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SMART NEGOTIATIONS FOR CLIMATE PROTECTION: CAN INFORMATION SYSTEMS SAVE OUR PLANET?

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Short Paper

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Abstract

Information systems (IS) and digital technologies have significantly influenced human history, giving rise to numerous innovations and transformative changes in our daily lives. In particular, the exploration of how IS can address societal challenges constitutes a noteworthy focus within IS research. One of our greatest challenges at present is the climate crisis, which so far has been insufficiently addressed despite decades of climate negotiations. Given the urgency to act, we, therefore, ask why climate negotiations fail. Based on the identified challenges, in this short paper, we highlight innovative opportunities that IS may offer to achieve more effective climate negotiations. Finally, we suggest that IS research should engage in rethinking IS solutions toward smart negotiations and further explore this direction in the future.

Keywords: Smart Negotiation, Information Systems Capabilities and Societal Challenges.

1 Introduction

In the era of rapid technological advancement, the transformative power of information systems (IS) has profoundly changed our society, offering a diverse range of new capabilities. Within the realm of IS research, there is a strong focus on leveraging these capabilities to successfully address various societal challenges, including circular economy, industrial innovation, health, or economic growth (Wolff et al., 2022; Zeiss et al., 2021). For instance, smart meter interfaces for monitoring and reporting, as well as digital data sharing platforms foster a circular economy (Zeiss et al., 2021). Furthermore, cyber-physical systems based on the Internet of Things (IoT) and cloud computing characterize the ongoing fourth industrial revolution (Kamal, 2020). Additionally, implementing self-management IS aid in managing chronic diseases (Savoli et al., 2020), while teleworking and face-to-face didactic tools enhanced productivity during the COVID-19 pandemic (Kamal, 2020). Nevertheless and undoubtedly, the climate crisis is among the most pressing challenges of our times (United Nations, 2023; European Environment Agency, 2023; Ripple et al., 2023). While IS have proven successful in the these fields, other domains seem to lag behind: In fact, despite efforts and first advancements in sustainable development and climate protection initiatives, global progress still remains insufficient (Ripple et al., 2023). This seems to be highly paradoxical if one considers that the global threat of climate change can only be successfully addressed by joint global efforts. Thus, it requires the crucial lever of climate negotiations and agreements, emphasizing the necessity for global cooperation rather than incremental changes by individual countries and other players such as non-governmental organizations. Recently, there has been first interest in examining digital technologies within the framework of (climate) negotiations (Engvall

et al., 2023). For example, Engvall et al. (2023) discuss the integration of digital technologies in climate negotiations in the context of paradox theory, highlighting how digital technologies support organizations manage conflicting priorities and tensions in climate negotiations. Despite decades of recognition of climate change and its consequences for humanity (Kuyper et al., 2018), the desired effective outcomes of such negotiations remain beyond reach, with the Paris Agreement yet to be fully realized. Overall, the current situation raises an important question about the reasons behind the failure of climate negotiations and, importantly, how IS and digital technologies – that have successfully been used to address a broad range of other societal challenges – can help make these negotiations more effective meaning that the negotiation's outcome is suitable to combat climate change and the implementation of the measures decided upon is (under certain circumstances) "guaranteed". Vice versa, a failed negotiation does not sufficiently combat climate change. Consequently, the primary research question arises: *How can IS and digital technologies provide solutions for effective climate negotiations?* To address this question, this paper aims to take two basic steps: first, identifying the main challenges that hinder effective negotiations and cooperation through a structured literature review, and second, conducting an expert workshop to pinpoint the opportunities where IS and digital technologies can play a key role in overcoming these identified challenges to reach successful and "smart" climate negotiations. Our results indicate high potentials for a broad range of digital technologies to play a key role in advancing effective climate negotiations provided their innovative application in that field is further researched and developed.

2 Methodology

Firstly, we conduct a structured literature review in line with (vom Brocke et al., 2015). The primary goal of this literature review is to systematically identify and analyze existing challenges concerning climate negotiations and cooperation. We present our literature review approach in Figure 1.

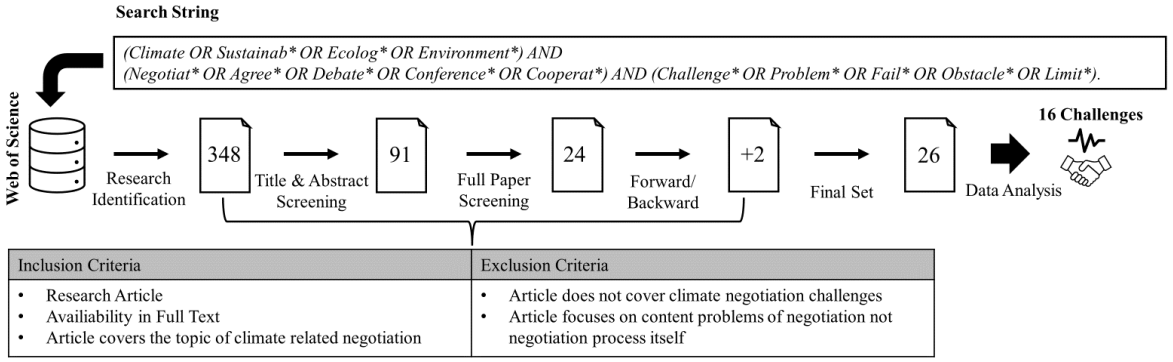

Figure 1. Literature review approach.

In a second step, we then connect the topic of climate negotiations with the IS research field. Through an expert workshop based on focus group methodology (Wilkinson, 1998) involving 16 IS researchers from relevant research streams, we aim to identify opportunities for IS to enable more effective climate negotiations and cooperation. In the workshop, the researchers are asked to name general capabilities of IS independent of a specific application area and to avoid later bias. Afterward, the experts learn about the issue of ineffective climate negotiations and the associated challenges. We then task the researchers with identifying possible solutions in which the capabilities of IS can address specific challenges or mitigate them. The experts record their findings in writing and subsequently discuss them. In a third step, the authors consolidate the results from the literature review as well as the contributions from the expert workshop, creating a comprehensive mapping of climate negotiation challenges and IS capabilities to address these challenges. In the following sections, we present the findings of each step of our methodological approach.

3 Why Climate Negotiations Fail and How IS Can Help

In this section, we expound upon the findings derived from our literature review. In our examination of 26 papers, we have identified 16 distinct challenges explicitly associated, though not exclusively, with climate negotiations. Against this background, lessons-learned for challenges like C4, C10 or C13 may also be used in another context. We inductively categorize these challenges into three dimensions and explain them in Table 1. Subsequently, we demonstrate how ISs can address and provide solutions for these challenges as an outcome of the expert workshop.

	C#	Challenge	Description	Source
Individual Negotiator	1	Perception of responsibility	Negotiators do not view it as their own responsibility to initiate actions.	Hübler and Finus (2013), Pandey (2014), Portman and Teff-Seker (2017), Stokke (1989), Wischmann (1998)
	2	Individual interests	Negotiators harbor individual concerns, including factors like reelection, reputation, or career prospects.	Bang (2011), Brandt and Svendsen (2002), Hisschemöller and Gupta (1999), Holzer and Zhang (2008), Hübler and Finus (2013), Portman and Teff-Seker (2017), Qian (2019), Segerson (2015), Skovgaard (2017), Spector and Korula (1993)
	3	Different understanding of problems and strategies	Negotiators have a different understanding of the problem's relevance and possible negotiation strategies.	Brandt and Svendsen (2002), Hisschemöller and Gupta (1999), Holzer and Zhang (2008), Segerson (2015), Wischmann (1998), Zartman (1992)
Negotiating Party	4	Lack of trust	Negotiating parties do not have sufficient trust in, e.g., available information, the other parties, and their claims.	Gupta (2012), Holzer and Zhang (2008), HUFBAUER and KIM (2010), Qian (2019), Segerson (2015), Skovgaard (2017), Wischmann (1998)
	5	Lack of science-based decision making	Scientific complexity and uncertainty hinder science-based decision-making.	Eastin et al. (2011), Hisschemöller and Gupta (1999), Ipsen et al. (2001), Pandey (2014), Portman and Teff-Seker (2017), Segerson (2015), Spector and Korula (1993), Stokke (1989)
	6	Lack of communication	There is a lack of explanation and transparency towards, e.g., the public about actions taken thus influencing the public's support on the negotiating party's position.	Aquino (2023), Portman and Teff-Seker (2017), Segerson (2015), Wischmann (1998)
	7	Stakeholder involvement	Difficulty in finding an effective number of stakeholders and appropriate degree of participation.	Clark et al. (1998), Hisschemöller and Gupta (1999), Portman and Teff-Seker (2017), Wischmann (1998)
	8	Differently affected & accountable countries	Negotiating parties expect different consequences due to climate change and bear distinct levels of responsibility for its existence.	Eastin et al. (2011), Gupta (2012), HUFBAUER and KIM (2010), Ipsen et al. (2001), Pandey (2014), Portman and Teff-Seker (2017), Romanovskaya and Federici (2019), Zartman (1992)
	9	Agenda setting & power imbalance	Negotiating parties are unequally powerful and have their own agenda within the negotiation, which can jeopardize the conclusion of the negotiations.	Bailer and Weiler (2015), Eastin et al. (2011), HUFBAUER and KIM (2010), Pandey (2014), Portman and Teff-Seker (2017), Skovgaard (2017), Stokke (1989), Zartman (1992)

	C#	Challenge	Description	Source
Negotiating Party	10	Different resources	Negotiating parties possess unevenly distributed resources, whether in terms of finances or expertise.	Boisseree (1972), Eyckmans and Tulkens (2003), Gupta (2012), Hübler and Finus (2013), HUFBAUER and KIM (2010), Ipsen et al. (2001), Qian (2019), Spector and Korula (1993), Zartman (1992)
Negotiation Environment	11	No global government	There is no global institution that can enforce global action and states do not want to surrender sovereignty.	Brandt and Svendsen (2002), Gupta (2012), Hübler and Finus (2013), Ipsen et al. (2001), Pandey (2014), Stokke (1989)
	12	Interdependences with other conflicts	The climate negotiations are linked to another conflict such as issues of territories or global economy.	Holzer and Zhang (2008), HUFBAUER and KIM (2010), Pandey (2014), Qian (2019), Stokke (1989)
Negotiation Environment	13	Competing interests	Several other conflicting interests such as short-term economic growth, globally increasing protectionism, or global prioritization of other crises influence climate negotiations in general.	Boisseree (1972), Eastin et al. (2011), Ipsen et al. (2001), Hisschemöller and Gupta (1999), Holzer and Zhang (2008), HUFBAUER and KIM (2010), Karp and Sacheti (1996), Pandey (2014), Portman and Teff-Seker (2017), Segerson (2015), Stokke (1989), Zartman (1992)
	14	Subject of negotiation	The subjects of negotiation are broad and complex. The number of combinations of measures may lead to ineffective compromises.	Boisseree (1972), Brandt and Svendsen (2002), Leonelli (2023), Skovgaard (2017), Wischmann (1998), Zartman (1992)
	15	Credibility of effectiveness and punishment	The achievement of agreed goals as well as the sanctions for not achieving them are not reliable.	Aquino (2023), Brandt and Svendsen (2002), Hübler and Finus (2013), HUFBAUER and KIM (2010), Portman and Teff-Seker (2017), Skovgaard (2017), Spector and Korula (1993)
	16	Free riding / Prisoner's dilemma	There are incentives to profit from climate protection measures of others without contributing to them oneself.	Bailer and Weiler (2015), Brandt and Svendsen (2002), Gupta (2012), Holzer and Zhang (2008), Hübler and Finus (2013), HUFBAUER and KIM (2010), Ipsen et al. (2001), Stokke (1989)

Table 1. Challenges outlined in climate negotiations literature.

The tripartite dimensions correspond to different levels in the context of climate negotiations. The first dimension encompasses challenges pertinent to the individual negotiator (i.e., the negotiating person as a human being), totaling three in number. The second dimension involves seven challenges attributed to a participating party (e.g., a country that sends negotiators to a climate negotiation) engaged in climate negotiations. Lastly, the third dimension concerns the negotiating environment, (i.e., the conditions and circumstances) in which climate negotiations take place and describes six associated challenges. We note that in all three dimensions, informational challenges manifest, encompassing issues such as varying methods of information processing (c.f. C#3), shortcomings in information availability (c.f. C#5), and the absence of verifiability (c.f. C#4 and C#15). In the following section, we spotlight challenges primarily identified in recent literature, i.e., between 2017 and 2023, relevant to the evolving digital landscape and growing complexity of negotiations or delegations. We propose specific digital technologies and IS concepts that deserve further exploration due to their innovative use in addressing part(s) of the listed challenges related but not limited to climate negotiations. Concerning an individual negotiator's perception of their own responsibility (c.f. C#1), the experts suggest the use of *Virtual Reality (VR)* or *Extended Reality (XR)* for smart climate negotiations. Existing research already

demonstrates how VR and XR can alter decision-making processes, such as in consumer behavior (Sharma and Dhote, 2022) or sustainable construction projects (Atwa et al., 2019). Used in climate negotiations, VR and XR could deepen negotiators' understanding of the complex issues and their impact on their respective parties and make personal responsibility more tangible. Furthermore, the expert panel proposes the use of *nudging*, in the sense of influencing one aspect of behavior (Hagmann et al., 2019), with the help of digital technologies. Currently, nudging is already employed to reduce environmental impact (Lehner et al., 2016). One expert proposed that the application of nudging (e.g., framing of negotiation subjects or phrasing of negotiation success) could lead negotiators to adopt different negotiation strategies and positions. This implies that research should explore the use of nudging in a way that not only alter consumption behavior but also negotiator behavior. Regarding lack of trust (c.f. C#4), an emerging research area addressing trust issues revolves around *Distributed Ledger Technologies (DLT)*, which refers to a special type of distributed system whose state is represented by a shared ledger (Gola and Sedlmeir, 2022), and identity management, such as *Self-Sovereign Identity (SSI)*. Blockchain platforms and the application of SSI concepts are notably characterized by creating a trustless environment, where actors trust transactions based on the platforms or certification design without necessarily trusting other participants. Further exploration of these approaches could investigate whether DLT could to some extent address the trust deficit in climate negotiations, for instance, by addressing concerns related to mistrust of information. Another solution approach involves *Federated Learning*. This application in the field of artificial intelligence (AI) and machine learning (ML) aims to leverage ML capabilities while simultaneously addressing privacy protection and data security (Yang et al., 2019). When applied to climate negotiations, research should investigate the utilization of ML models for predictions and climate models while ensuring the data security of individual parties. This approach seeks to alleviate concerns about sharing data among negotiating parties due to a lack of trust. To ensure that negotiation outcomes are based on science-based decision making (c.f. C#5), experts suggest the following: Firstly, *AI* and *ML* in particular, could contribute to better decision-making in various ways. Previous research indicates that ML can assist governments in policymaking by enhancing climate models (Jebeile et al., 2021). *Explainable AI (XAI)* expands on this by providing transparency and comprehensibility of predictions, addressing the often-criticized "black-box" nature of ML (Mamalakis et al., 2022). Hence, the exploration of AI and XAI is essential to better understand their role in supporting negotiating parties in decision-making by providing information and predictions about climate change consequences. In close relation to this, the *IoT* also plays a role in this domain, e.g. IoT solutions are currently applied to enhance the accuracy of climate predictions and knowledge (Park et al., 2021). This implies that IoT should also be considered when determining the information negotiating parties receive for their decisions and the knowledge upon which they base them. The combination of different technologies also holds promise: *Decision Support Systems (DSS)* could be developed to extend sustainability decisions to climate negotiations (Alavi et al., 2021). Exploring DSS that makes the complexity of climate negotiations more tangible and comprehensively support negotiating parties without sacrificing scientific foundation, could be meaningful in this context. Complex DSS could directly account for various (resource) limitations of negotiating parties, their views, preferences, priorities, and the broad array of possible measures (decisions to be made) to combat climate change. A fundamental challenge revolves around the issue of the credibility of measure fulfillment and the consequences for non-compliance (c.f. C#15). Effective agreements between different parties can only emerge when the assurance of credibility is established, including the possibility of punishment for non-fulfillment (HUFBAUER and KIM, 2010). Based on the context of lacking trust (c.f. *Lack of Trust*), the research field involving *DLT, SSI,* and *Zero-Knowledge Proofs (ZKP)* is noteworthy. Existing research analyzes how DLT, SSI, and ZKP can be employed to create verifiable tracing chains, ensuring that conveyed information is accurate and tamper-resistant while requiring minimal to no transparent sharing of sensitive data (Babel et al., 2022; Guggenberger et al., 2023). These IS capabilities serve as a crucial component in post-negotiation phases. Negotiating parties are generally willing to cooperate during the negotiation itself if they can be certain to a sufficiently high degree that the agreed-upon contracts can be verified and realized afterward. Therefore, the relationship between verifiability and effective climate negotiations should be further examined. In addition to that, in current IS research, *data spaces* are actively debated and developed (Gieß et al., 2023). Leveraging data spaces for secure data exchange and

value co-creation in a multi-stakeholder ecosystem could also be meaningful for collaboration among diverse parties and ensuring proper fulfillment of measures in climate negotiations without compromising sensitive data. *IoT* also plays a crucial role in verifying the fulfillment of measures. The data collection from smart objects can enhance visibility, enabling early detection of changes to prompting additional measures for goal attainment if necessary (Ben-Daya et al., 2019).

4 Conclusion and Future Research

Over the decades, IS research has explored fundamental application areas of IS and has identified numerous ways in which digital technologies can address various societal challenges. However, one of the greatest challenges in human history, namely the climate crisis, has thus far been inadequately addressed. Our research project emphasizes the need for a rethinking and innovative application of existing IS approaches to positively impact and enable smart climate negotiations, fostering global cooperation among the international community. We contribute to the IS community by introducing novel research opportunities for the IS community, as the approaches outlined in this paper should be further investigated in future research to enable a reevaluation of IS adaptation and use. Challenges that may not initially seem suitable for IS applications could be addressed by rethinking IS concepts from an interdisciplinary perspective on different levels, ranging from international climate agreements to local initiatives. By elaborating this short paper, we aim at providing a research agenda suggesting future research to delve into single-use cases where specific IS and digital technologies foster more effective negotiations by mitigating particular challenges, while also critically examining the limitations and obstacles associated with the global adoption of these solutions. To complete this paper in progress, the authors plan to add a background section about previous climate negotiations and the use of IS to solve societal challenges. Furthermore, we plan to conduct an interview study with negotiators at various levels, e.g., local, regional, national, and international, and IS experts to expand the results with further challenges and evaluate them from both a policymaker and technological perspective while maintaining rigor standards. These findings will be systematically presented to offer a comprehensive overview of potential solutions within the realm of IS. Based on those findings, the authors will develop a research agenda for the IS community to point out relevant research opportunities regarding an innovative use of IS to enable smart climate negotiations and, thus, successfully contribute to combatting climate change.

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