From Complexity to Clarity: A Taxonomy of GovTech Startup Business Models for Public Sector Innovation

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Abstract. Digital transformation in public administration is increasingly driven by GovTech startups, which leverage innovative technologies to address complex societal and administrative challenges. Despite their growing importance, the business models underlying these startups remain poorly understood, limiting their effective integration into public sector ecosystems. While existing research focuses on defining GovTech and exploring its potential, little attention has been paid to the systematic analysis of the business models that enable these startups to align technological innovation with the unique requirements of public administration. Addressing this gap, our study develops a taxonomy of GovTech business models to provide clarity and actionable insights for stakeholders. Our research identifies 11 dimensions and 55 characteristics that structure the business models of GovTech startups, emphasizing meta-dimensions such as value proposition, value creation and delivery, and value capture. These insights offer a comprehensive framework to classify and analyse the diverse approaches within the GovTech sector. By analysing 85 GovTech startups in Germany through an iterative taxonomy development process, we reveal distinct patterns in areas such as funding strategies, stakeholder alignment, technological enablers, and operational scope. The taxonomy highlights how GovTech startups address key challenges like citizen engagement, operational efficiency, and compliance assistance, providing practical examples of successful implementations. This study contributes to both theory and practice by offering a structured understanding of GovTech business models. For researchers, the taxonomy provides a foundation for further exploration of this emerging field. For practitioners and policymakers, it serves as a strategic tool to foster public-private collaboration, optimize innovation adoption, and address public sector challenges in a dynamic environment.

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1. Introduction

Governments play a central role in addressing complex societal challenges, yet they struggle to adapt their services to the demands of an increasingly digital world. While public institutions traditionally monopolized service provision, emerging technologies such as artificial intelligence (AI), the Internet of Things (IoT), and blockchain are reshaping this landscape. However, financial constraints, regulatory complexity, and a lack of technical expertise hinder their adoption (Bharosa, 2022). As standardized IT solutions often fail to meet the public sector's evolving needs, governments increasingly rely on GovTech startups to drive digital transformation. These startups offer agile, tailored solutions for key challenges such as digital identity management, smart infrastructure, and real-time data processing (Mergel et al., 2022). With a rapidly growing market—valued at 19.8 billion euros in Germany and 411 billion euros globally in 2021 (Public, 2021)—GovTech has become a key driver of public sector modernization, as demonstrated by successful innovations like *Vialytics*' smart road damage detection system (Stuck & Dieke, 2023).

Despite the growing importance of GovTech, successful collaborations between startups and government institutions remain limited, largely due to the uncertainty of GovTech business models. Unlike industry firms, startups in this sector face complex procurement processes, rigid regulatory frameworks, and long decision cycles, making it difficult to establish sustainable revenue streams (Hoekstra et al., 2023). Bureaucratic hurdles and varying digital maturity among public institutions further hinder scalability, leaving many promising innovations unable to gain traction (Kuziemski et al., 2022; Mergel et al., 2022). Without a clearer understanding of how GovTech startups can structure viable business models, governments risk missing out on critical technological advancements (Bharosa, 2022).

While existing research provides valuable insights into the technological applications, regulatory landscape, and ecosystem dynamics of GovTech, it falls short in addressing the business models that enable startups to navigate this complex sector. Studies on AI and blockchain in public administration highlight technological capabilities but overlook the structural barriers that GovTech startups face in scaling their solutions (Androutsopoulou et al., 2019; Engin & Treleaven, 2018). Research on GovTech ecosystems and their relationship to CivicTech (Yoshida & Thammetar, 2021) provides a macro-level perspective but lacks granularity in explaining how startups establish viable revenue models and sustain long-term collaborations with government institutions. While regulatory and market studies (Kuziemski et al., 2022; Mergel et al., 2022) acknowledge institutional constraints, they do not systematically classify the strategies startups use to overcome them. This disconnect underscores the need for a structured framework that captures the defining characteristics of GovTech startup business models. Without such an understanding, both academic research and policy discussions risk remaining too abstract to inform actionable strategies for fostering startup-driven public sector innovation.

While GovTech is gaining significance, research has yet to systematically classify the business models that enable startups to navigate technological innovation, regulatory requirements, and government procurement processes. Existing studies provide insights into ecosystem dynamics, regulatory challenges, and technological applications but do not comprehensively analyse the structural characteristics that shape GovTech business models (Bharosa, 2022). Given the sector's distinct challenges, including long procurement cycles, fragmented public sector demand, and reliance on public funding (Filer, 2019; Mergel et al., 2022), a deeper understanding of how these startups establish and sustain operations is necessary. Clarifying the key components of GovTech business models can enhance both academic inquiry and practical decision-making, supporting more effective collaborations between startups and government institutions. Against this backdrop, this study answers: *what conceptually grounded and empirically validated characteristics structure the business models of GovTech startups?*

To investigate this research question, we conduct a case-based analysis of GovTech startups in Germany, examining their business models to identify key characteristics. A case study approach captures the complexity of GovTech operations, while a purposive sampling strategy ensures diversity in sectors, technologies, and collaboration models. Data is drawn from company reports, industry analyses, and specialised databases, providing a comprehensive foundation. To structure findings, we apply an iterative taxonomy development approach (Nickerson et al., 2013), integrating theoretical insights with empirical observations.

The final taxonomy of GovTech startup business models consists of three meta-dimensions—*value proposition, value creation and delivery,* and *value capture*—covering 11 dimensions and 55 characteristics. It highlights the diversity of GovTech models and their strategies for public sector collaboration. In value proposition, startups focus on areas such as data-driven decision support and compliance, exemplified by *GovShare's* knowledge exchange and *Trail's* AI-powered automation. Value creation and delivery shows varying technological adoption, from established solutions to advanced AI and blockchain, with integration levels ranging from independent providers like *Breeze Technologies* to co-created solutions like *Convaise*. Value capture reflects financial constraints, with many startups relying on mixed funding and subscription models, while others lack clear revenue structures. This taxonomy offers a structured framework to analyse how GovTech startups develop, deliver, and sustain their services.

This study advances the understanding of GovTech startup business models by providing a structured taxonomy across value proposition, value creation and delivery, and value capture. It extends existing research on public sector innovation (Bharosa, 2022; Mergel et al., 2022) by identifying structural barriers such as limited openness, reliance on basic technology, and challenges in public sector integration. The findings refine business model frameworks for regulated environments (Wirtz et al., 2016) and offer practical insights for policymakers to foster startup-government collaboration. For entrepreneurs, the taxonomy provides strategic guidance on aligning business models with government needs and funding structures.

2. Theoretical Background

2.1 GovTech

GovTech, an acronym for "government" and "technology," (Bharosa, 2022) represents an emerging wave of digital transformation aimed at modernizing public sector operations through innovative socio-technical solutions. Unlike traditional e-government initiatives, which often rely on in-house development or large vendors, GovTech emphasizes the agility and innovation of startups and small and medium-sized enterprises (SMEs) to address public sector challenges (Mergel et al., 2022). The core technological competencies encompass AI, blockchain, big data analytics, cloud computing, predictive analytics, and the IoT (Dener et al., 2021; Engin & Treleaven, 2018). GovTech startups utilize these technologies to create public value by improving administrative processes, promoting citizen participation, enabling transparent governance, and contributing to the reduction of corruption risks (Santiso, 2022). A key characteristic of GovTech is its collaborative nature, where private organizations work closely with public sector entities to co-create value. This collaboration leverages the technological agility of private firms and aligns it with the mission-oriented focus of government agencies, enabling innovations that address complex societal needs (Bharosa, 2022).

GovTech has been defined in various ways (Mergel et al., 2022), highlighting different aspects such as collaboration with startups and SMEs (e.g., Filer, 2019), the use of innovative technology (e.g., Accenture & Public, 2018), and the improvement of efficiency in public administration (e.g., Yoshida & Thammetar, 2021). To navigate this conceptual variety, we follow the definition by Bharosa (2022, p. 3): "GovTech refers to socio-technical solutions – that are developed and operated by private organisations – intertwined with public sector components for facilitating processes in the public sector." This definition is particularly suitable for our purposes as it captures both the technological and organizational dimensions of GovTech and emphasizes the interdependence of public and private actors.

Despite its potential, the adoption of GovTech solutions faces several challenges. Public sector organizations often operate within rigid bureaucratic structures and stringent regulatory frameworks, making it difficult to implement agile and innovative solutions (Bharosa & Janowski, 2024). Additionally, traditional procurement processes are not well-suited for engaging startups, limiting governments' access to cutting-edge technologies (Filer, 2019; OECD, 2019). This "paradox of high potential but low adoption" underscores the importance of addressing barriers such as risk aversion, technical expertise deficits, and regulatory constraints (Hoekstra et al., 2023).

2.2 Business Models

The concept of the business model has been extensively explored in academic and practical domains since the 1990s, serving as both a theoretical framework and a practical tool for analysing and guiding business practices (Massa et al., 2017; Zott et al., 2011). Despite its widespread adoption, there remains a lack of consensus on its precise definition, leading to a variety of interpretations and frameworks. Scholars have proposed both simplified and comprehensive definitions, aiming to either focus on specific aspects or encompass the intricate interdependencies within business model elements (Foss & Saebi, 2017; Wirtz et al., 2016).

One of the earliest and most influential definitions by Chesbrough and Rosenbloom (2002) conceptualizes the business model as a mechanism for transforming technological potential into economic value by mediating between technological inputs and market demands. This perspective underscores the centrality of the business model in translating innovation into market success. Similarly, Teece (2010) defines a business model as a coherent framework that articulates the logic and evidence demonstrating how value is created, delivered, and captured. This widely accepted definition emphasizes three core components:

- **Value Proposition:** Identifies the problems a company solves for its customers and the needs it satisfies (Osterwalder & Pigneur, 2010; Wirtz et al., 2016).
- **Value Creation and Delivery:** Describes the organization of resources and key activities necessary to realize the proposed value (Teece, 2010).
- **Value Capture:** Focuses on how revenue is generated and managed alongside the associated cost structure (Teece, 2010; Wirtz et al., 2016).

The interconnected nature of these elements underscores the dynamic interdependencies within business models,

where changes in one dimension can significantly affect the others (Johnson et al., 2008).

With the rise of digital technologies, the concept of digital business models has gained increasing attention in Information Systems (IS) research (Sawy & Pereira, 2013). Digital business models leverage technological advancements to reshape how businesses operate and generate revenue. A defining feature of digital business models is their scalability and minimal reliance on physical assets, enabling businesses to offer highly personalized and efficient services at low marginal costs (Remane et al., 2022).

These advancements are especially relevant in sectors like GovTech, where digital tools enable more efficient governance, better public service delivery, and improved citizen interaction (Bharosa, 2022; Mergel et al., 2022). By facilitating innovative approaches to public sector modernization, digital business models play a pivotal role in addressing evolving societal needs.

3. Method

To ensure both practical relevance and scientific rigor, we employed design science research and utilized it as a guideline to elaborate further details of this research (Hevner, 2007; Hevner et al., 2004). Design science research is particularly well-suited for research aimed at developing and evaluating artifacts that address real-world challenges while contributing to the theoretical knowledge base (Hevner et al., 2004). This approach is applied to guide the iterative development of a taxonomy of GovTech startup business models, integrating insights from theoretical and empirical sources.

Taxonomy development is operated through three interrelated cycles: the rigor cycle, the relevance cycle, and the design cycle. The rigor cycle provides the theoretical foundation for the research by synthesizing existing literature and leveraging prior knowledge. The relevance cycle ensures the practical grounding of the research by testing the developed knowledge in real-world contexts. The design cycle serves as the iterative core of the research, where artifacts are continuously evaluated and refined based on inputs from both the rigor and relevance cycles. These three cycles are interconnected and ensure that the research process is both comprehensive and aligned with the study's objectives. Figure 1 illustrates these cycles and their respective activities.

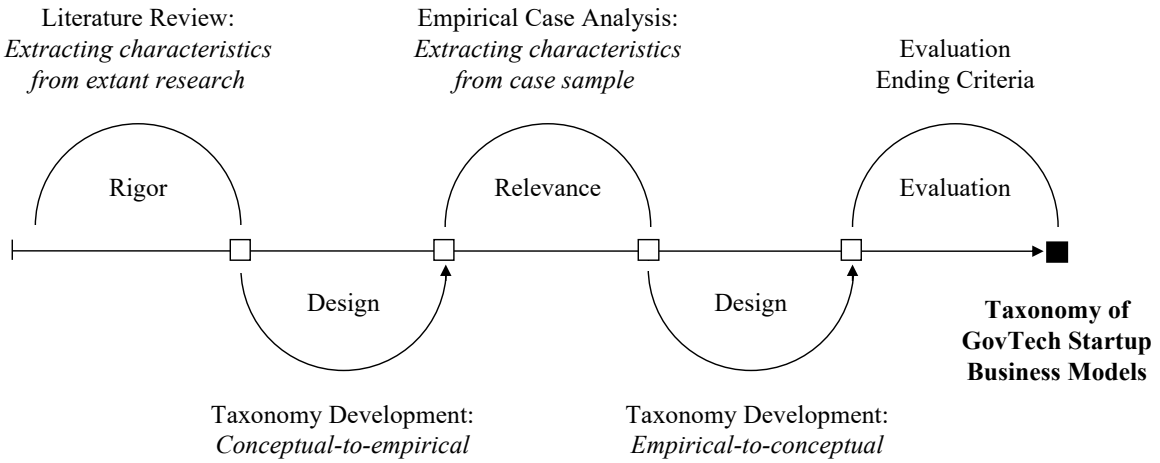

Fig. 1 - Iterative Design Science Cycles and Activities for Taxonomy Development.

The core of the design cycle is the taxonomy development method by Nickerson et al. (2013). This process develops a taxonomy with iterations from empirical-to-conceptual or conceptual-to-empirical until predefined ending-conditions are met. Nickerson et al. (2013) emphasized the importance of defining meta-characteristics at the very beginning since it eases the avoidance of examining many unrelated characteristics. The choice of meta-characteristics should be profoundly correlated with the taxonomy's purpose (Nickerson et al., 2013). In our case, the research purpose is to distinguish between various GovTech startup business models.

The **meta-characteristics** serve as the foundation for guiding the iterative development of the taxonomy and ensuring a structured and purpose-driven approach. As outlined by Nickerson et al. (2013), the meta-characteristic must represent the most comprehensive feature that aligns with the taxonomy's purpose and the needs of its users. For this research, the taxonomy is designed to assist stakeholders, including investors, public sector representatives, entrepreneurs, and researchers, in identifying, categorizing, and differentiating GovTech startups based on their business models. Accordingly, the meta-characteristic was defined as the identification of distinctive features within GovTech business models, encompassing universal business model components value proposition,

value creation and delivery, and value capture (Wirtz et al., 2016). This focus ensures that the taxonomy remains relevant to its primary users' needs, such as evaluating growth potential and scalability for investors, identifying tailored solutions for public sector challenges, and facilitating strategic differentiation for entrepreneurs. Grounded in prior studies across domains like AI startups (Weber et al., 2022), FinTech (Eickhoff et al., 2017), and blockchain startups (Weking et al., 2019), the meta-characteristic provides a universal framework for refining subsequent dimensions and characteristics, ensuring all elements logically stem from this foundational principle.

Ending conditions determine the point at which the taxonomy can be considered complete, providing clear criteria for concluding the iterative refinement process. Following Nickerson et al. (2013), this research adopts a dual approach by integrating both objective and subjective ending conditions. Objective criteria evaluate the taxonomy's structural integrity, ensuring that all objects can be classified, no dimensions or characteristics were added, merged, or split in the last iteration, and each dimension and characteristic is unique and relevant. Subjective conditions, on the other hand, focus on the taxonomy's utility, assessing its conciseness, robustness, comprehensiveness, extendibility, and explanatory power. By meeting these conditions, the taxonomy achieves a balance between structural rigor and practical relevance. Notably, this study incorporates universal business model components—value proposition, value creation and delivery, and value capture—as guiding principles throughout the iterative cycles. By doing so, the taxonomy avoids neglecting critical dimensions or characteristics, particularly those relevant to the physical environment of the public sector, ensuring a robust and contextually appropriate framework for GovTech startup classification.

The **rigor cycle** begins with a systematic literature review to provide a robust theoretical foundation for the taxonomy development. Following the methodology by Webster and Watson (2002), the literature review focuses on two key domains: GovTech and business model theory. The first step involved keyword-based searches in prominent academic databases, including Scopus, Web of Science, and IEEE Xplore. To ensure high-quality results, we targeted articles ranked as A+, A, or B in the VHB-JOURQUAL3 classification (VHB, 2022) and included relevant contributions from the Association for Information Systems (AIS) Special Interest Group on E-Government (AIS, 2011). The search string combined the keywords: "business model" AND ("digital government" OR "GovTech" OR "e-government" OR "government technology" OR "public sector"). This broad query minimized the risk of overlooking critical contributions and enabled a comprehensive understanding of the literature. Given the emerging nature of the GovTech field, grey literature sources such as industry reports and white papers were also included to supplement academic insights. This approach allowed for a more nuanced exploration of practical and theoretical dimensions in the domain. The initial search yielded 275 articles matching the search string in their title, abstract, or keywords. To refine this dataset, duplicate entries were first removed. Next, the titles and abstracts of the remaining articles were screened for relevance to the research domains. This process resulted in 41 articles. Further refinement through full-text screening reduced this number to 21 articles. In the subsequent step, a backward search was conducted, which involved reviewing the references cited in the selected articles, and a forward search, identifying articles that cited the selected publications. These efforts added 13 additional articles to the dataset. Therefore, the input of our rigor cycle was based on 34 journal articles or conference papers. The rigorous search and selection process ensured the inclusion of high-quality, relevant sources, providing a balanced mix of theoretical insights and practical applications.

In the **relevance cycle**, we extracted knowledge from real-world data and enhanced the practical consistency of our artifact. To achieve this, we followed a case survey guideline to ensure the sampling process is systematic, comprehensive, and theoretically sound (Larsson, 1993). For data collection, we selected Crunchbase as our initial data source, a widely recognized and comprehensive database with a focus on startups and innovative companies (Marra et al., 2015). Crunchbase has proven particularly useful for research on business model innovation in emerging markets, as it includes startups at all funding stages. Previous studies on successful taxonomy development have demonstrated the utility of Crunchbase data for similar research objectives (Weking et al., 2019). Using Crunchbase's filtering tools, we queried companies headquartered in Germany and tagged as GovTech under the Industries category, resulting in an initial list of 28 companies.

To enhance representativeness and address potential selection bias, we extended our search using multiple supplementary sources. These included blogs, articles, and reports identified via systematic web searches with keywords like "GovTech Startup." A key resource in this effort was the Berlin Startup Map, a dealroom-based platform that provided a list of 179 startups categorized as GovTech or CivicTech. Additionally, we identified 22 startups through participation in GovTech-specific events, such as the GovTech Tag 2022. Combining all sources, we compiled a preliminary sample of 209 startups headquartered in Germany.

We applied stringent inclusion criteria to this sample to ensure alignment with the research objectives. Verification involved a detailed examination of publicly available information, including startups' websites, press releases, and other supporting materials. This step confirmed the startups' classification as GovTech entities and verified their operational status and location in Germany. Further criteria included assessments of the startups' founding year, growth potential, and innovation in technology or business model to validate their classification as startups.

Following this rigorous screening process, 85 startups met all criteria and were included in the final sample. The substantial reduction in sample size was primarily due to entries from the Berlin Startup Map that did not meet the inclusion criteria. In rare instances, specific criteria, such as age limits, were relaxed when a startup's business model demonstrated strong alignment with GovTech, and its classification as a startup was consistently confirmed across multiple sources. These exceptions were applied sparingly and with careful consideration to preserve the theoretical integrity of the GovTech sector.

The final sample, along with links to their websites, is listed in Table 3 in the appendix. This structured and multi-sourced approach ensured a solid and representative sample for the development of our taxonomy. These empirical data served as input for the iterative refinement of the taxonomy.

The **design cycle** is the core of the research and follows the taxonomy development methodology by Nickerson et al. (2013). This iterative refinement process was initiated following the definition of meta-characteristics and termination conditions. This involved alternating between conceptual-to-empirical (deductive) and empirical-to-conceptual (inductive) approaches to develop a taxonomy of GovTech business models. The deductive approach leveraged insights from existing literature to propose new dimensions and characteristics, while the inductive approach derived dimensions and characteristics through the analysis of empirical objects, in this case, GovTech startups. Each iteration evaluated the taxonomy against the defined termination conditions to ensure its progressive refinement (Nickerson et al., 2013).

In the first iteration, we employed a conceptual-to-empirical approach grounded in the presented literature review in the rigor cycle. To garnish the business model aspect of the taxonomy, we appended the following four dimensions: *proposed solution, key channels, revenue model*, and *target customer* that originated in Osterwalder and Pigneur (2010) and are frequently discussed by other researchers. Additionally, we added dimensions like *key technology* (Amit & Zott, 2010). GovTech-specific dimensions, including *solution domain* (Stuck & Dieke, 2023), *public sector integration, data activity, operational scope* (Bharosa, 2022), and *funding sources* (Mergel et al., 2022), were also introduced.

Using these insights, we developed the initial dimensions and characteristics for the taxonomy, resulting in a preliminary, purely conceptual taxonomy. The identified dimensions were mapped to overarching meta-dimensions based on the meta-characteristic of identifying distinctive features of GovTech startup business models. This structure encapsulated the key elements of GovTech startup business models, including *value proposition, value creation and delivery*, as well as *value capture*. Several dimensions were enriched with specific characteristics. For instance, the *solution domain* dimension included characteristics such as *smart urban infrastructure, environmental monitoring, civic engagement, health and social services,* and *internal administration* (Stuck & Dieke, 2023). The *data activity* dimension featured characteristics like *personalized service delivery* and *data-driven decision support* (Bharosa, 2022).

In subsequent iterations, an empirical-to-conceptual approach was adopted, involving the sequential analysis of 85 GovTech startups. The sample was divided into multiple phases, with each phase introducing new startups to validate and refine the taxonomy. An overview of a selection of the startups analysed is provided in Table 1.

Tab. 1 - Analysed GovTech Startups (Excerpt).

Startup	Description	Website
Convaise	Converts form-based communication between citizens and public authorities into intuitive chat interactions using conversational AI, thereby optimising administrative processes and improving accessibility of public services.	www.convaise.com
GovShare	It facilitates municipal climate protection by enabling local governments to exchange practical solutions and experiences on an open platform.	www.govshare.org
Vialytics	An AI-powered system that uses smartphone technology to help local governments better manage infrastructure by assessing road conditions and planning efficient maintenance.	www.vialytics.com

During the empirical analysis, several refinements were made to enhance the taxonomy. For example, the *collaboration level* dimension was reinterpreted as *public sector integration*, providing a clearer description of the degree of integration with public systems and workflows. Additionally, new dimensions were introduced, such as *openness*, which encompasses open data and open-source initiatives, and *key technology*. At the same time, less relevant dimensions, such as *cost structure,* were removed to streamline the taxonomy. Some existing dimensions were consolidated to improve the taxonomy's usability and relevance. For instance, the *product/service offering* and *sector focus* dimensions were merged into a broader *solution domain* dimension. These adjustments significantly improved the taxonomy's practical applicability for classifying GovTech startups.

By the final iteration, all 85 startups had been analysed, and the taxonomy met all termination conditions. The finalized taxonomy successfully classified all startups, with every dimension and characteristic represented by at least one object. The iterative development process concluded once all objective and subjective termination conditions (Nickerson et al., 2013) were satisfied. The finalized taxonomy of GovTech startup business models is presented in detail in the results section.

4. Results

The final taxonomy of GovTech startup business models is presented in Table 2, visualized as a morphological box. In this framework, combinations of characteristics define the business model of a GovTech startup. The taxonomy comprises three meta-dimensions, eleven dimensions, and three to seven distinct characteristics per dimension, resulting in a total of 55 characteristics. Each dimension captures critical and distinctive elements of GovTech startup business models, structured around the overarching meta-characteristic that organizes business model components into the meta-dimensions of *value proposition*, *value creation and delivery*, and *value capture*. Selecting one characteristic from each dimension generates a unique profile for a GovTech startup's business model. The numbers in parentheses indicate the number of startups in our sample that exhibit the respective characteristic.

Tab. 2 – Taxonomy of GovTech Startup Business Models.

Meta-charact.	Dimension	Characteristics						
Value Proposition	Proposed Solution	Data-Driven Decision Support (22)	Collaboration and Knowledge Sharing (6)	Citizen Engagement (22)	Operational Efficiency (17)	Compliance Assistance (2)	Safety and Risk Management (6)	Data Control and Security (10)
	Solution Domain	Internal Admini-stration (18)	Citizen Services (25)	Education and Workforce Development (5)	Health and Social Services (2)	Smart Urban Infrastructure (18)	Defence and Safety (4)	Environ-mental Monitoring (13)
Value Creation and Delivery	Key Technology	AI and Advanced Analytics (24)	Blockchain (3)	IoT and Smart Sensors (10)	Cloud Computing (2)	Digital Twins (6)	Digital Identity (5)	Basic Technology Stack (33)
	Data Activity	Data Collection and Integration (19)	Personalized Service Delivery (27)	Data Analysis and Automation (26)	Data Sharing and Accessibility (10)	Data Governance and Security (3)		
	Key Channel	APIs and Modular Software (10)	Physical Devices (11)	Digital Platforms (64)				
	Public Sector Integration	Independent (36)	Partially Integrated (35)	Fully Customized (14)				
	Openness	Open Source (9)	Open Data (4)	Open Source and Open Data (2)	Proprietary (70)			
	Target Customer	B2G (42)	B2B (3)	B2C (8)	B2G and B2B (32)			
	Operational Scope	Municipal (38)	State (36)	International (11)				
Value Capture	Funding Sources	Private (28)	Public (13)	Mixed (8)	None or Undisclosed (36)			
	Revenue Model	Subscriptions and Licensing (31)	Non-Profit (2)	Transaction-based (3)	One-time Payment (6)	Consulting and Implementation Fees (4)	Undisclosed (39)	

Following Nickerson et al.'s (2013) recommendations, all dimensions are mutually exclusive to ensure clarity and applicability. For example, a startup cannot simultaneously be classified as leveraging *blockchain* and *digital twins* as its *key technology*.

Although multiple characteristics may theoretically apply to a single startup, each startup is assigned only one characteristic per dimension that fits best. This approach guarantees distinct classification within the taxonomy. Some dimensions, such as *funding sources*, are exhaustive and encompass all possible options for GovTech startups, while others, like *key technology*, reflect the most used technology.

The following sections detail each meta-dimension, its respective dimensions, and their defining characteristics, supplemented by examples from our empirical case sample.

4.1 Value Proposition

The first meta-dimension, *value proposition*, explores the benefits that GovTech startups deliver to their stakeholders. This meta-dimension is captured through two distinct dimensions: *proposed solution* and *solution domain.*

The *proposed solution* dimension outlines the core benefits GovTech startups aim to provide, driving the digital transformation of the public sector by addressing specific stakeholder needs. These benefits include the leveraging *data-driven decision support* that enable public agencies to effectively analyse large amounts of data to make informed decisions. *Collaboration and knowledge sharing* enable stakeholders to exchange information and work together on governance challenges. *Citizen engagement* focus on improving the quality and ease of public interactions with governments. *Operational efficiency* help optimize resources and reduce expenditures in public services. *Compliance assistance* supports organizations in adhering to regulations and standards. *Safety and risk management* enhance the protection of public resources and infrastructure. Lastly, *data control and security* ensure that sensitive data is controlled and protected within legal frameworks. For example, *GovShare* facilitates intergovernmental knowledge sharing by offering a platform for best practice exchange, while Trail automates regulatory compliance processes through an AI-powered copilot.

The *solution domain* dimension categorizes the operational focus of GovTech startups, emphasizing the primary areas where solutions are applied. *Internal administration* streamlines internal processes within governmental organizations. *Citizen services* enhance public-facing services such as healthcare or transportation. *Education and workforce development* improve access to learning and employment opportunities. *Health and social services* address public health challenges and social welfare. *Smart urban infrastructure* focuses on optimizing city management and infrastructure development. *Defence and security* improve security measures and emergency response capabilities. *Environmental monitoring* addresses sustainability and ecological concerns. For instance, *JobKraftwerk* connects job seekers with employers via a digital platform, supporting workforce development, while *SONAH* uses sensor-based technology to provide actionable data for urban planning.

4.2 Value Creation and Delivery

The second meta-dimension, *value creation and delivery*, examines the mechanisms through which startups generate and deliver value. This meta-dimension is comprised of seven dimensions: *key technology, data activity, key channel, public sector integration, openness, target customer,* and *operational scope.*

The *key technology* dimension identifies the primary technologies that drive GovTech solutions. *AI and advanced analytics* enable predictive insights and process automation. *Blockchain* provides secure and distributed systems based on blockchain technology. *IoT and smart sensors* gather real-time data from physical environments. *Cloud computing* offers scalable storage and processing capabilities. *Digital twins* simulate and analyse spatial data. For example, *Edgeless Systems* uses cloud computing to protect sensitive data, while *Natix* incentivizes users to collect geospatial data via smartphones for real-time applications. *Digital identity* refers to secure and verifiable online identification solutions that enable citizens and businesses to authenticate themselves for government and private sector services, thereby improving security, accessibility, and compliance with legal frameworks. One example is *Verimi*, which offers a secure digital identity platform for storing and verifying ID documents and facilitates digital signatures, logins, and payments. At the same time, most of the startups (33) leverage a *basic technology stack*, utilizing established and widely adopted technologies without incorporating advanced or disruptive elements–e.g., basic web applications.

Data activity captures how startups engage with data. *Data collection and integration* involve aggregating information from diverse sources, such as sensors. *Personalized service delivery* tailors services to individual users. *Data analysis and automation* streamline processes through advanced analytics. *Data sharing and accessibility* improve collaboration across stakeholders. *Data governance and security* ensure compliance with data protection standards. For example, *Brifle* provides a personalized digital mailbox service, while *Natix* focuses on integrating and monetizing geospatial data.

The *key channel* dimension explores how GovTech startups deliver their solutions. *Application Programming Interfaces (APIs) and modular software* enable seamless integration with existing digital infrastructures by facilitating interoperability between different systems. *Physical devices* combines hardware solutions with software functionalities. *Digital platforms*, such as web and mobile applications, provide user-friendly interfaces for accessing services. For instance, *Green City Solutions* offers physical air purification devices, which use moss filters to bind particulate matter and provide real-time air quality data through IoT sensors.

Public sector integration highlights the extent of collaboration with government workflows. *Independent* startups operate without direct involvement from public sector entities. *Partially integrated* startups utilize public sector data or systems. Customized solutions are developed in close collaboration with government agencies. The

independent *Breeze Technologies* provides standardized air quality monitoring solutions, whereas *Convaise* collaborates with public entities to transition citizen communication into an individualized chat-based system.

Openness reflects the degree to which startups adopt open principles. *Open source* and *open data* promote transparency and collaboration, while *proprietary solutions* protect intellectual property. For example, *HeiDi* offers modular applications for municipalities based on open-source principles, enabling easy customization and integration with existing systems. The software is developed collaboratively with 334 municipalities and cities, making it cost-effective, efficient, and strengthening communities.

Target customer and *operational scope* examine the stakeholders served by GovTech startups. As *target customers,* GovTech startups address governments *(B2G)*, businesses *(B2B)*, or individual citizens *(B2C)*. Most of the GovTech startups in our sample target government intuitions. While 42 operate as a pure B2G business, another 32 have a mixed business and also address business customers *(B2G and B2B)*.

The *operational scope* dimension further explores at which scale their solutions apply, distinguishing between *municipal*, *state*, and *international* levels. For example, a startup might operate nationally but their solutions only apply to cities on a municipal level. With 38, most startups operate at the local level in communities, closely followed by the state level with 36 startups. *FixMyCity*, for example, exemplifies a municipal-level B2G startup enhancing public services for the general population by providing a platform for citizens to report and track the resolution of urban issues such as potholes or broken streetlights. Only 11 startups operate internationally.

4.3 Value Capture

The final meta-dimension, *value capture*, focuses on how GovTech startups sustain their operations and generate income. This meta-dimension includes two dimensions: *funding sources* and *revenue model*.

Funding sources refer to the mechanisms by which financial support for startups is provided. *Private funding*, the most frequently mentioned category with 28 startups, includes investments from individuals, institutions or organizations, including venture capitalists or crowdfunding efforts. *Public funding*, on the other hand, consists of government grants or subsidies aimed at promoting innovation and growth. *Mixed funding* represents a combination of different funding sources, reflecting a diversified approach to securing resources. Most startups did not disclose their funding details or did not receive any funding (36), making *none or undisclosed* the most common funding source observed in our sample.

Revenue model describes how startups generate income. *Subscription and licensing models*, which involve recurring payments for service access, are the most disclosed revenue models used by 31 startups. *Transaction-based models* charge customers per usage, while *one-time payments* are single transactions for specific services. *Consulting and implementation fees* generate income through expertise or service deployment. Some startups operate under a *non-profit model*, focusing on creating value without direct profit, often relying on grants, donations, or other funding sources to sustain their activities. The largest group comprises startups with *undisclosed* revenue models, accounting for 39 startups.

5. Discussion

Understanding the business models of GovTech startups is key to driving the modernization of the public sector in an increasingly complex and technology-driven era. GovTech ecosystems have emerged as disruptive forces, with startups tackling critical public challenges such as administrative inefficiencies, regulatory complexity, and citizen engagement (Bharosa, 2022; Mergel et al., 2022). Despite their transformative potential, governments often face significant barriers to adopting these innovations due to strict procurement processes, complex legal frameworks, and an overall reluctance to embrace novel business models (Filer, 2019; OECD, 2019). However, countries like Germany, which boasts a rapidly growing GovTech market, show how customized digital solutions can effectively meet specific governmental needs. This highlights the importance of matching technological capabilities with the unique requirements of public institutions (Stuck & Dieke, 2023).

Our taxonomy provides a systematic framework for understanding how digital technology is implemented in various aspects of GovTech startup business models. By synthesizing research findings with empirical observations, the taxonomy reduces the complexity of the GovTech landscape and offers a clear, structured overview (Nickerson et al., 2013). Within the frame of business models, it articulates how startups can leverage digital technologies across three key dimensions: value proposition, value creation and delivery, and value capture (Wirtz et al., 2016).

For the dimension of *value proposition*, our research reveals that in the *solution domain,* 25 startups focus on *citizen services*, making it the most prominent domain in the GovTech landscape. These startups aim to improve citizen communication, enhance access to digital public services, and offer personalized solutions. For instance, *TaxFix*

simplifies tax returns, making the process faster, more accessible, and user-friendly. Similarly, *FixMyCity* enables citizens to report urban issues, such as potholes or broken streetlights, directly to local governments, fostering more efficient resolution mechanisms. Solutions targeting *internal administration* and *smart urban infrastructure* follow closely, with 18 startups each addressing these domains. For example, *GovRadar* streamlines public procurement through AI-powered vendor matching, while *Smart City Systems* optimizes urban infrastructure with automated parking management systems. This distribution reflects a dual intent: startups aim to enhance citizen-centric service delivery while governments seek to improve operational efficiency and engagement. Conversely, sectors like *defence and security*, as well as *health and social services* remain underrepresented, likely due to their heightened organizational complexity and reliance on sensitive data. These underrepresented areas underscore the need for targeted initiatives to reduce barriers to innovation and broaden GovTech's scope in addressing public-sector challenges (Bharosa & Janowski, 2024).

Value creation and delivery is substantially characterised by their key technologies, openness, and the degree of public sector integration in their business models. Among the 85 startups analysed, 33 employ a basic technology stack as *key technology,* such as simple web applications, rather than advanced innovations like AI or blockchain. This reliance points to persistent gaps in the public sector's digital infrastructure, where foundational technological needs remain unmet (Dener et al., 2021). Consequently, startups prioritize addressing these deficiencies to create immediate value. For instance, *Vilisto* offers straightforward scheduling software to help local governments manage resources more effectively, bridging critical operational gaps (Stuck & Dieke, 2023). These findings emphasize the urgent need for public administrations to invest in digital infrastructure and workforce training, creating a supportive environment where advanced technologies can flourish. A stepwise, incremental approach to technological transformation appears more feasible in the short term, allowing governments to address fundamental needs before adopting more complex innovations.

Another noteworthy finding is the limited *openness* of GovTech startup business models with the dominance of proprietary solutions. A clear majority of startups (70) offer proprietary solutions, with only nine startups applying open-source principles and four utilizing open data. An example of a startup with an open-source approach is *HeiDi*, which develops open-source municipal tools, enabling cost-efficient customization of digital services for local governments. *Geospin*, on the other hand, leverages open geodata alongside proprietary datasets to provide predictive analytics and geospatial insights for smarter urban planning and optimized business decisions. The overwhelming reliance on proprietary software highlights a missed opportunity for fostering openness and reducing vendor dependency. Governments must actively promote the development and procurement of open-source solutions to foster competition, enhance transparency, and build internal expertise (Yoshida & Thammetar, 2021). By encouraging the use of open-source technologies, public institutions could strengthen their resilience, reduce long-term costs, and establish a more diverse and competitive market ecosystem.

Public sector integration influences the success and adaptability of GovTech startups by affecting the alignment of their business models with government systems. Startups with high integration, such as *Vialytics*, which works with over 200 municipalities on AI-powered road maintenance, demonstrate the viability of deeply integrated models. These startups often adopt co-creation-based business models and work closely with public agencies to deliver *customized solutions* for specific needs such as administrative efficiency or infrastructure management (Bharosa, 2022; Stuck & Dieke, 2023). By embedding their services in public authority workflows, these startups ensure higher adoption rates and sustainable value creation, establishing themselves as indispensable partners. By contrast, *independent* startups with lower integration offer generic solutions such as web applications. While these solutions address immediate needs, their limited integration limits their systemic impact and long-term scalability (Mergel et al., 2022). Barriers to greater integration, such as rigid procurement processes, outdated IT systems, and cultural resistance, have direct implications for GovTech business models. Startups that focus on open innovation ecosystems and use open-source models could reduce these barriers by promoting adaptability and cost efficiency (Yoshida & Thammetar, 2021). In addition, startups can rely on platform-based models that enable modular integration and allow for a phased roll-out without overhauling existing systems. This highlights the need for business models that can be adapted to different levels of public sector readiness. Ultimately, prioritizing a public sector integration not only improves the alignment of startup solutions with public sector needs but also ensures the scalability, resilience, and broader adoption of public sector innovation.

For *value capture*, our results underscore the crucial role of *funding sources* in shaping the GovTech landscape. Of the startups that disclosed their funding, 28 rely on *private capital*, while only 13 startups benefit from *public funding*. GovTech startups often rely on venture capital funding, which can clash with the slower, fragmented nature of public procurement, limiting their scalability and growth (Mergel et al., 2022). This limited public investment reflects a missed opportunity to strategically support startups that address pressing government challenges. Scaling up public funding programs could significantly accelerate the growth of the GovTech sector and ensure that startups with tailored solutions receive the resources they need. Aligning public funding with modernization goals would also improve the sector's ability to deliver sustainable innovation.

Limitations

We must acknowledge two limitations of this study. First, taxonomies are inherently iterative and cannot claim to be complete or final (Nickerson et al., 2013). In developing our taxonomy, we specifically focused on the characteristics of business models that distinguish GovTech startups in Germany. While this approach ensures the clarity and relevance of the taxonomy, it may exclude certain characteristics that could be relevant in other geographic or regulatory contexts. This trade-off was made to strike a balance between comprehensiveness and parsimony, ensuring that the taxonomy remains both actionable and understandable for the target audience.

Secondly, our empirical data is mainly drawn from publicly available information on 85 GovTech start-ups in Germany, supplemented by secondary sources such as Crunchbase. While this approach provides a solid foundation, the sample is inherently skewed towards start-up business models and may not fully capture the strategies of larger, more established technology providers or innovations originating from the public sector. Nevertheless, the iterative process of taxonomy development mitigates this limitation by integrating conceptual insights from the literature to ensure broader applicability. Given the central role of start-ups as drivers of innovation in the GovTech sector (Bharosa, 2022). the taxonomy remains a valuable tool for researchers and practitioners seeking to promote digital transformation in public administration.

Practical Implications

First, the taxonomy of GovTech startup business models presented in this study equips public administrators, startup founders, and policymakers with a robust framework to navigate the complexities of GovTech ecosystems. Specifically, it allows stakeholders to identify strategic opportunities and challenges across the value proposition, value creation and delivery, as well as the value capture dimensions. For example, public sector organizations can utilize the taxonomy to prioritize engagement with startups offering tailored solutions for more citizen-centred services or operational efficiency, as these domains demonstrate significant potential for value creation. Simultaneously, startup founders can adopt the taxonomy to align their offerings with the needs of public institutions, improving the scalability and adoption of their innovative solutions. This structured approach supports both proactive planning and reactive decision-making, enabling more resilient and adaptive public sector modernization.

Second, our taxonomy highlights the necessity of fostering partnerships and open innovation practices to overcome systemic barriers such as procurement inefficiencies and rigid regulatory frameworks. Public administrators are encouraged to explore collaborations with startups that embrace open data and open-source technologies, reducing vendor dependency and promoting adaptability. Similarly, GovTech startups can leverage the taxonomy to refine their strategies for public sector integration, ensuring their solutions are not only innovative but also practical and implementable within government systems. By bridging the gap between technological capabilities and public sector readiness, the taxonomy facilitates a co-creative ecosystem conducive to sustained innovation and efficiency.

Theoretical Implications

The taxonomy extends existing literature on digital transformation in the public sector by introducing a structured framework that emphasizes the interplay between technological innovation and public sector constraints. Unlike prior studies that focused predominantly on technological capabilities or ecosystem dynamics, this research provides a granular analysis of business model components tailored to GovTech startups. It contributes to the understanding of how value proposition, value creation and delivery, and value capture dimensions are interrelated and how these interrelations drive innovation in regulated environments. This framework enriches theoretical discussions on digital government by offering new perspectives on how startups navigate and mitigate the unique challenges of public sector ecosystems.

Furthermore, the study advances business model theory by illustrating how contextual factors such as regulatory complexity, public funding dynamics, and citizen-centric goals shape the design and evolution of business models in the GovTech sector. By integrating empirical data with theoretical constructs, the taxonomy offers a foundation for comparative analyses across different domains and geographies, shedding light on the universal and context-specific characteristics of GovTech startup business models. This theoretical contribution not only fills a critical gap in the literature but also opens new avenues for interdisciplinary research on public-private innovation in digital government.

Future Research

Our taxonomy provides a foundation for studying transitional pathways between different GovTech business models. Future research could investigate how startups evolve their business models in response to changes in regulatory environments, technological advancements, or public sector demands. For instance, analysing the

transition from proprietary to open-source models or from independent solutions to fully integrated public sector systems could shed light on the antecedents and enablers of successful GovTech scaling. Such research could also examine how specific dimensions of the taxonomy, such as public sector integration or funding sources, influence the scalability and sustainability of GovTech innovations.

Another promising avenue for future research lies in exploring the performance implications of different business model designs within the GovTech sector. By leveraging the taxonomy as a coding scheme or survey instrument, scholars can compare the economic, social, and operational outcomes of various GovTech models. For instance, researchers could analyse whether startups focusing on citizen engagement outperform those targeting operational efficiency in terms of public value creation or long-term adoption. These insights could help refine the taxonomy further and provide actionable guidance for both academics and practitioners seeking to optimize GovTech innovations.

6. Conclusion

The growing importance of GovTech startups highlights their critical role in driving digital transformation in public administration, addressing complex challenges such as regulatory constraints, operational inefficiencies, and citizen engagement. This study aimed to systematically explore the business models of these startups, providing clarity on how they align technological innovation with the unique needs of the public sector. By developing a taxonomy structured around value proposition, value creation and delivery, and value capture, we offer a comprehensive framework that classifies and analyses diverse approaches within the GovTech sector. The findings underscore the importance of tailoring business models to overcome public sector constraints while leveraging opportunities for co-creation and innovation. Moreover, our taxonomy advances theoretical understanding of business models in regulated environments and offers practical guidance for fostering collaboration between startups and public institutions. In doing so, it equips stakeholders with actionable insights for fostering innovation and modernizing public services, ultimately contributing to a more agile and responsive public sector.

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References

(* included in the literature review)

Accenture & Public. (2018). GovTech: Europe's next opportunity. https://www.accenture.com/content/dam/accenture/final/a-com-migration/manual/r3/pdf/pdf-90/Accenture-GovTech-POV.pdf

AIS. (2011). *Senior Scholars' Basket of Journals*. https://aisnet.org/general/custom.asp?page=SeniorScholarBasket

*Al-Debei, M. M., & Avison, D. (2010). Developing a unified framework of the business model concept. *European Journal of Information Systems*, *19*(3), 359-376.

*Amit, R., & Zott, C. (2001). Value creation in e-business. *Strategic Management Journal*, *22*(6-7), 493-520.

*Amit, R., & Zott, C. (2010). Business Model Innovation: Creating Value In Times Of Change. *SSRN Electronic Journal*, *23*. https://doi.org/10.2139/ssrn.1701660

Androutsopoulou, A., Karacapilidis, N., Loukis, E., & Charalabidis, Y. (2019). Transforming the communication between citizens and government through AI-guided chatbots. *Government Information Quarterly*, *36*(2), 358-367. https://doi.org/10.1016/j.giq.2018.10.001

*Baden-Fuller, C., & Haefliger, S. (2013). Business models and technological innovation. *Long Range Planning*, *46*(6), 419–426. https://doi.org/10.1016/j.lrp.2013.08.023

*Bharosa, N. (2022). The rise of GovTech: Trojan horse or blessing in disguise? A research agenda. *Government Information Quarterly*, *39*(3). https://doi.org/10.1016/j.giq.2022.101692

Bharosa, N., & Janowski, T. (2024). *The GovTech Challenge – GovTech and Public Value Creation* Digital Government Research (DGO 2024), Taipei, Taiwan.

*Bock, M., & Wiener, M. (2017). *Towards a taxonomy of digital business models - conceptual dimensions and empirical illustrations* International Conference on Information Systems (ICIS), Seoul, South Korea.
*Chesbrough, H., & Rosenbloom, R. (2002). The Role of the Business Model in Capturing Value from Innovation: Evidence from Xerox Corporation's Technology Spin-Off Companies. *Industrial and Corporate Change*, *11*. https://doi.org/10.1093/icc/11.3.529
*Davydova, M. L. (2013). Govtech and smart regulation in election law. *Universidad y Sociedad*, *14*(1), 205–211. https://doi.org/10.1016/j.lrp.2013.08.023
*de Magalhães Santos, L. G. (2024). *Dynamic Capabilities in the Public Sector to Deal with GovTech* Electronic Government (EGOV 2024),
*Dener, C., Nii-Aponsah, H., Ghunney, L. E., & Johns, K. D. (2021). *GovTech Maturity Index: The State of Public Sector Digital Transformation*. The World Bank. https://doi.org/10.1596/978-1-4648-1765-6
Eickhoff, M., Muntermann, J., & Weinrich, T. (2017). *What do FinTechs actually do? A Taxonomy of FinTech Business Models*.
*Engin, Z., & Treleaven, P. (2018). Algorithmic Government: Automating Public Services and Supporting Civil Servants in using Data Science Technologies. *The Computer Journal*, *62*. https://doi.org/10.1093/comjnl/bxy082
Filer, T. (2019). *Thinking about GovTech A Brief Guide for Policymakers*.
Foss, N. J., & Saebi, T. (2017). Fifteen Years of Research on Business Model Innovation. *Journal of Management*, *43*(1), 200-227.
Hevner, A. (2007). A Three Cycle View of Design Science Research. *Scandinavian Journal of Information Systems*, *19*.
Hevner, A., R, A., March, S., T, S., Park, Park, J., Ram, & Sudha. (2004). Design Science in Information Systems Research. *Management Information Systems Quarterly*, *28*, 75.
*Hoekstra, M., Chideock, C., Bodea, G., Bharosa, N., Cave, J., Kokkeler, B., Oomens, I., Berg, A., Veenstra, A., & Alleweldt, F. (2022). *The digital single market and the digitalisation of the public sector – govtech and other innovations in public procurement*. European Parliament. https://doi.org/10.2861/830794
*Hoekstra, M., Veenstra, A. F. V., & Bharosa, N. (2023). *Success Factors and Barriers of GovTech Ecosystems: A case study of GovTech ecosystems in the Netherlands and Lithuania* Proceedings of the 24th Annual International Conference on Digital Government Research, https://doi.org/10.1145/3598469.3598500
*Johnson, M., Christensen, C. C., & Kagermann, H. (2008). Reinventing your business model. *Harvard Business Review*, *87*, 52–60.
*Kuziemski, M., Ulrich, P., Martinez, A., & Mergel, I. (2022). *GovTech practices in the EU – A glimpse into the European GovTech ecosystem, its governance, and best practices*. Publications Office of the European Union. https://doi.org/doi/10.2760/74735
*Labanava, A., Liiv, I., & Pappel, I. (2023). *Capacity Building in GovTech for Measuring and Achievement of Sustainable Development Goals*. https://doi.org/10.54941/ahfe1003888
Larsson, R. (1993). Case Survey Methodology: Quantitative Analysis of Patterns across Case Studies. *The Academy of Management Journal*, *36*, 1515-1546.
*Lukkien, B., Bharosa, N., & Reuver, M. D. (2023, July 11–14, 2023). *Barriers for developing and launching digital identity wallets* 24th Annual International Conference on Digital Government Research (DGO 2023), Gdańsk, Poland.
Marra, A., Antonelli, P., Dell'Anna, L., & Pozzi, C. (2015). A Network Analysis Using Metadata to Investigate Innovation in Clean-Tech – Implications for Energy Policy. *Energy Policy*, *86*, 17.
Massa, L., Tucci, C. L., & Afuah, A. (2017). A Critical Assessment of Business Model Research. *Academy of Management Annals*, *11*(1), 73-104.
*Mergel, I., Ulrich, P., Kuziemski, M., & Martinez, A. (2022). *Scoping GovTech dynamics in the EU*. Publications Office of the European Union. https://doi.org/doi/10.2760/700544
*Morris, M., Schindehutte, M., & Allen, J. (2005). The entrepreneur's business model: Toward a unified perspective. *Journal of Business Research*, *58*(6), 726–735. https://doi.org/10.1016/j.jbusres.2003.11.001
Nickerson, R. C., Varshney, U., & Muntermann, J. (2013). A method for taxonomy development and its application in information systems. *European Journal of Information Systems*, *22*(3), 336-359.
OECD. (2019). Embracing Innovation in Government: Global Trends 2019. https://trends2019.oecd-opsi.org/embracing-innovation-in-government-global-trends-2019.pdf
*Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. John Wiley & Sons.
*Osterwalder, A., Pigneur, Y., & Tucci, C. L. (2005). Clarifying business models: Origins, present, and future of the concept. *Communications of the Association for Information Systems*, *16*. https://doi.org/10.17705/1CAIS.01601
*Public. (2021). *The State of European GovTech*. https://www.public.io/researchreports/the-state-of-european-govtech
*Remane, G., Schneider, S., & Hanelt, A. (2022). Digital Business Model Types: Understanding Their Mechanisms As Recipes To Commercialise Digital Technologies. *International Journal of Innovation Management*, *26*.

https://doi.org/10.1142/S1363919622400199
*Santiso, C. (2022). Govtech against corruption: What are the integrity dividends of government digitalization? *Data & Policy*, *4*, e39, Article e39. https://doi.org/10.1017/dap.2022.31
*Sawy, O., & Pereira, F. (2013). VISOR: A Unified Framework for Business Modeling in the Evolving Digital Space. In (pp. 21-35). https://doi.org/10.1007/978-3-642-31765-1_3
*Stuck, J., & Dieke, A. K. (2023). *GovTechs in Germany, France and the UK*. https://www.wik.org/en/publications/publication/govtechs-in-deutschland-frankreich-und-grossbritannien-nr-507
*Svahn, M., Larsson, A., Macedo, E., & Bandeira, J. (2023). *Construct hunting in govtech research: An exploratory data analysis* Electronic Government (EGOV 2023),
*Teece, D. J. (2010). Business Models, Business Strategy and Innovation. *Long Range Planning*, *43*(2-3), 172-194.
*Veit, D., Clemons, E., Benlian, A., Buxmann, P., Hess, T., Spann, M., Kundisch, D., Leimeister, J. M., & Loos, P. (2014). Business models: An information systems research agenda. *Business & Information Systems Engineering*, *6*, 45–53. https://doi.org/10.1007/s12599-013-0308-y
*Vendrell-Herrero, F., Parry, G., Bustinza, O., & Gomes, E. (2018). Digital business models: Taxonomy and future research avenues. *Strategic Change*, *27*, 87–90. https://doi.org/10.1002/jsc.2183
VHB. (2022). *Verband der Hochschullehrer für Betriebswirtschaft e. V.: Alphabetische Gesamtliste der Fachzeitschriften in VHB-JOURQUAL3*. Retrieved July 2, from http://vhbonline.org/service/jourqual/vhb-jourqual-3/gesamtliste/
Weber, M., Beutter, M., Weking, J., Böhm, M., & Krcmar, H. (2022). AI Startup Business Models. *Business & Information Systems Engineering*, *64*(1), 91-109. https://doi.org/10.1007/s12599-021-00732-w
Webster, J., & Watson, R. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, *26*. https://doi.org/10.2307/4132319
Weking, J., Mandalenakis, M., Hein, A., Hermes, S., Böhm, M., & Krcmar, H. (2019). The impact of blockchain technology on business models – a taxonomy and archetypal patterns. *Electronic Markets*, *30*(2), 285-305. https://doi.org/10.1007/s12525-019-00386-3
*Wirtz, B. W., Pistoia, A., Ullrich, S., & Göttel, V. (2016). Business Models: Origin, Development and Future Research Perspectives. *Long Range Planning*, *49*(1), 36-54. https://doi.org/https://doi.org/10.1016/j.lrp.2015.04.001
*Yoshida, M., & Thammetar, T. (2021). Education Between GovTech and Civic Tech. *International Journal of Emerging Technologies in Learning (iJET)*, *16*(04), pp. 52-68. https://doi.org/10.3991/ijet.v16i04.18769
*Yoshida, M., & Theeraroungchaisri, A. (2021). Socialised creation literacy appeared during the covid-19 emergency: A case report. *International Journal of Information and Education Technology*, *11*(2), 96–101. https://doi.org/10.18178/ijiet.2021.11.2.1495
*Zott, C., Amit, R., & Massa, L. (2011). The Business Model: Recent Developments and Future Research. *Journal of Management*, *37*(4), 1019-1042. https://doi.org/10.1177/0149206311406265

Appendix A

Tab. 3 – Analysed GovTech Startups.

No.	Startup	Website	No.	Startup	Website
1	&effect	www.and-effect.com	46	JobKraftwerk	www.jobkraftwerk.com
2	Academa	www.academa.de	47	Komuno	www.komuno.de
3	Agvolution	www.agvolution.com	48	Leistungslotse	www.leistungslotse.com/en
4	Aleph Alpha	www.aleph-alpha.com	49	LiveEO	www.live-eo.com
5	Ankaadia	www.ankaadia.com	50	Locaboo	www.locaboo.com
6	Ark Climate	www.ark-climate.de	51	MeinBafög	www.meinbafoeg.de
7	AUTHADA	www.authada.de	52	Natix	www.natix.network
8	Bable	www.bable-smartcities.eu	53	NECT	www.nect.com/en
9	Better@Home	www.behome.info/	54	NETQUES	www.netqu.es
10	Breeze Technologies	www.breeze-technologies.de	55	Nextcloud	www.nextcloud.com
11	Brifle	www.brifle.de/en	56	Ororatech	www.ororatech.com
12	Brighter AI	www.brighter.ai	57	Plan4 Software	www.plan4software.de
13	Bundle	www.bundleregional.com	58	Plan4Better	www.plan4better.de
14	Certif-ID	www.certif-id.com	59	Polyteia	www.polyteia.com
15	Civocracy	www.civocracy.org	60	Preventio	www.preventio.de
16	codefy	www.codefy.de/en	61	Senf.app	www.senf.app
17	Comuneo	www.comuneo.org	62	ShiftDigital	www.shift-studio.de
18	Constellr	www.constellr.com	63	Silberfluss	www.silberfluss.io
19	Convaise	www.convaise.com/en	64	Smart City System	www.smart-city-system.com
20	Credium	www.credium.de	65	SONAH	www.sonah.tech
21	CrowdInsights	www.crowdinsights.de	66	SpotAR	www.spotar.io
22	Deine Studienfinanzierung	www.deinestudienfinanzierung.de	67	Stadt.Land.Netz	www.stadtlandnetz.de
23	DKSR	www.dksr.city/en	68	Summ AI	www.summ-ai.com/en
24	Door2door	www.door2door.io/en	69	Syte	www.syte.ms
25	Edgeless Systems	www.edgeless.systems	70	talent::digital	www.talentdigital.eu
26	Enclaive	www.enclaive.io	71	TaxFix	www.taxfix.de/en
27	ENEKA	www.eneka.de	72	Trail	www.trail-ml.com
28	famigo	www.famigo.info	73	TreeSense	www.treesense.net
29	FixMyCity	www.fixmycity.de	74	Tucan.ai	www.tucan.ai
30	Förderfunke	www.foerderfunke.org	75	Urbanistic	www.urbanistic.de
31	Geospin	www.geospin.de/en	76	Verimi	www.verimi.de/en
32	Global Goals Directory	www.globalgoals.directory	77	Vialytics	www.vialytics.com
33	GovMind	www.govmind.tech	78	Vianova	www.vianova.io
34	GovRadar	www.govradar.net	79	Viind	www.viind.com
35	GovShare	www.govshare.org	80	Vilisto	www.vilisto.de
36	Green City Solutions	www.greencitysolutions.de/en	81	VISARIGHT	www.visaright.eu
37	green gis	www.green-gis.de	82	Vote Rookie	www.voterookie.org
38	Groundkeeper	www.groundkeeper.net	83	Votebase	www.votebase.com
39	Hawa Dawa	www.hawadawa.com	84	XignSys	www.xignsys.com
40	HeiDi	www.heimat-digital.com	85	zdov	www.zdov.de
41	Helsing AI	www.helsing.ai			
42	hro.solar	www.hro.solar			
43	IDLoop	www.idloop.com			
44	Immovativ	www.immovativ.de			
45	Integreat	www.integreat-app.de/en			