

Journal of Engineering Research

PROMOTING WATER AND SANITATION FOR ALL: INSIGHTS FROM GERMAN EXPERTISE

Otávio Henrique Campos Hamdan
German Chancellor Fellowship, Alexander
von Humboldt Foundation, Germany

All content in this magazine is licensed under a Creative Commons Attribution License. Attribution-Non-Commercial-Non-Derivatives 4.0 International (CC BY-NC-ND 4.0).



Abstract: The sixth Sustainable Development Goal aims to promote access to safe drinking water and sanitation for all. The disparities in access to these services worldwide are evident: while developed countries have service rates above 85%, underdeveloped countries do not even reach 30%. In this sense, this study aims to explore elements related to the universalization process of water and sewage services in Germany. To achieve this, the research is based on information collected through interviews and literature review. As a result, 11 aspects of water supply and sewage services in Germany were identified and grouped into three categories: governance, financial resources, and social interface. This approach enabled the identification and visualization of German strategies in the sector, which can be analyzed by other countries and replicated after carefully assessing their relevance in a new context.

Keywords: water, sanitation, universalization, SDG, Germany.

INTRODUCTION

Access to water and sanitation is an essential human right, as stated by the United Nations (UN, 2010). The UN asserts that everyone has the right to sufficient, safe, acceptable, affordable, and accessible water. It also emphasizes that access to sanitation, in addition to being fundamental to human dignity and privacy, is the main mechanism for protecting the quality of water resources (UN, 2002). However, indicators reveal that access to water services and adequate sanitation facilities around the world remains a distant reality for many people. In total, 2.1 billion people lack access to safe drinking water, 4.5 billion lack safe sanitation, and 892 million still practice open defecation (UN, 2018).

To address this issue, one of the 17 Sustainable Development Goals proposed by the UN focuses on Clean Water and Sanitation.

The sixth goal, also known as SDG6, aims to ensure availability and sustainable management of water and sanitation for all. The first two targets of this goal aim to *achieve universal and equitable access to safe and affordable drinking water for all* and *ensure access to adequate and equitable sanitation and hygiene for all, including an end to open defecation, with special attention to the needs of women, girls, and vulnerable populations* (UN, 2022). However, according to Moyer and Hedden (2020), these targets, along with others related to different SDGs, are not likely to be achieved within the designated timeframe. The current pace of improvements in the sector is insufficient to ensure universal access to water and sanitation by 2030.

One way to accelerate this process is through the expansion of international cooperation in the sector - which is also a goal set in SDG6. The reason for expanding these cooperations stems from the significant discrepancy in access to water and sewage services in different regions of the globe. In 2020, 98% of the population in high-income countries had access to safe water, while only 29% of the population in low-income countries had access to this service. The inequality persists when assessing the sanitation service, with 87% and 18% of the populations of high-income and low-income countries, respectively, having access to safe sanitation facilities (Wash Data, 2021). Based on these data, it is evident that the transfer of knowledge from countries that have already achieved the universalization of water and sewage services (or are close to) represents a promising approach to achieve the goals set for SDG6.

In this context, the following question arises: what could these countries share? To address this, this study conducted an analysis on access to water supply and sanitation services in Germany. Germany has over 99%

of its population having access to safe water and over 91% with access to safe sanitation facilities (Wash Data, 2021). By collecting data, this work aims to present the factors that have enabled Germany to achieve such high service rates for these essential services.

METHODOLOGY

BENCHMARKING PROCESS

In the business sphere, Spendolini (1993) points out that benchmarking is a tool for evaluating the services, products, and processes of organizations that exhibit best practices. Additionally, Araujo (2001) emphasizes that the benchmarking technique should explore, understand, and analyze the solutions of a company [or in this study, a country] when faced with a problem. Therefore, the tool was used to evaluate the universalization of water and sewage services in a reference country, facilitating the dissemination of strategies and policies regarding these services.

As outlined by Camp (1998), the benchmarking process consists of 10 steps. The process starts with the identification of the benchmarking object and concludes with the implementation of specific actions identified throughout the process, with one of the intermediate steps involving data collection - in this crucial step, good practices adopted in the reference organization are identified, which will support the action plan for another organization. The following section presents how the data collection was carried out.

DATA COLLECTION

The methods utilized for data collection and analysis were Grounded Theory and exploratory review. Grounded Theory is a qualitative research approach that employs systematic procedures to comprehend a phenomenon based on interviews. In this study, the phenomenon under examination

was the strategies used in Germany to provide drinking water and sanitation services for all. The process involved conducting interviews and sending core questions to organizations involved in the water sector in Germany. This stage was conducted in three steps (BMJ, 2020):

1. Open coding to identify concepts and key aspects.
2. Axial coding to identify relationships and connections between all collected information.
3. Selective coding to categorize the information.

The main category identified in this research was the expansion of water and sanitation services in Germany, and it was further subdivided into three subcategories: Governance, Financial Resources, and Social Interface. The Governance aspect is related to political and institutional issues. The Financial aspect involves evaluating tariffs and investments. Lastly, the Social aspect focused on approaches towards the population, considering local needs, and ensuring the provision of high-quality service.

In the exploratory literature review, publications related to the water and sanitation sector in Germany were searched in both English and German, using keywords relevant to the topic. Additionally, during the contact with the interviewed institutions, suggestions for further reading materials on the subject were requested.

Next, theoretical sensitivity was applied to connect the findings from the exploratory review with the outcomes of the interviews. All the insights gathered during this stage were recorded and are available in the Results and Discussions section.

RESULTS AND DISCUSSION

THE WATER SECTOR IN GERMANY

The quality of water supply and sanitation services in Germany, beyond the technical aspects, is corroborated by users. According to ATT et al. (2021), 85% and 72% of consumers are satisfied with the cost-effectiveness of water supply and sewerage services, respectively. Also, according to the same publication, 83.9% of consumers are satisfied with the quality of the water received, which justifies the fact that 9 out of 10 consumers use tap water as a source of drinking water.

To serve more than 80 million inhabitants, Germany has 540,000 kilometers of water networks and 590,000 kilometers of sewage networks spread over 357,588 km² of the Germanic country. And this structure has been growing, the country has been investing about 8 billion euros annually in the sector, with an average of 2.5 billion euros being invested in water piping, storage, and treatment. In total, there are 5.2 billion m³ of water collected annually for public supply by 5,845 water companies and 10 billion m³ of sewage treated in more than 9,300 plants. It is also important to note that 1.8 million people in Germany use individual systems instead of centralized collection, such as septic tanks. (UBA, 2017; ATT et al., 2021).

Having understood this scenario, the next topics address the relevant aspects for the process of expansion of these services in Germany.

GOVERNANCE

Assessing the governance of water supply and sanitation services, which involves management, policy framework and institutional aspects, requires a look at the early days of the subject in the country. Wackerbauer (2011) reports that the water supply sector in Germany experienced significant development during the 19th century, as the government recognized it as a municipal service of public interest. With the industrial revolution and frequent epidemics, municipalities took over essential services such as waste and sewage collection, as well as water supply (Wackerbauer, 2011). Here, there is already an important sign of the role of municipalities in the universalization of services, which is confirmed in the following centuries. In this respect, a first point to be highlighted as contributing to the expansion of these services in Germany is the responsibility and structuring of the sector at the different levels of the federation.

Currently, water supply and sewage collection and treatment services in Germany are primarily considered public services, with municipalities generally holding the competence for their provision - in accordance with the German Basic Law's principles of local self-government. However, their public nature doesn't exclude private participation in the sector. Municipalities have the autonomy to implement and organize the local provision of services, keeping in mind the well-being of the population.

The business models for water supply and sanitation, as defined by municipalities or representatives, can be established under public or private law. One key distinction lies in the way the relationship with the user is established. Companies organized under private law charge users through a tariff for consumption, construction costs, and network connection. On the other hand, companies

organized under public law collect fees from users related to the operation, maintenance, and renewal of water supply and sewerage services. Alternatively, they can opt for a consumption-based tariff governed by private law rules. Furthermore, companies organized under public law are monitored by the municipal authority and the administrative court, while companies organized under private law are monitored by the civil court and cartel authority. This regulatory oversight helps to prevent abusive tariff practices (ATT et al., 2021).

Overall, 43% of the water produced in the country is the responsibility of companies governed by public law, while 57% is managed by companies governed by private law. The public-private partnership model and cooperation between municipalities and associations also play significant roles. Specifically, the public-private partnership accounts for 22% of the water production in the country. In this model, the private sector handles the operation of the system, while administrative tasks remain the responsibility of the municipality. On the other hand, cooperation between municipalities and associations, known as *Zweckverband* in German, is responsible for 19% of the water production and 39% of the sanitation sector. This cooperative approach is primarily comprised of companies governed by public law, with a few exceptions. Such diversity within the water supply and sanitation sector in Germany involves multiple stakeholders in service provision, which might be one of the contributing factors to the successful expansion of these services in the country (ATT et al., 2021).

The responsibility of the municipality in the provision of services and the modalities that can be used for this provision are well outlined. But what would be the role at federal and federated state level? According

to BMU and UBA (2001), the government is responsible for enacting laws and defining the main tasks and objectives of the sector, while the federated states are responsible for regulation. This makes the decision-making process in the sector decentralized and ensures a solid local basis for service provision - a perception confirmed in an interview with the DBVW (German Alliance of Water Management Association). However, this decentralization means that German companies in the sector do not have as much participation in the global market. Normally, they are not interested in the global market and are focused on providing services within the country (Wackerbauer, 2011).

Setting the global market aside, it is important to note that the structuring of the sector in Germany is clearly a factor favoring the universalization of services. This is because weak institutional structures and poorly delineated responsibilities can act as a bottleneck in promoting water and sanitation services for all, as pointed out by experts at the 5th Global WOPs Congress in Bonn, Germany. This lack of clarity regarding roles and responsibilities is also highlighted in documents by the International Water Association and UN-Habitat (IWA, 2022; UN-Habitat, 2023). To address this, the obligations of each stakeholder need to be clearly defined and recorded, through laws, contracts, or other legal instruments.

Another point that contributed to the expansion of water and sewage services in Germany is the legal basis. The German Constitution provides for a series of human rights in its articles but does not explicitly address the human right to water. However, the interpretations of German courts, and even legal doctrine, have understood water as a service of elementary necessity and of general interest. Services of general interest, from the German word *Daseinsvorsorge*, are prioritized

services of general interest are prioritized, which also include transportation, gas supply, electricity, waste collection, educational and cultural facilities, hospitals, cemeteries, fire department, and other services (OHCHR, 2007). This prioritization is seen as essential for achieving universalization. Around the world, it is observed that public policies and the legal framework do not prioritize water and sanitation services and sometimes do not recognize the importance of these services for public health, poverty eradication and inequality reduction (IWA, 2022).

Complementing this aspect, the German government published in 2023 the National Water Strategy, which presents among its objectives the reduction of pollution in water bodies and the guarantee of public water services to the population in the long term, even in the face of climate change (BMVU, 2023). In all, ten strategic issues were established, some of which interface with the water supply and sanitation service. And how does this strategy relate to the universalization process? Germany already realizes that climate change, extreme events and other phenomena expected in this century may compromise the availability of water for the population and the quality of water bodies. Therefore, the country is anticipating in order to maintain the availability of water and sanitation services for the population. Figure 1 presents a compilation of strategies related to this matter.

As can be seen in Figure 1, among the strategies presented in the document, there is a mention of the Sustainable Development Goals (SDGs). In this sense, Germany's performance in relation to Sustainable Development Goal No. 6 (SDG 6) should be highlighted. This relates to the governance aspect, involving monitoring and international relations policy. Clearly, many of the targets set for SDG 6 are no longer a concern in Germany

– for instance, targets 6.1 and 6.2 (which deal with access to water and sewage services) are considered to have been achieved. The main focus of Germany is now on target 6.3, which deals with improving water quality.

Regardless of the country's internal focus, it is relevant to note that Germany is one of the countries that donates the most for cooperation and development in the water sector worldwide. Between 2013 and 2017, the country donated more than 3.3 billion euros to partner nations to invest in improving people's access to drinking water and sanitation (German Federal Government, 2021). Moreover, Germany sponsors UN resolutions on the human rights to safe drinking water and adequate sanitation and hosts the Global Water Operators' Partnerships Alliance (GWOPA) in Bonn. Ratifying the importance of these actions by Germany, UN-Habitat (2023) highlights that international cooperation, investment in research, and collaboration will be enablers for the advancement of the sector around the world.

FINANCIAL RESOURCES

Regarding the financial aspect, two main issues were considered in this study: tariffs and investments. These aspects form the foundation of the service expansion process because, without investments, there can be no universalization, and without charging for the service, there can be no economically sustainable service provision.

Regarding tariffs, it was observed that the collection processes vary in each state. Typically, the tariff (which is the primary source of investment in the sector) is established by the state agency responsible for the economy through a request for tariff adjustment. Some characteristics of tariff structuring in Germany are as follows (GRDC, 2002):

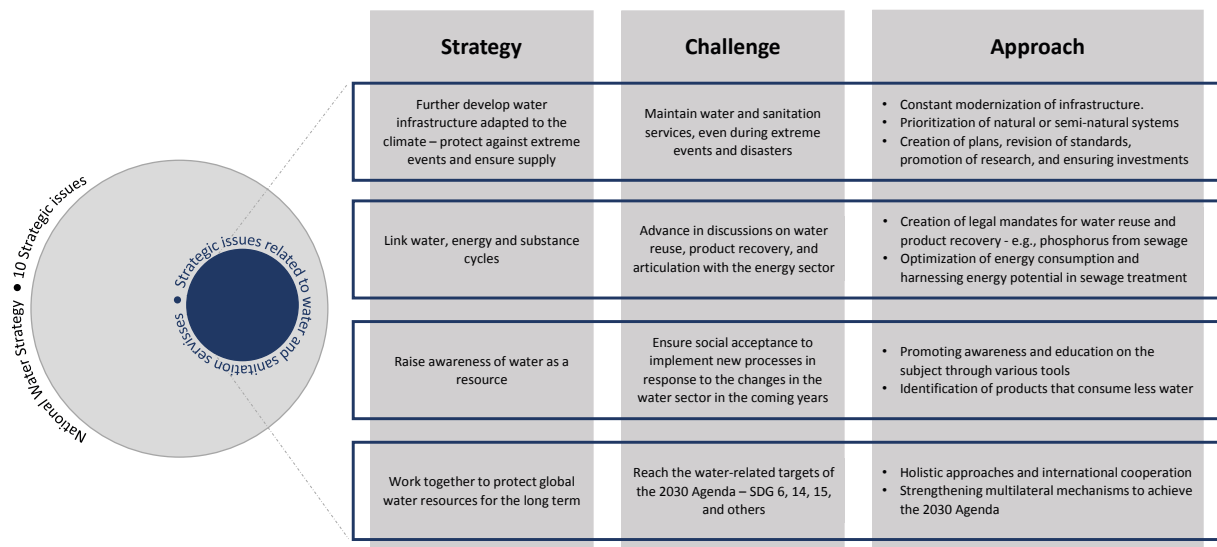


Figure 1: Strategies related to water and sanitation services.

Source: Produced by the author, based on BMVU (2023).

LEGAL BASIS	BRIEF DESCRIPTION
German Drinking Water Ordinance	Outlines the fundamental requirements concerning water quality
Urban Wastewater Directive	Sets uniform minimum standards for Member States of the European Union
German Wastewater Ordinance	Establishes the implementation of the Urban Wastewater Directive and the German Federal Water Act, covering sampling methods, analysis, measurement processes, technical standards, and requirements for sewage disposal
EU Directive 2020/2184	Emphasizes the responsibility of federated states to consider local, regional, and cultural factors in water distribution, and to implement measures to improve or maintain access to water for all, especially vulnerable and marginalized groups
EU Directive 135/42	Establishes a specific objective to ensure that all settlements have urban wastewater collection systems by 2005

Table 1: Ordinances and guidelines for the provision of water and sanitation services

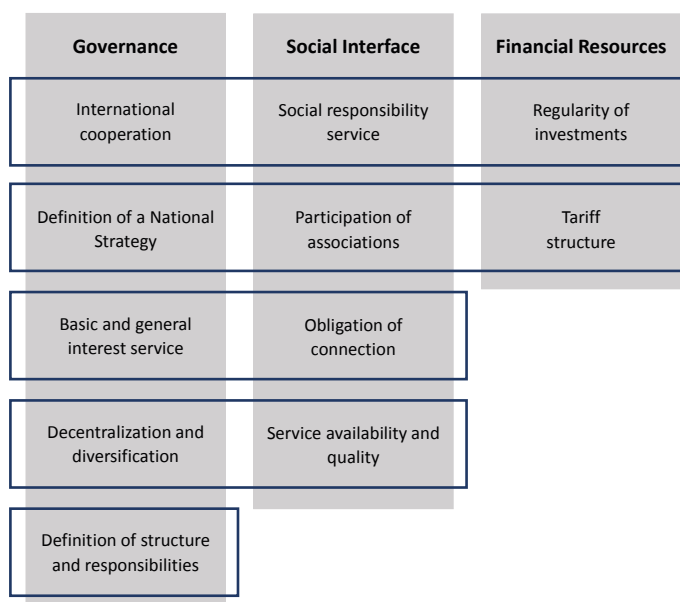


Figure 2: Central aspects related to the expansion process of water and sanitation services in Germany

1. Tariffs are calculated to cover the full costs of water supply and sanitation services, without considering the economic capacity of users. Consequently, services are significantly more expensive in the eastern part of Germany, where high investments were required after reunification.

2. The legislation of the federated states establishing the calculation of tariffs does not incorporate a variable based on the level of efficiency of service provision.

3. Historically, water supply services in Germany have received limited subsidies.

Some points need to be discussed regarding these characteristics. Considering the maturity of water and sanitation services in Germany, the above approach can be justified. However, the reality of developing and underdeveloped countries may necessitate a different approach, such as considering the economic capacity of users when setting tariffs. Additionally, implementing tariff mechanisms to consider the efficiency of the service provider and subsidizing the sector may also be crucial strategies for countries that have not yet achieved universal water and sanitation services.

Regarding costs, as mentioned in characteristics of tariff structuring, it is interesting to observe the conditions that influence their determination. According to ATT et al. (2021), six factors influence the cost of water supply and sewage services. These factors are: (i) water consumption, (ii) legal requirements, (iii) investment and modalities for the average cost of capital, (iv) necessary adaptations to climate change and demographic variations, (v) natural environment, and (vi) local structure.

In terms of numbers, compared to other countries in the European Union, users in Germany pay less for these services: 127 liters of water (average daily consumption per

person in Germany) cost 33 euro cents, and the disposal of sewage generated by this same consumption costs 37 euro cents (ATT et al., 2021).

Moving on to investments in the sector, one aspect that draws attention is the constancy of annual investments. A graph presented by ATT et al. (2021) reveals that between 1990 and 2018, annual investments of between 2.0 and 2.9 billion euros were made in water supply systems. The regularity of investments is undoubtedly a key factor for universalization. In short, the highest percentage of investment was made in water distribution networks, i.e., investment in network renewal and expansion. When it comes to sanitation, investments are also evident: between 1970 and 1994, municipalities in the former West Germany invested more than 78 billion euros (just over 3 billion annually) in the construction, expansion, and renewal of sewage systems (BMU and UBA, 2001).

SOCIAL INTERFACE

To conclude the discussion on the process of expanding water and sanitation services in Germany, the social aspects assessed during this study are presented. This aspect covers the interface of services with society, especially in places typically underserved by public services, as well as the quality of the service delivered to the population.

One notable perception is that the country views water supply and sanitation as a social responsibility (ATT et al., 2021). This goes beyond addressing public health issues and highlights the perspective that water and sanitation services are essential for social development and economic progress. This perspective has a significant impact on service provision and its connection to the universalization process. Considering services as a social responsibility prioritizes this activity, acknowledging that water

supply and sanitation are fundamental for development. Consequently, decision-making processes related to these services are driven by social considerations, which promotes the development of public policies that align with the needs of the population.

Another social aspect that deserves mention, and which contributes to the high level of service for water and sanitation in Germany, is the participation of associations in the sector. Associations play a crucial role in the German water sector. Apart from serving as an umbrella organization where institutions formally collaborate to coordinate activities and pool resources, some associations demonstrate an integrated approach to water. One such example is the DBVW - German Alliance of Water Management Associations, which focuses on themes such as water supply, sewage treatment, river and coastal protection, water body maintenance, and irrigation. The DBVW, interviewed for this research, is part of the EUWMA (European Union of Water Management Association) but also brings together smaller organizations like WVT - *Wasserverbandstag*. The *Wasserverbandstag* represents the interests of approximately 1000 members from the federal states of Bremen, Lower Saxony, and Saxony-Anhalt, supporting the implementation of tasks related to the maintenance of water bodies, water supply, sanitation, flood and coastal protection, landscaping, and groundwater balance. These associations are governed by federal law to ensure community participation in discussions and decisions. Additionally, the associations play a central role in regulating the sector in Germany. There is a responsibility of the federal states to regulate services, but the overall functions are decentralized - tariffs interface with the state economic agency, water quality monitoring is directly overseen by public health departments in the municipality, and the development of

technical standards falls under the purview of associations - specifically the DWA (German Association for Water, Wastewater, and Waste) and DVGW (German Technical and Scientific Association for Gas and Water) (BMU and UBA, 2001; ATT et al., 2021).

Going beyond associations and social approaches, it is important to note that the interface with society also ensures a quality service to the population and guarantees the protection of public health. In this regard, a fundamental premise of sewage services in Germany is the obligation to connect. Connecting to the sewerage system is mandatory. Therefore, all property owners within the jurisdiction of a given municipality are obligated by statute to connect their property to the local wastewater treatment system. There are exceptions, but as a general rule, mandatory connection is a duty delegated to municipalities and is part of the public health protection policy (BMU and UBA, 2001). Additionally, regulations for the construction of new buildings ensure that no residential property can be built without adequate water supply (German Environment Agency, 2017).

Moreover, concerning the availability and quality of service, service providers in Germany must adhere to ordinances and guidelines. Table 1 presents a summary of these instruments, highlighting the country's concern with the quality of services as well as achieving universal service (EUR-Lex, 1991; BMU and UBA, 2001; EUR-Lex, 2020; ATT et al., 2021).

In Germany, not adhering to established standards, like those outlined in the ordinances presented in Table 1, can lead to administrative action. In certain circumstances, the violation of the minimum standards is considered a crime and is subject to prosecution by the authorities (BMU and UBA, 2001).

REPLICATION OF BEST PRACTICES

In total, 11 themes were identified in Germany that contributed to the high level of access to water supply and sanitation services for the population. Some of these aspects are more developed than others and may be easier to replicate in other contexts. Figure 2 provides a compilation of the key aspects identified throughout this study.

It is important to consider that actions related to water and sanitation services require a deep understanding of local needs and challenges. There's no one-size-fits-all solution, but there's definitely a lot to learn from each other. Thus, it should be noted that the entire context presented in this study contributed to the expansion of water and sewage services in Germany. However, replicating these strategies is not a simple task and should not be carried out arbitrarily. As reinforced in consultation with the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety, and Consumer Protection (BMUV), geography, history, governance, and social reality vary, presenting particular opportunities and challenges for the universalization of services. Therefore, the main insights into the German strategies for expanding water and sanitation services need to be carefully evaluated for replication in other contexts.

CONCLUSION

At the end of this study, it becomes evident that the high percentage of the population with access to water supply and sewage services in Germany is attributed to a series of strategies adopted in the country. Notable aspects include international cooperation, national strategies, defining the service as a general interest, sector decentralization, clear delineation of responsibilities at various levels, consistent investments, recognizing the service as a social responsibility, active participation of associations, obligatory connection to sanitary sewage services, and ensuring service availability and quality.

While the replication of these strategies in other contexts is encouraged, as supported by SDG6 and UN-Habitat, it is essential to consider that each context has its unique peculiarities that necessitate careful consideration. For instance, the tariff structure utilized in Germany might not be suitable for underdeveloped or developing countries, where users' economic capacity must be taken into account. Hence, understanding these successful practices and critically analyzing the specific contexts are crucial for the successful implementation of initiatives in the sector.

ACKNOWLEDGMENT

This study was supported by the Alexander von Humboldt Foundation. The author would like to express gratitude to the foundation for funding this research, as well as to F.A.S.T GmbH, especially Edmund Riehle, for the invaluable support in conducting this study.

REFERENCES

Araujo, L. C. G. Benchmarking: ser o melhor entre os melhores. Organização, sistemas e métodos e as tecnologias de gestão organizacional [*Benchmarking: being the best among the best. Organization, systems and methods and technologies of organizational management*]. São Paulo: Atlas, 2001.

ATT, BDEW, DBVW, DVGW, DWA & VKU. Profile of the German Water Sector (2021). Retrieved November 15, 2022, from https://www.bdew.de/media/documents/6000_Sector_profile_of_the_German_water_sector_published_in_English.pdf.

BMJ. What is grounded theory? (2020). Retrieved August 20, 2020, from <https://ebn.bmj.com/content/19/2/34>.

BMU & UBA. The German Water Sector – Policies and Experiences (2001). Retrieved November 15, 2022, from <https://www.umweltbundesamt.de/sites/default/files/medien/publikation/long/2752.pdf>.

BMVU. National Water Strategy (2023). Retrieved June 20, 2023, from https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Binnengewasser/nationale_wasserstrategie_2023_en_bf.pdf.

Camp, R. C. (Ed.). Global cases in benchmarking: Best practices from organizations around the world. Milwaukee: ASQ Quality Press, 1998.

EUR-Lex. Directive 91/271/EEC concerning urban waste-water treatment (1991). Retrieved June 20, 2023, from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31991L0271&qid=1689767721341>.

EUR-Lex. Directive (EU) 2020/2184 of the European Parliament and of the Council of 16 December 2020 on the quality of water intended for human consumption (2020). Retrieved June 20, 2023, from <https://eur-lex.europa.eu/eli/dir/2020/2184/oj>.

German Environment Agency. Water Resource Management in Germany (2017). Retrieved June 20, 2023, from https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/wasserresourcenmanagement_germany_digital_aktualisiert.pdf.

German Federal Government. Report on the implementation of the 2030 Agenda for sustainable development (2021). Retrieved June 20, 2023, from https://sustainabledevelopment.un.org/content/documents/279522021_VNR_Report_Germany.pdf.

Glaser, B. G. & Strauss, A. L. The discovery of grounded theory: Strategies for qualitative research New York: Aldine de Gruyter, 1967.

GRDC. Water Resources Management: Country Profile Germany - a contribution to the Global Water Information Network (2002). Retrieved July 16, 2023, from https://www.bafg.de/GRDC/EN/02_srvcs/24_rprtstrs/report_27.pdf?__blob=publicationFile.

IWA. Workshop on Sanitation in Urban Informal Settlements - pointing at realistic solutions for accelerating improvements (2022). Retrieved June 20, 2023, https://iug.dk/media/116138/workshop-summary-report_final.pdf.

Moyer, J. D. & Hedden, D. Are we on the right path to achieve the sustainable development goals? *World Development*, 123, 2020.

OHCHR. Human Rights and Access to Water – Comments by the Federal Republic of Germany (2007). Retrieved May 13, 2023, from <https://www2.ohchr.org/english/issues/water/contributions/Germany.pdf>.

Spendolini, M. J. Benchmarking. São Paulo: Makroon Books, 1993.

UBA. Umweltbundesamt (2017). Retrieved June 20, 2023, from https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/wawi_flyer_eng_web_aktualisiert.pdf.

UN. United Nations (2002). General Comment No. 15. The right to water. Retrieved June 20, 2023, from [http://www.unhchr.ch/tbs/doc.nsf/0/a5458d1d1bbd713fc1256cc400389e94/\\$FILE/G0340229.pdf](http://www.unhchr.ch/tbs/doc.nsf/0/a5458d1d1bbd713fc1256cc400389e94/$FILE/G0340229.pdf).

UN. United Nations (2010). Resolution A/RES/64/292: The human right to water and sanitation.

UN. United Nations (2018). SDG 6 Synthesis Report 2018 on Water and Sanitation. Retrieved June 20, 2023, from <https://www.unwater.org/publications/sdg-6-synthesis-report-2018-water-and-sanitation>.

UN. United Nations (2022). The Sustainable Development Goals Report 2022. Retrieved July 14, 2023, from <https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf>.

UN-Habitat. Global Report on Sanitation and Wastewater Management in Cities and Human Settlements (2023). Retrieved June 20, 2023, from https://unhabitat.org/sites/default/files/2023/06/water_report_web.pdf.

Wackerbauer, J. Die deutsche Wasserwirtschaft im europäischen Vergleich. *Journal for Public and Nonprofit Services*, 34, 2011.

Wash Data. Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (2021). Retrieved July 14, 2023, from <https://washdata.org/data/household#!/>.