

Affordances of e-reporting on a supranational level: the case of Reportnet

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Abstract

An increasing emphasis on data driven and evidence-based policy making gives information and information systems a key role in governance processes. It is also argued that digital governance can support the implementation of the Sustainable Development Goals (SDGs). A number of grand challenges, such as climate change, need to be addressed at an international level. In climate governance, reporting has a central role to monitor progress, both under the Paris Agreement at a global level, and within the European Union (EU). Within the EU, reporting is also used to assess implementation and compliance with EU regulations. This paper is based on an interpretive study of the e-reporting platform, Reportnet, which is used to manage climate reporting within the EU. Affordance theory is applied as an analytical lens to uncover the possibilities of e-reporting in a supranational context. Our study identified six key affordances in the areas of submission of reports, quality controls, compliance, monitoring, transparency and communication and visualization. The study also suggests that an important area for improvement is to make the reported information more usable, particularly in further policy processes.

Keywords

Digital governance, e-reporting, affordances, EU climate governance

1. Introduction

The Sustainable Development Goals (SDGs) has been adopted within the United Nations (UN), as a global agenda for action towards 2030 [1]. Arguably, digital governance can facilitate the implementation of the sustainable development goals [2, 3], but more research is needed on how this is materializing in practice. Goal 13 of the SDGs is climate action [1].

The European Union (EU) works strategically to align digitalization with climate action [4, 5]. The strong emphasis on evidence-based and data driven policy making, implementation and evaluation [6], suggests that digital technologies have a key role in governance. However, little research has been done on IT's role for policy activities [7], in particular in the area of environmental policy, where there is a significant implementation gap [8]. One of the problems in environmental policy implementation relates to reporting, with problems of completeness, timeliness, comparability, and accuracy of data [8, 9]. It is argued that possibilities of digital technologies to improve data quality and to track progress of policy implementation should be further investigated [10].


EGOV-CeDEM-ePart 2022, September 06–08, 2022, Linköping University, Sweden (Hybrid)

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 CEUR Workshop Proceedings (CEUR-WS.org)

The UN Paris Agreement sets a global climate goal that individual nations work towards. A central element of the Paris Agreement is that countries are required to report on their emissions, commitments, and actions in order to monitor progress [11]. EU member states also report to the EU, which is used to compile the EU's international reporting and assess compliance with EU climate legislation, which ensures the EU's international commitments [12]. Environmental reporting is used to monitor the state of the environment, assess compliance with regulation, evaluate policy effects and effectiveness [13, 14], and inform policy makers to take adequate measures and decisions [15]. The use of digital technologies in reporting situates e-reporting in the digital governance field [16]. E-reporting offers means to enhance transparency and accountability on how governments perform in achieving policy goals, and hence handling societal challenges [17, 18]. However, challenges with information quality, administrative burden and issues of interoperability have been raised [19, 20], and it is worthwhile to further investigate how possibilities and challenges with e-reporting are applied and addressed to support governance.

The European Union's (EU) digital platform for climate reporting, Reportnet, was selected as a case for studying e-reporting in the context of climate governance. Reportnet was launched in 2002 and has undergone 2 major updates. The current version, Reportnet 3.0, is expected to improve efficiency and coherence by streamlining and simplifying reporting in accordance with the goals in the Digital Strategy [21]. The information reported to Reportnet is a foundation for evidence based and data driven policy processes. The EU is further considered an appropriate case for a study in a global governance context because it represents a supranational level which has legal authority as a means for implementation of international agreements.

A promising theory for analyzing and understanding possibilities with digital technologies in certain contexts is affordance theory. Affordances can be described as action possibilities [22] that emerge in the relation between technology and goal-oriented users [23]. This study therefore adopts affordance theory as an analytical lens to understand the possibilities that digital technologies offer in a supranational climate governance context. The research question guiding the paper is 'What affordances does Reportnet provide in a supranational climate governance context?' The rest of the paper is structured as follows: first we introduce related research relevant to the topic, then the theoretical lens and description of method. This is followed by reporting of results, discussion, conclusions and implications for research and practice.

1.1. E-reporting

In the digital governance literature, studies about reporting address different types of relationships, such as government reporting to the public (G2C), citizen reporting to public agencies (C2G), and business reporting to government (B2G). Government reporting enables transparency, accountability [24, 25], and communication of government performance [26]. Measuring and reporting on performance enable governments to show results, increase transparency, validate policy decisions, and build trust [17]. E-reporting provides tools for data analysis [27], utilizes ICT to advance reporting, and offer functions to communicate complex information in comprehensible ways to show how governments achieve their goals [17]. Access to information on how governments perform in handling societal challenges is an important democratic issue,

and central in developing trust between government and citizens [18]. Effective policy activities depend on data and systems that manage the data [28]. A challenge is to convert large volumes of data to actionable information that is made useful to support decision making, transparency and accountability [29]. Although digital technologies provide means for enhanced accessibility, it is important that information is presented in a meaningful way [29, 30]. Essential is also to ensure the accuracy, timeliness, and completeness of the information to secure the trustworthiness of data, which is crucial in building trust with citizens [29]. Electronic reporting is argued to provide means to ensure these qualities better, for instance by support of automated controls. Furthermore, e-reporting is argued to help regulatory agencies to identify violations of compliance more accurately. Automated controls can both check data quality, but also support assessment of compliance with regulations [31, 20]. An important foundation for efficient reporting is standardization, which makes data comparable, and machine-readable formats enable computer supported advanced analysis [32].

A significant challenge with reporting is the administrative burden, and electronic reporting is argued to reduce duplication of reporting, enable seamless transition of data, make the information easier to manage and organize, enable tailored e-reports to different audiences, provide accessibility through the web [20], and reduce costs [25]. Efforts have been made in the EU to streamline and simplify reporting, reduce administrative burden, provide cost-effective solutions, eliminate double reporting, and facilitate exchange of information, semi-automated aggregation of information, and faster availability of information [19].

As environmental problems do not stay within national borders, their resolve require collaboration across countries [15] and hence the exchange of environmental data. In a European context, there are challenges with differences in data structures, languages, workflow, cultures, and approaches to sharing of data. Other challenges are data silos that hinders re-use. Standards are key to enable interoperability and information exchange [28].

To sum up, the literature suggests that e-reporting provides means to communicate how policy goals are achieved and may enhance Government transparency and accountability. Key challenges include issues of information quality, administrative burden as well as interoperability. While the literature contains examples of the possibilities digital technologies represent for reporting and thus also governance, there is a need for a systematic approach to understanding how such possibilities can be identified and categorized. Affordance theory offers this possibility and was therefore selected as our analytical lens.

1.2. Affordance theory

Affordance theory was originally developed by the ecological psychologist J.J. Gibson [33, 34]. Affordances is based on the idea that goal-oriented actors perceive objects in their environment in terms of what the objects afford, how they can be used to meet a goal. Affordances are relational between an object and its user. In the IS domain, affordances emerge in the relation between users and technology [35, 36, 34]. Affordances are perceived related to the intentions and objectives of the user [37]. Volkoff & Strong define affordances as “the potential for behaviors associated with achieving an immediate concrete outcome and arising from the relation between an object (e.g., an IT artifact) and a goal-oriented actor or actors” ([23], p.823). Affordances can be seen as action possibilities [22, 34]. Properties of an object as well as ability of an actor are

necessary conditions for affordances to emerge [38].

A distinction is made between potential and actualized affordances. Actualized affordances require that a user with action capability interacts with the IT artefact to achieve some goal [22]. Otherwise, the affordances will only be latent ([39], p. 132). Some researchers also distinguish between perceived and actual affordances [40]. Perception and actualization of affordances are influenced by social, cultural, organizational, and technical factors, and contextual differences and abilities of users will affect how and to what extent affordances are actualized [41, 34]. Actualization of an affordance may also lead to new affordances and enhanced capabilities [22]. Strong et al. [33] defines actualization of affordances as “the actions taken by actors as they take advantage of one or more affordances through their use of the technology to achieve immediate concrete outcomes in support of organizational goals” ([33], p. 70). Actualization of affordances generate some effect, which relates actions for actualization of an affordance with organizational goals [33]. Affordance theory is used in this paper because it contributes with an understanding of the possibilities of IT artefacts in specific contexts, related to the goals in that context. In this case it is the affordances of Reportnet in a climate governance context, with goals of efficient and high-quality reporting that contributes to a data driven administration and policy processes that supports the achievement of governance objectives.

1.3. Method

The paper is based on an interpretive case study of the EU digital reporting platform Reportnet. Semi-structured interviews were carried out with experts at the European Environment Agency (EEA), an expert at DG CLIMA in the European Commission administration, reporters from eight countries, and an expert reviewer. The organizations were purposefully selected as they are key stakeholders to Reportnet. The European Commission is an important user of the information reported through Reportnet, for assessing compliance and progress towards policy goals. EEA hosts Reportnet and manages reports from EU member states, makes analyses based on the reporting, and develop an aggregated report for the EU (R2). Thereby, EEA is both an expert on the system and a user. The reporters from EU member states are reporting to Reportnet. The expert reviewer carries out review of EU member states' reports to the EU. The respondents are listed in Table 1.

The European Commission, EEA, and authorities responsible for climate reporting in EU member states were contacted with a request for participation in the research and interviews were made with those that the organizations assigned. The eight EU member states that were selected were those that responded to the request. Interviews were carried out and recorded via Zoom and lasted about 50 minutes with some additional follow-up questions by e-mail. Exceptions were one of the reporters (R11) and one of the experts at the EEA (R3), who responded to questions by e-mail. Questions included the role of reporting and Reportnet in a governance context, for instance how it is used in policy evaluation and analysis of progress towards governance goals; what action capabilities Reportnet 3.0 has; how it differs from earlier versions and how this was experienced by users; and what technological capabilities that are applied. The interview transcripts were coded, and themes were identified and aggregated. The themes emerged inductively from the data, based on questions to the material on what affordances that could be identified. This part served to uncover insights about actors' views and experiences

Table 1
Respondents

Role	Authority	Reference code
Expert	European Commission, DG CLIMA	R1
Expert	European Environment Agency (EEA)	R2
Expert	European Environment Agency (EEA)	R3
Reporter	Swedish Environmental Protection Agency	R4
Reporter	Slovak Hydrometeorological Institute	R5
Reporter	Netherlands Enterprise Agency	R6
Reporter	Malta Resources Authority	R7
Reporter	Environment Administration Luxembourg	R8
Reporter	Environmental Protection Agency Ireland	R9
Reporter	Environment Agency of Iceland	R10
Reporter	Danish Ministry of Climate, Energy and Utilities	R11
Expert reviewer	Expert reviewer for the EU	R12

on the affordances of Reportnet.

Strategic documents, such as the EU Digital Strategy, the European Strategy for Data, the Green Deal, and the Business Vision for Reportnet have been used to understand the context. The study has taken a hermeneutic approach in the sense that it intends to interpret meaning and make sense of the phenomena by developing a dialectic understanding of the parts as well as the whole [42]. In the IS field hermeneutic analysis has for instance been used to develop understanding of the use and impact of IT in a certain social setting [42]. In this paper, the affordances of Reportnet are related to governance, to develop an understanding of the role of technology in this context. In this way, it relates a part (Reportnet) to the whole (climate governance). Affordance theory was applied as an analytical lens to develop an understanding of the action possibilities of Reportnet related to the governance context. Affordance theory informed the data collection by asking questions on what Reportnet provides to the user, and how it is experienced. Based on that, affordances with Reportnet were identified and presented in the results section. Key concepts from affordance theory are then applied in the discussion section.

2. Results

2.1. The case

The EU's Digital Strategy (European Commission, 2018) and European strategy for data [5] set the EU vision for digital transformation in Europe, with an intention to promote a digitally advanced administration. Regarding climate policy, the Green Deal establishes the EU's climate objectives [4], which are further specified in the EU Climate Law [43]. The Effort Sharing Regulation states how much each member state should reduce its emissions [12]. The Governance Regulation [44] then explicates a governance mechanism for the implementation of the EU climate objectives and commitments under the Paris Agreement based on planning,

reporting and verification. Member states should develop and submit an integrated national energy and climate plan, as well as a long-term strategy. Every second year they should report on implementation of the plans in a Biennial progress report. Member states should annually report a greenhouse gas inventory to track progress of emission reductions. Reporting to the EU serves two purposes, both for the EU to monitor progress within the EU, and also to compile the EU's reports to the United Nations Framework Convention on Climate Change (UNFCCC) [44]. The European Commission monitors and assesses the progress of each member state as well as for the EU as a whole. At the European Commission, the DG CLIMA is leading the Commission's work on climate change and implementation of policies and legislation to achieve the objectives of the Green Deal [45].

The European Environment Agency (EEA) is responsible for coordinating and managing the reporting for the EU and receives member states climate reporting [46]. EEA hosts the digital reporting platform Reportnet, which is used for environmental reporting in the EU. This means that it is not only climate data that is reported to Reportnet, but also other types of environmental information. Reportnet has been in operational use since 2002. In 2018, a third version (Reportnet 3.0) was initiated in order to improve e-reporting by taking advantage of more advanced IT solutions [47, 48]. Implementation of Reportnet 3.0 is carried out successively in accordance with reporting cycles and commitment periods on different environmental reporting. Some of the climate reporting has been submitted to Reportnet 3.0, and some will be implemented 2023. The aim of Reportnet 3.0 is to modernize e-reporting and to make exchange of environmental data more efficient. The Business vision of Reportnet 3.0 is that it should simplify and streamline data flows across environmental domains and act as a central hub for e-reporting activities. It aims to improve effectiveness, efficiency, and coherence and to make use of new technologies to deliver the ambition and goals by the European Commission [21].

2.2. Affordances of Reportnet

Based on an inductive analysis of the interviews, affordances of Reportnet were identified. The key affordances of Reportnet are presented in Table 2, and explained and discussed in the text below.

2.2.1. Submission of reports

According to one of the respondents at the EEA (R2), the main difference between the old reporting system and the new is that the EEA is not collecting templates anymore but focus on the data. Previously, countries would use templates that would be uploaded to the EEA, who would take the data out and put it into a database.

“With Reportnet 3.0, a country can either type directly into the interface of Reportnet 3.0, they can take a filled-out template and upload the data to the data schema, or they can connect their national database to the system and pull the data automatically. But when they press the button to deliver to us, the data goes straight into the database. We don't keep whatever format the data are submitted in” (R2).

In this way, there are not manual operations in the transfer of reports that can introduce errors and be inefficient (R2). The reporter from Sweden (R4) said that by uploading the data

Table 2
Affordances of Reportnet

Area	Affordance
Submission	Efficient & secure submission of reports which can be semi-automated
Quality controls	Rigorous and automated quality controls ensure information quality
Compliance	Reportnet facilitates compliance with reporting requirements and assessment of compliance with climate legislation
Monitoring	Data in Reportnet is used for monitoring and evaluation
Transparency	Reportnet facilitates a transparent and traceable reporting process and access to reports
Communication & visualization	Reporting formats enable visualization of data. Database-website integration enables real-time visualization of data.

directly into the EEA's database, it is more secure also for them because it reduces the risk of loss of integrity of the data. One respondent (R11) thought that the new procedures were rather a burden because they had to use new templates. Based on the submissions from the member states, Reportnet automatically calculates an aggregated dataset for the EU as a whole. The aggregated EU data set is used both for analysis in the EU, but also for obligations for the EU to report its' greenhouse gas inventory to the UNFCCC (United Nations Framework Convention on Climate Change).

2.2.2. Ensuring information quality through rigorous quality controls

When member states submit their greenhouse gas inventories with statistical data, there is an extensive QA/QC process (Quality Assurance and Quality Controls). Member states do QA/QC before submitting their inventories to the EEA, and then EEA do QA/QC and review member states inventories before the EU then submits its inventory to the UNFCCC (EEA 2). Some of the QA/QC are embedded in Reportnet (R3). According to the expert at EEA (R2), when a country submits their data to the EEA, the QA/QC automatically performs several checks on the data that can trigger warnings, errors messages and blockers. The interface guides users through a process of uploading the data, validating the data, and correcting eventual errors. The automatic quality controls are designed based on expertise on what are reasonable values. When the EEA sets up a dataflow, they define what parameters there should be for each field and what kind of error breaking these parameters should be (R2). The quality controls check primarily completeness, if correct notation keys are used, time series inconsistencies (R5), and if numbers are added correctly (R9). After the automated quality checks in Reportnet, expert reviews are carried out. The expert reviewers assess the reports related to reporting guidelines. They verify information quality and assess if estimations are reasonable. A digital tool is used that applies so called implied emission factors, which compares emissions in a particular sector between countries (R12).

One of the reporters (R10) said that the QA/QC helped them to identify errors and mistakes. Another reporter (R5) appreciated that they could see the errors directly. One of the reporters (R9) pointed out that many countries have also developed QA/QC systems and argued that

“Because there could be thousands of rows, thousands of cells of data, it is difficult to find the mistake without automating it” (R9).

However, the experience with the quality controls differs between reports. One respondent (R6) thought that they could be cumbersome for large tables with many errors. Security was also emphasized, to ensure that there is no hacker attack that manipulate the numbers (R8).

2.2.3. Compliance

Reporting requirements in legal directives and regulations are transferred into specifications that are implemented in Reportnet, which thereby facilitates compliance with regulations. One of the respondents at the EEA (R2) said that the schemas and the quality checks were a direct implementation of the Governance Regulation, and that Reportnet works as a conduit for the countries to report according to legislation. Some of the reporters (R6, R8, R11) also highlighted that Reportnet made it easier to follow reporting requirements in legislation. On the question whether Reportnet and reporting would impact climate policy at national level, respondent R8 said that the Commission assesses compliance based on the data reported. Respondent R10 said that it has had some effect on a higher level, because the ministry and the government need to be involved, they might have thought more about it. Another respondent (R7) said that the next step would be to use the reports more in policy making.

“In reality, the reports provide a lot of information that one requires for policy making. And this is also why we do these reports. We use a lot of the data we produce for the reporting for policy makers. The next step is for people to become more familiar with these reports and use them on a more regular basis in the policy making process.” (R7).

2.2.4. Monitoring of emissions, policy implementation and performance

There are reporting from EU member states on emissions, as well as on policies, measures, and projections. In that way there is both a monitoring of emissions, as well as monitoring of compliance with EU climate legislation and evaluation of progress on climate goals. Progress monitoring is done both at the level of individual legislative instrument and more broadly (R2). According to the respondent at the EEA (R2), the European Commission can access the data on the Reportnet 3.0 public site, and the EEA also supply them with data after the QA/QC process is completed. For some dataflows the Commission is also an observer within the system. According to one of the respondents (R4), the national climate and energy plans and follow up reports, along with emission data, enable for the Commission to compare the development over time, evaluate progress and analyze scenarios and effects of policy instruments, and Reportnet will be the source for that information. As the respondent at DG CLIMA (R1) argued; monitoring, reporting and verification is an important pillar of the Governance Regulation and is a governance mechanism that will ensure the implementation of the EU’s climate objectives.

“It is the very core of climate policy. When you try to regulate a sector, you always start by monitoring and reporting because you can’t regulate what you don’t measure. Then there is also

reporting on policies, measures, and projections. A lot of the reporting is really about the how. The how is what makes the target credible. One of the issues in general with policies is that defining targets is not that difficult. What way more matters is what you put into account, so that you have some guarantees that you are going to reach those targets” (R1).

According to the respondent at DG CLIMA (R1), EEA first does some analysis based on reported data and then the Commission is adding an additional layer to the analysis in evaluation of member states reports. Then they evaluate how the member states’ national plans are adding up and compare that to the targets and where additional measures are needed. In that way, the reporting functions as a feedback loop. The respondent (R1) noted that a challenge in this task is not primarily a lack of information, but how information is presented. The information should be presented in a way so that gaps and needs for measures, as well as what measures have been successful can be identified easily. The respondent (R1) argued that not just the Commission, but also the EEA, EU member states and other stakeholders could be better at presenting information in various useful ways.

2.2.5. Transparency

An important aim of reporting is transparency, and this is also strongly emphasized by the EU. According to the expert at the EEA (R2), they publish the data on their website, even before the quality checks start, unless some country chose to hide their data for confidentiality reasons. In that way, various stakeholders can follow the process from submission of member state reports to an aggregated EU data set, which makes it transparent and traceable, which also facilitates accountability. The respondent further said that MRV (monitoring, reporting and verification) is foundational for the EEA’s mission, ambition, and strategy; to support policy making with actionable knowledge based on trustworthy data (R2). One of the reporters (R7) expressed that Reportnet 2.0 had been useful from an information access perspective in that they could just give the link to the report to those who asked for it. The respondent further emphasized that Reportnet 3.0 should not just be a repository, but a more intelligent tool to access and use information

“I hope that eventually we can move towards a system where we don’t necessarily submit one big, massive pdf report that you can only read if you download the whole document, but rather smaller reports for different sectors separately. And then, when someone wants to investigate this library, instead of going into the whole massive reports, you just go directly to the chapters you are interested in” (R7).

2.2.6. Communication and visualization of information

With large volumes of information, visualization is used to make data more comprehensible. A new EU climate and energy website has recently been developed [49], which shows progress of each member state’s emissions, energy consumption and projections, related to the EU targets. The website is integrated with Reportnet, and when the data in Reportnet is updated after the QC, visualizations on the website should update automatically (R2). On the EEA website there is also a tool to visualize emission data [50]. It shows the development of emissions over time, and trends in individual sectors or gases can be explored.

“the inventory data set is so enormous so a viewer like this is really useful to identify and download a share of the data set rather than the whole thing. It is important not just to be able to access the data but also to find out what the data is showing” (R2).

Another visualization is of policies, measures, and projections of emission reductions [49]. According to the respondent at the EEA (R2), even though it is qualitative reporting, because it is broken into fields in the reporting schema in Reportnet, it enables them to make it navigable in a database and make visualizations. As R2 further explicated, reporting can be seen as a data value chain, where submission of data is on one side of the value chain and communication of the data is on the other end of the value chain, with data management and QA/QC checks in the middle.

3. Discussion

This section applies key concepts from affordance theory in a discussion of the findings and relates the findings to selected literature in digital governance on e-reporting.

This study has found that Reportnet has affordances related to qualities of governance, within the areas of transparency, compliance, monitoring, and communication & visualization of government actions and progress. The study further found affordances related to the reporting process, where digital capabilities enabling automated quality controls and semi-automated submissions make the process more efficient and ensures information quality. Trustworthy information that is accurate, timely, and complete is the basis for data-driven governance, and processes and IT functions that facilitates this will also contribute to governance. The affordances that were found also resonates with what has been highlighted in previous research, which is an interesting finding as the literature review was done in parallel to the empirical investigation and was not used as a pre-understanding for the interviews. The digital governance literature on e-reporting in Section 2, suggests that e-reporting has affordances that enable improved transparency and accountability [24, 25], communication of government performance [17], improved efficiency [19] and information quality [31] and support assessment of compliance [20]. The literature further emphasizes the importance of presenting information in meaningful ways [18]. Reporting formats in Reportnet facilitates visualization of information and it is also integrated with a website which visualizes data in Reportnet. However, there is still a potential for further re-use of the information reported. The reports contain a lot of information that is useful for policy making, societal debate, learning among member states, and innovation. More possibilities to utilize digital technologies for analysis and presentation for different purposes should be explored, for instance as the respondent (R1) from the European Commission suggested, to clearly show gaps, needs for action, and success. The information reported is also a valuable source that, connected to the EU’s work on the strategy for data and Digital Europe, could support climate positive innovation and stakeholder engagement. The suggestion by one of the respondents (R7) to enhance the re-usability of the information in Reportnet should also be further investigated. These suggestions could be seen as potential affordances of the information, but which requires system development to be actualized. Central to actualization of affordances in areas of qualities of governance, related to transparency, compliance, and communication of performance, depends on facilities to make the information reported re-usable

and actionable.

Reportnet has functionalities that enable different affordances which can be actualized when they are enacted. Actualization of affordances is affected by contextual differences, such as social, cultural, technological, economic, and organizational factors, as well as capabilities of users [41, 34]. Therefore, there might be differences in actualization of affordances among member states. Some of the reporters (R4, R6, R10) expressed appreciation of the training that had been organized when Reportnet 3.0 was implemented. The training organized during the implementation of Reportnet 3.0 enhance the capability of users, and thereby increase the likelihood of actualization of affordances. The general experience by the reporters were also that Reportnet is easy to use, even though Reportnet 3.0 currently has some ‘child diseases’ (R7). Different stakeholders may also perceive and emphasize different affordances, which is important to consider in further system development.

The Paris Agreement implies expectations that countries make voluntary climate commitments. What measures countries take and what legal and institutional arrangement they establish differ. EU offers a supranational level with legislative power, which thereby has enforcement capabilities which can also ensure that the EU delivers according to its international commitments. The reporting from EU member states to the EU serves two purposes, both to assess compliance with EU legislation, and to be the basis for EU’s international reporting to the UNFCCC. Reportnet facilitates both tasks, and the reporting to the EU is also in alignment with international standardization and agreements. Although reporting to the UNFCCC is standardized, the EU offers yet another level of standardization. For instance, the quality controls at EU level are stricter compared to the UN level.

Affordance theory has been useful for identifying and classifying affordances of digital technologies in reporting in an EU supranational climate governance context, and is also related to a global governance context within the UNFCCC. However, the theory was found to be on a quite general level. It has been difficult to estimate to what degree capabilities of digital technologies are utilized and affordances are actualized. Research in digital governance could benefit from complementing affordance theory by some framework that can also reveal the degree of actualization of affordances. Affordance theory has traditionally been applied in the direct interaction between user and information system. This paper contextualizes this in a governance context. A suggestion is a further theoretical discussion on the applicability of affordance theory on the possibilities of digital technologies in a digital governance context. This includes multiple levels, from direct use of IT systems to the contribution of their effects on a more strategic level.

4. Conclusions

This paper contributes an overview of affordances of e-reporting based on the case of the EU reporting platform Reportnet in a supranational climate governance context. In doing so, it informs the discussion on the role of digital technologies in the global governance of critical societal challenges and implementation of the SDGs. The six key affordances of Reportnet identified in this study are in the areas of submission, quality controls, compliance, monitoring, transparency, and communication & visualization. Semi-automated tasks and standardization

contribute to more efficient and secure reporting processes, better information quality, and enable interpretation and analyses of the reported data. The main areas for improvements were found to be further use, analysis, and communication of the information, to improve its usefulness for climate policy processes, as well as for innovation and societal discourse.

4.1. Implications

Research: The paper contributes to the digital governance field with knowledge on the possibilities of digital technologies in reporting in a supranational governance context, which is also related to a global governance context. It highlights how digital technologies can support implementation of policy objectives, in particular climate goals and evaluation of climate policy implementation. The use of affordance theory in a societal governance context is novel and connects affordances that occur in the use of a system with organizational goals (digitalization strategies) and societal goals (climate policy).

Further research could investigate how information in Reportnet could be made actionable and facilitate re-use in policy processes. It has been argued that more research is needed on the role of digital technologies in monitoring and policy evaluation [8] as well as on the interaction between digitalization and political transformation [7]. A suggestion is a deeper analysis of the effects of actualized affordances [33] of Reportnet and related IT artefacts on policy processes, at both national and EU level.

Practice: The paper provides insights on how Reportnet is experienced by various users, and some suggestions are made on further improvements. In particular, emphasis should be on making the information useful, with the aim to further inspire climate action by various stakeholders and thereby enhance implementation of climate policy.

References

- [1] United Nations, The 17 goals, 2022. URL: <https://sdgs.un.org/goals>.
- [2] E. Estevez, T. Janowski, Z. Dzhusupova, Electronic governance for sustainable development: How egov solutions contribute to sd goals, in: Proceedings of the 14th Annual International Conference on Digital Government Research, ACM, New York, NY, USA, 2013, p. 92–101.
- [3] R. Medaglia, G. C., V. Aquaro, Digital government and the united nations' sustainable development goals: Towards an analytical framework, in: DG.O'21, Omaha, NE, USA, 2021.
- [4] European Commission, The European Green Deal, 2019.
- [5] European Commission, A european strategy for data, 2020. URL: <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1593073685620&uri=CELEX%3A52020DC0066>, brussels Retrieved from.
- [6] European Commission, European Commission Digital Strategy. A digitally transformed, user-focused and data-driven Commission, European Commission, Brussels, 2018.
- [7] J. Hocht, P. Parycek, R. Schollhammer, Big data in the policy cycle: Policy decision making in the digital era, *Journal of Organizational Computing and Electronic Commerce* 26 (2016) 147–169.

- [8] A. Bürgin, Modernization of environmental reporting as a tool to improve the european commission's regulatory monitoring capacity, *JCMS: Journal of Common Market Studies* 59 (2021) 354–370.
- [9] European Commission, The eu environmental implementation review 2019: A europe that protects its citizens and enhances their quality of life, 2019.
- [10] A. Bürgin, Compliance with european union environmental law: An analysis of digitalization effects on institutional capacities, *Environmental Policy and Governance* 30 (2020) 46–56.
- [11] UNFCCC, Report of the conference of the parties serving as the meeting of the parties to the paris agreement on the third part of its first session, 2018. Held in Katowice from 2 to 15 December 2018.
- [12] European Union, Regulation 2018/842 of the european parliament and of the council on binding annual greenhouse gas emission reductions by member states from 2021 to 2030 contributing to climate action to meet commitments under the paris agreement and amending regulation (eu) no 525/2013, 2018.
- [13] S. Jensen, H. Saarenmaa, J. Martin, Infrastructure and tools for a european environmental information system—the contribution through reportnet, 2002. In: Pillmann, W.; Tochtermann, K.(Eds.): *Environmental Communication in the Information Society*, EnviroInfo Vienna, 29–38.
- [14] S. Vaz, J. Martin, D. Wilkinson, J. Newcombe, T. Ribeiro, Reporting on environmental measures: Are we being effective?, 2001.
- [15] A. Kotsev, O. Peeters, P. Smits, M. Grothe, Building bridges: experiences and lessons learned from the implementation of inspire and e-reporting of air quality data in europe, *Earth Science Informatics* 8 (2015) 353–365.
- [16] M. Lee, The history of municipal public reporting, *Intl Journal of Public Administration* 29 (2006) 453–476.
- [17] K. Kloby, Performance measurement and e-reporting: Exploring trailblazing programs, in: *E-Governance and Civic Engagement: Factors and Determinants of E-Democracy*, IGI Global, 2012, p. 544–560.
- [18] M. Lee, E-reporting: Strengthening democratic accountability: Ibm center for the business of government, 2004.
- [19] K. Schleidt, Inspired air quality reporting, in: J. Hřebíček, G. Schimak, M. Kubásek, A. Rizzoli (Eds.), *Environmental Software Systems. Fostering Information Sharing. ISESS 2013. IFIP Advances in Information and Communication Technology*, volume 413, Springer, Berlin, Heidelberg, 2013.
- [20] G. Siedschlag, The effect of electronic reporting of discharge monitoring reports on Clean Water Act compliance in, Georgetown University, Ohio, 2011.
- [21] P. Kampa, Business vision document for reportnet 3.0, 2018. URL: <https://www.eionet.europa.eu/reportnet/reportnet-3.0>.
- [22] M. Hatakka, D. Thapa, O. Sæbø, A framework for understanding the link between ict and development: How affordances influence capabilities, in: *Proceedings of SIG GlobDev Ninth Annual Workshop*, Dublin, Ireland, 2016–12–11.
- [23] O. Volkoff, D. Strong, Critical realism and affordances: Theorizing it-associated organizational change processes, *Mis Quarterly* 37 (2013) 819–834.

- [24] A. Filipovic, V. Martic, S. Demirovic, Digitalization of financial reporting in local governments of three montenegrin regions - current situation and perspectives, *Management-Journal of Contemporary Management Issues* 23 (2018) 59–79. doi:10.30924/mjcmi/2018.23.1.59.
- [25] E. Ghani, J. Said, Digital Reporting Practices among Malaysian Local Authorities *Electronic Journal of E-Government* 8 (2010) 33–44.
- [26] P. Mullen, Performance reporting on united states digital government, in: A.-V. Anttiroiko, M. Mätkiä (Eds.), *Encyclopedia of digital government*, Idea Group Reference, Hershey, PA, 2007, p. 1323–1327.
- [27] F. Sikiru, R. Williams, E. Maggio, J.D., Accountability, transparency and citizen engagement in government financial reporting, *The Journal of Government Financial Management* 64 (2015) 40.
- [28] A. Abramic, A. Kotsev, V. Cetl, S. Kephelopoulos, M. Paviotti, A spatial data infrastructure for environmental noise data in europe, *International Journal of Environmental Research and Public Health* 14 (2017) 726.
- [29] A. Lewis, R. R. CGFM, C., J. Steinhoff, Building public trust through open government electronic reporting:” we’ve only just begun”, *The Journal of Government Financial Management* 61 (2012) 20.
- [30] W. Morehead, e-reporting: The opportunities and rewards are endless, *The Journal of Government Financial Management* 61 (2012) 12.
- [31] A. Lewis, C. Neiberline, J. Steinhoff, Digital auditing: modernizing the government financial statement audit approach, *The Journal of Government Financial Management* 63 (2014) 32.
- [32] Q. Zhu, M. Peng, Brief research on web-enabled business reporting: Based-on xbrl and cases from banking industry, in: 2010 International Conference on E-Product E-Service and E-Entertainment, 2010.
- [33] D. Strong, O. Volkoff, A. Johnson, P. S., L. R., B. Tulu, I. Bar-On, L. Garber, A theory of organization-ehr affordance actualization, *Journal of the Association for Information Systems* 15 (2014) 53–85.
- [34] O. Volkoff, D. Strong, Affordance theory and how to use it in is research, in: R. Galliers, M. Stein (Eds.), *The Routledge Companion to Management Information Systems*, Routledge, New York, 2017, p. 232–245.
- [35] A. Chemero, An outline of a theory of affordances, *Ecological psychology* 15 (2003) 181–195.
- [36] P. Leonardi, When flexible routines meet flexible technologies: Affordance, constraint, and the imbrication of human and material agencies, *MIS quarterly* (2011) 147–167.
- [37] S. Seidel, J. Recker, J. Brocke, Sensemaking and sustainable practicing: Functional affordances of information systems in green transformations, *MIS Quarterly* 37 (2013) 1275–1299.
- [38] M. Markus, M. Silver, A foundation for the study of it effects: A new look at desanctis and poole’s concepts of structural features and spirit, *Journal of the Association for Information systems* 9 (2008) 609–632.
- [39] L. Arto, D. Thapa, K. Stendal, When is an affordance? outlining four stances, 2016. Paper presented at the IFIP International Federation for Information Processing 2016.

- [40] D. Norman, Affordance, conventions, and design, *Interactions* 6 (1999) 38–43.
- [41] D. Thapa, M. Sein, K., Trajectory of affordances: Insights from a case of telemedicine in nepal, *Info Systems Journal* 28 (2018) 796–817.
- [42] M. Myers, Hermeneutics in information systems research, *Social theory and philosophy for information systems* 103-128 (2004).
- [43] European Union, Regulation 2021/1119 of the european parliament and of the council, establishing the framework for achieving climate neutrality and amending regulations (ec) no 401/2009 and (eu) 2018/1999 ('european climate law', 2021.
- [44] European Union, Regulation 2018/1999 of the european parliament and of the council on the governance of the energy union and climate action, 2018.
- [45] European Commission, Climate action, 2021. URL: https://ec.europa.eu/info/departments/climate-action_en.
- [46] European Commission, Governance of the energy union and climate action, 2022. URL: https://ec.europa.eu/clima/eu-action/climate-strategies-targets/progress-made-cutting-emissions/governance-energy-union-and_en.
- [47] European Environment Agency, Introduction to environmental reporting using reportnet, 2017. URL: <https://www.eionet.europa.eu/>.
- [48] Eionet, Eionet portal, 2021. URL: <https://www.eionet.europa.eu/reportnet/index>.
- [49] European Environment Agency, Climate and energy in the eu, 2022. URL: <https://climate-energy.eea.europa.eu/catalogue/data>.
- [50] European Environment Agency, Eea greenhouse gases - data viewer, 2022. URL: <https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer>.
- [51] European Environment Agency, How is europe fighting against climate change?, 2022. URL: <https://www.eea.europa.eu/themes/climate/national-policies-and-measures>.
- [52] M. Malesardi, Advances in reporting, *The Journal of Government Financial Management* 61 (2012) 4.
- [53] European Commission, Reporting system for eu countries, 2022. URL: https://ec.europa.eu/info/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/reporting-system-eu-countries_en.