope of DG reach and relevance is posited by the evolution models (Di Maio & Howard, 2017; Janowski, 2015; PwC, 2022) and confirmed by dedicated analyses (Alcaide–Muñoz et al., 2017; Bindu et al., 2019; Heidlund & Sundberg, 2022), but also can be inferred from the long-spanning adjustments of the popular narration around DG. Concerning the latter, tracing how

the topic was approached over more than 20 years through the United Nations E-Government Survey (UN-EGS), the most recognized DG measurement instrument, may be persuasive. Taking off with a perception of "utilizing the internet and the World-Wide-Web for delivering government information and services to citizens", the United Nations' (UN's) view evolved to find DG as a "key driver of transformation toward sustainable development" (United Nations, 2018, 2020, 2024b), a "support for resilient and sustainable societies" (United Nations, 2018), and a "catalyst for a more equitable and prosperous world" (United Nations, 2024b, p. v).

Given such statements, somewhat surprising may be the fact that the survey's flagship, i.e., E-Government Development Index (UN-EGDI), follows mostly the same measurement logic in 2024 (United Nations, 2024c, pp. 2–3) as it did in 2001 (United Nations & ASPA, 2001, p. 57), i.e., averaging technical infrastructure, human capital, and the contents of online services, and identifying the result of such an operation with the level of DG readiness (or maturity, or development). Some may find this a methodological nuance, but, in fact, it embodies the fundamental limitation of the available Digital Government Benchmarking (DGB) instruments.

1.2. Problem

Despite the extensiveness of DG both as a field of study and a domain of practice, as discussed above, the dominating approach to DGB instruments remains somewhat rudimentary and static. It is questionable whether this approach brings genuinely applicable insights beyond flattering leaders or "naming and shaming" laggards (Bannister, 2007). Illustratively, benchmarks tend to provide context-free "snapshots" of how DG operates rather than a preview of the whole process (Durkiewicz & Janowski, 2021a, 2022).

Such benchmarking – specifically, when the focus is on a DGB survey's final composites, which presumably is what reaches most of the non-expert audience – says very little about the dynamics of internal processes occurring within the DG ecosystem, the relations between invested resources and their effects, the degree to which DG mechanisms are aligned with the non-technological elements of a state's governance and policies, etc. In short, about whether public value is generated through DG. Still valid seems an observation made to address the DGB practice: "inclination to limit the definition of eGovernment might partly be explained by the difficulties of gathering the information necessary for a broader conception of eGovernment" (D. Janssen et al., 2004, p. 3). This critique is not to dismiss the

available instruments, but to argue (as done in this thesis) that they should be treated as intermediate rather than as final products.

These points were first addressed by Durkiewicz & Janowski (2018, 2020). However, the literature scarcely addresses this category of issues explicitly and regularly, cp. (Skargren, 2020). Occasionally, it includes a directed thread within a more general critique of the status quo (Afyonluoglu & Alkar, 2017; Bannister, 2007; D. Janssen et al., 2004; Mukamurenzi et al., 2016; Rorissa et al., 2011; Schellong, 2010), calling for both academic and practical responses. Some authors also propose dynamic/relative DG indicators, such as gain, efficiency, effectiveness, etc. (Bannister, 2007; Heeks, 2008; Schellong, 2010); others postulate holistic, value-aware approaches to DG evaluation (Kunstelj & Vintar, 2004), or DGB propositions constructed upon more specific presumptions, which will be discussed later.

1.3. Approach

A process is defined as a "series of actions that produce something or that lead to a particular result" (Encyclopædia Britannica, 2023). In turn, a system is defined as a "group of related parts that move or work together" (ibid).

A cursory preview of DG conceptualizations is enough to notice that, as a general phenomenon, DG responds to both definitions. As a process, it may be considered a series of "stages" expected to generate desirable outcomes that can be described in terms of public value (Bannister & Connolly, 2014; Panagiotopoulos et al., 2019; Twizeyimana & Andersson, 2019), itself a normative category encompassing nearly all postulated DG advantages; see the public value "inventory" by Jørgensen & Bozeman (2007). As a system, DG is, at the general level, a set of entities interacting within a technology-enabled network, e.g., governmental agencies, communities, service users, citizens, or businesses (Heeks, 2008).

This thesis postulates that these two perspectives can be effectively combined within a "value-generating system", that such a combination may provide a solid foundation for a new approach to designing DGB projects, and that building upon this foundation may generate tangible diagnostic benefits.

Such a "value-generating system" is conceptualized in this thesis as Digital Government Value Logic (DGVL), understood as a "technology-enabled system for generating public value through value-generating processes among conceptual components". While original in its shape and formulation, DGVL is conceptually akin to the DG "value chain" by Heeks (2008), the DG public value-oriented evaluation

framework by Loukis (2021), or more pragmatic models like (Berntzen, 2014; Durkiewicz & Janowski, 2021a; Savoldelli et al., 2013; Stragier et al., 2010).

1.4. Aim and objectives

The underlying aim of this thesis is to introduce a conceptual and methodological framework that positions DGVL as a foundation for more relevant DGB and to demonstrate the practical usefulness of such an approach. To this end, the thesis addresses four research objectives, disclosed in Table 1.1.

Table 1.1. Research objectives

#	**Objective**
RO1	To present DGVL as a platform for integrating ideas already present but scattered in the DG literature
RO2	To position DGVL as a substantive extension of the current DGB approaches
RO3	To provide a methodological guide and toolset for designing and implementing DGVL-based benchmarking instruments
RO4	To demonstrate the feasibility of this approach and its capacity to address substantial issues of DG operation

Source: own elaboration.

Aiming at a feasible measurement model means, for example, confining to data (indicators) that are effectively obtainable from available DGB instruments, even though such indicators may not exhaust all potential DG concepts.

1.5. Results

Research objectives RO1, RO2, and RO3 (to a certain extent) were addressed through the development of the DGVL conceptual framework, informed by the research agenda documented in (Durkiewicz, 2025; Durkiewicz & Janowski, 2020, 2021a, 2021b). In brief, the conceptual model was developed around DG as a macro construct, expressed through measurable concepts such as technology, services, democracy, and others. The process applied three underlying assumptions: 1) the indicators of the DGB instruments can be associated with specific concepts; 2) some relationships between such concepts represent value-generation processes; 3) the efficiencies of such value-generation can be mapped to the DG design, management, and policy problems recognized in the literature.

In principle, the conceptual layer is sufficiently generic to be adapted to diverse DG geographical contexts and available datasets. However, the development and

pilot application of the DGVL benchmarking model (partially RO3, RO4) had to be realized in a context that is: 1) rich in terms of DG advancement, to leverage the analytical advantages of the DGVL concepts fully; 2) sufficiently covered with data, both in terms of DG-specific indicators and complementary measures; and 3) politically interesting for European Union (EU) citizens which count the author. Therefore, these objectives were achieved in the EU context (specifically, 17 EU member states), as described below.

The development of the DGVL-based benchmarking model (henceforth, for clarity, referred to as DGVLB) proceeded in four studies, each addressing a specific task and providing inputs to the following study. The studies are summarized below.

Study 1:

The first study entailed a qualitative analysis, guided by the Activity Theory (Ojo, Janowski, et al., 2012a), of the general features of five DGB projects that regularly provide results for most of the EU countries: the European Commission E-Government Benchmark (EU-EGB), the United Nations Government Survey (UN-EGS), the OECD Digital Government Index (OECD-DGI), the Word Bank GovTech Maturity Index (WB-GTMI), and the Waseda University International Digital Government Ranking (WU-IDGR). Based on the analysis of conceptual coherence, technical realization, and EU relevance, UN-EGS and WU-IDGR were eliminated from further development. This study was based on and extended (Durkiewicz, 2025).

Study 2:

The second study aimed to extract "conceptual packages," i.e., subsets of indicators from the three remaining DGB projects that collectively capture particular aspects of the DG operation, i.e., components of the DGVL. Formal Concept Analysis (Belohlavek, 2008; Ganter & Wille, 1999) was applied as a mathematically grounded method for extracting formal concepts from sets of indicators, each described by up to three thematic tags. Five such packages were identified, referring to (DG) foundation, technology, data, service, and citizen orientation.

Study 3:

The third study elaborated the methodological toolset for DGVLB. To complete the value-generating system, additional indicators referring to the usage of DG services were obtained from the Eurostat database on the Information and Communication Technologies (ICT) usage, and the impact indicators from the Bertelsmann Foundation's Sustainable Governance Indicators (B-SGI) (Schraad-Tischler & Seelkopf, 2015), corresponding to the design documented in (Durkiewicz & Janowski, 2021b). Given this, a country's value generation was operationalized as

the relative technical efficiency of transforming inputs (e.g., services) into outputs (e.g., usage), both represented by the values of the respective indicators. Technically, the Data Envelopment Analysis (Charnes et al., 1978; Sexton et al., 1986), a nonparametric method for computing relative efficiency, was applied.

Study 4:

The fourth study was a pilot application of the model, aimed at expressing and analyzing several recognized DG policy/management problems in terms of value generation processes. The analyzed process included: 1) Foundation to Technology, cp. (Adam, 2020; Barcevičius et al., 2019; Gallo et al., 2014); 2) Data to Service, cp. (Anshari & Lim, 2017; Xia, 2017; Zou et al., 2023); 3) Technology to Governance/Policy, cp. (Bannister & Connolly, 2014; Durkiewicz & Janowski, 2020; Höchtl et al., 2016); 4) Service to Usage (Alkraiji, 2021; Wirtz & Kurtz, 2017; Yera et al., 2020); and 5) Citizen to Democracy, cp. (Åström et al., 2012; Lidén, 2015; Pirannejad et al., 2019). This way, certain DG inefficiencies were exposed in a data-evidenced manner.

The research process was complemented by a survey of a group of experts, who were asked to analyze and discuss the conceptual and methodological aspects of this work, and comment on their validity and prospects for further development. Their views were mainly favorable and encouraging.

1.6. Contributions

This thesis makes three main contributions to DG research and practice.

The first contribution is the identification and formalization of the problem of DG public value generation, and its adequacy for the design and use of DGB instruments. The thesis argues that adopting this perspective is necessary to enhance the usability and adequacy of DGB projects while calling for a more literal treatment of benchmarking, which is not as much about rankings as about providing actionable insights. The problem tends to be glossed over in the literature and does not resonate sufficiently in the debate on DGB improvement.

The second contribution is the systematization of DG value-oriented concepts, organized into a consistent, adaptable framework for designing new DGB instruments or enhancing existing ones. An analytical focus on the value-generating processes between DG components is particularly relevant.

The third contribution is a methodological guide that outlines the steps to take and the analytical tools that are practical for such an adaptation. This approach was

instantiated through the development of DGVLB, which may serve as a referential model for future efforts of this kind.

This work should be of interest and use to DGB practitioners responsible for designing and developing DG measurement instruments, public managers in charge of digital policies informed by DGB results, and DG scholars and analysts, for whom DGVL may provide an innovative analytical perspective that highlights the often-neglected question of DG value generation.

1.7. Structure

The remainder of this thesis is structured as follows. Chapter 2 provides a literature-based background for this research and identifies a knowledge gap that the research seeks to address. Chapter 3 provides the conceptual and methodological framework: elaborates on the DGB problems to be addressed, introduces the DGVL conceptual framework, including practical and technical considerations for addressing these problems, presents methodological positions, and explains how the DGVLB development proceeds. Chapter 4 presents the four studies of the DGVLB development. For clarity, the studies are separate, partial, but self-contained. Chapter 5 addresses the validity and expert evaluation of this work. Chapter 6 discusses the results of this work and its possible implications for research and practice. Chapter 7 concludes the thesis by summarizing the main outcomes, discussing limitations, and considering directions and prospects for future work.

2. Literature Background

This chapter provides the context for the research documented in this thesis. It is based on a corpus of literature of varied types – academic papers, monographs, reports, informative websites, etc., obtained throughout this research.

The chapter's flow is guided by four organizing questions: L1) How should DG be understood according to the literature?; L2) What perspectives can be applied when describing or studying DG?; L3) What issues of DG operation are of typical interest to researchers?; and L4) What are the assumptions of DG benchmarking, and how are they applied in practice? These questions are addressed in Sections 2.1, 2.2, 2.3, and 2.4, respectively. Additionally, Section 2.5 addresses the specificity of DG in the EU and, as such, provides the regional grounding for the development in Chapter 4. The chapter concludes with a section that reflects on the spotted tendencies and knowledge/practice gaps, setting the stage for subsequent chapters.

2.1. Digital Government Foundations

This section addresses the foundational question: L1) How should DG be understood according to the literature? The answer covers DG from its naming (Section 2.1.1) and definition (Section 2.1.2) to concept (Section 2.1.3) and scientific discipline (Section 2.1.4).

2.1.1. Nomenclature

As some state, DG is “an umbrella concept which means many things to different people, according to one’s focus” (Paoli & Leone, 2015, p. 186). This is a rather apt observation. As DG studies are a relatively young and eclectic field, there is debate about what exactly should be studied and what theoretical underpinnings such studies should have (see Section 2.1.4). However, literature and practical insights allow at least the marking out of the range of interest.

There is a supply of terms synonymous or related to "Digital Government", which may cause inevitable confusion, particularly for readers not very familiar with the topic. Table 2.1 presents some variants and examples of their use.

Table 2.1. Digital Government and its related terms

Term	**Examples of use**
Digital Government	(Accenture, 2014; Barcevičius et al., 2019; Janowski, 2015; OECD, 2020a; United Nations, 2022a)
Electronic Government (or E-Government)	(Bannister, 2007; Heeks, 2008; Rorissa et al., 2011; Skargren, 2020; United Nations, 2022a)
Digital Governance	(Erkut, 2020; Haque et al., 2014; Institute on Governance & DEEP Centre, 2018)
Electronic Governance (or E-Governance)	(Bannister & Connolly, 2011; Bindu et al., 2019; Estevez & Janowski, 2013; Ojo, Janowski, et al., 2012b; Xia, 2017)

Source: as listed.

Currently, the lead academic conferences on the topic, e.g., DG.O 2025 or HICSS-58, tend to favor the use of "Digital Government". In practice, the choice appears to rely mainly on the authors' personal preference. However, more explicit explanations can also be found, e.g., "synonyms for e-Gov include digital government, one-stop government, and online government. While digital government is the most commonly used term in the US, electronic government is most common elsewhere" (Grönlund & Horan, 2004, p. 713), or "fully realising this digital transformation requires a paradigm shift from e-government to digital government" (OECD, 2020b, p. 6).

The aspect of transformation, its positive or normative understanding, is highlighted in the European Commission's report: "Since around 2015, models focusing specifically on what we define as Digital Government have started to emerge. They provide a new look at the dimensions for the transformation in the public sector and aim to foresee the developments beyond what is traditionally understood as eGovernment" (Barcevičius et al., 2019, p. 16).

The use of the labels referring to "governance" suggests that "government" itself is neither the primary focus nor the lead actor in the transformation process (Bannister & Connolly, 2011). As it is noted, "Political scientists tend to use the term governance, while IS [Information Science; a/n] researchers tend to use government" (Grönlund & Horan, 2004, p. 720).

Aware of this debate, this thesis favors the use of the "Digital Government" variant, which emphasizes the disruptive role of strictly digital technologies, rather than a more generic "electronic" category. Moreover, when referring to the literature, which authors made different terminological choices, e.g., "E-Government", for the sake of clarity and consistency, the thesis still applies "Digital Government".

2.1.2. Definitions

There is no single, universally agreed DG definition. This fact is cited as one of the targets of critique of the position of DG as an autonomous scientific discipline (Bannister & Connolly, 2015). Construction of the applied variants differs in terms of the authors' interest, i.e., scope of impact – from information and service delivery to e-democracy enabling, recipients – from citizens to all public sector stakeholders, and technology – from computer and web presence to the Internet (Wirtz & Daiser, 2017, p. 9).

To illustrate this diversity, Table 2.2 aggregates definitions formulated across various contexts and times in the DG's history. Although defined in a relatively broad manner, there are common denominators: the key role of technology, the rationalization of technology use toward public benefits, and, consequently, more or less explicit recognition of DG's process character, i.e., a path from technology applications to public policy advantages.

Regarding "Digital Government" and "E-Government" refer to two distinct, albeit related, processes that may have tangible consequences for digital policy formulation. E-Government is "The use by the governments of information and communication technologies (ICTs), and particularly the Internet, as a tool to achieve better government" (ibid., p. 6). At the same time, Digital Government is "The use of digital technologies, as an integrated part of governments' modernisation strategies, to create public value" (ibid). The latter is closest to the logic adopted in this research.

The problem of finding the most informative definition motivated some authors (Alcaide–Muñoz et al., 2017; Hu et al., 2009) to harness an analytical toolset to analyze available definitions and extract their semantic core.

Table 2.2. Digital Government – selected definitions and adopted definition

Definition (literally)	**Source**
Efforts in the public sector to use information and communication technologies to deliver government services and information to the public.	(Gant & Gant, 2001, p. 1618)
Utilizing the internet and the World Wide Web for delivering government information and services to citizens.	(United Nations & ASPA, 2001, p. 1)
The use of information and communications technologies (ICT) to transform government by making it more accessible, effective, and accountable.	(infoDev & Center for Democracy and Technology, 2002, p. 1)
The optimal use of electronic channels of communication and engagement to improve citizen satisfaction in service delivery, enhance economic competitiveness, forge new levels of engagement and trust, and increase the productivity of public services.	(Accenture, 2014, p. 9)
The use of digital technologies, as an integrated part of governments' modernisation strategies, to create public value.	(OECD, 2014)
The use of information and communication technologies, particularly the Internet, in government.	(Chadwick, 2016)
The implementation of information and communication technologies (ICTs) in public organizations (…) process of modernisation and reform.	(Alcaide–Muñoz et al., 2017, p. 545)
The electronic handling of administration and democracy processes in the context of governmental activities by means of information and communication technologies to support public duties efficiently and effectively.	(Wirtz & Daiser, 2017, p. 10)

Source: as listed.

2.1.3. Concept

From a historical point of view, the roots of DG date back to the 1950s and 60s – the "heyday of ideas of scientific administration", but the shaping of its current form is associated with an "agenda for general reform of the public sectors of liberal democratic political systems" in 1990s, such as U.S. President Clinton's National Performance Review of the federal bureaucracy (1993), UK's Labour Party Modernizing Government program (1997), and Internet-enabled initiatives in Canada, Australia, New Zealand, etc. (Chadwick, 2016).

The potential reforming power of technology – not only to enhance the administration's efficiency but also to reshape and empower democracy – is addressed in early papers such as (Dahlberg, 2001; Hoffman, 2000; Meeks, 1997; Vittal, 2001). Also in 2001, the UN took a global DG benchmarking exercise to

scrutinize “E-Government capacity” in 169 out of 190 UN member states (United Nations & ASPA, 2001). The further DG expansion can be directly associated with the global spread of Internet use in the 21st Century, from below 10% of the worldwide population in 2000, to nearly 70% in 2024 (World Bank, 2025).

In terms of DG stakeholders, it is typical to posit relationships between government organizations, and citizens, businesses, non-profits, international bodies, and other government organizations (Rowley, 2011; Shareef M. et al., 2011; Wirtz & Daiser, 2017). This is generalized into technology-mediated government-to-government, government-to-business, or government-to-citizen interactions (Chadwick, 2016; Grodzka, 2009; Srinivas, 2023).

The rationale behind DG, i.e., the expected benefits its implementation may generate, falls into two main stances. Which one is adopted determines one’s approach to the role of DG and, consequently, the evaluation of DG projects. In the first stance, which can be regarded as technocratic, DG is mainly expected to facilitate public service delivery and enhance the efficiency of public administration. In the second stance, which can be considered pro-transformative, DG is the means for the general reshaping and qualitative change of state policy and civil society. In this case, the citizens’ regular and proactive involvement is a sine qua non for its sense (Chadwick, 2016).

These stances can be further refined into separate themes present in the DG debate: systems perspective on government, e.g., process remodeling, reorganization, rationalization; e.g., community network; social aspects, e.g., e-democracy, e-participation; the relations between the governing and the governed, e.g., user value or societal value (Grönlund & Horan, 2004). They may also be related to governance paradigms: bureaucratic, consumerist, participatory, and platform (Janowski et al., 2018), with citizen-administration relationships such as “administer”, “steer”, “regulate”, “serve”, “engage”, “transform”, “legitimize”, “disclose”, “monitor”, “participate”, “empower”, “learn”, “coordinate”, “create”, and “collaborate” (ibid).

While DG is studied here as a state-level phenomenon, it can also be studied in other geographical or governmental contexts, from global, through regional, to local (Gil-Garcia & Flores-Zúñiga, 2020; Gupta & Jana, 2003; Savoldelli et al., 2013; Suhardi et al., 2016; United Nations, 2022a). Municipal contexts in which DG is related to the “smart city” concept are also relatively popular (Conroy & Evans-Cowley, 2006; Höjer & Wangel, 2015; Ingrams et al., 2020; Kummitha & Crutzen, 2017; Morozov & Bria, 2018). DG can also be studied with a monographic approach,

i.e., focused on a single project, with precise time frames and formalized goals (Kettani & Moulin, 2014; Smith, 2016).

2.1.4. Discipline

The scope of what is understood as today's DG research can be initially identified by previewing DG thematic areas in the recent editions of the leading DG academic conferences, as provided in Appendix 1. This preview suggests that the discipline encompasses a broad spectrum of problems associated with the application of technological advancements in the public sector and society, and adapts to current technological trends, notably, Artificial Intelligence (AI). Also, technical topics, chiefly internal to policies, strategies, cybersecurity, and other public-sector operations, co-exist with topics addressing their external impact on democracy, sustainability, etc. In some sense, this dichotomy corresponds to the earlier discussed separation between e-government and DG.

DG research is an interdisciplinary and dynamic field of scientific inquiry (M. Janssen et al., 2025), originally developed at the intersection of information science and public administration studies (Grönlund & Horan, 2004; Heeks & Bailur, 2007; Homburg, 2008), and thus inherits some original deficiencies of this intersection (Heeks & Bailur, 2007). Whether to speak of an autonomous and distinct discipline, DG research "might best thrive as a multi-, inter-, or transdiscipline with the prospect of becoming an academic role model for integrative knowing capable of coping with the complexity of problems and phenomena without unduly simplifying them" (Scholl, 2008, p. 21).

A concept of how DG research and development can be structured ("tripartite model") is proposed by Hovy (2008) to encompass three DG research perspectives which collectively define the range of the discipline: 1) government as an information processor, 2) government as a function, and 3) government as an organization. Consequently, each of them is backed by a block of more established research fields: 1) information technology research, and large-scale systems, interfaces, and human factors; 2) political science, legal studies, ethics and morality; and 3) sociology, organization and management, and information systems (ibid., pp. 47-48).

Thus, DG research benefits from theoretical contributions from structuration theory, actor-network theory, game theory, public value theory, new public management, and other academic theories, along with its "native" theories, e.g., reinforcement hypothesis, transformative government, m-government, etc. (Bannister & Connolly, 2015); the authors state that the claims of DG research being

under-theorized are exaggerated since “a deep theorisation of a multi-disciplinary field may not be possible” (ibid., p. 10). Similarly, an elaboration by Molnar et al. (2015) highlights the potential of numerous theoretical stances in studying DG, some surprising, e.g., contrarian theory or gatekeeping theory. On the other hand, Meijer & Bekkers (2015) posit an integrative view through the proposed DG “meta-theory”.

Perhaps neither entirely autonomous scientific domain nor encompassed within rigid theoretical frames, DG studies have become a recognizable research direction, adapting smoothly to the dynamic nature of ICT; see DG scientific evolution tracing (Alcaide–Muñoz et al., 2017; Bindu et al., 2019). Through analyzing the corpus of DG research papers, four historical phases of DG research are identified: “The first phase until 2005 focuses on information systems and implementation models; the second phase between 2005 and 2009 focuses on evaluation models; the third phase from 2009 to 2012 focuses on social networking and multichannel communication; and the fourth from 2012 onwards focuses on e-democracy, open data, and e-participation” (Bindu et al., 2019, p. 394), along with their pivotal thematic domains: “information and administrative system modeling; quality surveys and evaluations of user adoption and customer satisfaction; the possibility of process re-engineering; and open data and the role of social networking and e-deliberation leading to participative government” (ibid).

2.2. Digital Government Perspectives

More in-depth, DG can be considered and analyzed from both process and system perspectives.

A process is a “series of actions that produce something or that lead to a particular result” (Encyclopædia Britannica, 2023). DG satisfies this description by its definition (see Table 2.2): a sequential implementation of technological innovations (a series of actions) leading to a more desired state of public affairs (the result). Frequently, DG is associated with transformation, understood as change, modernization, or innovation (Barcevičius et al., 2019, p. 18). Note that the subject of this transformation, e.g., its catalyst, is different from the object being transformed. Likewise, a system is a “group of related parts that move or work together” (Encyclopaedia Britannica, 2023). Hence, from this perspective, DG is described and analyzed as a system comprising several functional blocks, some linear and others not, that are related and interact with one another. This section details both perspectives: process (Section 2.2.1) and system (Section 2.2.2).

2.2.1. Process

The second definition of a process is "a series of changes that happen naturally" (Encyclopædia Britannica, 2023). The fact that both variants are reflected in the DG discourse raises a non-trivial question of what should be understood by "happen naturally" in the domain of human action. For instance, whether overall technological advancement may be considered "natural". This problem is philosophically interesting, but mostly beyond the scope of this text.

Whether driven by technical progress or planned, literature addresses the problem of how DG changes, expressing it through models/constructs such as DG maturity, growth, development, etc. These models are usually composed of a few stages that lead to a certain level of advancement. There are studies aimed at aggregating and comparing these models, e.g., (Almuftah et al., 2016; Barcevičius et al., 2019; Fath-Allah et al., 2014), moreover, proposing a meta-perspective on the problem. According to Fath-Allah et al. (2014), three categories of maturity models may be identified: 1) governmental – developed for governmental agencies, with direct applicability and diagnostic utility in mind, 2) holistic – designed to evaluate the chance of success of a specific DG project, and 3) evolutionary – considering and analyzing DG as an evolutionary process. Almuftah et al. (2016) provide a mapping of the stages of each analyzed model into three "meta-stages": 1) presence, 2) communication, and 3) full integration.

Most DG maturity models have utilitarian goals in mind, as they are meant to support policymakers and managers in developing a fully functional package of digital services, i.e., they correspond to the first two categories of maturity models. Others go beyond the utilitarian range of maturity models to propose a more universal perspective, more in line with the second definition of a process. One of these is the "Digital Government Evolution Model" (Janowski, 2015), which is presented as "not aimed at leading organizations toward higher stages of Digital Government maturity (micro level) but capturing de facto evolution of the area (macro level), with different stages of the evolution co-existing in time, and the earlier stages remaining the necessary and legitimate targets for new research and innovation" (p. 233), later engaged in the evaluation of countries' readiness towards DG-enabled achievement of Sustainable Development Goals (SDG) (Janowski, 2016). The OECD's generalizing view posits two complementary patches of transformation, from "analog" government to DG, and from DG to the state of "citizen well-being" (OECD, 2020b).

Table 2.3 presents several recognized evolutionary models, each with varying nomenclature proposed by its authors. The models show that DG development can be described and evaluated from diverse perspectives and motivated by varied positions on DG's role in society. For instance, the earliest models tend to focus on the business-like effectiveness of DG services, the Gartner model on the technical aspects of development, and Janowski's and OECD's approaches subscribe to the broadly held DG-driven transformation.

An answer to the question of what causes DG growth may be twofold. The application-oriented models implicitly assume that policymakers deliberately develop DG in the desired direction (therefore, the first definition of a process). A different answer follows when a model describes objective reality (the second definition of a process) rather than supplying a managerial recipe. The DG Evolution Model postulates that technological adoption and pressure on the government – understood as factors exogenous to DG management – both ignite DG innovation and, in turn, drive DG institutionalization (Janowski, 2015). According to the "Four Forces Model" (Wirtz & Daiser, 2017, p. 36), the driving forces are: 1) Convergence and Technology; 2) Citizen; 3) Empowerment, Society and Economy; and 4) State and Politics.

Table 2.3. Selected Digital Government growth/evolution models

Model	**Stages or levels**
The four-stage model of growth (Layne & Lee, 2001)	Catalogue Transaction Vertical Integration Horizontal Integration
The five-stage development model (United Nations & ASPA, 2001)	Emerging Enhanced Interaction Transactional Seamless
The five-stage maturity model (Belanger & Hiller, 2006)	Information Two-way communication Transactions Integration Participation

Model	Stages or levels
Digital Government Evolution Model (Janowski, 2015)	Digitization (Technology in Government) Transformation (Electronic Government) Engagement (Electronic Governance) Contextualization (Policy-driven Electronic Governance)
Gartner Digital Government Maturity Model 2.0 (Di Maio & Howard, 2017)	Initial: E-Government Developing: Open Defined: Data-centric Managed: Fully Digital Optimizing: Smart
DG "transitional paths" (OECD, 2020a)	Transition to DG: Analog government E-Government Digital Government
	The path toward citizen well-being: Digital Government Service Design and Delivery Citizen Well-being: Trust and Legitimacy of Institutions

Source: as listed.

2.2.2. System

The system perspective is advocated by Ayyad (2017), who discusses possible approaches to modeling DG structure and dynamics, postulating that, "at the core, E-Government is best represented by using a network structure. E-Government connects different actors [people, private sector, and public sector agencies] together. It establishes internal and external connections creating networks at different levels" (p. 488). The network perspective is also advocated in (Corsi et al., 2006; Khrais et al., 2019; Lee et al., 2018; Ostasius & Laukaitis, 2015).

Another proposition is to express DG in terms of the Value Activity System (Wirtz & Daiser, 2017), based on the value chain idea introduced by Porter (1985). As it may be said, "The underlying idea of the value chain is based on a process view of organizations. From this perspective, an organization is a system composed of subsystems that transform inputs into outputs. The effectiveness and efficiency of the associated activities, which are needed for the transformation process, finally determine the costs and the profit of the organization" (IfM, 2016). In contrast to the network perspective, value chain models chiefly address linear, directed value flows,

although some postulate complementing such flows with closed-loop counterparts (Fulconis et al., 2019). The value chain concept is generalized to describe "a series of organizational activities that create, deliver, and capture value at each step" (Simatupang et al., 2017, p. 4). It is sufficiently generic to be applied across domains.

In the DG studies, the value chain perspective is applied across many contexts, but it does not always capture the persistent role of DG within state policy. For instance, the Value Activity System focuses on descriptions that are technical in character and sectoral in range, arguing that the entire DG system is "made up of subsystem activities that have specific inputs, transformation operations, and outputs" (Wirtz & Daiser, 2017, p. 44). A similar philosophy is applied by Wassenaar (2000), Savoldelli et al. (2013), and Kumar et al. (2021).

A more public-value-oriented value chain, or so-called DG (E-Government) Value Chain (DGVC), is postulated by Heeks (2008) and considered in the context of benchmarking, with stages arranged sequentially: Readiness, Availability, Uptake, and Impact; Figure 2.1. This view is undertaken in other studies (Afyonluoglu & Alkar, 2017; Durkiewicz & Janowski, 2021a; Silal et al., 2019). Also, literature provides variations on DGVC, e.g., the ICT for Development impact assessment framework (Heeks & Alemayehu, 2009), the ICT and Hope for Development framework (Heeks & Krishna, 2016), or a procedural map of digital transformation (Mergel et al., 2019). The DGVC perspective is akin to the managerial concept of the logic model (NECS & NHS, 2016), which examines how inputs are transformed into outputs, outcomes, and impacts (Berntzen, 2014; Stragier et al., 2010).

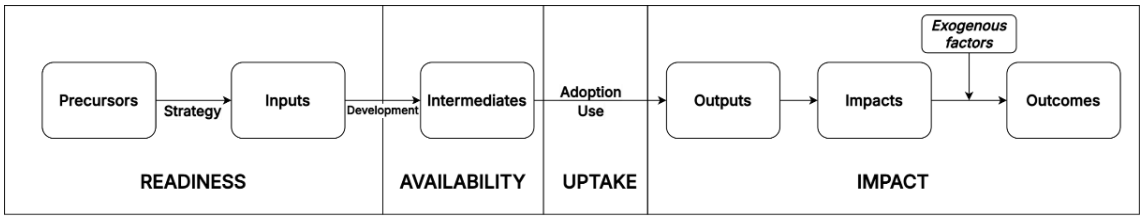

Figure 2.1. Digital Government (E-Government) Value Chain – Heeks' labeling
Source: own adaptation based on (Heeks, 2008).

To complement this discussion, the socio-technical theory (Trist & Bamforth, 1951) should be included. Central to this theory are assumptions that 1) a system should be analyzed concerning its constituent social (human) and technical subsystems, cooperating in the context of the environmental subsystem, and 2) the system succeeds by reaching the state of joint optimization, i.e., "goodness of fit" between its social and technical components (Abbas & Michael, 2022). While initially thought of as a new paradigm for analyzing and evaluating organizations (Abbas &

Michael, 2022), some authors adopted it for the sake of DG studies (Al Hussaini, 2021; Ayyad, 2017; Bakunzibake et al., 2019; Kompella, 2017; Kosenkov et al., 2019; Pereira et al., 2016; Zhai & Gao, 2023). The socio-technical theory is suitable to capture the system perspective on DG. An operational mapping of the socio-technical theory concepts to some DG entities and relationships is proposed in Table 2.4.

Table 2.4. Associations between socio-technical concepts and DG components

Socio-technical concept	**DG components or relations**
Technical subsystem	DG services, web channels, e-channels, back-office
Social subsystem	DG users, citizens, government employees
Work system	DG as a whole – the supply and demand sides
Environmental subsystem	Technical infrastructure, human capital, legal framework, and budgeting
Joint optimization	State of balance between the quality of DG services and the extent of their use,

Source: own elaboration based on (Abbas & Michael, 2022; Heeks, 2008).

2.3. Digital Government Themes

DG research literature addresses various DG themes, associated both with its internal operations and with its interactions with the environment, be it citizens, businesses, technological infrastructure, or more abstract categories, such as the qualities of governance. If referring to DGVC as an organizing concept, the topics above can be roughly matched to specific phases of value generation, e.g., a transition from readiness to availability. However, a straightforward assignment is not always possible. Therefore, at least three categories of studies can be identified: 1) Implementation – studies examining whether DG platforms and services are developed as much as they should be; 2) Usage – studies examining to what extent DG services are adopted and used by citizens and other stakeholders; and 3) Impact – studies examining whether DG-generated impact is sufficient given the level of DG advancement. In this section, these categories are illustrated and discussed: implementation (Section 2.3.1), usage (Section 2.3.2), and impact (Section 2.3.3).

2.3.1. Implementation

An established managerial term for the determinants of a project's success (or failure) is “success factors”. However, currently, it is arguably pointless to treat DG – at least at the country level – as a project or initiative, since every country has already developed DG to some extent. Thus, it tends to be a persistent element of the public sector landscape rather than an innovation by itself. Still, some studies focus on specific initiatives within DG, particularly those set up with well-defined expected outcomes (Kettani & Moulin, 2014; Savoldelli et al., 2013; Smith, 2016).

The literature supplies views on the conditions to be met when setting up or developing DG. According to the UN, there are three main classes of DG prerequisites: technological infrastructure, human capital, and electronic connectivity (United Nations, 2004, p. 8). The list may be extended. Barcevičius et al. (2019) identify factors affecting DG as transformation drivers and aggregate them into technological, organizational, legal, ethical, social/cultural, and economic/financial categories (p. 57). Heeks (2008) divides preconditions into two separate categories: precursors – data, legal, institutional, human, technological, leadership, driver, and demand factors; and inputs – money, labor, technology, political support, and targets (p. 268). Comparably, the European DGB project, EU-EGB (Capgemini et al., 2020), places DG within the spectrum of digitalization efforts, which are preceded and conditioned by connectivity, human capital, the use of the Internet, and the integration of digital technology (p. 29). Given the above, human, technological, and communication factors are common across categorizations.

An interesting effort by Gil-Garcia & Flores-Zúñiga (2020) proposes a comprehensive model of DG success, intended to balance the implementation of initiatives by government agencies and their adoption by users (i.e., citizens). Thus, this proposal also addresses DG usage. Note that the implementation phase of this model mediates between external conditions and the supply of DG (p. 5). Other views include drivers of municipal-level DG implementation in reference to the DG stage models (Ingrams et al., 2020) or DG critical success factors for public administration in Poland (Ziemba et al., 2013, 2016).

2.3.2. Usage

In economic terms, the usage issue is conceptually akin to the problem of finding an equilibrium between supply and demand, or the reasons for the lack of such an equilibrium. Its significance was confirmed by United Nations (2012), putting usage among the leading topics: “Over the past years, citizen usage of e-government

services ('demand-side') has also become a priority issue" (p. 101) with "impact generations of e-government services […] very much determined by the number and type of users of these services, and the frequency of their use" (ibid). This view is shared by Wirtz & Kurtz (2017): "Academic and managerial knowledge about the success of e-Government remains limited. Given that citizen needs have become a focus of interest, it is reasonable to investigate its success factors from a user-oriented perspective" (p. 353).

When asking why citizens use DG, T. Nam (2014) provides five motivations: service and transaction use, information use, government policy research, participation, and co-creation. These represent gradations of engagement from participation in necessary routines to active policy involvement. Comparably, DG adoption occurs at two "macro-levels": "shallow" – viewing, collecting information, downloading forms, etc., and "deep" – regular engagement, interaction, seeking government services, etc. (Yera et al., 2020).

Various specialized theoretical models address the continuous use of technological capabilities. Among them is the Technology Acceptance Model, which explains user acceptance of specific technology in terms of perceived usefulness and perceived ease of use (Davis, 1989), and several other propositions (Taherdoost, 2018). In the case of DG usage, the explanation offered by the Technology Acceptance Model may be extended with other factors, such as computer self-efficacy, trust in the Internet, and trust in government (Zhao & Khan, 2013); psychological factors, and civic-mindedness (T. Nam, 2014); attitude, and perceived behavioral control (Zahid et al., 2022); etc. Wirtz & Daiser (2017) further discuss the "e-demand" construct, identifying the dimensions of use quality, system quality, and service quality. The authors conclude that successful (i.e., used and positively received) provision of DG services requires "convenient, appealing, and reliable administration from a user's perspective", is sensitive to privacy-, risk-, and trust-related factors, and therefore requires expectation management (p. 136).

Some studies also aim to explain differences in the DG service demand. To illustrate this, Zahid et al. (2022) examine the adoption factors through the lens of the theory of planned behavior; Rodriguez-Hevía et al. (2020) highlight the role of digital skills in DG use and adoption in Europe; Faulkner et al. (2019) propose a quasi-experimental trial to test the effectiveness of behavioral interventions to increase citizens' use of e-government; Ma & Zheng (2018) refute the popular assertion that the performance of DG services boosts the level of their use; and T. Nam (2014) examines the models of DG usage and identifies two distinct groups of

users in such models: consumers of information and transaction services, and more engaged “policy researchers”.

2.3.3. Impact

Studies in this category examine whether DG generates the expected impact. Typically, in such studies, DG is implicitly reduced to its platform or service components, though occasionally some “usage effects” are considered (Lee & Shi, 2020; Wirtz & Kurtz, 2017). Furthermore, when quantitative evidence is required, authors tend to refer to popular benchmarking instruments, such as UN-EGDI (Basyal et al., 2018; Madzova et al., 2013; Wallis & Zhao, 2018).

DG impact generation is a natural object of interest given the expectations expressed in DG definitions or conceptualizations; see Table 2.2. The DG impact domains are diverse and frequently presented in thematic packages, e.g., 1) efficiency, government services, policy outcomes, economic policy objectives, public management reform, trust between government and citizens, citizen engagement and participation (OECD, 2003); 2) service delivery, social welfare, cost reduction, internal procedures of public agencies (Commonwealth of Australia, 2003); 3) service delivery, economic competitiveness, engagement and trust, public sector productivity (Accenture, 2014); 4) public administration, governance, policymaking, public services (Barcevičius et al., 2019).

Some authors associate impact expectations with specific evolutionary trends, be it scientific interest, from conventional governance to e-democracy (Bindu et al., 2019) or DG evolution itself – from technology in government to policy-driven electronic governance (Janowski, 2015). Therefore, the more ubiquitous and capable the technological infrastructure, the more articulated the transformative role of DG. However, expectations toward the transforming role of technology have been raised since the early days of DG (Meeks, 1997). The core of the assumed impact remains relatively stable over the years, though new points of focus emerge to reflect broader policy trends, e.g., the pursuit of sustainability (United Nations, 2016).

While the above are primarily normative postulates, many authors are more interested in the actual scale of impact. The text below captures the persistent thematic trends (omitting the strictly economic or financial impacts, which require dedicated idioms and tools and are beyond the scope of this study).

At the most general level, DG impacts public governance. Governance is a category that remains persistently vague despite its constant presence in public debate. One reason is the use of the term in many different contexts – corporate

governance, data governance, public governance, etc. From a political stance, governance has at least a few meanings (Fukuyama, 2016), with even more conceptual associations (A. K. Sharma, 2018; Welch, 2013). Concerning DG, governance refers to the functioning of the country's public administration or its public policies, i.e., "relations between the government and the governed or between state and society" (Iftimoaei, 2015, p. 310).

A set of desirable governance features – participatory, consensus-oriented, accountable, effective, etc. is labelled "good governance" (GG) (UNESCAP, 2009). GG addresses the country's technical and managerial capabilities, as well as the range of measures to empower citizens. International agencies widely use the GG concept as a management instrument to promote structural reforms, strengthen institutional capacity, and provide an evaluation framework for countries seeking external aid or support (Iftimoaei, 2015). Since the catalog of GG qualities is flexible, it is frequently adjusted to the current political context (Knoll & Zloczysti, 2012; A. K. Sharma, 2018), a practice subject to critique (Gisselquist, 2012). Other authors note that "one size does not fit all" and that GG, as a referential model, is not an effective tool given the diversity of countries' individual conditions (Stojanović et al., 2016).

The role of DG is addressed across different governance-related areas. Numerous studies also approach governance as a whole or focus on its meta-qualities, such as sustainability, business-oriented capacity, political modernization, etc. Table 2.5 provides a selection of interesting studies, assigned to governance domains/qualities. It starts with general categories, followed by more specific ones. Due to the diversity of research contexts and designs, their outcomes are not always comparable. At times, they may reach opposite conclusions, e.g., in the corruption studies. Thus, a meta-analysis might be needed to extract some generalizations.

Table 2.5. Digital Government governance impact studies

Governance domain/quality	**Studies**
General governance	(Bannister & Connolly, 2011; Bekkers & Homburg, 2007; Navarra & Cornford, 2012)
Good governance	(Durkiewicz & Janowski, 2018; Haque et al., 2014; Kettani & Moulin, 2014; Madzova et al., 2013; Suhardi et al., 2016)
Political modernization	(Xia, 2017)
Public values	(Bannister & Connolly, 2014; Panagiotopoulos et al., 2019; Twizeyimana & Andersson, 2019)

Sustainable qualities	(Durkiewicz & Janowski, 2021b; Estevez & Janowski, 2013; Janowski, 2016; Lim, 2014; United Nations, 2016)
Administrative routines, bureaucracy	(Gallo et al., 2014)
Government efficiency	(Dobrolyubova et al., 2019; Mahmoodi & Nojedeh, 2016; Paoli & Leone, 2015; Wallis & Zhao, 2018)
Corruption	(Basyal et al., 2018; Krishnan et al., 2013; Lupu & Lazăr, 2015)
Accountability and transparency	(Bannister & Connolly, 2011; Islam & Grönlund, 2012)
Participation and democracy	(Åström et al., 2012; Grönlund, 2011; Maerz, 2016; Simon et al., 2017; Spirakis et al., 2010; Stier, 2015)

Source: own elaboration.

2.4. Digital Government Benchmarking

DG researchers and practitioners have been addressing the DGB problem for over two decades, with UN-EGS (United Nations & ASPA, 2001) as the most prominent, global DGB instrument, often serving as a trigger for this interest. In the process, DGB has matured into an outright "subdiscipline" within DG studies. This section aims to scrutinize this subdiscipline: research positions on DGB in the literature (Section 2.4.1), the managerial origins for DGB adopted in this thesis (Section 2.4.2), the theoretical foundations of DGB (Section 2.4.3), measurement in DGB (Section 2.4.4), and innovations in DGB (Section 2.4.5).

2.4.1. Positions

The literature addresses DGB from several positions, at times intertwined within a single study. Here is an overview of three such positions.

First, there are often critical reflections on the character of DGB, its nuances, and its significance in supporting DG, e.g., (Bannister, 2007; Heeks, 2008; Janssen et al., 2004; Kunstelj & Vintar, 2004; Salem, 2007; Young-Jin & Seang-tae, 2007). Second, some studies address DGB from integrative or comparative perspectives (Heidlund & Sundberg, 2022; Lnenicka et al., 2024; Martínez et al., 2022; Mukamurenzi et al., 2016; P. N. Sharma et al., 2018; Skargren, 2020; Zahran et al., 2015). Third, there are studies oriented at a constructive response to the deficiencies of the status quo, e.g., (Ardielli & Halásková, 2015; Durkiewicz & Janowski, 2020; Kunstelj & Vintar, 2004; Przeybilovicz et al., 2023; Salem, 2007; Schellong, 2010; Scott et al., 2016; Suri & Sushil, 2017). They often focus on a particular aspect of

DG, e.g., e-participation (Grönlund, 2011; Kabanov, 2022; Lidén, 2015) or a specific survey or index (Ayanso et al., 2011; Kabanov, 2022; Whitmore, 2012).

Among the studies are numerous comprehensive propositions or models for redesigning the logic and methods of DG evaluation, which are further discussed in this text. Among them is a series of UN-originated DGB reports that comprehensively address the whole process, both as an object of research and as a political, organizational, and technical endeavor (Ojo, Dzhusupova, et al., 2012a, 2012b; Ojo, Janowski, et al., 2012a, 2012b).

2.4.2. Origins

Under the "benchmarking" umbrella, DGB research is pursuing several related, though by no means identical, concepts, including measurement, ranking, scoring, assessment, and evaluation. However, despite this convention, the nomenclature should be handled with care. Thus, this section revises what "benchmarking", in its most generic, practical sense, primarily means.

The Xerox Company's 1979 initiative is typically regarded as the precursor to benchmarking as a managerial practice (Yasin, 2002). However, the term itself is much older, with its semantic roots in the 19th-century "surveying practice of establishing marks in the ground" and evolving through successive generations (Kyrö, 2003). Various formal definitions of benchmarking are formulated from varied standpoints – managerial, business, etc. A preview is provided in Table 2.6.

Table 2.6. A preview of benchmarking definitions

Definition (literally)	**Source**
Measuring the quality of something by comparing it with something else of an accepted standard.	(Cambridge Dictionary, 2021)
The process of measuring products, services, and processes against those of organizations known to be leaders in one or more aspects of their operations.	(American Society for Quality, 2021)
An exemplar-driven teleological process operating within an organization to intentionally change an existing state of affairs into a superior state of affairs.	(Moriarty & Smallman, 2009, p. 486)
[An action undertaken – a/n] to identify and implement best practice.	(Helgason, 1997, p. 1)
Searching for best practices that lead to superior performance.	(Camp, 1989, p. 25)

Source: as listed.

More in-depth, Kyrö (2003) uncovers three types of goals behind benchmarking efforts: performance, process, and strategic; and four associated perspectives: internal, competitor, functional, and generic. A slightly different taxonomy, though openly business-oriented, is provided by the Global Benchmarking Network (2025). The taxonomy is depicted in Figure 2.2.

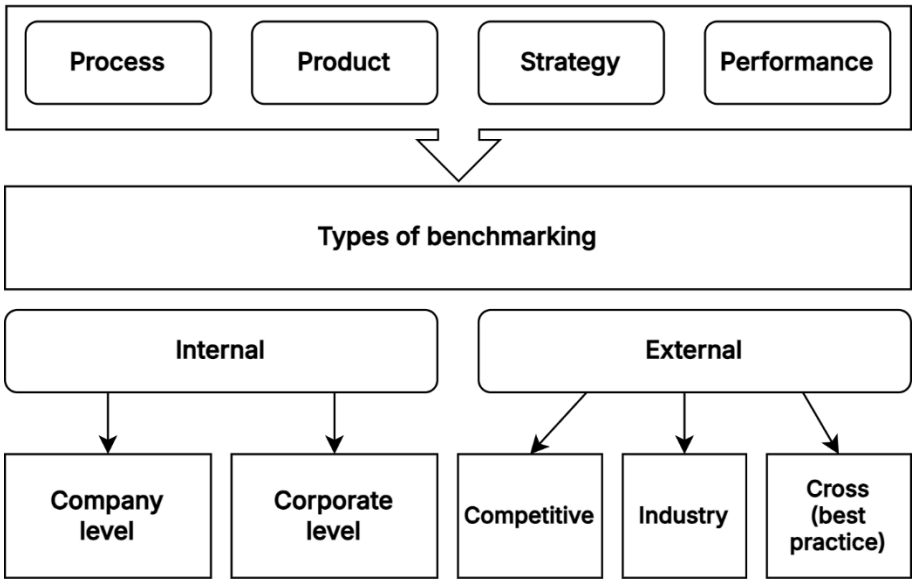

Figure 2.2. Types of benchmarking – a taxonomy
Source: own adaptation based on (Global Benchmarking Network, 2025).

The literature identifies several key features of benchmarking. These include the utilitarian character of the process, comparison drive, analytical orientation toward efficiency, and the rational choice of the reference group. These features are addressed in Table 2.7.

Table 2.7. Essential features of benchmarking

Feature	Treatment
Utilitarian character of the process	Scores and rankings are inevitable side-effects of benchmarking, since the main goal is "to identify best practices that can be adopted and implemented" (Freytag & Hollensen, 2001, p. 25). Given this, benchmarking is "a means towards the end of achieving a more desirable organizational state of affairs than is currently the case" (Moriarty & Smallman, 2009, p. 497). Thus, some authors complement benchmarking with derived actions such as "benchlearning" or "benchaction" (Freytag & Hollensen, 2001).
Comparison drive	Benchmarking proceeds through comparisons. That is, a unit's performance is compared to the performance of other units, particularly those regarded as leaders, "best-in-class" or "exemplar" in the whole business or its particular aspects (Camp, 1989; Freytag & Hollensen, 2001; Moriarty & Smallman, 2009).
Analytically oriented at efficiency	Since benchmarking is an efficiency-raising process (Freytag & Hollensen, 2001), the state of efficiency and the points of inefficiency constitute its analytical focus, along with related issues, e.g., productivity or strategic effectiveness (Yasin, 2002). In a general sense, efficiency is understood as "the ability to do something or produce something without wasting materials, time, or energy" (Encyclopaedia Britannica, 2022).
Rational choice of the reference group	Benchmarking as a tool for feasible improvement of a unit makes sense when the units being analyzed are broadly comparable. That is, the desirable directions and the scope of change, disclosed through the benchmarking process, appear realistic enough. Thus, leaders "represent best practices and establishing rational performance goals" (Zairi, 1994, pp. 62–63) and do not have "a totally different starting point" (Freytag & Hollensen, 2001, p. 30). Benchmarking actions can be counterproductive and meaningless, for example, when comparing the production costs of car models representing entirely different market segments (Kaplan, 2006).

Source: own elaboration.

2.4.3. Foundations

Some authors sum up DGB with sarcastic quotes like "mine's bigger than yours" (Janssen, 2003), "if you measure it they will score" (Janssen et al., 2004), and speak of a "curse" (Bannister, 2007) or a "bulldozer" (Salem, 2007). This shows that DGB may be controversial, and its practical value depends on the quality of its design and implementation. Some DGB studies provide conceptual framings, though these are rarely complete. A few of them are discussed below.

Bannister (2007) argues that the process is developed upon addressing a few fundamental questions, that is, 1) purpose, i.e., an unambivalent business case for DGB; 2) the object of benchmarking, i.e., what shall be measured and whether such a decision is justified by the objective and backed by available resources, including data; and 3) the type of benchmark, i.e., whether DGB is realized for the sake of

comparison between benchmarked unites, or whether it follows some adopted standard. The author classifies DGB projects by attributes such as frequency, source, scope, scale, and highlights important factors, e.g., the technological context – the relevance of the DGB project depends on how it accounts for the current state of technological development; the expectations of the project's owners; the profile of the target audience; the risk of the benchmarked units "playing the system"; etc.

Heeks (2008) defines DGB as undertaking a review of the comparative performance of DG between nations or agencies (p. 257) and identifies two types of purpose: external and internal. Further, the possible foci of benchmarking are considered, in terms of its 1) scope, i.e., a subset of the DG stakeholders and the processes they participate in; 2) DG levels, e.g., national or regional; and 3) channels, i.e., the way services, data, information, or other results of the DG operation are delivered via Internet, e-mail, mobile application, etc.

Salem (2007) highlights the centrality of the benchmarking report and posits that DGB efforts can be classified and analyzed concerning: 1) the context of the report, i.e., authors, sector, purpose, timeframe; 2) the methodological level; 3) the benchmark type; and 4) the "sociological paradigmatic tendency", e.g. positivist, interpretivist, radical structuralist, or radical humanist.

Janssen et al. (2004) observe that the underlying question is no longer "what should we do" but "how are we doing (compared to others)". The authors categorize DGB projects by focus: supply, demand, and the information society. They provide rationales behind projects: "Finding out if lessons can be learned from other countries' eGovernment policies; measuring eGovernment progress compared to other countries; identifying and learning from best practices in other countries; discovering global trends in eGovernment; measuring underlying eGovernment concepts to identify points of leverage" (p. 2).

According to Bannister (2007), "Much of the discussion of 'improving' benchmarks is based on finding a better, more representative set of indicators and/or altering the weightings. The fundamental difficulty with the whole process is not considered" (p. 179). This suggests that the measurement component, though vital, is often treated as the sole concern of DGB projects.

Indeed, it is not the case, as demonstrated by the Activity Theory-based outlook on the complexity of the DGB projects (Ojo, Janowski, et al., 2012a), depicted in Figure 2.3. According to this figure, a DGB project places DG measurement within a broader application context, shaped by questions about why the measurement is

undertaken, how it is arranged, what information it is expected to reveal, who may substantially benefit from learning such information, etc.

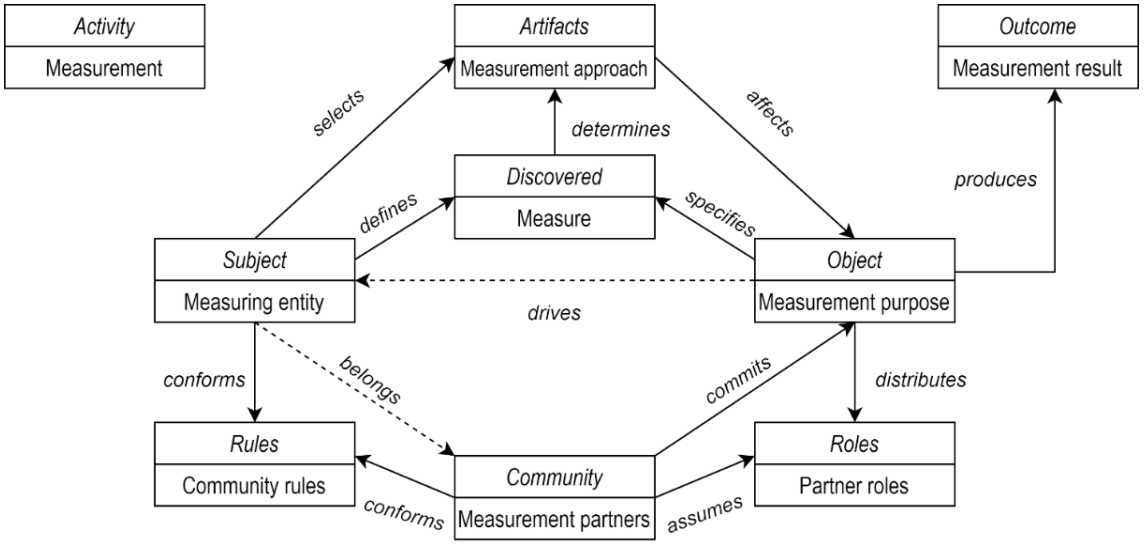

Figure 2.3. A model of DGB process complexity, through Activity Theory
Source: own adaptation based on (Ojo, Janowski, et al., 2012a).

2.4.4. Measurement

While measurement is at the core of DGB projects, the literature often uses this term interchangeably with assessment and evaluation – these terms are related but distinct. Measurement is the process by which the attributes of an entity are determined; assessment is the process by which information is obtained relative to a known objective; and evaluation is the classification of the entities according to the predefined quality criteria (Kizlik, 2014).

Mapping the above to the DGB context, it can be said that a country's performance in selected DG domains is measured, progress in this performance relative to the declared policy targets is assessed, and its alleged impact on the society's well-being is evaluated. In other words, measurement is the most technical, chiefly quantitative, ingredient of a DGB process, while assessment and evaluation build on the measurement outputs by placing them in a policy context. This logic is applied in this thesis.

The measurement terms used in DGB, their key categories – construct, concept, variable, indicator, operationalization, and validity – are presented in Table 2.8.

Table 2.8. Core measurement terms in DGB projects

Term	**Explanation**	**DGB working example**
Construct	A conceptual basis of research, not developed upon observations but rather through further abstraction and generalization of several concepts, possibly latent.	Digital Government (performance/development/ advancement)
Concept	A labeled abstraction that is developed upon several observed cases, thus meant to describe a specific phenomenon; a systematic formalization of a construct.	Quality of government websites
Variable	A measurable representation of a particular aspect of a concept	Completeness of the provided information on the government website
Indicator	A specific measure of a variable	Binary flags to mark whether a particular component, e.g., contact information, is present on the government website
Operationalization	Transferring concepts into the domain of measurement, through an arrangement of directly measurable variables and postulated relationships between them	A researcher assumes that a government website is high-quality if it contains certain essential elements, and designs an assessment form for a surveyor to use when visiting the website.
Validity	A set of criteria to determine whether these categories were treated in a substantively and technically correct way.	Reflection on whether the researcher's assumptions were correct and well-informed, and whether the designed measurement scheme indeed captures website quality.

Source: own elaboration based on (McKee, 2024; Ojo, Janowski, et al., 2012b).

Given the ongoing debate on how to properly delimit DG and which of its components to measure (see Section 2.1), the appropriate treatment of the terms in Table 2.8 may be disputed. This is confirmed by the information in Table 2.9, which contains a preview of how DG is approached and operationalized in several established DGB projects. As many of such projects undergo regular updates and conceptual refinements, this preview is strictly time-bound.

Table 2.9. DG conceptualizations and operationalizations in DGB projects

Project	Source	Base framework/concept	Output DG measures
UN-EGS (2022)	(United Nations, 2022a)	A holistic view of DG that societies can benefit from. Three dimensions of DG: telecommunication, human capital, and online services.	Measures of comprehensiveness and quality of services: 1) UN-EGDI (general DG), 2) UN-EPI (participation).
EU-EGB (2022)	(van der Linden et al., 2019)	An analytical instrument supporting the European Commission's eGovernment Action Plan, meant to envision digital, borderless, and open public administrations.	Four top-level "benchmarks": 1) User-centric government, 2) Transparent government, 3) Cross-border mobility, 4) Key enablers.
OECD-DGI (2019)	(OECD, 2020a)	OECD Digital Government Policy Framework and OECD Recommendation on Digital Policy Strategies. Public value creation by ICT in terms of openness and engagement, governance and coordination, and capacities to support implementation	Indicators for the six DG dimensions: 1) Digital by design, 2) Data-driven public sector, 3) Government as a platform, 4) Open by default, 5) User-driven, 6) Proactiveness.
WB-GTMI (2022)	(World Bank, 2022)	Whole-of-government approach to public sector modernization	Four dimensions, measured by four indices: 1) Core Government Systems, 2) Public Service Delivery, 3) Digital Citizen Engagement, 4) GovTech Enablers.
WU-IDGR (2020)	(Obi & Iwasaki, 2020)	The overall DG development in a country. Criteria: development strategies, policy implementation, and public online services.	Ten high-level indicators: 1) Network Preparedness / Infrastructure, 2) Management Optimization / Efficiency, 3) Online Services / Functioning Applications, 4) National Portal / Homepage, 5) Government CIO, 6) D-Government Promotion, 7) E-Participation / Digital Inclusion, 8) Open Government, 9) Cyber Security, 10) The Use of Emerging ICT.

Source: as listed.

2.4.5. Innovation

Alongside DG development, various authors proposed original DGB solutions intended to either address the specific shortcomings of existing instruments or introduce fundamental conceptual or methodological shifts in how DG efforts are compared, assessed, or evaluated. While these efforts typically remain academic, without a chance of practical realization, some interesting examples are worth discussing. They are presented in Table 2.10, confirming the need for more versatile, accurate, and reliable means of DGB that span diverse directions of reasoning and methodological positions.

Table 2.10. A preview of innovative DGB concepts (in chronological order)

Study	**Treatment**
(Bertelsmann Stiftung, 2001)	An attempt to introduce a benchmark that captures a unit's performance in terms of technology-driven modernization and democratization. The eponymous instrument combines e-administration and e-democracy, measured across five dimensions: benefit, efficiency, participation, transparency, and change management. The units analyzed in the pilot study are diverse, ranging from countries to regions to governmental portals.
(Gupta & Jana, 2003)	A framework for the evaluation of DG projects. Introduced mainly from managerial and financial perspectives, the study examines "Return on e-government," organized into levels of measurement, from System Characteristics to Return on Investment. The model was tested on the data from the New Delhi Municipal Corporation. It is unclear whether such an approach applies to countries.
(Kunstelj & Vintar, 2004)	A comprehensive conceptual model for DG evaluation, elaborated as the authors' response to the identified limitations and deficiencies of DGB practice and tools in the EU. The model postulates an evaluation chain comprising environment maturity, back-office, front-office, and impact stages. As such, the model implicitly subscribes to the value-generation logic.
(Esteves & Joseph, 2008)	DG project evaluation based on six dimensions: strategic, technological, organizational, economic, operational, and service.
(Stragier et al., 2010)	A framework designed to capture the dynamics and logic of DG progress. The authors distinguish three elements in the public service value chain: input, output, and outcomes, where the transition between the first two is associated with efficiency, and between the last two with effectiveness. The model was applied in Belgium, including measured elements: input, output, outcomes, impact, and contextual variables. Arguably, highly detailed data is needed to implement this model, which challenges its application in the international context.

Study	Treatment
(Andreasson et al., 2012)	A conceptual framework built around the UN-EGS model. The authors propose concepts for how the UN's model should evolve to better adapt to technological/social trends and thus more accurately capture essential policy issues, such as the effectiveness of public investment in DG development.
(Luna-Reyes et al., 2012)	An effort to address the problem of DG multidimensionality and its accurate reflection in the measurement, producing a model for "comprehensive measuring of electronic government". The model is designed to integrate data on DG determinants, characteristics, and results, and to be associated with impacts or outcomes. A simulation including Mexico and three hypothetical countries was run to test the model.
(Whitmore, 2012)	Reframing UN-EGDI by applying a different measurement scheme, i.e. factor analysis and related statistical techniques, for the sake of producing an "integrated model of e-government".
(Savoldelli et al., 2013)	The eGEP 2.0 model for DG impact measurement in the context of public value creation. Similar to the work discussed above. The model was applied locally to support the telematics project in the Italian region of Emilia-Romagna.
(Siskos et al., 2014)	A model for a country's DG evaluation through multicriteria decision analysis. The framework introduces eight evaluation criteria, built on four "points of view": infrastructures, users, investments, and e-processes, addressing multidimensionality. The model was applied to 21 European countries.
(Lidén, 2015)	A proposition for mitigating the potentially misguided UN-EPI assessment by balancing its values with the respective values of the Polity and Freedom House indices.
(Scott et al., 2016)	Another public value-oriented approach, described as "measuring eGovernment success". DG impacts ("net benefits") are assigned to three categories: efficiency, effectiveness, and improved democracy. The practical study was conducted through a survey of users of the "eGovernment 2.0 system" in the US.
(Pirannejad et al., 2019)	A model of the "balanced e-participation index", computed as the weighted average of UN-EPI and the measures of human development, political rights, and civil liberties.
(Durkiewicz & Janowski, 2020)	A study addressing the problem of an imbalance between countries' DG achievements and their levels of governance, built on the assumption that the assessment of DG performance should be compared with the countries' "analog" qualities. The model uses data from the World Economic Forum's Networked Readiness Index (NRI) and the World Bank's Worldwide Governance Indicators (WGI) obtained by applying methods such as factor analysis and TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) across a large number of countries.

Study	Treatment
(Loukis, 2021)	An evaluation model oriented at directed "value flow" within a DG organization or project, comprised of three connected "layers" differing in terms of the type of DG value generated (efficiency/effectiveness); tested and verified in the Greek context.
(Osman & Zablith, 2020)	An effort to improve the UN-EGDI quality. The declared motivation is to provide a toolset to monitor countries' success in employing DG to achieve SDGs. It applies a diverse set of statistical methods to the UN Member States.
(Durkiewicz & Janowski, 2021a)	A model for tracing a country's value creation within the DGVC. Through methodological reframing of the UN-EGS and WGI data, the study captured the realization of DGVC among UN Member States over the period from 2014 to 2018.

Source: own elaboration.

2.5. Digital Government in the European Union

From a global perspective, EU countries collectively represent the highest tier of DG development worldwide (United Nations, 2024a). UN-EGS considers countries with UN-EGDI scores greater than 0.75 "very high", and greater than 0.5 "high", based on the normalized 0-1 score interval. Appendix 2 provides the EU country ratings for the recent five editions of UN-EGS. Since 2020, all EU countries have been in the "very high" category.

Setting aside the debate over the adequacy of the UN-EGDI construction, this fact suggests that the processes and regularities within European DG implementations constitute a fruitful object of interest for DG analysts. That is, the maturity of standard DG components and the emergence of new ones provide a deep insight into the arcana of DG development, which is worth attention also for countries yet to pave their way towards DG as a fully functional and beneficial element of the public landscape.

This section provides an overview of DG in the EU, considering its position within the EU policy landscape (Section 2.5.1) and the EU's current approach to DG development (Section 2.5.2).

2.5.1. Policy

At the level of political vision, in the EU, DG serves as a backbone of efficient public administration, an igniter of far-reaching democratic reforms (European Commission, 2022a), and a direct driver behind many EU policies (Nixon, 2017). Thus, DG and its compliance with EU policies are regularly addressed by EU authorities through a diverse stream of formal positions, which define common goals

and standards and provide an agreed agenda, even if most responsibility rests with individual governments (Davies, 2015; Nixon, 2017).

The history of EU policies abounds with DG-directed legal and organizational acts emerging at various levels of authority. These include action plans that define DG development priorities and their means of implementation (European Commission, 2010, 2016); ministerial declarations – Tallinn in 2017 and Berlin in 2020 – addressing the key challenges (Ministers of the European Union, 2017, 2020); interoperability frameworks like Interoperable Delivery of European eGovernment Services to public Administrations, Businesses and Citizens (IDABC) (European Commission, 2004) and Interoperability Solutions for European Public Administration (ISA) (European Union, 2011); see (European Commission, 2018). Thus, the EU calls for informed DG development are explicitly answered by its various bodies, though the multitude of acts may obscure the guiding vision.

As pointed out by Davies (2015), the rationale behind the EU DG development is chiefly pragmatic, with tangible benefits such as cost savings (through the "digital-by-default" policy) and reduced administrative burden (through the "once-only" data registration and the "whole-of-government" approach to service design and delivery). The author also indicates a less direct impact: redesigning and rethinking organizational structures and procedures that lead to increased public-sector efficiency, greater transparency, citizen participation, and corruption control, and reductions in carbon footprint due to paperless document circulation and mitigation of business travel needs.

Nixon & Koutrakou (2017) provide a catalog of how DG can benefit EU policy in two main categories: improving the machinery of governance, and increased participation. These categories are further elaborated into: improved coordination of EU policies and legislation; more efficient and effective use of resources by government, citizens, and businesses; better access to information to stimulate participation and consultation; stronger citizen capacity to audit government; boosting inclusion and equal treatment; reconfiguring interfaces between citizens and the EU to enhance participatory democracy (p. xx).

Nixon (2017) covers the historical record of pan-European initiatives toward rational and policy-aligned DG development, beginning with the "innovation and integration through computerization" proto-stage. The author aptly notes that while DG development practices in the EU mostly proceed at the level of national governments, the guiding, promoting, and integrating acts by EU-level bodies (mainly the European Commission) play a significant role.

Lips (2017) identifies three phases of successive broadening of the range of EU DG-oriented policies. First, the exclusive focus on service provision expands to encompass all primary government processes, i.e., agenda-setting, policy development, evaluation, etc. Second, citizens are treated not only as customers but also as active participants in the DG enhancement process. Third, citizens provide constructive informational input to DG design. Thus, the whole EU DG agenda tends to evolve towards "citizen-centricity".

2.5.2. Development

Currently, the EU tends to approach DG development as an inherent component of its agenda for policy-informed digital transformation and for fostering a sustainable society. This is reflected in the Berlin ministerial declaration (Ministers of the European Union, 2020), which puts forward "Digital Society and Value-Based Digital Government" and adopts seven core principles: 1) Validity and respect of fundamental rights and democratic values, 2) Social participation and digital inclusion to shape the digital world, 3) Empowerment and digital literacy, 4) Trust and security in digital government interactions, 5) Digital sovereignty and interoperability, 6) Human-centred systems and innovative technologies in the public sector, and 7) Towards a resilient and sustainable digital society. On DGB, declaration is accompanied by a monitoring framework to "encourage Member States to progress at the national level in various policy areas" (Oliveira et al., 2024, p. 470).

The Berlin Declaration can be positioned within the Digital Decade 2030 policy program (European Commission, 2024b), which aims to define tangible, achievable digital goals across four areas: skills, government, infrastructure, and business. The program aligns with the so-called digital rights and principles: people at the centre, freedom of choice, safety and security, solidarity, inclusion, and participation. Several monitoring measures are deployed (European Commission, 2021), including insightful reports of progressive accomplishment (European Commission, 2024a) and the Digital Economy and Society Index (DESI) platform for continuous data aggregation and analytics (European Commission, 2025). As of 2025, the EU's long-running DGB project, i.e., EU-EGB, is alive and regularly updated and used; its results contribute to the "Digitalisation of public services" section of DESI.

To summarize, the specificity of the EU DG lies in its alignment with the EU policies and priorities. Thus, the agenda for EU DG development is generally shaped, endorsed, and monitored by the European Commission and other EU authorities. At the same time, responsibility for implementation lies with the individual Member

States' governments. An extensive catalog of policy objectives, principles, and guidelines, and their coverage by rich, reliable data, provides a valuable context for the design of more sophisticated DGB instruments.

2.6. Summary

This section provides a summary of the chapter's findings. First, it addresses the questions raised at the start of this chapter (Section 2.6.1). Second, it describes the knowledge gaps uncovered (Section 2.6.2).

2.6.1. Answering Guiding Questions

On the question L1: How should DG be understood according to the literature? There is no dominant, let alone single, definition of DG. Individual authors or digitally-focused organizations often provide their own variants, leading to epistemological pluralism and possible confusion among those not well acquainted with the topic. Perhaps, the safest variant would be "The use of ICT by government for a better state of public matters", but it is too generic to inform in-depth studies like designing DGB instruments. This thesis adopted the OECD definition: "The use of digital technologies, as an integrated part of governments' modernisation strategies, to create public value".

On the question L2: What perspectives can be applied when describing or studying DG? Depending on the application context, both process and system perspectives may apply. Their superposition, that is, a system of directed value generation, is particularly relevant when describing or evaluating DG operation. This also substantially addresses the question L1.

On the question L3: What issues of DG operation are of typical interest to researchers? As a relatively developed field of study, DG research introduces considerable conceptual and methodological eclecticism, being a research object itself (Alcaide–Muñoz et al., 2017; Bindu et al., 2019; M. Janssen et al., 2025). However, in the context of DG evaluation and in reference to the perspectives addressed by question L2, three essential threads concern problems of DG implementation, usage, and impact. While tentative and simplified, this classification is adequate to address this thesis's objectives.

On the question L4: What are the assumptions of DGB, and how are they applied in practice? The answer can be provided in three parts. First, while DGB is a recognizable stream within DG research, there is no consensus that any DGB effort generates value in isolation. Usability depends on whether such efforts adequately

address foundational issues, such as how its outcomes will be interpreted and used. Second, a tendency to limit the scope of benchmarking to its measurement component (specifically, the generated rankings) is clearly wrong with respect to the original utilitarian character of "benchmarking". Third, different DGB projects develop frameworks that are incompatible with one another, and many authors seek to address their deficiencies or propose alternative solutions designed from scratch. Alas, in this domain, the gap between theory and applicability remains considerable.

2.6.2. Identifying Knowledge Gaps

This chapter uncovered several significant knowledge gaps in the DG and, particularly, the DGB literature. For consistency, these knowledge gaps are presented along the four guiding questions.

First, the literature mostly neglects providing a consistent demarcation between "Digital Government" and preceding terms. Authors tend to apply chosen variants for no specific reason. This may lead to rather unappealing inconsistencies, as in United Nations (2024b, p. v): "…the role of digital government has become increasingly central to these efforts. E-government stands to benefit greatly from these advancements…". Terminological inconsistency is one of the main problems of the DG debate; it may hinder the effective development and dissemination of rational postulates. This thesis chose the OECD definition because it clearly distinguishes between DG and E-Government, not out of personal preference, but because these terms reflect different views on the role of technology in the public sector.

Second, the process and system perspectives provide a solid conceptual basis for describing and analyzing DG. However, once again, their uses are largely distinct, depending on individual authors' preferences, and thus do not form a consistent narrative stream within the DG debate. Heeks' (2008) elaboration remains one of the most convincing integrations of process and system perspectives with the value generation logic. Such integration can help effectively organize the problems of DG analysis and evaluation.

Third, the literature addresses a whole spectrum of problems related to DG implementation and operation. However, these problems are typically analyzed in isolation, operationalized through fragmented, context-dependent models of DG impact (e.g., the influence of DG on corruption), rather than as instances of value generation. A comprehensive framework for such analytics would reduce arbitrariness and mitigate the confusion often caused by conflicting results.

Fourth, authors often provide relevant observations on how DGB projects should be handled, why particular instruments are incorrect, how they should be corrected, what technological advancements should be considered, etc. However, too little is said about the very logic behind DGB itself. Specifically, whether DGB should address DG as a set of arbitrarily picked thematic snapshots, or as a consistent teleological system. If one takes public value generation as the de facto goal of DG (as argued), then it would be logical to advocate measuring, assessing, and evaluating DG in terms of how effectively this goal is achieved. This also aligns with the problems discussed previously. Literature remains surprisingly silent on this type of DGB critique. Notably, the studies by Durkiewicz & Janowski (2021a, 2022), which lay the groundwork for this thesis, also represent pioneering work in this direction.

3. Conceptual and Methodological Framework

This chapter aims to present the research problem addressed in the thesis, based on the author's prior research agenda and the outcomes of the literature review documented in Chapter 2; introduce the Digital Government Value Logic (DGVL) conceptual framework underpinning the proposed solution; and describe the methodology for developing this solution – a DGVL-based benchmarking model, for distinction, referred to as DGVLB. The development itself, as documented in Chapter 4, follows this methodology. The chapter covers the research problem (Section 3.1), the conceptual framework (Section 3.2), and the methodology (Section 3.3).

3.1. Research Problem

This section formulates and justifies the research problem addressed in this thesis. It describes the research agenda conducted in preparation for this thesis, recalls the DGB issues uncovered while pursuing this agenda, compares these issues against the outcomes of the literature review in Chapter 2, and formulates a set of assumptions and postulates for the developed solution. The section comprises four parts: the research agenda (Section 3.1.1), agenda-identified issues (Section 3.1.2), literature-identified issues (Section 3.1.3), and solution-oriented assumptions and postulates (Section 3.1.4).

3.1.1. Research Agenda

To put it in context, this thesis provides a natural closure to the research agenda the author pursued over 2018-2025 in co-operation with his scientific supervisor. If not strictly linear, the agenda aimed to identify, describe, and propose partial solutions to the varied problems of elaborating a relevant, applicable, and useful approach to DGB.

The partial outcomes of this endeavor were progressively documented in research articles and presented at specialized peer-reviewed DG conferences. These articles are summarized in Table 3.1, which provides the problems addressed, the primary outcomes achieved, and references for each study. This collection is consistent in its thematic scope, though each study had its own specific context, goals, and approach to achieving them.

Table 3.1. Research agenda – published articles (in chronological order)

Study	**Problem**	**Main outcome**
(Durkiewicz & Janowski, 2018)	Correspondence between instruments declared to measure specific DG aspects and their alleged "analog" counterparts, e.g., electronic participation vs. "real" participation.	Correlation analysis between pairs of allegedly corresponding indicators on both sides.
(Durkiewicz & Janowski, 2020)	Discrepancy between the recognized measures of DG advancement and indicators of governance quality (in the traditional sense).	A quantitative model that allows for comparing DG performance on one side and governance quality on the other; informed policy insights from the model's application.
(Durkiewicz & Janowski, 2021a)	Identification of the DG value chain logic as a conceptual foundation for new DGB instrumentation.	First iteration of a value chain-based DGB model: readiness, availability, uptake, and relations between these stages; informed policy insights based on the model's application.
(Durkiewicz & Janowski, 2021b)	DG development impact on the qualities of governance, as understood by the B-SGI framework.	Elaboration on the conceptual framework for the interplay between DG, sustainability, and governance; a DEA-based analysis of DG development (input) impact on B-SGI performance (output).
(Durkiewicz & Janowski, 2022)	DGVC as a foundation of a more relevant DGB scheme – assumptions and challenges.	Conceptual refinement of a DGVC benchmarking framework, including specific stages interconnected by a set of relationships.
(Durkiewicz, 2025)	Recognition, analysis, and comparison of DGB projects available in the EU, with an emphasis on their idiosyncrasies.	A structured inquiry into the conceptual, formal, and technical aspects of several EU DGB projects; elaboration of a "meta-indicator" to integrate information coming from diverse projects' datasets and mitigate their biases.
(Durkiewicz & Janowski, 2025)	DG vs Digital Dependence, as understood by Mayer & Lu (2022).	A conceptual elaboration on the topic; a quantitative study of DG performance vs. Digital Dependence.

Study	Problem	Main outcome
(M. Janssen et al., 2025)	Trajectories and dynamics of DG research.	Contrbution to the study analyzing the trends and dynamics of DG research, interpreted in reference to the history of Government Information Quarterly journal.

Source: own elaboration.

3.1.2. Agenda-Identified Issues

From the research agenda in Section 3.1.1, several conclusions are particularly relevant to advancing DGB. They are included in Table 3.2 and refer to specific studies in Table 3.1. The order roughly follows the increasing specificity of the issues, and the labels are assigned ad hoc to facilitate reference. The content of this table could serve as conceptual and technical inputs to the design of a new DGB model.

Table 3.2. Research agenda-identified DGB-relevant issues

Label	Issue	Explanation
CLASH	Digital vs analog clash	The discrepancy between countries' digital performance, as measured by digital indicators, and their alleged "analog" counterparts. This is particularly evident in assessing various facets of digital participation vs. the corresponding qualities of "real" democracy. This thread was undertaken in (Durkiewicz & Janowski, 2022, 2025) and followed through the whole agenda, with some propositions to address this problem (Durkiewicz & Janowski, 2020, 2021a, 2022).
RETURN	Unaddressed DG return on investment	As DG requires public investment and a policy agenda, it is expected to produce tangible returns – improved quality in the governance areas it aims to address. The studies (Durkiewicz & Janowski, 2021a, 2021b, 2022) propose specific solutions.
GOV	Problematic relationship between DG and sustainable governance	Given the broad scope of possible DG impacts, a catalog of DG-responsive domains and qualities of societal well-being would be helpful. According to Durkiewicz & Janowski (2021b), a relevant candidate for this catalogue is sustainable governance, as comprehensively captured by the B-SGI framework (Schraad-Tischler & Seelkopf, 2015).
VALUE	Unaddressed DGB value logic; lack of a comprehensive DGB context	As argued earlier, the DGVC and other value-oriented frameworks may provide a basis for describing the role of DG in the public sector. This view is, alas, absent in the major DGB projects – according to their design, DG is static and context-free. (Durkiewicz & Janowski, 2021a, 2022) include propositions of how to adapt DGB principles to the value-generation logic.

Label	Issue	Explanation
FLAW	Idiosyncrasies, design flaws, or peculiarities of specific DGB instruments	The indicators introduced by DGB projects vary widely in their DG conceptualizations and technical realization. In part, this is understood, given the nature of measurement and assessment. The problem begins when measurement results are interpreted as objective proxies of DG development. This is particularly the case for some problematic composite measures, e.g., the UN-EGDI. Studies that uncritically rely on them may produce misleading or incorrect conclusions.

Source: own elaboration

3.1.3. Literature-Identified Issues

Similar to Table 3.2, which summarizes DGB-related issues uncovered through the author's research agenda (Section 3.1.1), Table 3.3 summarizes DGB-related issues identified by other authors, some of which are also identified as knowledge gaps in Section 2.6.2, based on the literature analysis in Chapter 2.

Table 3.3 also notes whether literature-identified issues overlap with agenda-identified issues – CLASH, RETURN, GOV, VALUE, and FLAW. Indeed, most do, at least partially. Hence, both sources of insight agree on: 1) the adequacy of considering DG as a purposefully-structured system or a value-generating process; 2) the importance of a dynamic value generation, though specific problems of DG operation often eclipse this broader perspective; 3) the need for a benchmarking ecosystem that handles potential points of confusion by design; and 4) the design flaws, biases, and analytical limitations of the available DGB instruments.

Table 3.3. Literature-identified DGB-related issues – selection and treatment

Problem	Studies	Problems/shortcomings	Related labels from Table 3.2
Digital-analog analytical confusion	(Almukhlifi et al., 2019; Åström et al., 2012; Grönlund, 2011; Krishnan et al., 2013; Lidén, 2015; Maerz, 2016; Pirannejad et al., 2019; Spirakis et al., 2010; Stier, 2015; Wallis & Zhao, 2018)	Many authors tend to notice possible clashes between the measured state of DG in a country and corresponding estimates of the qualities of governance expected to benefit from DG; this is particularly noticeable in the participation/democracy domain. Pirannejad et al. and Lidén's efforts serve as proofs of concept rather than as regular treatments of the problem.	CLASH GOV FLAW

Problem	Studies	Problems/shortcomings	Related labels from Table 3.2
Public value in the DGB context	(Esteves & Joseph, 2008; Lee et al., 2018; Savoldelli et al., 2013; Scott et al., 2016; Stragier et al., 2010; Valle-Cruz, 2019).	These studies are notable efforts, yet neither provides a comprehensive, widely applicable DGB model.	RETURN VALUE
DG as a value-generating process	(Loukis, 2021; Luna-Reyes et al., 2012; Mergel et al., 2019; Savoldelli et al., 2013; Stragier et al., 2010)	Mergel's study is primarily theoretical, while the others are developed in a particular local context or as responses to specific policy needs.	RETURN VALUE
DG as a value chain	(Heeks, 2008; Heeks & Krishna, 2016; Kumar et al., 2021; Wassenaar, 2000; Wirtz & Daiser, 2017)	Heeks' works provide an apt conceptualization; the remaining ones adopt a different, i.e., technical and business-oriented perspective. However, neither provides an actionable country-level DGB model.	RETURN GOV VALUE
Recognition of the DGVC stages	(Bannister, 2007; Janssen et al., 2004; Martínez et al., 2022; Ojo, Janowski, et al., 2012b; Schellong, 2010)	Reference to the DGVC stages, though chiefly as labels for functional categories of a given indicator, and not to encompass the DGVC logic.	RETURN VALUE
Transitions between DGVC stages as an object of benchmarking	(Bannister, 2007; Heeks, 2008; Janssen et al., 2004; Schellong, 2010)	When authors speak of indicator types, terms such as "efficiency", "effectiveness", "gain", etc., come up, and they can be associated with DGVC transitions. This, however, is not followed up with more articulate advocacy of their role in DGB.	RETURN VALUE
The core character and rationale of benchmarking itself	(Bannister, 2007; Mukamurenzi et al., 2016; Salem, 2007; Schellong, 2010; Skargren, 2020)	Authors indeed note the problem of how many original benchmarking ideas are in DGB, yet specific postulates or enhancement concepts do not follow this critique.	VALUE FLAW
Informed critique of DGB in the EU	(Ardielli & Halásková, 2015; Lněnička, 2015; Lnenicka et al., 2024; Máchová & Lněnička, 2015; Schellong, 2010)	Critical and analytically thorough studies on available instruments, though only Schellong's study provides some constructive concepts of augmentation.	FLAW

Source: own elaboration.

3.1.4. Solution Assumptions and Postulates

The agenda- and literature-identified issues in Sections 3.1.2 and 3.1.3, respectively, inform an initial list of assumptions and postulates that should be realized by the DGVL framework, with DGVC as a conceptual starting point, thereby guiding the remainder of this study. Some of them are conceptual, others technical. They are presented and discussed in Table 3.4.

Table 3.4. DGVL – general assumptions and postulates

#	Assumption/ postulate	Line of argumentation
P1	To regard the system perspective	DGVC is an example of a system perspective on DG: a set of (conceptual) components, represented as sequential stages, that work together.
P2	To regard the process perspective	DGVC also advocates the logic of value generation, which interprets DG as a process. Matching this with P1, we assume that DG is a system for generating value.
P3	To model the DG value generation	If treating the DGVC design literally, it presumes the linear logic of value generation (Figure 2.1), implying that value is generated only at stage transitions. The variety of DG studies (Section 2.3) suggests that such a view is too limited. We assume that a process of value generation can occur between any pair of components (P1) when it corresponds to well-defined managerial or political problems, thereby addressing RETURN, GOV, and VALUE issues (Table 3.2).
P4	To provide a clear view of what is happening within the DG system	This would mitigate CLASH and confusion, and automatically address RETURN (Table 3.2) since both sides of the relationship, e.g., e-participation and "real" democracy, would co-exist within the holistic model of value generation rather than separately and in parallel.
P5	To provide a time-aware outlook	If value generation is a process, it makes sense to consider it in relation to a specific period, e.g., the period of evidence collection for a given survey.
P6	To recycle and reframe available data	Despite the shortcomings of the available instruments (FLAW in Table 3.2), we assume that these are still valuable sources of information/data, and thus postulate that a new model should reuse the existing indicators in an informed way, by extracting and classifying the effective DG information they convey.
P7	To maintain some design flexibility	We assume that, while possibly intact in its conceptual basis, the benchmarking model should be adjusted to what is effectively available and feasible, given reliable information and data. As demonstrated in Table 2.10, some models may be conceptually flawless, yet will remain academic exercises if they require unattainable actions or resources.

Source: own elaboration.

3.2. Conceptual Framework

This section presents the Digital Government Value Logic (DGVL) framework. It starts with the DGVL concept (Section 3.2.1), then the DGVL framework and how it enables DGVL-based benchmarking (Section 3.2.2), and then comparisons with related DG benchmarking work (Section 3.2.3).

3.2.1. Concept

DGVL can be defined as a "technology-enabled system of public value generation by value-generating processes considered among conceptual components". The rationale for this definition is explained below.

First, the focus on "technology", chiefly digital, is what distinguishes DG from other public sector innovations. Second, the "system" perspective directly addresses the P1 postulate. Third, the reference to "public value" addresses P3, i.e., the rationale for this system's operation is to generate public value. Formalized in the DG context, e.g., by Twizeyimana & Andersson (2019), public value clearly differs from other possible DG outcomes, e.g., enabling government propaganda or suppressing legitimate political dissent. Fourth, the reference to "conceptual components" indicates that these components generally reflect DG concepts, which may have (e.g., infrastructure) or not have (e.g., participation) direct references to material entities. This system is modelled as a foundation for measurement, not as an ontology or technical documentation. Fifth, the mention of "value-generating processes" means that some pairs of conceptual components can be considered as inputs and outputs to the recognized DG processes, which are expected to add value. This addresses the postulate P3 and refers to Porter's idea of the value chain as a system composed of subsystems that transform inputs into outputs (Section 2.2).

3.2.2. Framework

Building on the DGVL concept, the DGVL framework, how it enables the development of DGVL-based benchmarking models using data drawn from existing DGB projects, how such models can be used to analyze the efficiency or inefficiency of DG to generate public value, how such analysis informs relevant managerial and policy decisions, etc., are depicted in Figure 3.1. In the figure, conceptual assumptions are marked with dashed lines.

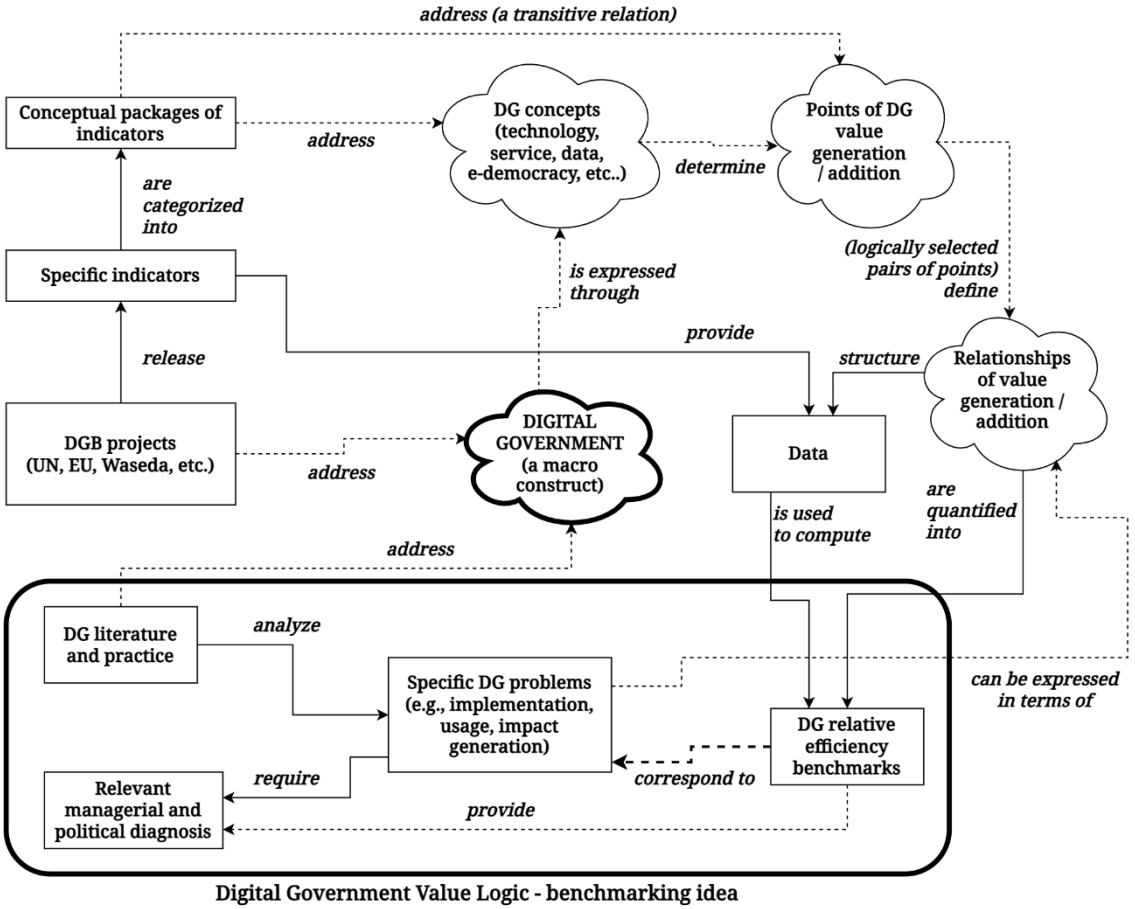

Figure 3.1. DGVL framework

Source: own elaboration.

The explanation of this figure is as follows. Central to the figure is DG itself. It serves as a central construct representing a broad category of ideas about how technology affects the state, government, and society in institutionalized ways. As a construct, it is not to be measured directly, but is represented by more articulate concepts. This is dual to the system perspective, i.e., concepts correspond to components (subsystems) of the DG system. This way, the P1 postulate is satisfied. As an assumption, both the DG projects and the DG literature treat DG as a broad category of ideas and topics.

Specific DGB projects claim to address DG, but, through selected indicators, they cover only certain DG concepts. In a system view, these concepts correspond to points (i.e., parties or terminals) in value generation processes (see P2). If more than one indicator addresses a concept, they constitute a conceptual package, i.e., a group of indicators collectively addressing roughly the same topic within the DG operation. This way, the "indicators vs concepts" mapping is handled.

Selected pairs (or larger sets) of concepts define value-generation processes (see P3 and P4). One side of such a process is input (e.g., mechanisms of electronic participation), while the other is output (e.g., quality of democracy). The literature informs the selection of such pairs.

On the technical side, the lower benchmarking section of the figure concerns turning the elements discussed above into an action scheme aligned with the fundamental assumptions of benchmarking (Table 2.7). First, available indicators provide datasets expected to quantify value-generation processes; this satisfies postulate P6. Next, the quality of value generation processes is operationalized in terms of their efficiencies, understood technically (Banker et al., 1984; Charnes et al., 1978; Sexton et al., 1986); not as a public value in a normative sense (Jørgensen & Bozeman, 2007; Twizeyimana & Andersson, 2019) but a contextual assessment of whether satisfactory output was achieved, given what input was engaged.

Operationally, the levels of process output indicators (approximately the effects of the government's efforts in realizing specific value generation effect) are examined against the levels of the input indicators (approximating the extent of the government's efforts). Hence, DG relative efficiency benchmarks. Thus, the P5 postulate is addressed as well. This is further explained in Chapter 4.

The core benchmarking asset (mostly contained within the bold-lined frame) is that the identified processes are understood as generalizations of the recognized and relevant managerial and policy issues discussed in Section 2.3. In consequence, the efficiency benchmarks, by design, provide an adequate diagnosis of a country's performance, thereby identifying where a problem may lie and assessing its scale. Therefore, their primary rationale is not to generate more rankings but to provide valuable and actionable information.

For clarity and completeness, Table 3.5 summarizes the above explanation of DGB issues and how DGVL addresses them.

Table 3.5. DGVL issues and responses

Issue	**How DGVL addresses the issue**
Understanding of DG	In DGVL, DG is an "umbrella" construct, covering a spectrum of ideas on how ICT and other technologies affect the state, public sector, governance, and society.
DGVL	DGVL is a system-oriented formalization of DG, referring to the organizational value chain (Porter, 1985), logic models (Milstein & Chapel, 2011; NECS & NHS, 2016), DGVC (Heeks, 2008), DG Value Activity System (Wirtz & Daiser, 2017), etc.

Issue	How DGVL addresses the issue
DGVLB	DGVLB is a benchmarking model developed upon DGVL.
DG concepts and components	DG is expressed through a set of concepts. Components can be thought of as representations of these concepts (in principle, those that are effectively operationalizable) within the DGVL system.
Public value and value-generating processes	Public value is a conventional label for what DG is supposed to deliver (Twizeyimana & Andersson, 2019, p. 167), e.g., improved public services, administrative efficiency, trust and confidence in government, social value, etc. (ibid).
Value-generating processes	Individual DGVL processes are regarded as specific contributions to public value. A value-generating process has a specific component as its input (effort) and another component as its output (effect). Value-generating processes are not arbitrary but underlie real DG operational issues (e.g., service usage or impact on democracy), as recognized by the DG literature and analytics.
Efficiency	The operationalization of how the output responds to the input is achieved through the technical efficiency of a value-generating process. DGVLB adopts these efficiencies as a central concern of benchmarking, building on the assumption that they may provide valuable managerial and policy insights.

Source: own elaboration.

3.2.3. Related Work

The DGVL approach may be related to and compared with studies that also address the problem of developing a more relevant approach to DGB.

In a conceptual layer, DGVL benefited from the DGVC conceptualization by Heeks (2008), which inspired and initially guided its development. Nonetheless, DGVL replaced the linear form of DGVC with a more flexible network of (knowledge-informed) interconnections. The precursor studies (Durkiewicz & Janowski, 2021a, 2022) anticipated the DGVL approach, seeking to quantify value generation and present it as a benchmarking object.

The general idea behind DGVL design is conceptually akin to the Value Activity System, which is "made up of subsystem activities that have specific inputs, transformation operations, and outputs", presented in the DG context by Wirtz & Daiser (2017). However, the thematic coverage and goals are different.

Among the frameworks listed in Table 2.10, the efforts partially related to the present one can be identified in (Berntzen, 2014; Bertelsmann Stiftung, 2001; Kunstelj & Vintar, 2004; Loukis, 2021; Luna-Reyes et al., 2012; Savoldelli et al., 2013; Stragier et al., 2010). The DGVL/DGVLB approach, however, is unique in several aspects, which clearly differentiates it from the studies above. First of all, it

is designed to integrate, recycle, and reuse existing data, so that its application across a wide range of DG analytical contexts is smooth and natural. Second, it seeks to associate various topics that are hardly ever discussed together: DG analytical perspectives (Section 2.2), persistent DG research threads (Section 2.3), foundational ideas of benchmarking (Section 2.4.2), public value as a construct covering the desirable DG outcomes, etc, into a consistent and actionable framework. Third, it builds upon a holistic rethinking of the very sense of DGB so that value-generating activities are positioned at the center; in other words, the significance of particular elements is determined by the relationships they hold with other elements.

3.3. Methodology

This section explains the epistemological position shaping the author's understanding of the research goals and approach, methodological position informing how the author pursues the research goal, and the development logic organizing how exactly the process to achieve the research goal was conducted. The section consists of three parts: epistemological position (Section 3.3.1), methodological position (Section 3.3.2), and development logic (Section 3.3.3).

3.3.1. Epistemological and Methodological Position

The research agenda was approached from an essentially pragmatic position. As DGB is firmly tied to policy and practice, the pivotal value of DGB lies in the feasibility of introducing models into DG practice, their usability to inform managerial and policy decisions, and their capacity to inform and induce direct action. Thus, the research was conducted with practical outcomes in mind, interested in "what works" (Ragab & Arisha, 2017, p. 5) as much as in the theoretical soundness of the proposal to be put into practice.

Earlier in this text (Section 2.4.4), several innovative DGB concepts were outlined that meticulously adopt a particular theory while remaining purely theoretical exercises. As such, an outcome that does not directly improve DGB quality, this research was set to avoid it. Consequently, this research subscribed to the functionalist paradigm, "highly pragmatic in orientation, (…) problem-orientated in approach, concerned to provide practical solutions to practical problems" (Burrell & Morgan, 1979, p. 26).

Concerning the "quadrant schematic" of research approaches (Pettigrew & Cooke, 2022) and the two extremes – the "Bohr quadrant" of pure basic research and

the “Edison quadrant” of pure applied research, this work belongs to the “Pasteur quadrant”: use-inspired basic research.

Regarding ways of reasoning, this research applies abductive reasoning (Frankfurt, 1958), in which findings from one research stage inform theoretical and conceptual positions in subsequent stages. Thus, the research applies abduction to generate plausible ideas (Schvaneveldt & Cohen, 2010, p. 5).

The research applies a mixed methods approach, i.e., “the combination and integration of qualitative and quantitative methods in the same study” (Molina-Azorin, 2016, p. 37). While conceptually and theoretically the research was grounded in the literature analysis, it also contains an important quantitative, data-based component, whether explicitly stated as a study goal or as a means to illustrate and instantiate a respective analytical model.

Further, the methodological stances subscribe to the action research philosophy, understood as the integration of research (here, the identification and recognition of prominent DGB problems) with directed action (the development of a benchmarking model) (Oosthuizen, 2002).

3.3.2. Agenda of the Benchmarking Model Development

The development of the DGVL-based benchmarking model (DGVLB), i.e., a presentation of how DGVL can underpin a feasible, practical DGB toolset, was structured into four sequential stages. Each stage addressed approximately a part of the DGVL framework; together, they constitute the process of turning the conceptual framework into an applicable DGB instrument. While DGVL, as a conceptual platform, is sufficiently general to various analytical scenarios, the DGVLB development was realized in the EU context. This context is particularly interesting from a scientific point of view, since DG advancement in the EU is relatively very high (see Appendix 2). Thus, particular arcana of how DG is developed and the challenges it may face may appear more pronounced in the European than in the global context. Second, as discussed in Section 2.5, DG has a steady, rather critical position within the EU and is openly informed by EU policies. Therefore, the obtained benchmarking results may be effectively interpreted as reflecting political stances. Third, and more technically, the supply of potentially relevant data for EU member states is sufficient to leverage the analytical potential of DGVL.

Figure 3.2 is a variant of Figure 3.1, adapted to illustrate the thematic scopes of consecutive stages (labels #1 to #4). These stages, including their objectives and

approaches, are described in Table 3.6, while Chapter 4 provides a detailed account of applied methods and results.

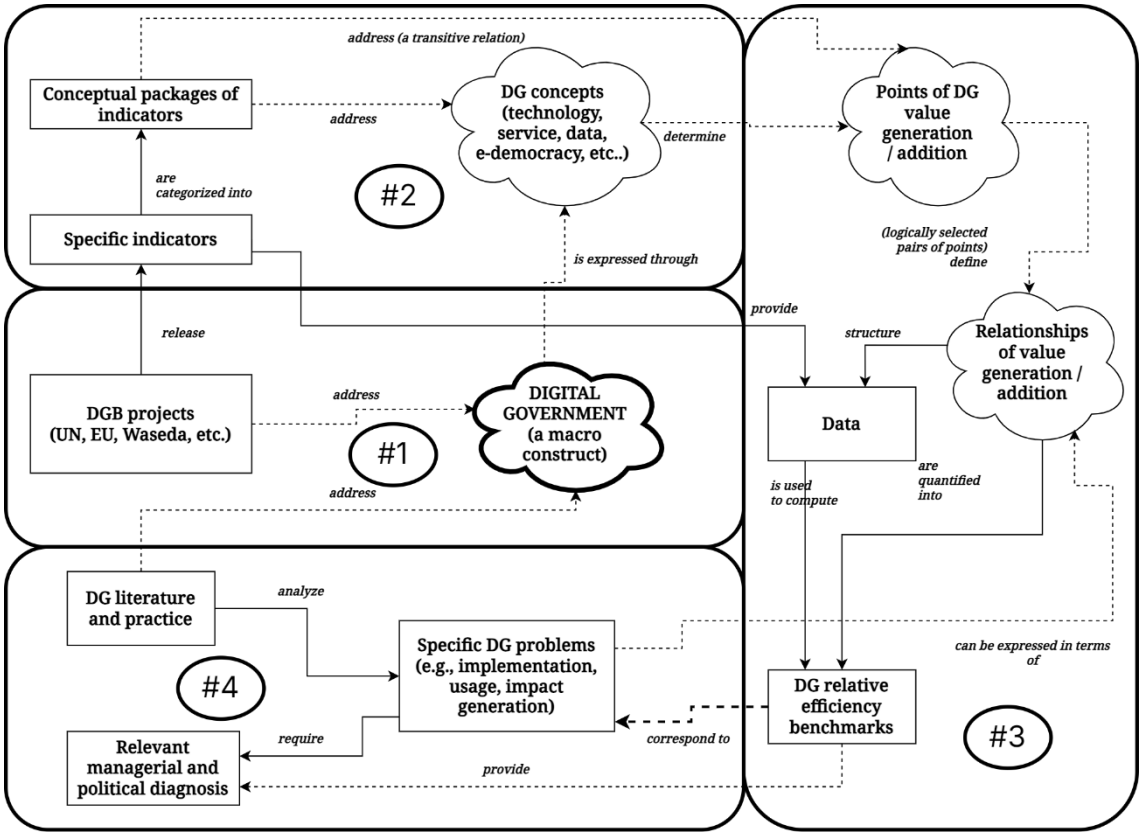

Figure 3.2. Stage-based development of DGVLB

Source: own elaboration.

Table 3.6. DGVL benchmarking model – development stages

#	Stage	Objective(s)	Approach
1	Project Study	To analyze the DGB projects available in the EU, and to select and retain those that fit the goals of the study.	Qualitative analysis based on the respective DGB project reports, conducted through comparative case studies that use the Activity Theory framework (Figure 2.3).
2	Concept Study	To identify DG topics conveyed by the indicators of the selected DGB projects, and to classify them into interpretable conceptual packages.	Content analysis, text processing, and Formal Concept Analysis for identifying conceptual packages.

#	Stage	Objective(s)	Approach
3	Method Study	To complete the system representation, to work out a methodological toolset for handling and processing the data, to formalize value generation, and to elaborate a recipe for obtaining efficiency benchmarks.	Data research, method exploration, and Data Envelopment Analysis.
4	Pilot Study	To apply DGVLB to actual DG policy, management, and operation issues.	Literature review for issue identification, application of tools elaborated in the Method Study.

Source: own elaboration.

4. Model Development – Methods and Results

This chapter presents the development of the DGVL-based benchmarking model, i.e., how the assumptions and postulates of the conceptual framework (DGVL) informed the design and implementation of the benchmarking model (DGVLB), as shown in Tables 3.5 and 3.6. In line with the logic described in Section 3.3.2, the development comprises four stages. Each is realized as a self-contained study, with its own objectives, materials, methods, and results, and outputs of one study shaping inputs to the next. The studies are as follows: project study (Section 4.1), concept study (Section 4.2), method study (Section 4.3), and pilot study (Section 4.4).

4.1. Project Study

In line with Table 3.6, the project study aims to analyze the DGB projects available in the EU and select and retain those that align with the study's goals. The section consists of: introduction (Section 4.1.1), objectives (Section 4.1.2), materials (Section 4.1.3), methods (Section 4.1.4), and results (Section 4.1.5).

4.1.1. Introduction

Over the nearly quarter-century of DGB's history, a considerable number of initiatives to measure countries' DG performance have emerged. Alas, only a small fraction of them managed to establish a persistent position within the DGB landscape, see the lists/factsheets included in (Bannister, 2007; Máchová & Lněnička, 2015; Mukamurenzi et al., 2016; Ojo, Dzhusupova, et al., 2012b; Salem, 2007; Zahran et al., 2015), etc. Many of such initiatives turned out to be ephemeral, despite a rational concept behind, e.g., Sustainable Governance Indicators by the Bertelsmann Foundation (Schraad-Tischler & Seelkopf, 2015); others effectively fell

apart at the level of agenda setting, e.g., (Partnership on Measuring ICT for Development & Economic Commission for Africa, 2011).

The fact is that when speaking of country-level DG assessment, the offer is relatively modest. In particular, among global surveys, the UN-EGS project effectively operates as a monopolist despite the model's obvious deficiencies. In theory, an analyst may attempt to extract the DG information from more general technology-oriented surveys, e.g., the Network Readiness Index (Dutta & Lanvin, 2020). However, this raises a question: what subset of such data is representative of exactly DG, not other components of the technology industry or the information society?

The choice is wider when addressing the DG performance of more developed countries, such as the EU member states. To better understand the complex reality of DG progression, some studies have availed themselves of this fact (Durkiewicz, 2025; Lnenicka et al., 2024; Martínez et al., 2022). Specifically, DGB projects endorsed by prominent international organizations may fulfil expectations towards a reliable and persistent presence. On the other hand, the WU-IDGR initiative (Obi & Iwasaki, 2010), despite its rich historical record, it tends to stay off the radar for most scholars and analysts, let alone the public.

To summarize, there are several existing DGB projects nominally designed to capture aspects of DG, all of which build on diverse DG conceptualizations. Each of them can potentially contribute to a comprehensive picture of DG value generation, though not necessarily directly, through the raw use of the proposed indicators. This leads to the central question of this study: how do existing DGB projects effectively understand and measure DG?

4.1.2. Objectives

The first objective of this study was to recognize and understand DGB projects that: 1) are thematically associated with DGB, 2) were active in recent years, 3) appear reliable enough for prospective DGB in the EU, and 4) are well-documented. Five such projects were identified: EU-EGB, UN-EGS, OECD-DGI, WB-GTMI, and WU-IDGR. Among them, OECD-DGI and WB-GTMI are relatively new. However, the organizational and research machinery behind them suggests they may establish a steady position in the DGB landscape. The second objective was to select, among the five projects, those that provide a solid contribution to the EU DGB, and to include them in subsequent studies. The selection was based on a set of relevant criteria.

4.1.3. Materials

The source of information for this study was the official reports of the respective DGB projects, including references to specific fragments within those reports. The five projects with corresponding reports are listed in Table 4.1. Among them, the EU-EGB project is represented by three reports, due to the owner's dissemination policy of releasing a set of complementary documents. In this case, the respective references are additionally marked by I (Insight), B (Background), or M (Method). The years of the projects' editions were selected to be relatively up-to-date at the time of writing this thesis, and each refers to roughly the same period, i.e., 2020-2022. Typically, a DGB project's edition includes data collected over the previous 1-2 years.

Table 4.1. DGB reports analyzed in the Project Study

DGB project	**Report**	**Reference**
EU-EGB	Insight Report, 2022	(Capgemini et al., 2022b)
	Background Report, 2022	(Capgemini et al., 2022a)
	Method Paper, 2020-2023	(Capgemini et al., 2022c)
UN-EGS	survey report, 2022	(United Nations, 2022b)
OECD-DGI	survey report, 2023	(OECD, 2024)
WB-GTMI	survey report, 2022 (update)	(World Bank, 2022)
WU-IDGR	survey report, 2022	(Waseda University & IAC, 2022)

Source: own elaboration.

4.1.4. Methods

From a methodological perspective, report analysis was carried out through a qualitative review (Bowen, 2009; Kayesa & Shung-King, 2021; Morgan, 2022)with its advantages, such as efficiency, availability, cost-effectiveness, non-obtrusiveness, stability, and broad coverage (Bowen, 2009), but also potential drawbacks, e.g., insufficient coverage and biased selectivity (ibid). However, given this study's objectives, a qualitative review was the only feasible option.

The inquiry framework was developed upon the Activity Theory-based framework for DGB (Section 2.4.3). A relevant subset of Activity Theory served as a guide in designing a comparative scheme for content review, further complemented or extended by additional questions. Such a design aimed at addressing the

formulated research problems, hence, providing a foundation for conducting a comparison-oriented case study (Ryan, 2012; Yin, 2003).

Table 4.2 depicts the inquiry framework. Note that if strictly following the Activity Theory nomenclature, Q4 would belong to the "result" category. In favor of the logical flow, here Q4 is considered an element of "purpose". Q8 refers to the functional categories of indicators – Readiness, Availability, Usage, and Impact, as in DGVC (Heeks, 2008), or in the report by Ojo, Dzhusupova, et al. (2012b).

Table 4.2. DGB Project Study – evaluation framework

Aspect	**Question**	
DG conceptualization	Q1	How is DG understood in the project?
Measuring entity	Q2	Who runs the project?
Measurement purpose	Q3	Why is the project run?
	Q4	What is the target audience of the project?
Measurement approach	Q5	What is the project scope (geographical coverage, frequency)?
	Q6	What is the general logic of measurement and data obtainment?
	Q7	What measures of DG are obtained?
	Q8	What types of indicators are included?
Measurement result	Q9	What is the final outcome?
	Q10	How are the results disseminated?

Source: own elaboration.

In the case of Q8, the categorization at this stage is indicative, as it is based on the reports' descriptions rather than on a comprehensive content analysis of specific indicators, which is provided in Section 4.2. Furthermore, three inclusion criteria for the DGB projects were defined to assess their conceptual coherence, technical realization, and EU relevance. The criteria are listed in Table 4.3.

Table 4.3. Inclusion criteria for DGB projects

Criteria	**Questions**
Conceptual coherence	Is the project developed upon a coherent and well-argued conceptual basis?

Technical realization	Does the project proceed transparently and logically? Are the results complete and available for researchers?
EU relevance	Are the project's outcomes likely to contribute to EU DGB?

Source: own elaboration.

4.1.5. Results

Tables 4.4a to 4.4e present the evaluation results of the respective DGB projects, with respect to the questions formulated in Table 4.2.

Table 4.4a. DGB project evaluation – EU-EGB

#	**Answer**
Q1	Several terms are used in this report: "eGovernment", "electronic government", and "digital government"; the authors treat them as terms referring to the same entity (I, p. 10). Interestingly, "digital government" does not appear in the Method Paper; it appears only in other reports. On the other hand, an EU Parliament-endorsed study notes that DG is a "concept which extends the eGovernment model by building on the notion of new services that public sector 'open data' can support, as well as the collaborative community of public authorities, businesses, citizens and civil society" (Davies, 2015, p. 3). Aside from terminology, DG is associated with digital, borderless, and open public administration (M, p. 7), and has to be developed upon the following principles: 1) digital by default, 2) cross-border by default, 3) once-only action, 4) inclusiveness, 5) privacy and data protection, 6) openness and transparency, thus is considered an openly multidimensional construct (M, p. 9). Effectively, DG understood this way is tied to European policies and development priorities (M, p. 9; I, p. 12), hence it should not be taken as a universally adoptable conceptualization.
Q2	The project is ordered and endorsed by the European Commission, namely, the Directorate-General for Communications Networks, Content and Technology (I, p. 1), and realized by its partners — Capgemini, Sogeti, IDC, and the Polytechnic University of Milan (I, p. 4). Thus, the contributors are a mixture of political, business, and academic entities.
Q3	To evaluate the availability and characteristics of DG in Europe (M, p. 7); to compare how governments deliver digital public services (I, p. 7); to study how platforms for citizens, businesses, tourists, and expats continue to change and improve (B, p. 10); to serve both as a source of inspiration for strategy making and a companion for government digitalization (ibid).
Q4	DG leadership – results synthesized and presented in the insight reports; anyone engaged operationally with DG – background reports (M, p. 7).
Q5	In 2022, 35 European countries, including all 27 EU Member States (I, p. 12). The project is realized biennially, i.e., a full data turnover every two years, while reports are issued annually, along with a partial data update (M, p. 10).
Q6	Measurement is designed around "life events", i.e., scenarios meant to reproduce a user experience when facing a particular DG service (M, p. 10). To serve this agenda, the mystery shopping methods are mostly employed, for instance, "persona" simulations (M, p. 13), and to a lesser extent, automated service

#	Answer
	assessment tools (B, p. 12). Additionally, new "pilot" methods are tested and implemented (M, p. 10).
Q7	The project's indicators form a hierarchical structure. The direct results of applying assessment methods are aggregated into domain-specific indicators, e.g., online availability or cross-border eID, which, in turn, compose four top "key dimension" indices: User Centricity, Transparency, Key Enablers, and Cross-Border Services (M, p. 9). Additionally, the arithmetic average of those is computed as the overall score of a country's DG maturity (I, p. 16).
Q8	Since the indicators address service qualities, their natural positioning is Availability. On the other hand, the methods used to obtain data (perspective user simulation) may suggest a particular relation to Usage.
Q9	The results are published and presented in diverse forms, varying in target audiences and level of detail (M, p. 7). Reports contain thorough analyses, comparisons, and benchlearning insights, oriented toward specific countries (background reports) or toward general European trends (insight reports).
Q10	An extensive collection of documents accompanies each edition and is freely downloadable. Full datasheets are available (European Commission, 2022b).

Source: own elaboration.

Table 4.4b. DGB project evaluation – UN-EGS

#	Answer
Q1	Although both terms are used, there is no stated rationale for the distinction between "e-government" and "Digital Government", which may be confusing. Example: "…helping them build a solid foundation for accelerating the transition to digital government; however, e-government development efforts are undermined by…" (p. xxv). It appears somewhat ambiguous what DG is measured in this survey. Various formulations are scattered throughout the report, e.g., "adoption of … a digital government framework, so that advances in e-government are integrated with broader sustainable development initiatives" (p. v), [DG] "as an integral and thoroughly integrated aspect of the physical functioning of public institutions and services delivery" (p. xxiv), etc. Its main index, the E-Government Development Index (UN-EGDI), is assumed to reflect a construct comprising the quality of online services, the availability of technology, and citizens' intellectual potential (p. 1-2, 189). At the same time, the whole survey is declared to capture e-government effectiveness in public service delivery, e-government development at the national level, or relative e-government performance (p. xix). Perhaps, the whole project should be considered utilitarian and applicable rather than conceptually sound. Also, the authors declare their openness to adjust their model to technological trends and broader development goals (p. xx).
Q2	UN – a global intergovernmental organization. Specifically, the project is run by the UN Department of Economic and Social Affairs, through its Division for Public Institutions and Digital Government (p. vi). A broad list of partners /contributors is acknowledged, including political and academic ones (p. vi).
Q3	To serve as a benchmarking and development tool for countries to learn from one another, identify areas of strength and challenges in e-government, and shape their policies and strategies; to facilitate and inform discussions within intergovernmental bodies, including the UN General Assembly (p. xix).

#	Answer
Q4	Policymakers, government officials, academia, civil society, the private sector, and other practitioners and experts in the areas of sustainable development, public administration, digital government, and ICTs for development (p. xix).
Q5	UN Member States (193 in 2022) are covered, biannually, since 2001 (p. xix).
Q6	Part of the data is obtained from external sources, i.e., International Telecommunication Union and UNESCO (pp. 196-197). The survey's original data are generated internally through the research process, which targets the review and assessment of governmental online services and resources (p. 193), guided by submissions of Member State Questionnaires from officials in particular countries (pp. 201-202).
Q7	The top-level measure is UN-EGDI, computed as the average of the domain-specific indices: the Online Service Index (UN-OSI), the Telecommunication Infrastructure Index (UN-TII), and the Human Capital Index (UN-HCI). UN-EGDI is intended to benchmark e-government development at the national level (pp. xix, 1, 190), albeit in relative rather than absolute terms (p. xix). The UN-OSI's analytical scope comprises the following thematic areas: technology, institutional framework, content provision, service provision, and (interestingly) e-participation (p. 191). Complementarily, the survey includes the E-Participation Index (UN-EPI), which enhances insight into the participatory aspects of DG, built on a framework comprising three analytical domains: e-information, e-consultation, and e-decision-making (pp. 199-200). Additionally, since 2018, DG service provision at the city level has been measured through the Local Online Service Index.
Q8	UN-OSI and UN-EPI address the problem of service quality and, to a lesser extent, service usability. However, UN-EPI is more focused on the supply side of e-participation than on the demand side (p. 201). In turn, UN-TII and UN-HCI are clearly dedicated to the DG preconditions. Hence, Readiness, Availability, and (partially) Usage are covered in this project. A distinct issue is a mixture of these three distinct categories within UN-EGDI.
Q9	Each survey edition is documented and published as an extensive report, typically headlined and driven by current, vital throughlines, notably sustainable development (United Nations, 2016, 2018, 2020).
Q10	Fully accessible reports and datasets, which are available within a comprehensive database of historical records (United Nations, 2024a).

Source: own elaboration.

Table 4.4c. DGB project evaluation – OECD-DGI

#	Answer
Q1	The DG concept in this project traces back to OECD's earlier recommendation on DG strategies (p. 8), which makes a distinction between DG – the use of digital technologies, as an integrated part of governments' modernization strategies, to create public value, and E-Government – the use by the governments of ICTs, particularly the Internet, as a tool for better government (OECD, 2014). OECD also recognizes a shift from E-Government to DG with a view to opening, innovating, and modernizing the public sector (ibid).

#	Answer
Q2	OECD Directorate for Public Governance, more specifically, its Innovative, Digital and Open Government Division, with acknowledged contributions from external experts, mainly political (p. 4).
Q3	To benchmark government efforts to establish the foundations necessary for public sector digital transformation that is coherent and human-centered (p. 3); to serve as a support for running comprehensive policy reforms in the digital transformation of government to increase government productivity, enhance government services, and improve people's lives (p. 7); to assess the degree to which countries have the necessary foundations in place to be able to leverage data and technology to deliver a whole-of-government and human-centric digital transformation of the public sector (p. 8).
Q4	Governmental policymakers (p. 7)
Q5	38 countries: 33 OECD member countries, four accession countries, and one partner country (p. 9). Within this group, 21 EU Member States are represented. The survey's expected frequency is not yet specified. The present "full" edition follows the 2020 pilot (p. 7).
Q6	The measurement process relies on original data, aggregating evidence from the central/federal level of government, covering all ministries and agencies (p. 27). The collected responses are then subjected to formal validation and, in cases of inconsistencies, are resubmitted by problematic countries for final OECD validation (ibid). The obtained responses (in varied forms) constitute so-called transversal facts, which, in turn, are mapped into six DG dimension indicators; the data aggregation uses weighted averaging (pp. 27-33).
Q7	The top-level measure is meant to be the OECD-DGI composite score, which represents the overall DG performance (p. 27). It is composed of second-level indicators that represent performance across six DG dimensions: Digital by Design, Data-driven public sector, Government as a Platform, User-driven, Open by Default, and Proactiveness. The lowest level consists of transversal fact indicators, composed directly from the respective answers (pp. 27-33).
Q8	The report clearly states that it focuses on the supply (governmental) side of DG and that service uptake is not within the project's scope (p. 8). Thus, the indicators may be situated between the Readiness and Availability categories. However, a conceptual idiosyncrasy of the project, and its focus on some DG meta-qualities, suggests that such a categorization is not straightforward.
Q9	A country ranking of DG performance in six dimensions, which is presented within an insight report ("policy paper").
Q10	The results are disseminated, along with a moderately in-depth analysis, within a freely accessible report. No separate datasets are provided.

Source: own elaboration.

Table 4.4d. DGB project evaluation – WB-GTMI

#	Answer
Q1	The project claims to address the "GovTech" construct: "whole-of-government approach to public sector modernization that promotes a simple, efficient and

#	Answer
	transparent government with the citizen at the center of reforms", meant to represent the "current frontier of digital government transformation" (p. 11).
Q2	The project is run by the World Bank, through its GovTech Global Partnership initiative, and is supported by the Korean KDI School of Public Policy and Management (p. 11).
Q3	The project is intended to inform/influence development pathways, thereby supporting the World Bank's declared goals: the elimination of extreme poverty and the boosting of prosperity. The project's outcomes are designed to "complement existing tools and diagnostics by providing a baseline and benchmark for GovTech maturity" and to identify improvement areas (p. 11).
Q4	Policymakers and officials in charge of GovTech from the client countries. Low- and middle-income countries are of concern because they may benefit from the World Bank's financial/technical support for GovTech (p. 11).
Q5	198 world countries (economies) under observation, including several territories not belonging to the UN, e.g., Taiwan and Hong Kong (pp. 33-35).
Q6	An upgrade over the previous edition, which relied on information from governmental websites, the data for the present edition was primarily collected through a dedicated online survey, completed by 135 governmental teams, and the data for the remaining 63 countries was obtained remotely (p. 25). The data were further subjected to a validation procedure, and, in cases of uncertainty, clarification was provided (pp. 25-26). Also, eight external indicators (including UN-EPI and UN-OSI) were included in the framework.
Q7	WB-GTMI considers DG (GovTech) across four dimensions, measured by four indices: Core Government Systems, Public Service Delivery, Digital Citizen Engagement, and GovTech Enablers. These second-level values are averaged to yield the top-level composite, i.e., GovTech Maturity Index, normalized to a 0-1 interval (pp. 25, 28). The third tier of indicators comprises 48 specific GovTech aspects categorized into the dimensions above (pp. 26-27). Most of these indicators are composed of the (lowest level) sub-indicators. Indicators of the third and fourth level are assigned to a specific type, e.g., "progressive", scored binarily or normalized to an interval, and assigned to one of several weighting categories (pp. 29-30).
Q8	Different dimension indices address different stages and aspects of DGVC. In the case of Core Government Systems, Readiness and Availability are primarily addressed through technical and organizational solutions. Public Service Delivery chiefly corresponds to the Availability of citizen-targeted services, e.g., tax or job portals. (pp. 26-27). Digital Citizen Engagement is akin to UN-EPI (it encompasses this measure), as it scrutinizes the availability of services in the participatory dimension. However, two indicators refer to citizen feedback and the publication of engagement statistics (p. 26). On the other hand, GovTech Enablers mainly covers aspects of Readiness, including legal and organizational framework, e.g., data protection law or a strategy for public sector innovation (p. 27).
Q9	A country assessment based on GTMI, expressed through categorization of countries into four GovTech advancement groups: A – very high, B – high, C – medium, or D – low (p. 34). Also, a catalogue of good governmental practices serving GovTech advancement is provided.

#	Answer
Q10	A fairly extensive and detailed report, including reasonably in-depth insights, is available on the World Bank portal, along with an interactive data dashboard and downloadable datasheets.

Source: own elaboration.

Table 4.4e. DGB project evaluation – WU-IDGR

#	Answer
Q1	The scope of DG covered is not specified precisely. The project declares assessing the "overall digital government development in a country, ranging from policy development and e-Services implementation to management optimization and digital government promotion" (p. 75). Thus, one can deduce that the thematic borders of DG are considered flexible, chiefly considering the successively mutating set of analyzed DG features (ibid). The project tends to favor the term "Digital Government," although "e-government" is also frequently used. It is hard to capture the dominant logic here, since the report, for instance, identifies the "shift from e-government to digital government" as an "ideal digital society" (p. 72).
Q2	The project is run by the Institute of Digital Government at Waseda University in Japan, in cooperation with the International Academy of CIO (p. 2). Thus, its lineage may be considered academic.
Q3	To mark digital transformation in over 64 digitally-advanced countries; to contribute value globally (p. 2); to provide various information and data on both Digital Innovation and Digital Economy (p. 7).
Q4	All parties concerned (p. 2); government and policymakers, particularly those capable of preventing the digital divide and innovation gap (p. 7). In general, the target audience is not clearly defined.
Q5	64 countries (p. 11), including 17 EU Member States. According to the authors, the examined units are "over-advanced digital countries" (p. 2), which may be at least debatable. The project is realized, and its results are published annually, starting from 2005 (p. 7).
Q6	The measurement is described as an essentially linear process, from preparation to final check (p. 76). However, its description is not straightforward. Presumably, the values of 10 domain indicators are obtained through expert analysis, supported by questionnaires submitted by government officials and academics in participating countries (p. 75).
Q7	Ten indicators referring to the identified dimensions of DG: Network Infrastructure Preparedness, Management Optimization, Online Service, National Portal, Government Chief Information Officer, DG Promotion, E-Participation, Open Government Data, Cybersecurity, and Emerging Technology (pp. 75-76). The weighted average yields the final score (p. 75).
Q8	The project engages a very eclectic set of indicators. Some of them, e.g., Networked Infrastructure Preparedness, navigate directly to Readiness, others, e.g., E-Participation, to Availability. In their detailed descriptions, one can find a clue that, to some extent, Usage is also addressed, though in a facile way, e.g., in the case of the National Portal (p. 26).

#	Answer
Q9	An extensive report composed of the full composite ranking, rankings within domains, various analyses (e.g., DG trends), and case studies of participating countries, organized by their performance in respective DG dimensions.
Q10	Reports are accessible to download. Separate datasets are not available, and specific data is scattered in the report, making it challenging to process individually.

Source: own elaboration.

Based on the evaluation results for the five DGB projects presented in Tables 4.4a to 4.4e, the projects can be checked against the inclusion criteria in Table 4.3: conceptual coherence, technical realization, and EU relevance. A consolidated outcome for each of them is described in Tables 4.5a to 4.5c.

Table 4.5a. Inclusion assessment of DGB projects – conceptual coherence

Project	Assessment	Justification
EU-EGB	Medium	The project is openly developed with a utilitarian purpose in mind. DG is what is expected from the aggregation process, adjusted to the EU policy monitoring needs rather than guided by an articulate framework. The analytical focus is on the desired qualities of services, which certainly is a fragmented view of DG.
UN-EGS	Low	The framework is mature since its foundations have remained stable for over two decades. However, the mixture of information sources that are declared to make up the DG picture is unconvincing.
OECD-DGI	High	Arguably, the highest among the analyzed projects. The measurement is designed upon a solid conceptual basis and addresses the distinction between DG and "E-government". The project provides a consistent narrative of the value-generating transformation of public administration, thus most clearly aligns with the DGVL perspective.
WB-GTMI	Medium	Not unlike OECD-DGI, WB-GTMI also seeks to provide an illustrative narration of digital transformation. This is, however, more blurry and less underpinned by conceptual soundness, despite the survey's claim that it allows for "the most comprehensive measure of digital transformation in the public sector" (p. 11).
WU-IDGR	Low	The composition of indicators (which varies across surveys) is stated to capture the state of DG, but its underlying logic remains unclear. An expectation that this may provide a consistent and comprehensive DG picture is unfounded.

Source: own elaboration.

Table 4.5b. Inclusion criteria assessment of DGB projects – technical realization

Project	Assessment	Justification
EU-EGB	High	Relatively solid and comprehensive, though relying on human or automated methods of usage simulation as a primary data source may be debatable/limiting.
UN-EGS	High	Solid, particularly given the project's global scope. However, its approach to assessing governmental websites and ad hoc updates to the measurement framework may raise some doubts.
OECD-DGI	High	Relevant, however, taking governmental officials as the primary source of information may lead to bias.
WB-GTMI	Medium	Generally reliable, though one may find it too eclectic, encompassing too many diverse information inputs. Also, the convoluted construction of the measurement framework adds to an impression of arbitrariness.
WU-IDGR	Low	The project's reports typically contain numerous treatments on various DG topics, which, alas, do not constitute a consistent whole. Most importantly, the measurement design, the scope of this process, and the way it is presented do not appear reliable.

Source: own elaboration.

Table 4.5c. Inclusion criteria assessment of DGB projects – EU relevance

Project	Assessment	Justification
EU-EGB	High	Naturally relevant since the whole framework was designed to guide, support, and evaluate the EU Member States' DG policies.
UN-EGS	Low	Due to the relatively low level of specificity and the prominent role of readiness measures (e.g., technical infrastructure), its relevance is limited. The project is regularly updated to address recent technological trends, but, in the case of highly advanced countries in DG, it remains too facile. Nevertheless, it can well serve as a generous source of auxiliary data.
OECD-DGI	High	The project's idiosyncratic conceptualization of DG, as opposed to E-Government, is somewhat convoluted, but its orientation on DG-advanced countries provides a fairly in-depth resource of applicable insights.
WB-GTMI	High	While the project's coverage is global, its design implicitly addresses DG at a level beyond rudimentary, including advanced concepts. Its methodological logic may be debatable, if occasionally obscure, yet at least a subset may be effectively adapted to the context and needs of EU DG development.

Project	Assessment	Justification
WU-IDGR	Low	Due to arbitrary coverage and the scarcity of reusable resources, there is no compelling reason to use it.

Source: own elaboration.

Given the assessment above, two projects are eliminated from further studies, UN-EGS and WU-IDGR. Both are unlikely to contribute substantially to the development of the DGVLB model. In addition, for WU-IDGR, such a contribution would not even be technically feasible. While UN-EGS will not be directly included in further studies, it will be included indirectly as its two indicators, UN-OSI and UN-EPI, are part of the WB-GTMI project.

Collectively, the three selected DGB projects introduce 14 indicators that represent various measures of DG identified in the answers to question G7. Four indicators from the EU-EGB project: User Centricity (EU-UC), Transparency (EU-TR), Key Enablers (EU-KE), and Cross-border Mobility (EU-CBM). Six indicators from the OECD-DGI project: Digital by Design (OECD-DD), Data-driven Public Sector (OECD-DPS), Government as a Platform (OECD-GP), Open by Default (OECD-OD), User Driven (OECD-UD), and Proactiveness (OECD-P). And, finally, four indicators from the WB-GTMI project: Core Government Systems (WB-CGS), Public Service Delivery (WB-PSD), Digital Citizen Engagement (WB-DCE), and GovTech Enablers (WB-GTE).

4.2. Concept Study

In line with Table 3.6, the concept study aims to identify DG topics conveyed by the indicators of the selected DGB projects, and to classify them into interpretable conceptual packages. The section consists of six parts: introduction (Section 4.2.1), objectives (Section 4.2.2), materials (Section 4.2.3), methods (Section 4.2.4 and Section 4.2.5), and results (Section 4.2.6).

4.2.1. Introduction

As discussed in Chapter 2, DG encompasses a broad spectrum of ideas and postulates, and approaches to measuring it reflect this complexity. They often put forward concepts that are not always standardized and possibly disputable from the perspective of other approaches.

The study documented in Section 4.1 confirms that a straightforward aggregation of indicators from multiple DGB projects will generally not produce a comprehensive and consistent measurement toolset. Instead, an informed

identification and treatment of possibly latent information are required to yield a sensible collective picture of DG. This study is devoted to such an endeavor.

While a good part of the literature on the conceptual complexity of DG is, in principle, developed on theoretical assumptions and/or common sense, notable efforts also address this issue from more formalized positions, supported by specific analytical apparatus. Examples include Malodia et al. (2021), who interviewed DG stakeholders to elaborate on a consistent description of the DG's structure; Bindu et al. (2019), who applied network analysis; Alcaide–Muñoz et al. (2017), who engaged in science mapping techniques; Hu et al. (2009), who adopted text-mining tools, etc. In addition, there are propositions for specialized DG domain ontologies (Hinkelmann et al., 2010; Ilieva & Deliyska, 2011).

Such exercises, however, seek to capture the DG operation without directly addressing the practical problems of policy-relevant DGB. Studies addressing the problem of the variety of DGB instruments (Bannister, 2007; Heeks, 2008; Ojo, Dzhusupova, et al., 2012b; Schellong, 2010) focus on their technical and formal aspects rather than conceptual substance. This is understandable given the overall flux of the DGB offer. However, some in-depth analyses also appear (Mukamurenzi et al., 2016; P. N. Sharma et al., 2018; Whitmore, 2012), indicating ongoing interest in the “referential” UN-EGS model.

Somewhat related to the present study is the work by Martínez et al. (2022), which assigns indicators from several projects to generic logic model categories (input, process, output, outcome, impact) and DG-specific classes (governance, platform, digital services, connectivity, citizenship). However, this effort is not aimed at leveraging the acquired knowledge into an alternative DGB model.

In this context, the present study may be an original effort to deliberately design a new DGB model through conceptual analysis.

4.2.2. Objectives

The general objective of this study is to map the indicators of the DGB projects selected in the Project Study, i.e., EU-EGB, OECD-DGI, and WB-GTMI, into “conceptual packages”, i.e., groups of indicators capturing relatively consistent and manageable DG concepts or system components (Section 3.2). Consequently, indicators within a package may address a DG dimension (e.g., adoption of technologies), a specific aspect of DG operations (e.g., provision of services), or more abstract categories (e.g., DG impact on governance).

Note that if taken literally, the objects under analysis are indicators rather than theoretical categories. Thus, the packages effectively correspond to specific thematic foci within the DG measurement process, i.e., "(measures of) service", "(measures of) preconditions", etc. However, to keep the text readable, this disclaimer is omitted in the elaborated descriptions.

Beyond the cognitive advantage, the motivation was to further engage these "conceptual packages" in covering value-generation processes. The second-tier indicators, i.e., those directly below the top composites, are of particular interest because they are expected to be reasonably clear in the messages they convey.

Operationally, the overall object of this study is arranged into four partial objectives. First, to thoroughly recognize what the included indicators actually capture, inquiring beyond what is summarized in their brief report summaries. Second, to describe each indicator in terms of reasonably specific attributes referring to its contents, i.e., what DG themes this indicator addresses. Third, to provide a "conceptual map" of the indicators, developed upon the above. Finally, to identify and characterize the DG concept captured by the indicators. The bottom line is that, in this approach, the concepts emerge from the domains of specific DGB projects rather than from a priori positions.

4.2.3. Materials

The material content of each indicator is assumed to be conveyed by, first, its general summary provided by the DGB project's owner, and second, more substantively, by the indicator's components. In the case of EU-EGB, it was the explicit descriptions of the third-tier components for all four second-tier indicators. In the case of OECD-DGI, the list of questions/issues contributed to the respective dimensions. In the case of WB-GTMI, it was the (notably eclectic in terms of sources) list of each indicator's components. Thus, the respective DGB project reports were used, particularly the sections listing the aforementioned components (Capgemini et al., 2024, pp. 12–13; OECD, 2024, pp. 27–33; World Bank, 2022, pp. 26–27).

4.2.4. Methods – Content Extraction

Guided by project-level outcomes, the extraction of the indicators' contents, as disclosed by the project's owners, followed.

While the EU-EGB indicators present a relatively straightforward coverage, namely DG services, in the other studies, particularly OECD-DGI, the situation was more complex. To extract a set of conventional DG issues covered by each indicator,

the author collected and analyzed the summaries and component lists (as discussed above) for each indicator. Next, content analysis proceeded with help from the Voyant project's text-analytic tools (Voyant Consortium, 2025),i.e., a set of keywords was extracted for each indicator, and their relative frequency (within the respective word corpus) was analyzed. Only keywords with a relative frequency of at least 1% were retained. This operation played a significant yet supportive, rather than conclusive, role in the analysis.

Having an initial list of keywords for each indicator, they were reviewed in terms of their actual semantic connotations, their salience concerning the indicator's description (e.g., eliminating the keywords that are generic to DG, like "digital", "government", "public", "sector", etc.), and the presence of unhandled stopwords. This allowed categorizing the keywords into 10 context-relevant attributes (tags), roughly reflecting the value generation logic, i.e., from the DG prerequisites to the DG outcomes, as postulated by Heeks (2008).

As a result, each indicator was annotated with up to three tags to categorize its core content succinctly. This limit was found to provide a sensible balance between expressiveness and granularity, as required for the rest of this analysis. The tags that capture substantial parts of an indicator's thematic range, rather than incidental questions, as is the case for OECD-DGI, were preferred.

4.2.5. Methods – Concept Analysis

Given the matrix of indicators vs. attributes, concept extraction and analysis could proceed. To this end, the established and mathematically grounded method of Formal Concept Analysis (FCA) was used.

This method was developed in the 1980s by Rudolf Wille and his collaborators as a means of "activating mathematical thinking for conceptual data analysis and knowledge processing" (Ganter & Wille, 1999, p. vii). FCA provides a framework for concept modelling using lattice theory (Ganter & Stumme, 2003, p. 7), which itself originated with Gareth Birkhoff in the 1930s. Various publications cover the conceptual and mathematical foundations of FCA (Belohlavek, 2008; Ganter & Wille, 1999; Ignatov, 2017). Table 4.6 consolidates the essential concepts of this method.

Table 4.6. Essential issues of Formal Concept Analysis

Issue	**Explanation**
Formal context	A triplet $<X,Y,I>$ where X is a set of elements called objects, Y is a set of attributes, and I is a binary relation between X and Y, i.e., $I \subseteq X \times Y$. Hence, a statement $<x,y> \in I$ means that an object x has an attribute y.

Issue	Explanation
Concept-forming operators	For a formal context $\langle X,Y,I \rangle$, operators $\uparrow: 2^X \rightarrow 2^Y$ and $\downarrow: 2^Y \rightarrow 2^X$ are defined for every $A \subseteq X$ and $B \subseteq Y$ by: $A\uparrow = \{ y \in Y \mid \text{for each } x \in A : \langle x, y \rangle \in I \}$ $B\downarrow = \{ x \in X \mid \text{for each } y \in B : \langle x, y \rangle \in I \}$
Formal concept	A formal concept in the context $\langle X,Y,I \rangle$ is a pair $\langle A,B \rangle$ of $A \subseteq X$ and $B \subseteq Y$ such that $A\uparrow = B$ and $B\downarrow = A$.
Concept extent and intent	Within a particular formal concept, A and B are, respectively, its *extent* and *intent*.
Concept hierarchy	For formal concepts $\langle A_1,B_1 \rangle$ and $\langle A_2,B_2 \rangle$ of the formal context $\langle X,Y,I \rangle$: $\langle A_1, B_1 \rangle \leq \langle A_2, B_2 \rangle$ *iff* $A_1 \subseteq A_2$ (*iff* $B_2 \subseteq B_1$) The above should be understood that $\langle A_1,B_2 \rangle$ is a *subconcept* of its *superconcept* $\langle A_2,B_2 \rangle$. Intuitively, the subconcept is the more specific concept (e.g., a landlocked European country), while the superconcept is the more general one (e.g., a European country).
Concept lattice	A collection of all formal concepts within a given context, that is, $\beta (X, Y, I) = \{ \langle A, B \rangle \in 2^X \times 2^Y \mid A\uparrow = B, B\downarrow = A \}$ with a defined subconcept-superconcept ordering hierarchy. This can be represented graphically.

Source: own elaboration based on (Belohlavek, 2008).

FCA constitutes a vivid and progressing area of applied science, with numerous applications and a growing ecosystem of methods and approaches (Ignatov, 2017; Singh et al., 2016; Škopljanac-Mačina & Blaškovic, 2014). However, the method has been applied only sparingly in DG studies. As of November 2025, the Scopus search for ["formal concept analysis" AND ("e-government" OR "digital government")] yielded just one result: (Frtunic Gligorijevic et al., 2021). This is surprising, as many DG-focused qualitative studies could benefit from the formal rigor of the FCA apparatus.

Applying FCA concepts to the problem of this study, the formal context is defined by a matrix whose rows correspond to specific indicators (objects) and whose columns correspond to the introduced tags (attributes). Hence, the binary relation refers to whether a particular indicator has (1 or “x”) or does not have (0 or “”) a specific attribute. In this study, formal concepts are composed of a specific subset of indicators sharing a particular subset of attributes. The concept lattice pictures the conceptual map of the present problem.

The current study aimed to identify concepts that could be used reliably in constructing the DGB model. By its nature, a concept lattice reveals numerous

concepts, only a fraction of which provide some adequate analytical value, and some mainly contribute to conceptual "noise". This can be addressed, e.g., by imposing a minimal extent/intent for a concept and rewriting a lattice (Andrews & Orphanides, 2010), thereby eliminating some redundant objects or attributes.

Before knowing the lattice, the assumption was that: 1) the selected concepts should represent integrative ideas that are interpretable within the value generation logic and, collectively, cover its possibly large part; 2) they should not be in a "subconcept-superconcept" relation to one another; and 3) to avoid a single DG operationalization-favoring bias, the selection set should, preferably, encompass all included projects. Thus only a particular subset of the indicators was retained.

The FCA procedure was realized using the Concept Explorer (Yevtushenko, 2000) and InClose (Andrews, 2009) software. Its outputs were reviewed against the study's objectives, specifically regarding adequacy, clarity, and correspondence with the indicators' reported coverage.

4.2.6. Results

Table 4.7 presents the first output of the content extraction method (Section 4.2.4) applied to 14 indicators representing various measures of DG provided by three selected DGB projects: EU-EGB, OECD-DGI, and WB-GTMI (Section 4.1.5). The output comprises lists of keywords extracted for each indicator from its summaries and component lists, after removing DG-generic keywords, stop words, and keywords with a relative frequency below 1% (Section 4.2.4). The keywords in the lists are ordered by their frequency.

Table 4.7. Keywords extracted from the indicators of selected DGB projects

Indicators	**Keywords**
EU-UC: User Centricity	services, online, mobile, extent, support, provided, interface, website, user, transactional, responsive, reached, portal, mechanisms, information, help, friendly, friendliness, feedback, features, device, concerning, available, availability
EU-TR: Transparency	service, transparency, extent, user, personal, design, data, process, policy, organisations, manage, involved, informed, held, expectations, delivery, clarified
EU-KE: Key Enablers	service, extent, used, citizens, user, sources, security, proof, processes, post, identification, electronic, eid, edocuments, authentic
EU-CBM: Cross-border Mobility	users, online, extent, European, countries, electronic, used, support, services, service, processes, identification, eid, edocuments, documents, cross, border

Indicators	Keywords
OECD-DD: Digital by Design	body, availability, skills, charge, strategy, organization, coordination, policies, level, formal, existence
OECD-DPS: Data-driven Public Sector	data, availability, strategy, requirements, national, management, interoperability, institutions, leadership
OECD-GP: Government as a Platform	availability, identity, ICT, services, projects, standardized, govtech, service
OECD-OD: Open by Default	open, data, available, availability, use, source, requirements, impact, catalogue, services, mechanisms, institutions, information, indicators, compliance, assessment, accessible
OECD-UD: User Driven	services, design, plan, action, public, groups, divides, users, user, tools, divide, delivery
OECD-P: Proactiveness	use, sector, AI, services, ethical, strategy, risk, initiatives, implemented, data, advice
WB-CGS: Core Government Systems	place, management, information, framework, service, public, portal, platform, interoperability, FMIS, debt, cloud
WB-PSD: Public Service Delivery	service, online, portal, tax, customs, available, window, universal, stop, social, single, similar, shop, services, remote, portals, pension, payment, OSI, measures, maturity, job, insurance, index, ID, focus, filing, enables, design, declarations, citizen, centric, authentication, accessibility, access
WB-DCE: Digital Citizen Engagement	open, platforms, portal, participation, feedback, data, citizens, allow, web, statistics, site, service, regularly, publish, provide, policy, performance, participate, national, mechanisms, measures, index, EPI, engagement, delivery, decision, aspects
WB-GTE: GovTech Enablers	data, strategy, govtech, innovation, ID, entity, transformation, support, skills, protection, program, national, laws, index, improve, focused

Source: own elaboration.

Table 4.8 presents the second output of the content extraction method (Section 4.2.4): 10 tags identified from the indicators' keywords (Table 4.7) to encompass their scope. In the table, each tag is explained by the DG issues covered. This is not an exhaustive list of issues, but rather a set of tags that covers the selected indicators' actual domains of interest. For instance, it was pointless to extensively develop an external IMPACT tag, since the current indicators cover it only tangentially.

Table 4.8. Tags covering DG issues and classifying the indicators' content

Tags	**DG issues covered**
HUMAN	Human capital, workforce, skills
TECH	Technologies, infrastructure, software, connectivity
LEGAL	Legislative and institutional backing, formal regulations
STRATEGY	DG strategies and policies
PLATFORM	Organization, back office, management, control, monitoring, information systems, interoperability
DATA	Data policies, data management
SERVICE	Service provision, accessibility, quality, convenience
INFORMATION	Information provision
USER	User orientation, user engagement, user feedback
CITIZEN	Openness, transparency, accountability, participation

Source: own elaboration.

Applying tags to indicators yielded a matrix (Table 4.9) that constitutes the formal context for the concept analysis method (Section 4.2.5). In the matrix, "1" at the intersection of row I (indicator) and column T (tag) means: the indicator I substantially addresses the DG issues covered by the tag T.

Table 4.9. Are indicators addressing DG issues covered by tags?

	HUMAN	TECH	LEGAL	STRATEGY	PLATFORM	DATA	SERVICE	INFORMATION	USER	CITIZEN
EU-UC							1	1	1	
EU-TR							1		1	1
EU-KE							1		1	
EU-CBM							1	1	1	
OECD-DD	1		1	1						
OECD-DPS				1	1	1				
OECD-GP		1			1		1			

	HUMAN	TECH	LEGAL	STRATEGY	PLATFORM	DATA	SERVICE	INFORMATION	USER	CITIZEN
OECD-OD					1	1				1
OECD-UD				1			1		1	
OECD-P		1		1		1				
WB-CGS		1			1			1		
WB-PSD							1		1	
WB-DCE								1	1	1
WB-GTE			1	1		1				

Source: own elaboration.

According to the FCA method (Section 4.2.5), the visualization in Table 4.9 yields the concept lattice in Figure 4.1, produced using the Concept Explorer software. The lattice contains 28 circles (small and large) that represent the identified concepts.

For a less formal explanation, white boxes represent indicators, and grey boxes represent their tags. Indicators "travel" upward the lattice, successively "meeting" their tags. A concept is expressed as a set of indicators sharing the same tags, plus a set of tags "possessed" by those indicators.

If it is possible that travelling from a certain concept A upwards (turning only at circles, not at other "crossings"), another concept B can be reached, then it can be concluded that concept A is a subconcept (i.e., more detailed – in biology, it could be a mammal) of concept B, which is then a superconcept (i.e., more general – in biology, it could be an animal) of concept A.

For instance, EU-UC contains all the attributes of WB-PSD, and more (INFORMATION); those indicators that address any of HUMAN or LEGAL also address STRATEGY, etc.

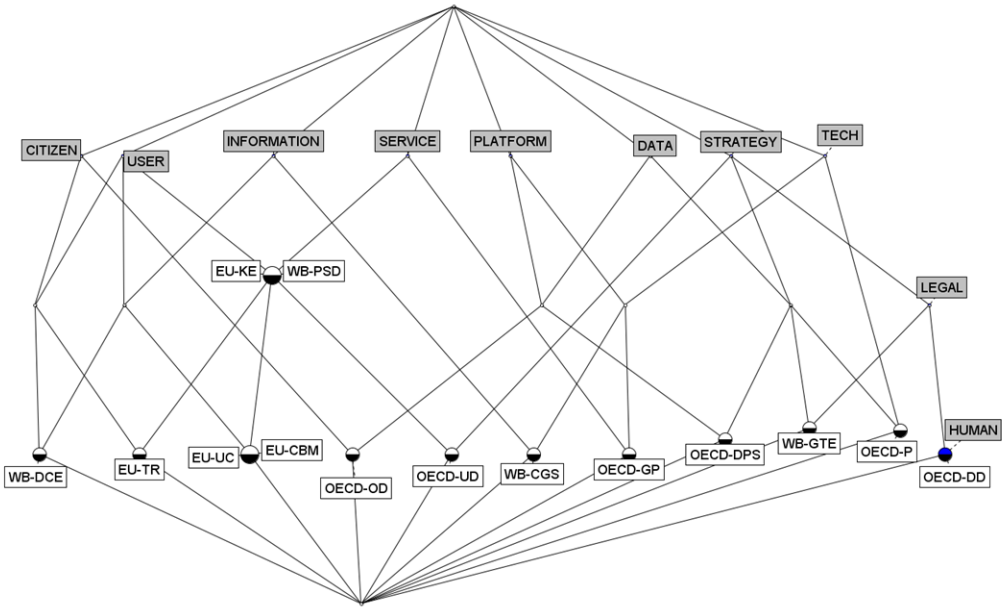

Figure 4.1. Concept lattice visualization
Source: own elaboration using Concept Explorer software.

Nonetheless, this picture is somewhat cluttered, making it difficult to interpret. Thus, in the next step, the lattice is reduced by setting lower limits for objects (extent) and attributes (intent) within a concept (both set to two). This strategy generated a more compact set of concepts, limited to eight. Table 4.10 lists and characterizes these concepts.

Table 4.10. Identified DG concepts (reduced context)

#	**Attributes (intent)**	**Indicators (extent)**
1	LEGAL, STRATEGY	WB-GTE, OECD-DD
2	USER, SERVICE	OECD-UD, EU-CBM, EU-UC, EU-TR, EU-KE, WB-PSD
3	SERVICE, USER, INFORMATION	EU-CBM, EU-UC
4	USER, INFORMATION	EU-CBM, EU-UC, WB-DCE
5	STRATEGY, DATA	OECD-DPS, OECD-P, WB-GTE
6	DATA, PLATFORM	OECD-DPS, OECD-OD
7	USER, CITIZEN	EU-TR, WB-DCE
8	PLATFORM, TECH	OECD-GP, WB-CGS

Source: own elaboration using InClose software.

Notice that concepts #2 and #4 are superconcepts (i.e., are more general) of concept #3; thus, only the latter should be retained. Also, concept #5 is difficult to interpret clearly and involves two indicators that occur elsewhere. For clarity, this concept was not included in further analysis. Thus, five concepts correspond aptly to the logic/order of DG value generation. Concerning such an order, they are listed and interpreted in Table 4.11.

Table 4.11. Retained concepts (in approximate order of DG value generation)

Label	#	Indicators	Interpretation (measurement domain)
FOUNDATION	1	WB-GTE, OECD-DD	Legal and organizational backing for DG operation.
TECHNOLOGY	8	OECD-GP, WB-CGS	Technology-enabled platform of DG operation.
DATA	6	OECD-DPS, OECD-OD	Data handling and use by governmental entities and the public sector.
SERVICE	3	EU-CBM, EU-UC	DG service quality and comprehensiveness.
CITIZEN	7	EU-TR, WB-DCE	Citizen society-oriented features of DG operation.

Source: own elaboration.

To emphasize once again, the analysis above was conducted upon the formal, i.e., declarative, features of particular indicators. Their quantitative aspects are addressed further in this text. Also, due to the limited coverage of the indicators, two vital elements of the DG system required separate concern: actual usage of the DG offer and the broader impact of DG outcomes.

4.3. Method Study

In line with Table 3.6, the method study aims to develop a methodological toolset for handling and processing DGB data, and to elaborate a recipe for obtaining efficiency benchmarks. The section comprises seven parts: introduction (Section 4.3.1), objectives and approach (Section 4.3.2), system completion (Section 4.3.3), value generation (Sections 4.3.4 and 4.3.5), further technical considerations (Section 4.3.6), and summary (Section 4.3.7).

4.3.1. Introduction

To recap, in two previous studies, three DGB projects were found adequate for this research: EU-EGB, OECD-DGI, and WB-GTMI. These contain 14 indicators in total. Among them, 10 were retained to cover five conceptual clusters that

approximately address five aspects of DG measurement: FOUNDATION, TECHNOLOGY, DATA, SERVICES, and CITIZEN.

If referred to DGVC (Heeks, 2008) as a relatively comprehensive overview of DG value-generating components, it is apparent that two critical topics are missing: USAGE and IMPACT. USAGE asks: "Do citizens actually use DG?" rather than "Is DG designed to attract and satisfy the needs of potential users?" The DGB projects do not cover these domains, and this has to be addressed.

Moreover, DGVL puts forward an analytical focus on the processes between components, which means that value generation must be precisely formalized and operationalized, directed toward the quantitative description and comparison of countries' performances.

All the above had to be realized with one of the key DGVL postulates in mind, i.e., ensuring the feasibility of DGVLB's effective implementation.

4.3.2. Objectives and Methods

This study was designed to formalize and operationalize several elements instrumental to the construction of DGVLB (Figure 3.2) and to identify and argue for a dedicated methodological toolset that enables the accurate conveyance of the original ideas behind DGVL. To realize these objectives, the study proceeded in three parts: system completion, value generation formalization, and value generation operationalization. Table 4.12 describes these three parts – what actions they entailed and how their outcomes correspond to the DGVLB scheme (Figure 3.2).

Table 4.12. Method study – parts, actions, and DGVLB correspondence

Part	**Actions taken**	**DGVLB correspondence**
System Completion	The inclusion method of the USAGE and IMPACT components was defined and implemented.	Points of value generation/addition; ensuring the optimal level of system completeness
Value Generation Formalization	The processes of value generation were formalized and described in economic/managerial terms.	Relationships of value generation/addition
Value Generation Operationalization	The processes of value generation were expressed as quantifiable entities; relevant methods were identified and adopted.	DG relative efficiency benchmarks

Source: own elaboration.

4.3.3. Results – System Completion

The DGB projects do not address the problems of DG usage and, in general, are discussed modestly in terms of measurement. This contrasts with the topic's validity as signaled by the studies discussed in Section 2.3.2.

However, the EU-EGB's "Background Report" (Capgemini et al., 2022a) includes a fairly developed analysis of the so-called "penetration" aspect of DG, which refers to the rate of "individuals who used the Internet, in the last 12 months, for interaction with public authorities" (p. 80). While this is a relatively restrained perspective, it allowed countries to be positioned on a "digitalisation vs penetration" plane based on their scores in both dimensions. This analysis constituted an "explorative benchlearning perspective".

The indicator above is included in the DESI system (Section 2.5.2) and handled by Eurostat (2025), along with several other measures of DG usage and users' activities. This dataset is extensive, but not very consistent – the majority of indexes reveal significant coverage incompleteness. Thus, for this study, just four usage indicators were found relevant and reasonably complete: 1) INTERACT – interaction with public authorities, 2) OBTAIN – obtaining information from public authorities' websites, 3) DOWNLOAD – downloading official forms, and 4) SUBMIT – submitting completed forms. Collectively, they provide insight into DG usage among EU citizens. Due to their directness, they are a priori adopted as operationalizations of DG usage.

A situation was more complex in the impact case. As shown in Section 2.3.3, the DG impact domain is large, and so is the catalog of potential indicators to include. This DGVLB implementation opted for non-purely-economic indicators: 1) available for all EU countries, 2) reasonably persistent and stable in their releases, and 3) backed by a reliable conceptual framework.

Also, among the DG impact topics, two categories were found relevant for this study (Table 2.5): governance, understood as the way in which public affairs are handled, and sustainability, explained as "maintaining or improving the quality of life for present and future generations without placing an unfair burden on future generations" (Schraad-Tischler & Seelkopf, 2015, p. 2). Governance and sustainability are naturally addressed together, since the former should take the latter into account, and the latter should affect the former (Bosselmann et al., 2008; European Commission, 2002; Kardos, 2012; Stojanović et al., 2016). DG is often posited to foster such interplay (Abu-Shanab & Al-Quraan, 2015; Durkiewicz & Janowski, 2021b; Janowski et al., 2018; Lim, 2014; Marcovecchio et al., 2019).

Therefore, an optimal source of IMPACT indicators was the B-SGI framework, which is built upon a convincing conceptualization of sustainable governance (Schraad-Tischler & Seelkopf, 2015). B-SGI postulates three dimensions: 1) policy performance – aligned with sustainable economic development, environmental protection, and social equity; 2) democracy – state of democracy, rule of law, substance, procedures, and institutions; and 3) governance – executive capacity and accountability (p. 3). Thus, IMPACT refers to DG's impact on the governance quality.

To summarize, Table 4.13 lists all components of this DGVLB realization.

Table 4.13. DGVLB components of the present implementation

Category	**Components/indicators**		**Source**
Analytically obtained DG conceptual components	FOUNDATION, TECHNOLOGY, DATA, SERVICE, CITIZEN		EU-EGB, OECD-DGI, WB-GTMI
Externally obtained components	USAGE	INTERACT, OBTAIN, DOWNLOAD, SUBMIT	Eurostat
	IMPACT	POLICY, DEMOCRACY, GOVERNANCE	B-SGI

Source: own elaboration.

The elements of USAGE and IMPACT may be treated as components in their own right, given that they fit the specificity of the analyzed process. Technical specifications of the indicators are provided further in this text.

4.3.4. Results – Value Generation Formalization

The DGVL idea is that DG problems, as studied by academia and experienced in practice, can be expressed as value-generation processes. As discussed in Section 2.2, a process may be understood as action(s) that lead to a particular result.

Referring to the studies adduced in Section 2.3, process examples to consider include: the government develops a particular DG service [SERVICE] expecting it to be used [USAGE] by citizens and other stakeholders (Gil-Garcia & Flores-Zúñiga, 2020); the government develops technical infrastructure [TECHNOLOGY] and invests in workforce [FOUNDATION], expecting them to produce a functional ecosystem of services [SERVICE] (Capgemini et al., 2020); the government provides an e-participation mechanism [CITIZEN] to advance the quality of democracy [DEMOCRACY] (Grönlund, 2011; Lidén, 2015), etc.

A blueprint for processes such as those above is as follows: an effort (financial, organizational, technical, etc.) invested in advancing a subset of DG components is expected to produce a tangible effect in another subset. The former subset

constitutes the input of a process, while the latter is the output. Both subsets are marked in Figure 3.2 as points of value generation/addition.

From a benchmarking perspective, what is interesting is whether, for a given range of effort (input), a satisfactory range of effect (output) was achieved; see the benchmarking qualities addressed in Tables 2.6 and 2.7. The question of whether the effort led to the "right" effect (what exactly should be understood by "right" is explored further in this text) is related to the economic/managerial category of efficiency. Such efficiency should not be confused with a qualitative notion of efficiency as one of the general public values, as approached in, e.g., (Jørgensen & Bozeman, 2007; Panagiotopoulos et al., 2019; Valle-Cruz, 2019).

Kisielewska & Kozuń-Cieślak (2007) list some efficiency conceptualizations present in the economic discourse: effects of an activity determined by the relation of achieved results to invested resources; a way of measuring the effectiveness of an organization through comparing the value of effects to the level of resources, etc. More specifically, Cooper et al. (2011) discuss the evolution of efficiency as a formalized and manageable concept, to point out, e.g., Pareto's view of efficient public policies as able to "make some persons better off without making others worse off" or Farrell's efficiency as an analytical extension of productivity. Charnes et al. (1978) advocate the concept of "decision-making efficiency", which can be employed (as demonstrated by the authors) to evaluate public programs. This perspective corresponds to DGVLB.

While several directed types of efficiency are considered, e.g., technical, cost, revenue, or profit (Huguenin, 2012), the DGVLB approach is generally focused on the first one, i.e., technical, which addresses the relationship between inputs and outputs. Thus, a unit (a country or, more precisely, its DG policy and management) is considered efficient if and only if it maximizes the level of outputs (DGVLB effects) given the level of inputs (DGVLB efforts) (Vincová, 2005). Note that the other way round, i.e., minimizing inputs given the level of outputs, may also be considered the state of efficiency.

To summarize, DGVLB value generation is formalized as a literature-informed process of turning the effort invested in improving the state of a particular DG component (or components) into the effects that emerge from the improved state of another DG component (or components). Such a process is assessed for its technical efficiency. This understanding is entirely consistent with the original assumptions of benchmarking.

4.3.5. Results – Value Generation Operationalization

Regarding a value generation process, what is available within DGVLB are the values of the respective indicators that capture the inputs and outputs of such a process. As argued above, the relationship between such values is understood as the process's (technical) efficiency. Such efficiency is deduced directly from the available process data rather than any presumed function.

While process efficiency may (and most likely is) affected by exogenous factors, the DGVLB itself does not directly address such factors – this may be a concern for a separate analysis (meant to explore what affects DGVLB efficiency) or a future extension of the DGVL/DGVLB framework.

Given the above, an appropriate means of assessing efficiency is Data Envelopment Analysis (DEA). DEA is a spectrum of non-parametric methods for data-oriented analytics in performance evaluation and benchmarking, opening up possibilities for use in cases that have been "resistant to other approaches because of the complex (often unknown) nature of the relations between the multiple metrics labeled as inputs and outputs" (Zhu, 2020, p. 3). This allows, e.g., for a simultaneous treatment of multiple inputs and outputs within a single process. In the DEA nomenclature, the unit (in the present case, a country) under analysis is referred to as a Decision-Making Unit (DMU).

DEA has been effectively applied to problems of diverse domains, e.g., electronic public administration (Krejnus et al., 2023), institutional efficiency of countries (Votápková & Žák, 2013), public health (Cinaroglu, 2020), agriculture (Santos et al., 2013), banking (Khek & Naenna, 2015), education (Gökşen et al., 2015), let alone DG (Durkiewicz & Janowski, 2021b; Osman & Zablith, 2020).

DEA is widely adopted as a versatile toolset for benchmarking (Rostamzadeh et al., 2021). In this context, "the efficient DMUs, as defined by DEA, may not necessarily form a <<production frontier>>, but rather lead to a <<best-practice frontier>>" (Zhu, 2020, p. 4), though care is recommended when applying DEA in non-production contexts (Wojcik et al., 2019).

The DEA approach dates back to Charnes et al. (1978) assessing the efficiency of non-profit organizations involved in public programs. Since extensive elaborations on the mathematical foundations of DEA and the ecosystem of its extensions can be found in many publications, e.g., (Charnes et al., 1994; Hosseinzadeh Lotfi et al., 2013; Huguenin, 2012; Talluri, 2000; Zhu, 2020), reproducing mathematical

formulas would be redundant for this text. Thus, the following discusses the main issues of DEA relevant to the DGVLB context, elaborated based on Huguenin (2012).

DEA contributes to benchmarking through 1) calculating efficiency scores, which indicate whether a unit is efficient or has capacity for improvement; 2) setting target values for both output and input, to indicate how much these should be increased/decreased to make a unit efficient; 3) identifying the nature of returns to scale, i.e., indicating whether increasing the range of a unit's effort is desirable; and 4) identifying a set of "benchmark" units, i.e., those which should be considered role models (in terms of best practice) for a specific inefficient unit (Huguenin, 2012, p. 5). The above is arguably relevant to the DG benchmarking addressed in Section 2.4.1.

In a general form, a unit's efficiency concerning a specific process is computed as the ratio of the sum of its weighted outputs to its weighted inputs. Then, the efficiency score is obtained by comparing a unit's efficiency against the so-called efficiency frontier. The efficient units have an efficiency score of 1 (100%) and thus are situated on the frontier and serve as benchmarks (peers) for some inefficient units (Huguenin, 2012, p. 6). In the DGVLB context, this feature may be particularly relevant, as it indicates efficient countries that an inefficient country may learn from, helping manage unrealistic expectations that may arise when comparing countries operating at the lower level of the overall development to those at the higher level. In the European context, it would be irrelevant, e.g., to expect Romania to follow Denmark.

Concerning the sets of inputs and outputs, a unit's efficiency score is obtained by solving a linear programming problem, designed to maximize /minimize the defined objective function (in the simplest case, to maximize the efficiency score itself) by assigning weights to inputs and outputs, according to a set of model-specific constraints. The exact formula for the objective function depends on which particular model is adopted (Huguenin, 2012, pp. 48–58).

Mathematically, a model can be expressed either in a primal (multiplier) form or in its dual (envelopment) form. Further, a model can assume either constant returns to scale (Charnes et al., 1978) or variable returns to scale (Banker et al., 1984). Finally, a model can be oriented either at maximizing outputs or at minimizing inputs, though the orientation may not have a significant impact on the obtained efficiency scores (Huguenin, 2012, p. 8). Though the character of DG operation may suggest that returns to scale are not constant (there are no reasons to assume that the effect of a process changes always proportionally to the effort) and that output

orientation is more in line with the sense of DG development, for impartiality, several variants of DEA analysis realization may be considered and compared.

To summarize, a DGVL process of value generation is assumed to be quantified using indicator scores for both its input and output components, which correspond to the DG efforts and the effects achieved, respectively. Then, the value generation of a process is operationalized as its input-output technical efficiency and assessed using a DEA efficiency score.

4.3.6. Further Technical Considerations

Some technical issues must be addressed when applying the DGVLB scheme as described in the sections above.

One of the assumptions of benchmarking is the rational choice of reference groups (Table 2.7). This suggests that it may be desirable to divide the countries into groups so that each group contains countries with a similar starting point, i.e., comparable values of both input and output indicators. This may be particularly relevant when applying DGVLB in the global context. To this end, additional analytical methods such as hierarchical clustering or k-means analysis may be used (Hair Jr. et al., 2014, pp. 415–420),

However, this should be agreed with the DEA's practical considerations as compiled by Sarkis (2007). First, while most of the potentially relevant processes are assumed to have two inputs and two outputs (due to the DGVL component structure, Table 4.13), there may be cases where more indicators are involved. To preserve discriminatory power and the dataset's homogeneity, some optimal output-input ratios are suggested, e.g., the number of inputs multiplied by the number of outputs should not exceed the number of DMUs (p. 1-2).

Also, if there are strong correlations among either input or output factors, some highly correlated indicators may be removed (Sarkis, 2007, pp. 3–4). Further data treatments should include balancing the magnitudes of the included indicators; for instance, EU-EGB provides scores on the 1-100 scale, while OECD-DGI and WB-GTMI provide scores on the 0-1 scale (p. 4-6). Furthermore, ensuring that the data is strictly positive (DEA generally does not handle negative values), which can be addressed by adding a constant to all scores for a specific indicator (p. 6-12), which avails of the translation invariance feature of DEA models (Pastor & Aparicio, 2015).

Finally, despite their advantages, basic DEA models have some debatable qualities. The process of weight computation is, by design, handled by an optimization procedure (Section 4.3.5). Illustratively, each DMU "performs" self-

evaluation or self-appraisal. This may lead to arbitrary and, possibly, unrealistic weight schemes for a country. Further, in principle, the basic models do not distinguish between efficient units, which limits the analysis's discriminatory power (Sadeghi Gavgani & Zohrehbandian, 2014) and hinders potentially valuable performance insights. Among recognized methods of dealing with these deficiencies are the cross-efficiency extensions of DEA models (Chu, 2018; Sadeghi Gavgani & Zohrehbandian, 2014; Sexton et al., 1986), where each DMU is evaluated not only by itself (using its unique set of weights for self-appraisal), but is also assessed further about the corresponding weights of each of its peers – the average of such weightings yields a more impartial (cross-)efficiency score. This is an approach that may be effectively adapted in DGVLB.

4.3.7. Summary

To summarize the outcomes of this section, Table 4.14 presents how the essential conceptual inputs of DGVL are addressed within DGVLB and translated into the measurement domain (here - EU-based DGVLB).

Table 4.14. DGVLB approach summary

Conceptual element	**DGVLB realization**	**Measurement**
DG components	Concept-based datasets derived from DGB projects: FOUNDATION, TECHNOLOGY, DATA, SERVICE, CITIZEN. Complementary datasets: USAGE and IMPACT.	Data for respective indicators, adjusted to comparable ranges
Points of value generation/addition	Subsets of components that may constitute either the input or output of a value-generating process	
Value-generating process	A direct (input to output) relationship between two value generation points	A directed relationship between input and output indicators
State of a value-generating process	Benchmarks of the (relative) efficiency of achieving outputs (effects) given inputs (efforts)	DEA efficiency scores
Political/managerial diagnosis	Analytical information package	Interpretation of the efficiency scores along with managerial information, e.g., efficient (benchmark) peers as examples of best practices to follow, decomposition of inefficiency, etc.

Source: own elaboration.

4.4. Pilot Study

In line with Table 3.6, the pilot study aims to apply DGLV benchmarking to actual DG policy, management, and operation issues. The section comprises seven parts: introduction (Section 4.4.1), objectives (Section 4.4.2), materials – data (Section 4.4.3), materials – processes (Section 4.4.4), methods (Sections 4.4.5), and results and observations (Section 4.3.6 and 4.3.7).

4.4.1. Introduction

This pilot study is designed to demonstrate, in practice, how DGVLB functions as an applicable DGB instrument, what benchmarking insights it may yield, and thus how it differs from "conventional" DGB approaches.

The name "pilot study" is deliberate. The study should not be taken as a fully-fledged analytical take on the state of the EU's DG. This is due to data shortages (further characterized in the text) and a deliberately limited study range (i.e., the results are not followed by a particularly in-depth analysis). Instead, it serves as a preliminary implementation of the DGVLB toolset.

The flow of the text is organized as follows. First, study objectives and their implication for managerial practice are defined. Second, the materials for this study are presented, including the data collected for each included indicator and significant value-generating processes, based on their presence in the literature, the public value they contribute, and their significance to DG operations, described in the DGVL manner. Third, the method for assessing the efficiency or inefficiency of value-generating processes using Data Envelopment Analysis (DEA) is instantiated following the DGVLB procedure (Section 4.3). Finally, the results are presented.

4.4.2. Objectives

The overall problem addressed by this study can be formulated as follows (see the bottom part of Figure 3.1). Concerning selected value-generating processes, which countries are considerably inefficient in terms of generating value by their DGs? An answer to this question both highlights potentially significant political/managerial/operational issues (given the obtained efficiency scores) and provides a package of policy feedback (given additional diagnostic information). This corresponds to the increasingly recognized ideas of benchlearning, aimed to "support each [country, in the DGVLB context – a/n] to improve their own performance through a structured and systematic reflection on their performance against the

performance of other [countries] and through institutional learning from peers" (Fertig & Ziminiene, 2017, p. 6).

4.4.3. Materials – Data

The data was to be collected for each included indicator and each EU country. In practice, three issues were encountered and addressed.

First, the timing and coverage of particular sources partially determined the range and timeframes of this study, given that OECD-DGI and WG-GTMI are relatively new DGB projects, with limited data available yet. The dataset construction was intended to ensure that the periods covered by the respective indicators align. However, the perfect alignment was not always possible, as explained in Table 4.15. Effectively, the dataset covers the years 2020-2022, so it is relatively up to date. The data sources are described in Table 4.15.

Second, the OECD-DGI indicators were somewhat problematic due to limited country coverage. Scorings for Bulgaria, Cyprus, Malta, and Slovakia were unavailable, and records for Germany and Greece were available for the first edition (OECD, 2020a) but not for the most recent one (OECD, 2024). This gap was addressed as follows. For each OECD-DGI indicator, the median difference between the first and second editions was calculated for those countries whose records were present in both editions' datasets. The results were: OECD-DD +0.16, OECD-DPS +0.24, OECD-GP +0.18, OECD-OD -0.07, OECD-UD +0.21, and OECD-P +0.19. Then, Germany's and Greece's records were completed by updating their first-edition values to reflect respective differences. Hence, 23 rather than 27 EU countries are included in this study.

Third, further data treatment was determined by the DGVLB design and specific DEA requirements (Section 4.3.6). Thus, to ensure a comparable range, the original values were transformed into a standard 0-100 range. Thus, dependent on the original range, they were left intact, multiplied by 10, or multiplied by 100. The datasets treated as above are disclosed in Appendices 3a and 3b; the former aggregates analytically obtained DG component indicators, the latter aggregates USAGE and IMPACT indicators. For readability, specific indicators are assigned a prefix indicating which component or group they belong to, e.g., "f-" for FOUNDATION or "u-" for USAGE.

Table 4.15. Pilot study – data sources

Subset	Data timing	Scale	Source (URLs as of 19/11/2025)
EU-EGB	Biennial average 2021-2022 (in line with the project's policy of data aggregation)	0-100	https://digital-strategy.ec.europa.eu/en/library/digital-decade-2024-egovernment-benchmark
OECD-DGI	2023 results (collected 2020-2022, see p. 27)	0-1	(OECD, 2020a, 2024)
WB-GTMI	2022 update (collected 2022, see p. 16)	0-1	https://datacatalog.worldbank.org/search/dataset/0037889/govtech-dataset
IMPACT (B-SGI)	2022 issue	0-10	https://www.sgi-network.org/2024/Publications
USAGE (Eurostat)	2021	0-100	https://ec.europa.eu/eurostat/databrowser/view/isoc_ciegi_ac__custom_18998846/default/table

Source: own elaboration.

Note #1: for OECD-DGI and WB-GTI, pages are in their respective reports, see Table 4.1.

Note #2: USAGE indicators refer to the percentage of individuals who performed a specific action (see Table 4.13) during the recent year.

4.4.4. Materials – Processes

Within DGVL, a high number of processes can be identified and analyzed. For this Pilot Study, however, five representative problems were chosen. The selection was based on three criteria: 1) solid recognition in the literature; 2) precise match with the enhancement of specific public values in the catalogue by Twizeyimana & Andersson (2019); and 3) convincingly assigned input and output components, in terms of the DGVL processes. These problems are collected in Table 4.16, in approximately the order of the overall logic of DG value generation (Table 4.11).

Table 4.16. Selected DGVL processes to analyze

Process-corresponding problem	Key public values addressed	Exemplary related studies
FOUNDATION to TECHNOLOGY (F2T)		
Do the legal framework and organizational structure support the implementation and development of the public	Improved Public Services; Improved Administrative Efficiency	(Adam, 2020; Barcevičius et al., 2019; Codagnone et al., 2015; Gallo et al., 2014; Weerakkody et

Process-corresponding problem	Key public values addressed	Exemplary related studies
sector's technological and interoperability platforms?		al., 2012; Ziemba et al., 2016)
DATA to SERVICE (D2S)		
Do data policies and mechanisms of data handling, processing, and sharing positively affect the quality/comprehensiveness of DG services?	Improved Public Services; Open Government Capabilities; Improved Trust and Confidence in Government	(Anshari & Lim, 2017; Máchová & Lněnička, 2015; Xia, 2017; Zou et al., 2023)
TECHNOLOGY to GOVERNANCE/POLICY (T2GP)		
Do qualitative and quantitative enhancements in the use of technology-enabled platforms by the public sector improve the traditionally conceived quality of governance and governmental policies?	Improved Public Services; Improved Administrative Efficiency; Improved Trust and Confidence in Government; Improved Ethical Behavior and Professionalism; Improved Social Value and Well-Being	(Bannister & Connolly, 2014; Durkiewicz & Janowski, 2020; Höchtl et al., 2016; Janowski et al., 2018; Linhartova, 2022; Paoli & Leone, 2015)
SERVICE to USAGE (S2U)		
Are DG services offered to citizens and other stakeholders, and are they adopted and used?	Improved Public Services; Open Government Capabilities; Improved Trust and Confidence in Government	(Alkraiji, 2021; Faulkner et al., 2019; Ma & Zheng, 2018; Wirtz & Kurtz, 2017; Yera et al., 2020; Zhao & Khan, 2013)
CITIZEN to DEMOCRACY (C2D)		
Do implemented mechanisms and facilities for e-democracy, e-participation, e-consultation, etc. boost the quality of democracy and citizen society, and engagement?	Open Government Capabilities; Improved Ethical Behavior and Professionalism; Improved Trust and Confidence in Government; Improved Social Value and Well-Being	(Åström et al., 2012; Hennen et al., 2020; Horvath & Paolini, 2014; Lidén, 2015; Pirannejad et al., 2019; Silal & Saha, 2021; Spirakis et al., 2010)

Source: own elaboration.

Note: the impact components GOVERNANCE and DEMOCRACY here are treated as standalone, in line with the specific problem formulations.

4.4.5. Methods

Regarding the processes in Table 4.16, the main problem of this study is to assess which countries are substantially inefficient in generating value through their DGs. Technically, the answer is obtained by applying a set of DEA analyses, whose generated outputs – efficiency scores, target values, and reference sets – are

described in Table 4.17. DEA computations were realized with OSDEA software (Open Source DEA, 2025), except for the cross-efficiency parts handled with the "deaR" library for R (Coll-Serano et al., 2021).

Table 4.17. DGVLB process analysis – generated outputs

Analytical output	**Understanding/relevance**
Efficiency score	If it is 1, a country's DG is efficient. The lower the score, the more inefficient a country's DG is, i.e., it does not generate sufficiently high output given the inputs.
(Projected) target values	Display (project) the values of either output (in case of output orientation) or input (for input orientation) that should be reached for a country to become efficient. In other words, they quantify the gap between reality and the desired state of a DG process.
Reference set	A set of efficient peers, whose combined performance determines (through so-called lambda values) the projected values for an inefficient country. It can be translated into a benchmarking practice, such that this set indicates which efficient "best practices" and to what extent should be followed by an inefficient country.

Source: own elaboration, based on (Huguenin, 2012; Ruiz & Sirvent, 2020; Santos et al., 2013).

Efficiency scores were obtained using three variants of the standard DEA models: output-oriented CCR (Charnes et al., 1978), which assumes constant returns to scale, and both input- and output-oriented BCC (Banker et al., 1984), which assumes variable returns to scale. The input-oriented variant of CCR is not applied since it yields the identical efficiency scores as its output-oriented counterpart (Huguenin, 2012, p. 8). CCR is stricter – unlike BCC, it does not consider the scale of a unit's operation (Lu & Liu, 2016). Hence, efficient DMUs in the BCC model are typically a superset of DMUs efficient according to CCR.

For simplicity, projected values and reference sets were determined only for the output-oriented BCC variant, since this is conceptually most aligned with both the DG reality and the DGVL idea. Additionally, to address the bias introduced by the self-appraisal procedure (Section 4.3.6), cross-efficiencies (Balk et al., 2021; Sexton et al., 1986) for each country were computed using the BCC model. This provides a more balanced and realistic perspective and also mitigates the potential issue of an excessive number of nominally efficient countries. Cross-efficiency was computed using an arbitrary method, considered neutral (no additional objectives), rather than more directed methods such as benevolent or arbitrary (Lu & Liu, 2016).

4.4.6. Results

Tables 4.18a and 4.18b provide the calculated efficiency scores for all countries, processes (Table 4.18a for F2T, D2S, and T2GP, and Table 18b for S2U and C2D), and for three DEA variants. Results are rounded to two digits, and efficient cases are marked in bold. Note that all countries efficient with regard to CCR-O are also efficient with regard to the BCC variants, but not the other way round.

Table 4.18a. Efficiency scores for processes F2T, D2S, and T2GP

	F2T			D2S			T2GP		
Country	CCR-O	BCC-I	BCC-O	CCR-O	BCC-I	BCC-O	CCR-O	BCC-I	BCC-O
Austria	0.94	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	0.60	0.60	0.79
Belgium	0.95	0.95	0.97	**1.00**	**1.00**	**1.00**	0.65	0.66	0.76
Croatia	**1.00**	**1.00**	**1.00**	0.82	0.89	0.95	0.67	0.67	0.76
Czechia	0.92	0.94	0.97	0.52	0.52	0.86	0.63	0.64	0.72
Denmark	**1.00**	**1.00**	**1.00**	0.51	0.69	0.99	0.76	**1.00**	**1.00**
Estonia	0.91	**1.00**	**1.00**	0.66	0.66	1.00	0.68	0.69	0.87
Finland	0.93	0.97	0.95	0.90	**1.00**	**1.00**	0.92	**1.00**	**1.00**
France	0.86	0.97	0.99	0.44	0.53	0.94	0.70	0.73	0.87
Germany	0.79	0.85	0.83	0.75	0.80	0.95	0.91	0.92	0.95
Greece	**1.00**	**1.00**	**1.00**	0.58	0.66	0.94	0.65	0.67	0.72
Hungary	0.84	0.90	0.87	0.66	0.76	0.93	0.66	0.72	0.70
Ireland	0.88	**1.00**	**1.00**	0.62	0.63	0.92	**1.00**	**1.00**	**1.00**
Italy	0.87	0.90	0.94	0.66	0.74	0.95	0.67	0.68	0.76
Latvia	0.91	0.93	0.91	0.64	0.64	0.94	0.70	0.71	0.81
Lithuania	0.93	0.94	0.97	0.65	0.67	0.95	0.72	0.72	0.81
Luxembourg	0.93	0.95	0.97	**1.00**	**1.00**	**1.00**	0.78	0.81	0.93
Netherlands	0.86	0.87	0.91	0.84	0.95	0.99	0.71	0.73	0.82
Poland	**1.00**	**1.00**	**1.00**	0.57	0.69	0.90	0.56	0.65	0.65
Portugal	0.84	0.87	0.92	0.73	0.85	0.98	0.65	0.66	0.77
Romania	0.81	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

Country	F2T			D2S			T2GP		
	CCR-O	BCC-I	BCC-O	CCR-O	BCC-I	BCC-O	CCR-O	BCC-I	BCC-O
Slovenia	**1.00**	**1.00**	**1.00**	0.75	0.85	0.96	0.70	0.71	0.81
Spain	0.94	**1.00**	**1.00**	0.75	**1.00**	**1.00**	0.67	0.67	0.82
Sweden	0.93	0.96	0.95	0.68	0.74	0.95	**1.00**	**1.00**	**1.00**

Table 4.18b. Efficiency scores for processes S2U and C2D

Country	S2U			C2D		
	CCR-O	BCC-I	BCC-O	CCR-O	BCC-I	BCC-O
Austria	0.88	0.97	0.90	0.60	0.66	0.78
Belgium	0.81	0.96	0.83	0.68	0.73	0.79
Croatia	0.57	0.93	0.61	0.61	0.86	0.64
Czechia	0.87	**1.00**	**1.00**	0.73	0.82	0.78
Denmark	**1.00**	**1.00**	**1.00**	0.65	0.70	0.96
Estonia	0.94	0.98	0.95	0.60	0.61	0.95
Finland	**1.00**	**1.00**	**1.00**	0.76	0.87	0.98
France	**1.00**	**1.00**	**1.00**	0.63	0.73	0.79
Germany	0.60	0.92	0.64	**1.00**	**1.00**	**1.00**
Greece	0.80	0.96	0.89	0.76	0.89	0.79
Hungary	**1.00**	**1.00**	**1.00**	0.32	0.77	0.36
Ireland	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
Italy	0.45	0.87	0.45	0.92	0.99	0.99
Latvia	0.86	0.96	0.87	0.63	0.68	0.86
Lithuania	0.68	0.91	0.69	0.59	0.62	0.87
Luxembourg	0.92	0.97	0.94	0.53	0.56	0.82
Netherlands	0.97	0.99	0.97	0.57	0.65	0.71
Poland	0.74	0.98	0.94	0.66	**1.00**	**1.00**
Portugal	0.55	0.87	0.55	0.68	0.73	0.81
Romania	0.29	**1.00**	**1.00**	0.77	**1.00**	**1.00**

Country	S2U			C2D		
	CCR-O	BCC-I	BCC-O	CCR-O	BCC-I	BCC-O
Slovenia	0.86	0.95	0.86	0.59	0.72	0.73
Spain	0.76	0.90	0.77	0.59	0.65	0.78
Sweden	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**

Source: own elaboration.

Table 4.19 includes projected target values for the respective processes' outputs that should be achieved for a country to become efficient (BCC-O).

Table 4.19. Projected efficiency targets for specific outputs

Country	F2T		D2S		T2GP		S2U				C2D
	t-OECD-GP	t-WB-CGS	s-EU-CBM	s-EU-UC	i-POLICY	i-GOVERNANCE	u-INTERACT	u-OBTAIN	u-DOWNLOAD	u-SUBMIT	i-DEMOCRACY
Austria	77.3	89.2	65.6	92.8	63.4	67.3	81.3	73.2	62.4	67.5	92.9
Belgium	68.4	82.4	71.4	92.9	60.2	64.3	83.5	73.0	60.8	67.6	92.6
Croatia	40.3	83.4	79.8	94.6	55.4	51.5	73.7	69.4	54.9	63.6	88.3
Czechia	65.3	87.2	80.7	99.1	57.8	62.6	68.2	57.9	31.1	51.9	90.0
Denmark	89.6	77.5	80.7	99.1	78.7	85.8	92.3	90.6	38.2	68.4	92.9
Estonia	70.5	91.0	90.5	95.9	69.6	73.7	90.6	85.5	55.4	79.5	92.9
Finland	71.0	75.2	80.7	99.1	74.1	87.3	89.4	85.8	72.5	73.8	92.9
France	61.2	93.0	80.7	99.1	69.1	69.2	80.7	51.5	47.7	71.1	92.4
Germany	66.5	87.0	83.1	96.5	73.0	77.8	79.0	72.7	55.3	67.3	87.3
Greece	57.4	85.9	72.6	98.2	47.0	64.0	61.6	60.4	55.9	55.4	88.3
Hungary	48.3	87.3	80.5	99.1	51.1	42.4	72.6	72.1	66.8	66.3	89.7
Ireland	63.2	46.7	80.7	99.1	67.4	74.1	91.2	67.4	49.0	65.8	82.7
Italy	62.7	92.9	75.7	97.2	60.9	66.1	74.7	66.7	61.8	67.6	73.4
Latvia	74.8	79.6	79.4	98.8	62.0	66.0	88.8	79.6	52.1	74.5	92.9
Lithuania	67.2	84.8	80.7	99.1	64.9	71.6	89.8	82.8	53.9	77.2	92.9
Luxembourg	69.8	84.4	91.3	95.6	74.2	75.7	83.3	79.0	68.2	70.3	92.9

Country	F2T		D2S		T2GP		S2U				C2D
	t-OECD-GP	t-WB-CGS	s-EU-CBM	s-EU-UC	i-POLICY	i-GOVERNANCE	u-INTERACT	u-OBTAIN	u-DOWNLOAD	u-SUBMIT	i-DEMOCRACY
Netherlands	63.8	90.9	79.3	96.7	65.2	61.5	89.6	85.0	61.6	77.0	92.9
Poland	66.7	79.2	77.3	98.0	51.7	54.4	50.6	48.8	44.9	44.5	46.1
Portugal	64.2	93.0	80.0	97.3	61.7	62.5	88.3	77.5	53.6	77.5	92.9
Romania	14.6	58.2	28.1	76.0	51.0	46.8	14.7	10.8	9.3	9.0	48.8
Slovenia	62.1	79.0	85.6	96.0	63.9	62.9	80.4	70.7	58.5	70.3	92.2
Spain	61.6	93.7	66.6	97.5	65.1	70.3	88.8	84.3	59.3	77.3	92.9
Sweden	53.8	85.9	80.7	99.1	79.8	89.0	90.6	85.5	55.4	79.5	92.9

Source: own elaboration.

Particularly useful may be the information in Table 4.20. Inefficient countries (mentees) could learn how to efficiently execute a process from those that are already efficient (mentors). Values in the matrix indicate how much an inefficient performer could learn from an efficient peer. For instance, regarding F2T in Table 4.20, the best-practice sources for Czechia are Greece (36%), Austria (33%), Spain (16%), and Slovenia (15%). Efficient countries are "benchmarks for themselves"; hence, 100% in their respective cells. Table 4.20 summarizes the F2T process. Matrices for the remaining four processes are included in Appendices 4a-4d.

Table 4.20. Best practice matrix for the F2T process

F2T		**At what rate could an inefficient country in the F2T process learn from an efficient one in the same process?**									
		Mentors									
		Austria	Croatia	Denmark	Estonia	Greece	Ireland	Poland	Romania	Slovenia	Spain
Mentees	Austria	100%									
	Belgium	27%						46%		23%	3%
	Croatia		100%								
	Czechia	33%				36%				15%	16%
	Denmark			100%							
	Estonia				100%						
	Finland			20%			11%	68%			
	France					8%					92%
	Germany	32%				6%				33%	30%

F2T	At what rate could an inefficient country in the F2T process learn from an efficient one in the same process?									
	Mentors									
	Austria	Croatia	Denmark	Estonia	Greece	Ireland	Poland	Romania	Slovenia	Spain
Greece					100%					
Hungary		62%								38%
Ireland						100%				
Italy				15%	5%					80%
Latvia	1%		49%		19%				32%	
Lithuania	17%		20%		63%					
Luxembourg	45%						19%		31%	5%
Netherlands	15%				5%				12%	68%
Poland							100%			
Portugal	16%									84%
Romania								100%		
Slovenia									100%	
Spain										100%
Sweden		23%			69%					7%

Source: own elaboration.

Finally, cross-efficiency computation allowed for assessing countries not with their individual optimal weights (self-appraisal), but the weights of other countries (that is, a more objective peer-appraisal).

Table 4.21. Cross efficiency computations for processes (arbitrary method)

Country	F2T	D2S	T2GP	S2U	C2D	Average
Austria	0.90	0.94	0.58	0.86	0.55	0.77
Belgium	0.90	0.89	0.62	0.83	0.61	0.77
Croatia	0.92	0.75	0.61	0.76	0.53	0.71
Czechia	0.88	0.42	0.59	0.90	0.66	0.69
Denmark	0.91	0.54	0.75	0.86	0.63	0.74
Estonia	0.89	0.57	0.66	0.84	0.57	0.70
Finland	0.84	0.86	0.87	0.89	0.71	0.83
France	0.81	0.46	0.67	0.93	0.57	0.69
Germany	0.73	0.71	0.87	0.76	0.97	0.81
Greece	0.92	0.57	0.55	0.84	0.68	0.71
Hungary	0.75	0.62	0.56	0.99	0.22	0.63

Country	F2T	D2S	T2GP	S2U	C2D	Average
Ireland	0.63	0.52	1.00	0.91	0.75	0.76
Italy	0.83	0.65	0.63	0.71	0.82	0.73
Latvia	0.82	0.61	0.68	0.84	0.59	0.71
Lithuania	0.82	0.61	0.68	0.78	0.56	0.69
Luxembourg	0.89	0.98	0.75	0.81	0.48	0.78
Netherlands	0.81	0.82	0.66	0.89	0.48	0.73
Poland	0.95	0.55	0.52	0.82	0.48	0.66
Portugal	0.78	0.78	0.62	0.72	0.60	0.70
Romania	0.51	0.56	0.91	0.76	0.62	0.67
Slovenia	0.96	0.76	0.66	0.82	0.54	0.75
Spain	0.90	0.72	0.64	0.80	0.54	0.72
Sweden	0.84	0.65	0.95	0.93	0.86	0.85

Source: own elaboration.

4.4.7. Observations

Considering Table 4.18, note that Romania's performance may be surprisingly impressive, but one should keep in mind that high efficiency can be achieved, to put it simply, either through high outputs or through low inputs. In this case, it is primarily the latter. Table 4.19 confirms that the targets are mostly set at low or very low levels. Also noticeable are the high process efficiencies of Ireland and Sweden – countries that, in terms of DG, operate at a significantly higher performance range than Romania, which generally plays in its own league and serves as an adequate reference for relatively few countries.

Table 4.20 and Appendices 4a to 4d may serve as a guide for designing benchlearning practices. DGVL is about providing applicable information for government decision-making, and identifying approachable peers, rather than remote aspirations, is a vital component of such information. For instance, perhaps unexpectedly, Hungary, by no means a DG leader, may serve as an example of good practices for attracting DG users (Appendix 4c). In turn, Sweden may provide lessons on how to leverage e-democracy mechanisms to foster real democracy (4d), which is clearly a problem for Hungary.

Table 4.21 shows that the DGVL approach, focused on the utilitarian qualities of benchmarking and concerned with the details of the DG operation, rather than seeking a simple, unnuanced message, may yield considerably different results than typical DGB surveys. The provided average scores may technically yield a different DG ranking. However, DG rankings play a marginal role: insights into individual processes show that specific countries can reveal efficiency in various domains.

5. Validity and Evaluation

This chapter discusses aspects of the thesis's validity, followed by a survey of leading international DG experts, designed to validate the thesis's results and gather actionable feedback on its future development. The chapter consists of two sections: validity (Section 5.1) and expert survey (Section 5.2).

5.1. Validity

Since this research was designed and conducted as a multi-study effort, with each study driven by its own logic and generating specific outputs, the question of validity is less straightforward (more nuanced) than it is for more compact, directed studies. To recap, this research contributed to the DG/DGB debate in terms of the following essential outcomes: 1) identification and integration of several thematic domains in DG research, relevant to DGB; 2) formulation of essential DGB issues, followed by the postulates for addressing them; 3) proposition of a conceptual framework for informed DGB enhancement (DGVL); 4) proposition of a methodological framework for DGVL application (DGVLB); and 5) illustrative realization of DGVLB in the EU context.

The author sought to document and argue each stage of the work precisely. Thus, each of these outcomes was underpinned by DG/DGB literature analysis, knowledge of DGB practice, or awareness of methodologically sound and reliable tools adequate to the respective category of research problems, and was logically guided by the previous outcomes. These outcomes are synthesized in Table 5.1.

Table 5.1. Study outcomes – character and rational underpinnings

Outcome	**Character**	**Rational underpinnings**
Identification and integration of several thematic domains in DG research, relevant to DGB	Knowledge synthesis	Acquired familiarity with the topic literature and practice; cross-sectoral line of thinking and associating
Formulation of essential DGB issues and postulates	Action research	Same as above, plus recognition of available tools and data, anticipating feasibility
Conceptual platform for DGB enhancement (DGVL)	Action research Conceptual model	Integrative approach to the previous outcomes
Methodological platform for building DGVL benchmarking tools (DGVLB)	Methodological framework in the form of a sequence of steps addressing specific sections of DGVL	Recognition of qualitative and quantitative tools, in terms of their methodological foundations and applicability to a particular problem
Demonstrational realization of DGVLB in the EU context	Pilot study serving as a proof of concept and a reference for further study	Understanding of the model's applicability domain; clearly defined logic of actions

Source: own elaboration.

Though put in the context of behavioral studies, Drost (2011) discusses four aspects of social science research validity: 1) statistical conclusion validity, concerning correlation between relevant variables; 2) internal validity – addressing the adequacy of positing causal relationships; 3) external validity – addressing the adequacy of further study generalizations; and 4) construct validity – concerning the accuracy of construct operationalization. These aspects can be partially interpreted in the context of this research.

The first aspect, i.e., statistical validity, is marginally relevant, since in this iteration of DGVL/DGVLB no statistical inference methods were employed, and quantitative data were not involved until the Pilot Study. Conceptual packages were operationalized as groups of indicators identified through FCA, a set-theoretic approach. Among the datasets for indicators that comprise particular concepts, no negative correlations were observed, suggesting no fundamental conceptual conflicts. Correlations are moderately positive: 0.24 for FOUNDATION, 0.29 for TECHNOLOGY, 0.69 for DATA, 0.66 for SERVICE, and 0.54 for CITIZEN, which is desirable given that excessively high correlations may reduce the discriminatory power of DEA (Section 4.3.6). On the other hand, higher correlations occur among the indicators

of, respectively, USAGE and IMPACT components – these components, however, were not the results of concept extraction, but taken “as is” from auxiliary sources.

The second aspect, i.e., internal validity, may concern either the DGVL construction (Figure 3.1) or specific value-generating processes. In both cases, they were informed by the literature, and a cross-sectional synthesis was applied to the literature findings.

The third aspect, i.e., external validity, is associated with further generalization of the results – DGVL/DGVLB themselves do not verify specific DG hypotheses (which could raise a question of how much they are binding), but are designed as reasonably generic instruments applicable and relevant to DG operation contexts beyond the EU.

The fourth aspect, i.e., construct validity, as Drost (2011) notes, may be considered in several more specific dimensions: face validity, content validity, concurrent and predictive validity, and convergent and discriminant validity. Face validity is a subjective judgment of the operationalization of the construct; content validity addresses whether concepts and their operationalizations are clear and adequately cover the respective domain; the remaining types refer to more specific consequences of a construct's adoption and formalization. Face and content validity are arguably most relevant to the character of this study.

Alas, as noted by Shanks et al. (2003), “little is known about how to validate conceptual models effectively and efficiently” (p. 87). This can be completed with an observation that “the [validation – a/n] burden falls on the researcher not only to provide a theoretical definition (of the concept) accepted by his/her peers but also to select indicators that thoroughly cover its domain and dimensions”, and “there are basically two ways of assessing content validity: 1) ask several questions about the instrument or test; and/or 2) ask the opinion of expert judges in the field” (Drost, 2011, p. 118). Given this, the DGVL/DGVLB construction was subject to a DG expert survey, as described below.

5.2. Expert Survey

An expert survey, designed to validate the main ideas and results of this research and to collect feedback for further development, was conducted from 12 to 21 December 2025 via Gdańsk University of Technology’s online form platform. Thirty leading international DG experts were approached with a presentation on the DGVL/DGVLB concepts and results, and were asked to (anonymously) complete a questionnaire about the study. The questions were open-ended: a respondent could

either select a predefined option or provide their own comment. These questions are presented in Table 5.2.

Table 5.2. DGVL expert survey – design

#	Question	Options
1	Do you find the rationale behind and the main concepts of the DGVL sufficiently justified and clear?	Yes Partially No Comment
Please grade the adequacy of the following assumptions and conceptual elements comprising DGVL.		
2.1	Conceptualization of DGVL as a "technology-enabled system of public value generation by value-generating interactions among material and conceptual components"	High Medium Low Comment
2.2	The assumption that individual indicators of the DG benchmarking instruments can be mapped to specific DG concepts	
2.3	The assumption that transitions/processes between (certain) pairs of DG concepts can lead to value generation	
2.4	The assumption that value generation transitions/processes (understood as above) are relevant targets of benchmarking	
Please assess the validity of the following methodological decisions comprising DGVL development.		
3.1	Description and evaluation of the DG benchmarking projects based on the Activity Theory framework	High Medium Low Comment
3.2	Identification of the DG concepts based on the in-depth descriptions of the indicators and Formal Concept Analysis	
3.3	Assessment of value generation transitions/processes in terms of relative efficiency and the Data Envelopment Analysis	
Other		
4	Please mark DGVL transitions that you find worth exploration and add new transitions/processes, if relevant.	SERVICE-TO-USAGE USAGE-TO-DATA CITIZEN-TO-DEMOCRACY FOUNDATION-TO-TECHNOLOGY TECHNOLOGY-TO-DATA DATA-TO-SERVICE TECHNOLOGY-TO-GOVERNANCE
5	Please provide any additional comments to the survey.	

Source: own elaboration.

Thirteen filled-out forms were received, a 43% response rate. Table 5.3. summarizes the received answers.

Table 5.3. DGVL expert survey – preview of answers

Q	Summary of results
1	7 out of 13 respondents answered “yes”; 1 answered “partially”; no one selected “no”. Some respondents provided more detailed comments, e.g., “The DGVL presents a coherent, useful ambition (re-centering value generation in digital government benchmarking)”; “Process Perspective and System Perspective definitions are well articulated”; “The major element of the concept rely in <<interactions>> as the means to deliver value. Certainly, that is a very interesting concept when introduced as an entry state point”; “The framework is exciting and well founded”. The feedback concerned the clarity between the categories of “value” and “efficiency”, the need for “practical examples” and “theoretical grounding”, and a suggestion that “value propositions need to balance the perception and reality in Public Policy delivery”.
2.1	8 out of 13 respondents selected “high”; another two opted for “medium”; and 1 deemed it “okay”. No respondents selected the “low” option, though the provided comments suggested a more precise formalization of public value and value propositions, and clarification of value-generating interactions.
2.2	7 out of 13 respondents selected “high”, four opted for “medium”, and none chose “low”. Comments included raising the risk of unclear definition and scope of individual indicators and their potential overlap; the potential issue of generalization; or calling for arguments for “indicator-concept” mapping.
2.3	6 out of 13 graded it “high”, three opted for “medium”, and one respondent declared that “they agree”. Notably, one expert argued that “treating value as a transition from one state to another seems to be the core of the model explaining DG”. However, three respondents criticized the lack of clarity in explaining the idea, particularly the linkage between value transitions and public value generation.
2.4	8 out of 13 respondents selected “high”, and another three opted for “medium” (no “low” choices); one respondent verbally declared their agreement. Several comments concerned: generalization of "value" and "related transition/process"; the relationship between measured efficiency and public value; and the association between “interaction” and “transition”.
3.1	8 out of 13 experts selected “high”; 2 selected “medium”; 1 expressed agreement; no “low” answers. One of the respondents confirmed that Activity Theory is an “excellent choice for analyzing complex technical systems”. On the other hand, one comment postulated the use of International Function Point User (IFPUG) metrics and CMM (for process and integration); another discussed the feasibility and potential country-based biases of assessing meta-qualities of conceptual coherence, technical realization, and EU DG relevance (Section 4.1).
3.2	9 out of 13 experts assessed the FCA approach as “high”, and a further two as “medium”; no respondent selected “low”. One expert declared that they “fully agree”, and another one “tends to agree”. Among additional comments, one respondent confirmed that FCA is “very relevant” to the problem; another proposed considering additional methods, such as the Delphi method; and yet another suggested a more articulate demonstration of how FCA was applied.
3.3	6 out of 13 experts agreed with the DEA method of computing the efficiency; 4 deemed it “medium”; and none deemed it “low”. One respondent convincingly confirmed the adequacy of this approach, stating that DEA is an “appropriate method for calculating relative efficiency in the public sector”. Further comments

Q	Summary of results
	suggested considering regression methods, subjecting the processes to expert validation, or being careful about asserting efficiency in the DG value-generation context, noting that efficiency is internal to the government, unlike public value, which is external.
4	Most of the proposed processes were accepted by respondents. Also, some propositions that are not quite manageable within DGVL in its current iteration emerged, such as “Transition to Maturity”, “Cost to Benefit”, trust-related transitions, etc.
5	Some experts provided additional comments, e.g., finding this work “exciting and promising”. Specific ideas of how the DGVL framework should develop, e.g., through considering the highly dynamic character of technology, recognizing the “usage-free” character of some modern DG services, or a more pronounced distinction between utilitarian efficiency and public value.

Source: own elaboration.

Overall, the DG experts' comments were positive and encouraging. They also provided many constructive comments. Subject to timeframes and technical feasibility, the author sought to address them and introduce desirable improvements to the study. Specifically, further clarifications of the concepts, terms, and relationships addressed in the study were introduced, including more explicit articulation of what is understood by public value, how efficiency that is computed within DGVLB differs from efficiency in a more colloquial, normative sense, what the analyzed processes are meant to represent, etc.

6. Discussion

This chapter discusses how the research was conducted, how to interpret its results, and how these may resonate with DG research or practice. The text first addresses the research process and outcomes (Section 6.1), followed by a review of the scientific and practical implications (Section 6.2).

6.1. Research Process and Outcomes

Guided by the general intention to propose a constructive response to the fundamental downsides of current approaches to DGB, the research was planned and conducted as a sequence of actions, each expected to deliver specific, tangible outcomes that would inform the succeeding phases.

The inception of this research was oriented toward identifying and integrating thematic threads relevant to the problem of what the underlying philosophy and practice of DGB should look like. This exposed several critical issues and, at the level of meta-reflection, confirmed the initial assumptions: many authors intuitively sense that something is wrong with the current DGB practice, but relatively few of them address it in a comprehensive, directed, and constructive way. Literature supplies elaborate takes on the DGB phenomenon (Bannister, 2007; D. Janssen et al., 2004; Mukamurenzi et al., 2016; Skargren, 2020), postulates interesting theoretical ideas and methodological innovations for improving the quality of measurement and evaluation (Luna-Reyes et al., 2012; H. Nam et al., 2022; Osman & Zablith, 2020; Scott et al., 2016), or attempts to patch the flawed instruments (Ayanso et al., 2011; Kabanov, 2022; Pirannejad et al., 2019; Whitmore, 2012). Alas, such efforts have not yet produced motivated, versatile, and actionable DGB methodological guides and toolsets. This study helped fill this gap.

Acquaintance with other authors' studies enabled the formalization and integration of relevant DGB problems, which were then addressed through a set of

directed postulates. The study by Loukis (2021) derives its postulates from information system success models and public value theory, (Stragier et al., 2010) transfer logic model-oriented managerial reasoning to the DG evaluation, (Stanimirovic & Vintar, 2013) draw upon an evaluation-level/aspect matrix, assuming that its cells should be filled with dedicated indicators, etc. In turn, DGVL was deliberately built on pragmatic foundations: a set of clearly expressed, well-documented, and undeniably significant DGB problems to be constructively addressed within a designed concept/method ecosystem.

Aside from the postulated features of a new instrument, DGVL development was based on several design pillars: 1) overcoming the fluidity of DG definitions or conceptualizations through a set of more palpable concepts; 2) recycling rather than rejecting the available DGB instruments; 3) modelling DG as a system composed of interconnected and interacting components that realize the concepts; 4) adopting public value as a general construct representing what is desirable from a state's and society's standpoint in the DG operation; 5) unlike DG which is concretized through (static) concepts, concretizing DG public value creation through (directed) interaction processes occurring between pair of DG components; and 6) realizing that the operationalized state of such processes capture specific DG problems, and as such is a sensible object of benchmarking.

DGVL differs substantially from conceptually related takes on the problem. Unlike the chiefly unidirectional value-flow assumptions in (Durkiewicz & Janowski, 2021a; Heeks, 2008; Loukis, 2021; Savoldelli et al., 2013; Stragier et al., 2010), DGVL does not presume any specific process order. In DGVL, a process is meant to reflect a particular, well-defined problem of concern. For instance, while data policies obviously affect DG service quality, the opposite relation may also hold: services may stimulate data policies in various (efficient or not) ways.

While guiding public value orientation relates DGVL to the efforts like (Berntzen, 2014; Durkiewicz & Janowski, 2021a; Hellang & Flak, 2012; Loukis, 2021; Savoldelli et al., 2013; Scott et al., 2016; Stragier et al., 2010), the consideration of specific kinds of public value, like effectiveness, efficiency and democracy (Heeks, 2008), trust in government, social value and well-being (Twizeyimana & Andersson, 2019), transparency and equality (Panagiotopoulos et al., 2019), are not directly part of DGVL. The catalog of such values is nearly unlimited (Jørgensen & Bozeman, 2007), and, to the author's best knowledge, there are no objective criteria for determining whether researcher X's selection is more adequate than researcher Y's. Instead, as shown in Section 4.4, specific types of public value may be associated with specific

processes. Hence, in line with what was said before, in DGVL, public value itself is an "umbrella" term for what DG is expected to bring to the state and society.

Adaptiveness to various DG contexts and "built-in" compatibility with existing DGB instruments distinguish DGVL from models like (Esteves & Joseph, 2008; Loukis, 2021; Luna-Reyes et al., 2012; Scott et al., 2016; Stanimirovic & Vintar, 2013), for which the high level of specificity and data requirements (especially, survey-collected responses) may hinder their application to contexts broader than the original targets.

Another substantial outcome of this study is DGVLB, i.e., a model, methodological guide, and toolset for adapting the DGVL ideas to specific benchmarking requirements. While the DGVLB pilot focused on the EU context, the DGVLB development introduced several methods that can be effectively replicated beyond the EU. In short, five steps were argued and realized: 1) precise recognition of what is actually available in terms of DGB instruments and selection of what is valuable and relevant to the context; 2) precise recognition of the information conveyed by specific indicators – report-provided summaries, often limited to short descriptions, may be too limited or even misleading; 3) extraction of the DG concepts that are effectively covered by the indicators – in the DGVL system view, they constitute "conceptual components"; 4) completing the above with potentially significant aspects of the DG operation that are not covered by the indicators; 5) formalization and operationalization of the interaction processes occurring between components – given that inputs and outputs are known and measurable, and a specific functional relationship between them is presumably unknown, the managerial/economic notion of efficiency is a sensible means of operationalization.

Specific points of the above were addressed by other studies, e.g., the recognition of DGB instruments (Afyonluoglu & Alkar, 2017; Lnenicka et al., 2024; Mukamurenzi et al., 2016; Rorissa et al., 2011), treatment of individual indicators (Martínez et al., 2022), DG efficiency relations (Savoldelli et al., 2013; Stragier et al., 2010), etc. However, to the author's best knowledge, there are no other studies integrating these issues into a targeted analytical sequence. Also, the formalized approach to the indicators' concept extraction is original and was appreciated by the DG experts responding to the survey (Section 5.2).

6.2. Implications

This thesis has implications for both research and practice.

Regarding research, the thesis identified and integrated multiple thematic threads in DG research and formulated them as conceptual input to the debate on the shortages and prospects of DGB. Among these threads are: system and process perspectives of DG description and conceptualization, recognized and analyzed DG operation problems as instances of value generation, etc.

Though DGVL development was mainly motivated by the need for more useful DGB instruments, DGVL may also, as a conceptual and narrative base, constitute a valuable platform for integrating diverse streams of DG academic debate. By providing a consistent view of DGVL as a value-oriented system of components, intertwined through value-generating processes, it may organize the discussion and reduce the confusion caused by clashing analytical perspectives.

Specifically, the study identified deficiencies in both the DGB approaches themselves and in the way academic debate addresses and criticizes them. Thus, the author hopes that the innovative approach to DGB elaborated within DGVL may help formulate a more apt critique of DGB and encourage a focus on DGB's fundamental logic instead of the technical details of specific instruments.

Additionally, some methodological tools used in this study, which are omitted mainly in current DG research, such as FCA, may be helpful and bring mathematical rigor to future analyses.

Regarding practice, this study may be an asset in at least three aspects: 1) as an informed, organized, and implementable set of DGB postulates; 2) as a conceptual basis for designing more relevant and versatile DGB instruments, integrating or building upon various existing instruments; and 3) as a methodological guide for how to proceed with such design (DGVLB).

Public managers, analysts, and policymakers may appreciate DGVL's formalization of value generation as the primary assessment criterion for both country-level systems and individual projects. A curated list of adequate value-generating processes may be involved in various implementation or evaluation agendas. Specifically, within the EU policy context, where DG is recognized as the core of a functional digital administration and digital agenda and is tied to diverse policies, the DGVL approach may be highly appropriate.

7. Conclusions

This study raised a set of postulates concerning the problem of adequate and useful Digital Government Benchmarking (DGB), proposed a conceptual model and a measurement framework aimed at realizing these postulates – Digital Government Value Logic (DGVL), designed a sequence of actions toward building an applicable DGB instrument based on DGVL – Digital Government Value Logic Benchmarking (DGVLB), and applied this design in the EU context.

The objectives defined at the beginning of this study were: RO1) to present DGVL as a platform for integrating ideas already present in the DG literature, yet scattered across diverse research currents; RO2) to position DGVL as a comprehensive extension of the current approaches to DGB; RO3) to provide a methodological recipe and toolset for designing and implementing DGVL-based benchmarking instruments; and RO4) to demonstrate the DGVL's capacity to address substantial issues of DG operation.

The author assesses that the objectives above were all successfully fulfilled. Regarding RO1, informed selection, critical analysis, and integration of literature-based knowledge yielded a set of conceptual inputs to DGVL that correspond to specific DGB issues. Regarding RO2, the thesis demonstrated that the DGVL approach does not require building the entire measurement ecosystem from scratch. Instead, existing instruments and datasets can be reused, recycled, or reframed to enable more comprehensive and reality-aligned DGB. Regarding RO3, the designed sequence of methodological actions and decisions showed that well-grounded tools and techniques may effectively support the development of DGVLB instruments.

Regarding RO4, the thesis demonstrated that the application of such instruments may bring outcomes of largely different character than those produced by "conventional" DGB instruments. The DGVLB outcomes are not intended to produce new rankings or "name and shame" anyone. Instead, there are substantial

categories of DG issues that can be expressed in terms of value-generation processes that require: 1) a precisely formulated diagnostic message; 2) an indication of which aspects of a country's DG operation need reviewing and reworking; and 3) which other countries can serve as good practice models, and are realistic enough to follow. Perhaps, this logic is closest to what the original benchmarking idea represents.

This research has some limitations. First, unlike some related efforts of this kind, DGVL is not founded on a single theoretical framework. Instead, it is eclectic in its approach, drawing on the contributions from across DG and DGB research. DGVL was designed mainly as a response to documented deficiencies in DGB and developed with a practical application in mind – an entirely deliberate strategy. However, some may find it not sufficiently theorized.

Similarly, some terms occurring in the DGVL nomenclature and throughout this study, such as "efficiency", "value", or "public value", have context-adjusted meanings that are technical rather than normative. While the author sought to explain the idioms of this work precisely, some terms may appear slightly unfamiliar to parts of the DG research audience. For instance, it is difficult to judge which of the many catalogs of public values is the "right" one. In DGVL, "public value" is treated mainly as an aggregate label for DG outcomes that are desirable from the state's and society's perspective. However, in Section 4.4, a relatively uncluttered classification by Twizeyimana & Andersson (2019) was operationally adapted.

In terms of model development, some may contest the selection of methods, though, given the purpose and limitations, such a selection seemed appropriate and optimal. It should also be highlighted that the success of DGVLB realization strongly depends on the availability of reliable data. What was successfully and effectively implemented in the context of the EU may be much more challenging to implement in less developed and less data-rich contexts.

The DGVL project will most likely continue beyond this thesis. The framework is planned to undergo several conceptual and/or methodological refinements to enhance its theoretical grounding and applicability across different contexts and issues. Another direction is to apply the DGVL/DGVLB logic across different geopolitical contexts, and to other DG-implementing units than countries. Last but not least, the regularities disclosed by the DGVLB efficiency analysis are a conceivable topic for a separate study.

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Appendices

Appendix 1. DG thematic tracks at major DG conferences in 2025

Conference and its URL	Tracks
The 59th Hawaii International Conference on System Science (HICSS-59) – planned for January 2026 hicss.hawaii.edu/tracks-59/digital-government/	AI in Government; Cybersecurity and Privacy in Government; Design, Implementation, and Management of Digital Government Policies and Strategies; Disaster Information, Resilience, for Emergency and Crisis Technologies; e-Democracy, e-Participation and e-Voting; Narrowing the Digital Divide: Creating Opportunities and Addressing Barriers; Smart and Connected Cities and Communities
26th Annual International Conference on Digital Government Research (dg.o 2025) – June 2025 dgsociety.org/dgo-2025/	Application of Artificial Intelligence, Data Science, and Computational Methods for Data-driven Governance; Artificial Intelligence Transforming the Public Sector; Beyond Bureaucracy & e-Anarchy: Self-Governance of the Public Sphere and Innovative Use of Technology by Civil Society; Data-Driven Services in Government for Evidence-Based Policy and Public Value; Digital Democracy & AI; Digital Government and Sustainable Development Goals; Digital Government Cybersecurity Management: Paradoxical Tensions and Responsible Innovation and Public Value; Digital Government for Stronger Society; Digital Platform Government and Core Public Values; Digital Transformation in Subnational Governments; Generative Artificial Intelligence in Government; Government Cyberinfrastructure and Platforms for Discovery and Innovation; GovTech and Digital Autonomy; Increasing Citizen Engagement and Active Citizenship through Digital Government; Legal Informatics; Organizational Factors, Adoption Issues and Value Creation of Digital Government; Re-imagining Flexible Work in the Public Service: the Shift to Remote and Hybrid Offices; Smart Cities for Social Cohesion; Social Media and Government – Democratic Challenges, Regulation, Uses of Platforms, and Actors' Behavior; Sustainable and Ethical Public Service Co-creation; Sustainable Public and Open Data Ecosystems for Inclusive and Innovative Digital Government
International Conference on Theory and Practice of Electronic Governance (ICEGOV) – planned for November 2025 icegov.org/2025/	Building Trust through Inclusive and Ethical Digital Governance; Securing Digital Governance: Privacy, Cybersecurity, and Sovereignty for the Future; Harnessing AI for Public Good: Balancing Innovation and Responsibility; Digital transformation and innovation in the Public Sector; Harnessing Emerging Technologies for Smarter and More Efficient Public Services; New Metrics and Approaches for Measuring Digital Governance Success; Building Digital Public Infrastructure for Scalable and Inclusive Digital Service Delivery; Smart, Sustainable and Resilient Communities, Cities and Regions; Participation in the Era of Social Media and Digital Platforms; Governing Digital Economies: Public-Private Sector Perspectives; Digital Transformation in the Global South

Source: as listed.

Note: URLs as of 2025/08/23.

Appendix 2. EU countries' UN-EGDI performance ratings 2016-2024

Country	2016	2018	2020	2022	2024
Austria	VH	VH	VH	VH	VH
Belgium	VH	VH	VH	VH	VH
Bulgaria	H	H	VH	VH	VH
Croatia	H	H	VH	VH	VH
Cyprus	H	VH	VH	VH	VH
Czechia	H	H	VH	VH	VH
Denmark	VH	VH	VH	VH	VH
Estonia	VH	VH	VH	VH	VH
Finland	VH	VH	VH	VH	VH
France	VH	VH	VH	VH	VH
Germany	VH	VH	VH	VH	VH
Greece	H	VH	VH	VH	VH
Hungary	H	H	VH	VH	VH
Ireland	VH	VH	VH	VH	VH
Italy	VH	VH	VH	VH	VH
Latvia	H	H	VH	VH	VH
Lithuania	VH	VH	VH	VH	VH
Luxembourg	VH	VH	VH	VH	VH
Malta	H	VH	VH	VH	VH
Netherlands	VH	VH	VH	VH	VH
Poland	H	VH	VH	VH	VH
Portugal	H	VH	VH	VH	VH
Romania	H	H	VH	VH	VH
Slovakia	H	H	VH	VH	VH
Slovenia	VH	VH	VH	VH	VH
Spain	VH	VH	VH	VH	VH
Sweden	VH	VH	VH	VH	VH

Source: (United Nations, 2024).

Appendix 3a. Pilot Study dataset – FOUNDATION, TECHNOLOGY, DATA, SERVICE, CITIZEN

	f-WB-GTE	f-OECD-DD	t-OECD-GP	t-WB-CGS	d-OECD-DPS	d-OECD-OD	s-EU-CBM	s-EU-UC	c-EU-TR	c-WB-DCE
Austria	89.2	76.6	77.3	89.2	38.0	41.6	65.6	92.8	71.1	81.0
Belgium	77.7	65.2	66.4	80.0	54.3	34.7	71.4	92.9	65.5	69.2
Croatia	68.4	49.6	40.3	83.4	53.5	38.0	51.5	90.2	52.4	66.8
Czechia	85.0	61.3	63.1	84.2	67.9	64.2	53.3	85.4	57.3	63.5
Denmark	80.9	85.1	89.6	77.5	83.3	78.3	70.4	97.9	78.0	93.2
Estonia	91.6	69.2	70.5	91.0	94.9	62.3	90.3	95.7	86.7	99.8
Finland	73.7	72.1	67.6	71.6	67.9	42.8	80.7	99.1	71.5	80.2
France	95.2	67.7	57.7	92.3	81.6	76.1	45.9	93.3	64.9	95.0
Germany	82.6	66.0	55.4	72.5	51.3	48.0	59.6	91.3	49.2	61.2
Greece	85.9	46.0	57.4	85.9	59.3	62.0	37.9	92.5	52.4	76.5
Hungary	75.2	59.3	41.3	75.6	67.7	45.6	40.2	91.7	56.6	75.4
Ireland	64.9	84.4	63.2	46.7	86.1	56.0	72.5	90.9	70.8	31.4
Italy	88.0	68.4	59.0	87.4	53.4	54.9	41.7	92.6	49.2	48.4
Latvia	79.1	68.5	67.8	72.2	65.4	62.9	74.8	93.1	71.3	95.3
Lithuania	94.0	59.0	65.1	82.2	75.3	56.1	74.0	93.9	77.7	95.0
Luxembourg	80.7	67.2	67.5	81.6	47.6	41.1	91.3	95.6	89.7	88.1
Netherlands	85.1	67.9	57.9	82.5	51.3	52.1	78.7	96.0	81.3	58.3
Poland	73.0	62.7	66.7	79.2	59.8	50.2	35.6	88.6	56.8	29.1
Portugal	89.6	77.0	59.3	85.9	55.5	49.3	61.7	95.5	70.9	64.9
Romania	62.2	42.0	14.6	58.2	28.0	24.3	28.1	76.0	43.8	32.6
Slovenia	72.1	55.9	62.1	79.0	48.9	46.5	51.0	92.6	64.2	86.2
Spain	86.5	69.7	61.6	93.7	52.9	64.7	66.6	97.5	72.7	80.7
Sweden	81.9	48.6	48.9	81.3	74.6	51.2	66.6	94.6	66.3	44.7

Source: own elaboration based on respective datasets.

Note: indicators' prefixes mark a respective component, e.g., "f-" is FOUNDATION.

Appendix 3b. Pilot Study dataset – USAGE, IMPACT

	u-INTERACT	u-OBTAIN	u-DOWNLOAD	u-SUBMIT	i-POLICY	i-DEMOCRACY	i-GOVERNANCE
Austria	73.0	62.7	56.0	53.5	63.4	72.7	67.3
Belgium	69.6	58.6	50.7	51.4	60.2	73.4	64.3
Croatia	45.1	42.5	33.6	24.4	55.4	56.3	51.5
Czechia	68.2	57.9	31.1	51.9	57.8	70.4	62.6
Denmark	92.3	90.6	38.2	68.4	78.7	89.0	85.8
Estonia	81.9	68.7	47.3	75.9	69.6	88.6	73.7
Finland	89.4	85.8	72.5	73.8	74.1	91.5	87.3
France	80.7	51.5	47.7	71.1	69.1	72.7	69.2
Germany	50.3	46.3	35.2	27.4	73.0	87.3	77.8
Greece	55.0	52.3	43.9	36.6	47.0	70.2	64.0
Hungary	72.6	72.1	66.8	66.3	51.1	32.2	42.4
Ireland	91.2	67.4	49.0	65.8	67.4	82.7	74.1
Italy	33.9	26.2	27.0	23.0	60.9	72.3	66.1
Latvia	77.4	67.8	36.5	64.9	62.0	80.0	66.0
Lithuania	61.6	56.8	32.9	51.6	64.9	80.4	71.6
Luxembourg	78.2	48.4	64.0	52.3	74.2	76.2	75.7
Netherlands	87.3	81.9	60.0	75.0	65.2	66.3	61.5
Poland	47.5	29.4	27.4	39.9	51.7	46.1	54.4
Portugal	48.9	41.8	27.2	34.2	61.7	75.6	62.5
Romania	14.7	10.8	9.3	9.0	51.0	48.8	46.8
Slovenia	69.1	60.8	32.0	38.1	63.9	67.4	62.9
Spain	68.7	56.1	45.9	54.6	65.1	72.5	70.3
Sweden	90.6	85.5	55.4	79.5	79.8	92.9	89.0

Source: own elaboration based on respective datasets.

Note: indicators' prefixes mark a respective component, e.g., "u-" is for USAGE.

Appendix 4a. Best practice matrix: DATA to SERVICE

Follower	Best practice to follow					
	Austria	Belgium	Finland	Luxembourg	Romania	Spain
Austria	100%					
Belgium		100%				
Croatia		52%	12%	36%		
Czechia			100%			
Denmark			100%			
Estonia			8%	92%		
Finland			100%			
France			100%			
Germany			11%	61%		28%
Greece			43%			57%
Hungary			99%			1%
Ireland			100%			
Italy			14%	29%		57%
Latvia			85%	3%		12%
Lithuania			100%			
Luxembourg				100%		
Netherlands			6%	48%		46%
Poland			51%	14%		35%
Portugal			30%	37%		33%
Romania					100%	
Slovenia			0%	77%		23%
Spain						100%
Sweden			100%			

Source: own elaboration based on respective datasets.

Appendix 4b. Best practice matrix: TECHNOLOGY to GOVERNANCE/POLICY

Follower	Best practice to follow				
	Denmark	Finland	Ireland	Romania	Sweden
Austria					100%
Belgium	34%				66%
Croatia				25%	75%
Czechia					100%
Denmark	100%				
Estonia					100%
Finland		100%			
France					100%
Germany	7%		25%		68%
Greece					100%
Hungary			1%	23%	76%
Ireland			100%		
Italy					100%
Latvia	39%		22%		39%
Lithuania					100%
Luxembourg					100%
Netherlands					100%
Poland	43%		1%		55%
Portugal					100%
Romania				100%	
Slovenia	31%		3%		65%
Spain					100%
Sweden					100%

Source: own elaboration based on respective datasets.

Appendix 4c. Best practice matrix: SERVICE to USAGE

Follower	Best practice to follow							
	Czechia	Denmark	Finland	France	Hungary	Ireland	Romania	Sweden
Austria			18%		51%	31%		
Belgium			21%		39%	40%		
Croatia	29%				58%	2%		11%
Czechia	100%							
Denmark		100%						
Estonia								100%
Finland			100%					
France				100%				
Germany	17%				43%	12%		27%
Greece					81%		19%	
Hungary					100%			
Ireland						100%		
Italy				26%	74%			
Latvia	8%					20%		72%
Lithuania	4%					9%		87%
Luxembourg			54%		37%	9%		
Netherlands			34%		3%	1%		61%
Poland					62%		38%	
Portugal				24%				76%
Romania							100%	
Slovenia				19%	46%	11%		23%
Spain			17%		9%			74%
Sweden								100%

Source: own elaboration based on respective datasets.

Appendix 4d. Best practice matrix: CITIZEN to DEMOCRACY

Follower	Best practice to follow				
	Germany	Ireland	Poland	Romania	Sweden
Austria					100%
Belgium	5%				95%
Croatia	81%				19%
Czechia	53%				47%
Denmark					100%
Estonia					100%
Finland					100%
France	8%				92%
Germany	100%				
Greece	81%				19%
Hungary	57%				43%
Ireland		100%			
Italy	50%			38%	12%
Latvia					100%
Lithuania					100%
Luxembourg					100%
Netherlands					100%
Poland			100%		
Portugal					100%
Romania				100%	
Slovenia	12%				88%
Spain					100%
Sweden					100%

Source: own elaboration based on respective datasets.

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