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Facilitating Collaborative Consensus Building in Web-based Discussion through Collective Task-Based Roles: A Case Study

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Abstract

Effective group decision-making relies on consensus processes, which often involve various models. However, when applied to web-based social systems as communication networks, these processes reveal multifaceted challenges. These challenges encompass the management of information overload, the dynamics of asynchronous discussions, and the intricacies of coordinating participants within the same time zone. To address these issues comprehensively, we employ a multifaceted approach. This approach involves the automation of consensus processes through AI assistance, along with human-human and human-AI collaboration mechanisms. In light of this, we aim to explore approaches that not only streamline consensus building but also facilitate stakeholder interactions for meaningful problem-solving. Our investigation centers on collaborative consensus building through task-based roles assigned to human agents, complemented by conversational AI agent support. Diverging from traditional role-playing, we assign participants specific tasks such as summarizing discussions and contributing to policy sections. Our overarching objective is to enhance the collaborative consensus-building process within web-based discussions. Our research is deeply rooted in the exploration of how humans interact and collaborate on digital platforms, with a special focus on Human-AI collaboration tasks. We present a web-based case study where participants collectively craft policy proposals for informal settlement upgrades. Remarkably, 20 out of 24 groups, each consisting of four participants, successfully presented their proposals. Post-experiment survey results further indicate a high level of participant satisfaction with the process, the proposals, and teamwork. This study holds significant implications for the development of consensus-building support systems, offering varying degrees of agency in collaborative tasks.

Keywords: Collaborative decision-making, Consensus building, Task-based roles, AI facilitated discussions, policy development.

1 Introduction

Decision making processes are one of the most frequent mankind activities in daily life that have emerged as potent tools for addressing intricate societal challenges [1]. Consensus reaching processes are applied in group decision making (GDM) to reach a mutual agreement before making a common decision. Consensus building is a multi-step group process whereby all participants

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are engaging and collaborating together to achieve a mutual understanding before making a decision. Different consensus reaching process models have been deployed to facilitate consensus building. In GDM problems, a group of decision makers try to achieve a common solution to a problem consisting of two or more possible solutions or alternatives [2]. A key aspect in GDM problems is to achieve a solution which is accepted by all decision makers in the group.

Classically, GDM-based approaches are aimed at making decisions where few decision makers participate. However, nowadays digital societal models could imply the participation of diverse groups of decision makers in GDM problems. Thus, using classical approaches do not guarantee achieving a solution accepted by all decision makers. Therefore, it is critical to find effective teaming approaches that not only facilitate reaching consensus building processes but also provide an opportunity to support interactions among stakeholders to solve their shared problems together in a meaningful way. For instance, Consensus Reaching Processes (CRPs) are becoming increasingly necessary [3] as part of GDM problems resolution [4]. A number of consensus models have been proposed in the literature to conduct CRPs [2] [3].

The characteristics of consensus decision-making include 1) Collaboration, 2) Cooperation, 3) Egalitarianism, 3) Inclusion, and 5) Participation [4]. Participation in consensus decision-making without cooperation and collaboration are meaningless, and participation without inclusion is passive. These five elements are required to maintain a widely accepted consensus decision-making process.

In modern policy development and decision-making, collaborative approaches have emerged as potent tools for addressing intricate societal challenges. For instance, collaborative governance [5] and collaborative process, where stakeholders contribute to a shared proposal and shape it into a decision that meets the concerns of all group members as much as possible. This is particularly relevant within the realm of city planning [6], particularly informal settlements, where the formulation of sustainable and inclusive policies necessitates concerted collaborative efforts.

Utilizing the capabilities of technology [7] to support collaborative consensus building process, online discussion support platforms have gained prominence as arenas fostering engagement, dialogue, and collective decision-making [8]. Amid these platforms, D-Agree is a discussion support forum [8], integrating artificial intelligence (AI) as facilitators to navigate participants through collaborative deliberations. Against this backdrop, this research embarks on a nuanced exploration of consensus-building dynamics within the AI-driven discussion platform D-Agree, with a specific focus on probing the efficacy of task-based roles.

Central to this inquiry is the intricate process of consensus building—an endeavor striving to harmonize divergent perspectives into a shared trajectory. Drawing inspiration from the domain of collaborative planning theories, we build upon the foundational work of Innes and Booher [6] to investigate the effectiveness of assigning participants specific tasks instead of adopting fictional roles in web-based collective discussion.

Innes and Booher's theory proposed effective consensus-building processes to transcend conventional decision-making paradigms in collaborative planning. Their work introduces the concept of role playing, wherein participants momentarily assume roles extending beyond their immediate organizational affiliations [6]. While our research takes a distinct avenue, their insights serve as a robust framework for unraveling the intricate interplay between task-based roles and the dynamic process of consensus building, all nested within AI-mediated platforms. We build upon their theory of collaborative planning to investigate the effectiveness of assigning participants specific tasks instead of adopting fictional roles in web-based collective discussion.

Our goal is to facilitate collaborative consensus building in web-based discussions. The research question is focused on how humans interact and collaborate with other humans on digital platforms in general, and in particular in Human-AI collaboration tasks. We present an experimental web-based case study using D-Agree [8], where participants collaboratively within a team crafted policy proposals for upgrading Kabul city informal settlements. Notably, 20 out of 24 groups of four people successfully presented their proposals. Survey results further reveal participants' satisfaction with the process, the proposal, and teamwork.

By transposing these foundational principles into the context of AI-facilitated dialogues, this article presents valuable insights into the benefits of this combined approach of task-based roles, human teaming and AI-assisted facilitation support can foster collaborative web-based discussion. This work has implications for the development of consensus building support systems with varying degrees of Agency in collaborative tasks.

The rest of the paper is structured as follows. The study methodological pipeline is shown in Section 2, and research results are discussed in Section 3. Section 4 presents the discussions. Finally, Section 5 presents conclusions, and future work.

2 Methods

2. 1 Participants

Participants were recruited through a respondent recruiting agency based in Afghanistan, responding to a call for participation announced on the agency's online job portal. The recruitment process aimed to establish a pool of subjects for a comprehensive research initiative. From this broader endeavor, the present study selectively analyzed a subset of participants who belonged to the treatment group. Specifically, 96 subjects were included in the analysis, forming 24 collaborative groups, each consisting of four individuals.

Random assignment ensured the equitable distribution of participants across the groups. Ethical considerations, including informed consent and confidentiality safeguards, were adhered to throughout the recruitment and assignment procedures.

These participants engaged in collaborative activities on the D-Agree platform, collectively working toward policy proposals for the advancement of informal settlements. Notably, the

analysis within this study focuses solely on the treatment group, as this research explores a distinct facet of the broader research initiative.

The participants were Afghan nationals residing in Afghanistan at the time of the study. The group consisted of 72 males and 24 females, with ages ranging from 23 to 37 years. Their educational qualifications encompassed Bachelor's and Master's degrees. Additionally, all participants demonstrated proficiency in the English language, a prerequisite for active participation in the English-language discussions facilitated by the AI-powered D-Agree platform.

As compensation for their involvement, participants received a total of $30 (equivalent to AFN 3000) as part of the compensation provided for their participation in the broader study.

2. 2 Study Instrumentation

The research made use of D-Agree as the discussion tool, an online text-based support system designed for collaborative interactions. Previously, it has been used as a digital support tool to promote participatory democracy in Afghanistan [9-11]. D-Agree consists of an artificial agent and a web platform that enables participants to engage in text-based exchanges with both the agent and their peers. The automated facilitation agent fulfills a range of functions, including observing the textual content contributed by users, identifying argumentative expressions through the Issue-based Information System (IBIS) framework [12], generating facilitation messages according to predefined guidelines, and posting these messages on the discussion board as responses to other participants' contributions [8].

Employing the IBIS framework [12], the system extracts the structural essence of discussions, guiding their progression by permitting participants to elucidate issues and ideas and subsequently debating their merits and demerits. The facilitation agent plays a pivotal role in encouraging participants to address a broader array of topics, concepts, advantages, and disadvantages by disseminating facilitation messages relevant to the ongoing discourse [8].

For the post-discussion survey, we utilized SurveyMonkey, a licensed web-based survey software commonly employed by researchers for survey administration.

2. 3 Procedures

The research procedures were meticulously structured to investigate the dynamics of consensus-building within the context of three-day collaborative asynchronous discussions on the D-Agree platform, as well as through the subsequent post-discussion survey. While a broader research initiative encompassed multiple procedures, this study exclusively centers on these specific components.

Participants engaged in the three-day collaborative discussions within the D-Agree platform. Guided by distinct task-based roles, each group collectively developed policy proposals for the upgrading of informal settlements. The AI-driven facilitation agent within D-Agree dynamically guided the discussions, encouraging the exploration of diverse topics, ideas, pros, and cons.

Upon the conclusion of the collaborative discussions, participants were directed to the post-discussion survey hosted on SurveyMonkey. This survey aimed to capture participants' perceptions, satisfaction levels, and overall experiences with the collaborative process, as well as their appraisal of the formulated policy proposals.

This focused research design allowed for an in-depth exploration of consensus-building mechanisms within the AI-driven discussion platform, while maintaining the integrity and confidentiality of the broader research context.

2. 4 Role Assignment and Task Specification

To ensure effective collaboration and task-oriented discussions, participants were assigned specific roles within their respective groups. As mentioned previously, each collaborative group consisted of four participants, and specific tasks were assigned to each participant. The theme description provided a comprehensive framework for these roles, guiding participants through a structured process of policy proposal development for upgrading informal settlements. This unique approach aimed to capitalize on each contribution while fostering a collective effort.

The theme description set the context by outlining the challenges faced by informal settlers in Afghanistan and articulating the objective of formulating policies for incremental upgrading and regularization of existing informal settlements. The task was divided into three key components, each addressing a crucial dimension of the policy proposal (Figure 1).

Criteria for Upgrading: On the first day, participants engaged in discussions focused on determining the criteria that would identify settlements suitable for upgrading. Participant 1, the assigned summarizer, played a pivotal role in capturing the group's collective opinions and insights, which would ultimately contribute to forming the first part of the policy proposal.

Funding Strategies: On the second day, discussions centered around funding strategies for the upgrading projects. Participants deliberated on potential funding sources, ranging from government entities to international organizations and informal settlers themselves. Participant 2, designated as the summarizer, synthesized the group's perspectives, shaping the second part of the policy proposal.

Minimum Services Requirements: The third day's discussions revolved around defining the minimum services necessary for the upgraded settlements, encompassing essential provisions like clean water supply, sewage disposal, and electricity. Participant 3, the appointed summarizer, consolidated the group's discussions, contributing to the formulation of the third part of the policy proposal.

Upon the culmination of these three days of collaborative discussions, Participant 4, undertook the responsibility of synthesizing the individual contributions into a comprehensive policy proposal encompassing all three parts. Participants had the opportunity to engage in further deliberations, refining and shaping the proposal as needed.

It's important to note that participants were provided with pseudonyms (Mr./Ms. A, Mr./Ms. B, Mr./Ms. C, and Mr./Ms. D) to ensure privacy and confidentiality.

This structured role-based approach not only harnessed participants' collective expertise but also facilitated a dynamic and inclusive consensus-building process within the AI-driven discussion platform.

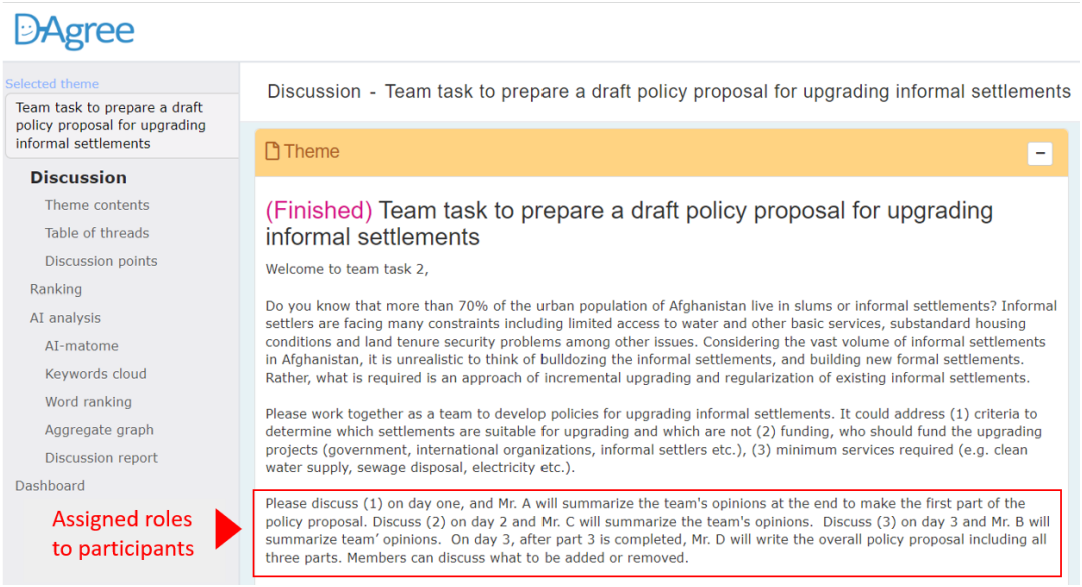

Figure 1: Screenshot of D-Agree Theme Description - Collaborative Task for Upgrading Informal Settlements with Assigned Task-Based Roles

3 Results

Our study involved 96 participants organized into 24 groups of four people tasked with creating a policy proposal for upgrading informal settlements in Afghanistan.

The results of the qualitative engagement of the three days discussion reveals that 20 out of 24 groups of four people successfully presented their proposals, and the findings of quantified data of the 3-days post-survey responses further reveal participants' satisfaction with the process, the proposal, and teamwork. Thus, the quantified results are in good agreement with the results of the qualitative engagement of the three days discussion.

The results of the qualitative engagement of the three days discussion and findings of quantified data of the 3-days post-survey responses are presented as follows:

3. 1 Participant Engagement and Task Fulfillment

The participants actively engaged in the collaborative task, which encompassed three key components: criteria for upgrading, funding strategies, and minimum services requirements. Each day, designated participants summarized their group's discussions to contribute to the policy proposal.

Notably, nearly all groups successfully completed the daily tasks, demonstrating consistent engagement. Impressively, 20 out of 24 groups of four people successfully presented their final policy proposals within the stipulated three-day timeframe. This high rate of completion underscores the participants' commitment and engagement in the collaborative process.

3. 2 Participant Satisfaction

To gauge participant satisfaction, we conducted a post-discussion survey following the completion of the task. The survey collected feedback on various aspects of the collaborative experience, including satisfaction with the discussion process, the proposal, and the effectiveness of teamwork.

Preliminary analysis of the survey responses revealed a notable degree of satisfaction among participants. The majority expressed contentment with the collaborative discussion process, indicating that it facilitated their engagement and contributed to their understanding of the complex policy issue. Participants also rated the quality of the final proposal positively, suggesting that the task-based approach within the AI-driven platform effectively supported their consensus-building efforts. Furthermore, respondents appreciated the synergy cultivated among team members during the discussions (see Figure 2).

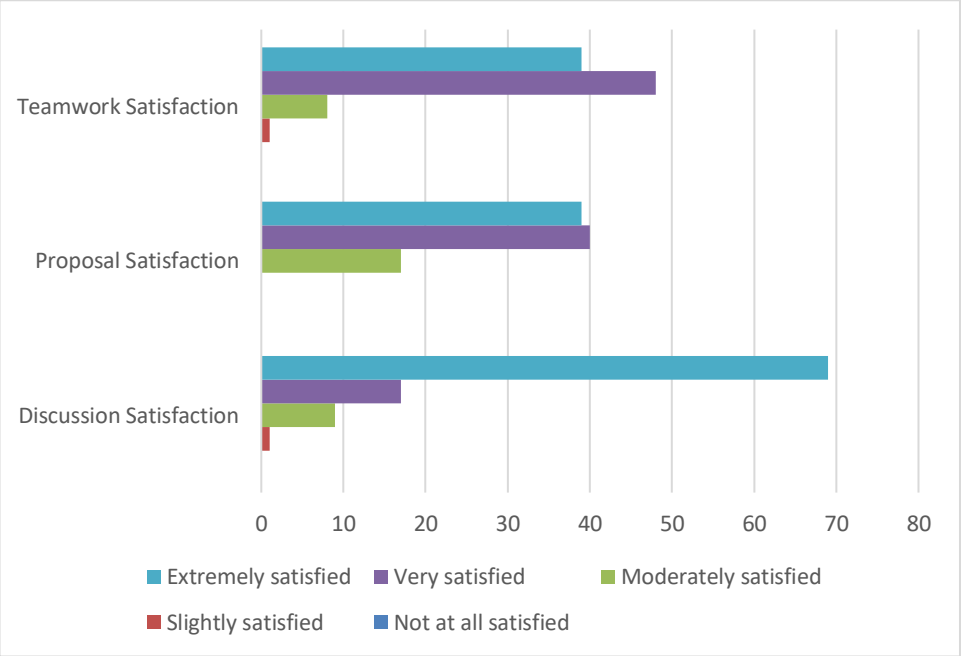

Figure 2: Glowing Satisfaction with Teamwork, Proposal, and Discussion in D-Agree (n=96)

3. 3 Consensus and Agreement

Although the primary focus of this study was not to compare groups or measure the level of consensus quantitatively, it is worth noting that most groups demonstrated a substantial degree of agreement within their policy proposals. Consensus was evident in the form of supportive comments and agreement on the proposed policy elements, as indicated in the comments section within the D-Agree platform, suggesting that the task-based approach within D-Agree effectively facilitated the consensus-building process (see Figure 3, 4).

4 Discussion

4. 1 Task-Based Approach in Consensus Building

Our study focused on exploring consensus building within the AI-driven discussion platform, D-Agree, employing a task-based approach. The success of this approach, as evidenced by the high completion rate of final policy proposals, underscores the effectiveness of assigning specific roles and responsibilities to participants. This task-based framework encouraged active participation and ensured that each group member contributed meaningfully to the policy development process. The positive outcomes align with the findings of collaborative planning theories, particularly the role-playing concept introduced by Innes and Booher (1999) [6]. While our study didn't employ role-playing in the traditional sense, it embraced a role-based method where participants were assigned distinct tasks.

4. 2 Participant Satisfaction and Collaborative Synergy

Participant satisfaction surveys revealed a positive outlook on the collaborative process. Participants appreciated the engagement, found the discussions informative, and rated the final proposal favorably. These findings echo the theory of collaborative planning as a learning process, where participants transform their perspectives and engage in genuine, innovative approaches to complex issues. The synergy cultivated among team members through task-based collaboration is indicative of the potential for AI-driven platforms like D-Agree to facilitate inclusive and effective policy development.

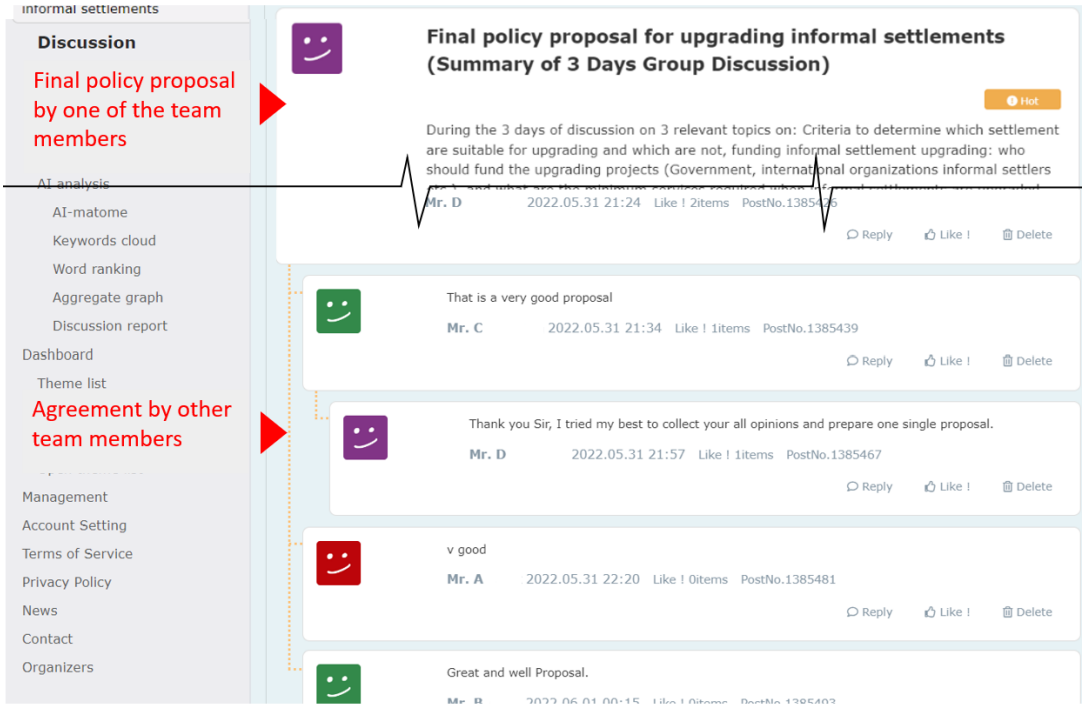

Figure 3: Excerpt from the Final Policy Proposal by an Assigned Participant and Consensus Comments

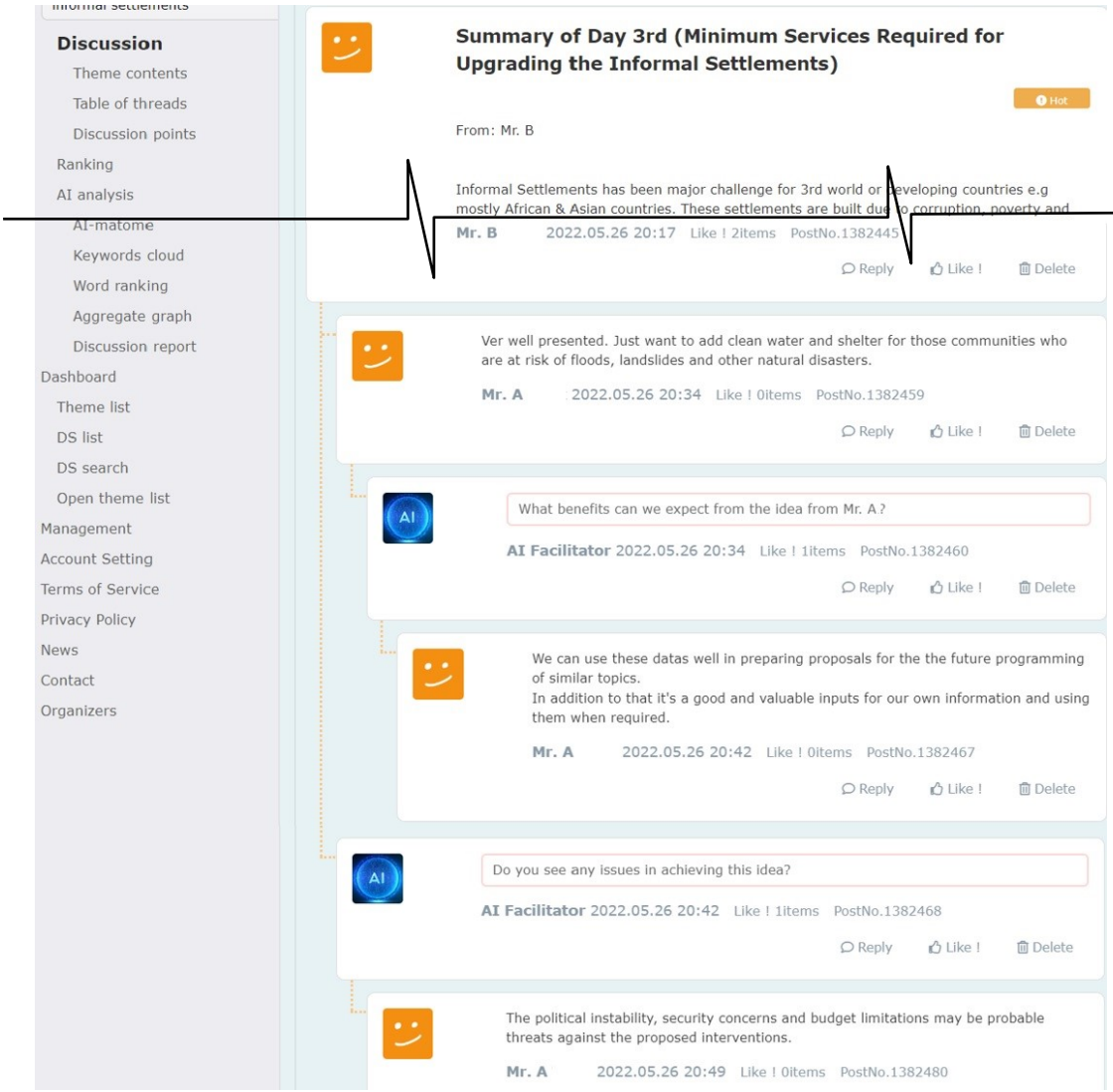

Figure 4: Evolution of AI-Facilitated Messages Leading to Unanimously Accepted Proposal

4. 3 Limitations and Future Directions

While our study demonstrated the value of task-based consensus building in an AI-driven discussion platform, it is not without its limitations. These limitations should be acknowledged to guide future research efforts.

One limitation is that we did not employ quantitative consensus measures, which could provide a more objective assessment of agreement among participants. Future studies might consider incorporating quantitative metrics to complement our qualitative findings and provide a more comprehensive understanding of consensus-building dynamics. Additionally, the lack of diversity in participants' roles is another limitation that warrants attention in future research. Exploring a more diverse set of roles and examining how different roles contribute to consensus building could enhance the depth of our insights.

There are several promising directions for future work in this area. Extending this approach to different policy domains beyond informal settlement upgrading could yield valuable insights into the generalizability of our findings. Exploring consensus building in diverse policy contexts may uncover unique dynamics and challenges.

In summary, while our study contributes valuable insights, addressing these limitations and exploring these future directions can further advance the field of AI-driven consensus building and its applications in policy development and decision-making.

5 Conclusion

Our research has illuminated the effectiveness of a task-based approach to consensus building within AI-driven discussion platforms. By assigning specific roles and responsibilities to participants, we observed a remarkable rate of task completion and overall participant satisfaction. This task-based methodology, distinct from traditional role-playing, resonates with the principles of collaborative planning and learning.

In summary, our study underscores the immense potential of AI-facilitated platforms like D-Agree in nurturing inclusive and efficient policy development processes. Through an experimental web-based case study, we witnessed the collaborative success of 20 out of 24 groups, each composed of four individuals, in crafting policy proposals for the upgrading of informal settlements. These qualitative findings find resonance in participants' satisfaction, as revealed through post-discussion surveys, with both the process and the resulting proposals.

As technology continues to advance, grasping how task-based roles can enhance consensus building becomes increasingly essential for collectively tackling complex societal challenges. The implications of this work reverberate in the development of consensus building support systems that accommodate varying degrees of agency within collaborative tasks. By harnessing the power of AI and structured roles, we aspire to pave the way for more inclusive, effective, and equitable approaches to policy development and decision-making in an ever-evolving digital landscape.

Ethics Statement

Participant consent was obtained before participating in the study.

Acknowledgement

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