A Study on Conversational AI Platform for Participatory Democracy

（参加型民主主義のための会話型AIプラットフォームに関する研究）

By

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DEDICATION

This work is humbly dedicated to:

My beloved parents (Mir Ahmad and Friba),

My beloved wife (Sofia) and kids (Ava Soha and Emad Ahmad),

My professor (Takayuki Ito),

To the spirit of an exemplary human being who devoted his life to Afghanistan (Tetsu Nakamura),

&

My country Afghanistan, especially the beloved capital city Kabul.

Those people's support and love is always the source of power during my study program.

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Abstract

In the literature, many studies are reported that implemented and investigated the determinants of internet-based participatory platforms in promoting democratic citizens involvement all over the world. The intention was to democratize discussion, allowing stakeholders from all walks of life to communicate and discuss with each other at scale. However, most of these studies heavily focused on contributing for technical fixes for scaling up deliberation, with a heavy concentration on social experimental design at lab-setting or real-world implementation focusing on developed countries. Therefore, there is a distinct lack of discussion on the nature of the smart design process that enables the inclusion of human beings, mainly the inclusion stakeholders such as government officials and people in least developed countries (LDCs) to come together to discuss in order to solve their common problems. It is because the main reason why a technology is successful is due to their acceptance and breakthrough on the way to build real social networks rather than system's distributed and parallel computing technologies itself. Hence, this vision has not been fully realized as how LDCs (such as Afghanistan) cope with restraints such as issues of space, security, and gender and promise to increase the interaction between public officials and their citizens using participatory tools at scale. As a result, participatory democracy at scale remains unavailable in decision-making processes. Thus, we need a break-through that utilizes those evolutions of technologies in LDCs.

In this thesis, I present a practical framework, in which a new system is its key part to empower discussion participants to work collectively in order to bring insights to participatory process through a range of support functions that superimpose richer understanding for both citizens to collaborate and city for policy-making.

This study aims to investigate the impact of conversational AI platform for participatory democracy in a real-world setting promise of not only evaluate the system but also intend enhancing citizen participation in democratic participative process to serve as guides for the city planning and developments in Kabul, including helping crowd identify issues and its solutions for policy makers using real-world case studies.

The system enables the following new capabilities: 1) autonomous facilitation using AI techniques, 2) autonomous discussion argumentation mining using NLP and NLG, and 3) autonomous gamification using AI-based incentive mechanisms in a country of abundant democratic participative process (Afghanistan).

By putting more meaningful and powerful participatory tools for contribution in the hands of both city and citizens, I envision a future where LDCs are empowered to actively co-create every aspect of their society and environments, bringing in their nuanced and contextual insights.

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Sub-Thesis Supervisor: Dr. Shohei Kato
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TABLE OF CONTENTS

LIST OF FIGURES

Chapter 1

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

LIST OF TABLES

Chapter 1

Chapter 4

Chapter 5

Chapter 6

Chapter 7

Chapter 8

LIST OF ACRONYMS AND ABBREVIATIONS

AD	Augmented Democracy
AI	Artificial Intelligence
A-SDGs	Afghanistan Sustainable Development Goals
ANPHI	Afghanistan National Public Health Institute
AMS	Amazon Web Services
AIF	Argument Interchange Format
BERT	Bidirectional Encoder Representations from Transformers
Bi-LSTM	Bidirectional Long Short-Term Memory
BAF	Bipolar Argumentation Framework
CI	Collective Intelligence
CCAP	Citizens' Charter Afghanistan Project
COVID-19	Coronavirus Disease of 2019
COLLAGREE	Collective Agreement
CCDP	Crowd-based Communicative and deliberative e-Planning
CRIDA	Capital Region Independent Development Authority
D-Agree	Discussion Agreement
DCs	Developed Countries
DL	Deep Learning
GDSS	Group Decision Support System
GPT	General Purpose Technology
GAT	Graph Attention Network
Herat-M	Herat Municipality
ICTs	Information Communication Technologies
IBIS	Issue-based Information System
JICA	Japan International Cooperation Agency
Kandahar-M	Kandahar Municipality
Km^2	Square kilometer
KMDP	Kabul Municipal Development Program
KM	Kabul Municipality
KSP	Kabul Solidarity Program
Kyoto-U	Kyoto University

LDCs	Least Developed Countries
LOOCV	Leave-One-Out Cross-Validation
MIT	Massachusetts Institute of Technology
ML	Machine Learning
MoE	Afghanistan's Ministry of Economy
MoPH	Afghanistan's Ministry of Public Health Afghanistan
MUDL	Afghanistan's Ministry of Urban Development and Land
N	Negative
NISA	National Statistic and Information Authority
NITech	Nagoya Institute of Technology
NLP	Natural Language Processing
NLG	Natural Language Generation
No.	Number
P	Positive
RNN	Recurrent Neural Network
R&D	Research and Development
RSS	Really Simple Syndication
SM	Social Media
TAM	Technology Acceptance Model
TTF	Task Technology Fit
WHO	World Health Organization
UI	User Interface
UNAMA	United Nations Assistance Mission in Afghanistan
UN-Habitat	United Nations Human Settlements Program
UNEP	United Nations Environment Program

CHAPTER 1

INTRODUCTION

CHAPTER 1: INTRODUCTION

In this *chapter,* we begin with a general background on online forums for social participatory good, particularly for participatory planning democracy, role of these platforms on participative process development, and outlining issues being faced within these platforms. This chapter presents the general research remarks on existing digital participatory platforms, and questions and hypotheses are posed within the context of Kabul city, Afghanistan. Particularly, this chapter outlines the issues within contemporary participatory planning methods by least developed and war-ravaged countries such as Afghanistan and present the need for a digital platform in the context of Afghanistan. Additionally, the chapter lays out the major justifications and objective that was set out to achieve in this study. Finally, this chapter gives information about the overall thesis in general framework and study area, and also, provides an outline of how the remaining chapters of the thesis are organized.

1.1. Background

Internet is a most remarkable invention of humankind that led to largest and fastest growing society platform in the world affecting not only the full spectrum of social relationship [1, 2, 3] but also others such healthcare [4, 5], political activity [6, 7, 8] and even the most intimate decision-making tool for society through online deliberative democracy [9, 10, 11, 12, 13, 14]. This technology has the potential to enhance interactivity, transparency, and openness, thus forming a new globalized democratic society as social networks and virtual communities. For instance, this rapid internet development has opened up a single online channel as a communication line, and half of all humanity has become linked and connected by single general purpose communication technology (GPT) [15] using different communication means and devices. For example, an internet-enabled smartphone user in Nagoya can jointly be connected with an iPad user on the WiFi network of Emirates airlines all from the sky above and a desktop user in an internet café in Kabul city and they all discuss with each other using a web forum. Thus, the internet helps humanity to not live in three different worlds, and live in one world that is based on a huge pocket of truly global world inclusion. This open moment in history led to globalizations and rapid spread of knowledge and information.

Information can be shared through its main means of communication (internet) with distribution support through novel technologies such as Web 2.0 and Web forum [16]. These technologies are considered the latest step in internet development. The term Web 2.0 was first coined in 2005 by O'Really to refer to 2-generation web based on technologies such as Really Simple Syndication (RSS), widgets, podcasting, mashups, folksonomies and starting facilities. Based on these technological bases, the so-called web forums have been developed [16].

The web forum not only became one of the necessary means of communications but also an efficient means to power participatory and deliberative democracy through efficient and democratic public policy making [17] [18] [19] [20]. Scholarship believes that online tool and digital societal community's growth is attributable to the smarter human collective intelligence through participative modernization initiatives such as deliberative and participatory democracy [21] 22], which started by utilizing these tools [14] [23] [24] [25].

It is worth mentioning that online discussion tools can broadly be encompassed by the four categories: (1) Mailing List; (2) Group Chat; (3) Web Forum; and (4) social media. These systems have uniqueness and similarities with each other, and have their advantages and disadvantages. The difference between mailing list, group chat, web forum and social media is the way they are accessed. The mailing list and group chat users' expectation could be both synchronous and discussion will be centered around communication types, however, web and social media platforms could be both synchronous and asynchronous usage and discussion will be centered around collective question-and-answer discourse types.

With the advent of mass digital participatory technologies, human collective intelligence able to be used for democratization process, as it is interlinked with open-based gathering and idea sharing, thus, contributes to a better understanding of problem from the lens of both mass and diverse society and promote participatory democracy [23] [26] [27].

According to John Dewey long ago observation, that democracy is constituted and formed through public opinions and discussion which accomplished through meaningful communication [28, 29, 30, 31, 32, 33, 34]. Which type of democratic participation; the type that improve equity, equality, civility and inclusiveness between citizen involved in discussion [35] [36] [37] [38].

Although social media allow mass participation and citizens' engagement on local government [39] [40] [41], and despite their mass usage to enhance transparency by local governments [42], researchers argue that these technologies limit exposure to

opposing views [43], create echo chambers [44], and may have negative implications for civic discourse due to the filter bubbles [45] [46]. Therefore, arguably social media platforms are clearly unsuited to enabling respectful and reasoned discussions around urgent sustainability complex systemic challenges like climate change [47]. For example, Facebook helps to allow mass participation and sharing of common problems in discussion process [16] [39] [41] [42] but it does not provide meaningful support to facilitate discussion process [48], and discussion via it are of significantly low deliberative quality [49]. Furthermore, the structure of comments not help deliberative quality of discussions, and also, posts are more difficult to navigate and connect to each other, thus, discussion often involve in an atmosphere of confrontation, particularly in least developed countries and the of ability of social media to promote fair and transparent discussion is debatable [22] [50] [51]. As a result, the insights from these platforms cannot be used because policymakers might face a decision problem while integrating the unstructured voices of citizens collected through such platforms [52].

Towards that end, newer platforms (online forums) intended to visualize discussions and map out arguments to help participants better connect posted information [53]. It is important to sample online discussion [54] and increase democratic equity, equality, civility and inclusiveness between citizens involved in discussion [52]. It is because the design purpose in these platforms is a matter of how to support discussion. Support technologies such as machine learning and natural language processing requires widening the circle of people involved in deliberation through support functions such as integrating discussion elements using smart argumentation and facilitation towards achieving consensus among participants [55] [56] [57] [58]. This is because the key goal of deliberation is rational dialogue, and rational dialogue is considered to be the basis of discussion [59], thus, the meaningful deliberative platform promises not only eliminate discriminatory effects, reduce polarization and inequalities but also, redistribute power among citizens [60], promote thoughtful and higher quality discussion [61] through providing a certain guarantee of ‘representativeness’ [62] with inclusion and facilitating of all voices [63].

Web forum same as other three (mailing list, group chat and social media) also have a long history, but in contrast from the first two (mailing list and group chat) have changed a lot, where mailing list and group chat didn’t change so much and remain the same as we had in early days [56]. One of the main reasons for the fast and rapidly changing and development of web forums compared to the first two are the volume of attraction which they have received from both research and social communities, and also, their possible democratic mass citizens involvement and wide-area real-world

application[37]. For example, today, many of these websites' forums are becoming crucial for the smarter participatory democracy service for citizens and organization [52]. In 1962 researchers reported that this augmented participatory democracy would yield a multiplier effect for social good [64] towards mass participatory question-and-answer (Q&A) service, that any user in the community can come together to devise solutions such as a participatory platform. Due to such benefits, digital forums have been considered as an emerging application and employed to shift knowledge from individual to collective and are posed to be the next next-generation platforms for democratic citizen involvement [23].

When we talk about smarter democracy [65] [66], we are talking about collective-based power on human collective intelligence [67] [68]. Etymologically, the term "democracy" recalls the power (kratos) of the people (demos) [69]. Based on this vision, organizations and people collectively come together to solve their problem (shown in Figure 1.1). For instance, people came together in Landsgemeinde Glarus, Switzerland [87], to practice their traditional participatory democracy (shown in Figure 1.2).

Based on that evidence, there is a broad attention on the need to adopt practical solutions to address urban sustainability challenges, for the cities with citizens because scholarship argues adopting digital society will mitigate local issues through harnessing the wisdom of the crowd and help smart policymaking. It will also achieve an adequate balance between policy making aspects and sustainability issues from the lens of not only officials but also all urban stakeholders particularly citizens, thus, promote participatory democracy in local governance such as participatory planning [25].

Digital participatory resembles augmented democracy using online participatory methodologies. Augmented democracy (AD) based on collective intelligence strongly contributes to the shift of knowledge and power from the individual to the collective, thus, a digital participatory platform based on facilitation is essential for the communication and collaboration at scale [67].

Researchers have been inspired by recent trends in information communication technologies (ICTs) including digital participatory tools, which are analogous to Arnstein's ladder of citizen participation [70], and a new topology has been adopted to reframe participatory planning as participatory e-participation and planning.

Participatory e-planning resembles e-participation using online participative methodologies [70] [35] to empower citizens to climb the participation rungs in urban policy processes without time or space limits [71]. However, researchers argue that a publicly virtual presence without supportive means through online social platforms alone cannot guarantee meaningful discussions [67] and consultations because it fails to provide

such (1) supportive means to facilitate a fair reasoning process among all stakeholders and (2) incentive mechanisms required to stimulate efficient communication and collaboration among users [72] [73].

The importance of adopting digital participatory tools in local government to address sustainability problems across diverse cities has since been widely agreed and adopted [74]. For instance, digital participatory tools such as Decidim and Decide in Spain [75] [76], MeinBerlin in Germany [77], Participate Melbourne in Australia [78], COLLAGREE [79] were used in collaboration with cities such as Barcelona, Spain; Berlin, Germany; Melbourne, Australia; and Nagoya, Japan to promote citizens involvement within participative process with the collaboration of the local municipal government.

Even though the literature [79] [80] is heavily focused on perspective for internet deliberative democracy through technical contribution for facilitating and scaling up digital public deliberation platform in different spectrum of our life such planning process [81], there is a distinct lack of study and discussion on the inclusion of stakeholders and issues relating to inclusion, which may unwittingly perpetuate bias [82] [83] [84]. Particularly, less attention is paid to how to foster long-term government-to-citizen and citizen-to government relationships using such technologies. Particularly, how to evaluate these technologies in least developed countries (LDCs) (such as Afghanistan) cope with budgetary restraints as well as issues of space, security, and gender. How can these technologies simultaneously promise to increase community participation and increase the interaction between public officials and their citizens at scale? This is because, due to the atmosphere of confrontation in war-ravaged countries like Afghanistan, enacting social platforms without the support of functions as mentioned above is complicated. As a result, participatory democracy at scale remains unavailable in decision-making processes and fostering long-term government-to-citizen and citizen-to government relationships is needed.

Furthermore, less attention is paid to how these technologies can be used by the government for crowd consultation in complex and urgent problems such as city planning and development in those countries [85]. As a result, smart communicative planning remains unavailable in decision-making processes in the context of Afghanistan. In this chapter, we present the needs of adopting a participatory framework, which digital participatory tool is its key part for LDCs like Afghanistan, but before that we are outlining the issues being faced by existing digital participatory platforms.

Currently, more than societal activities are held using online tools. With the adverse effects on the global Coronavirus Pandemic on travelling, the scientific

community has developed many tools to create a joint solution towards an environment that supports productive collaboration online. Thus, many societal activities in recent years since 2019 were conducted virtually, particularly using video or text-based communication such as Zoom [86]. However, transition to these unconventional platforms not only posed challenges for activities such as intensive group-based discussion but also the scale of participation afforded by virtual participation (through internet) has led to problems with leading and managing large-scale discourse for these communication tools such as large-scale online discussion platforms. These challenges have led researchers to rethink their research direction and have resulted in attempts to reconcile digital participatory and discussion support platforms [68].

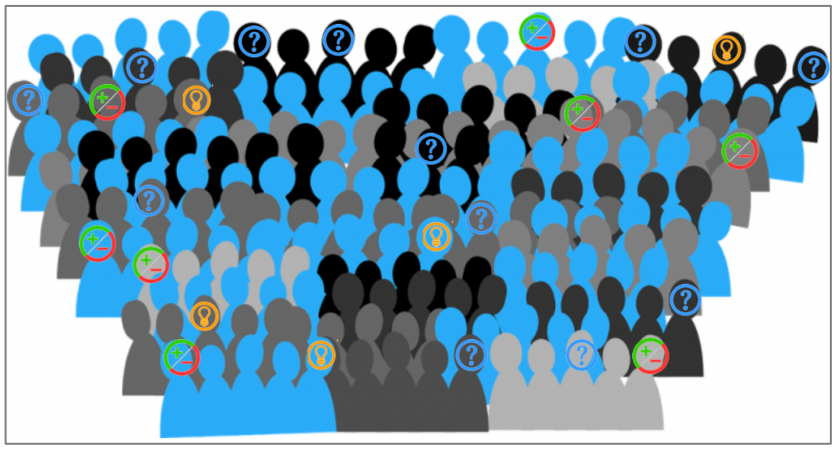


Figure 1. 1: People discussing together will produce a collective intelligence and superminds [26].

Figure 1. 2: Landsgemeinde Glarus, Switzerland, the first practical example of traditional participatory democracy [87].

1.2. General Remarks on Mass Digital Participatory Platform

Web forums are widely used at individual and organizational levels to discuss a variety of topics ranging from poverty, inequality, climate change to organizational policy development [26] [35] [37]. The social insights gathered through such forums are further analyzed for policy purposes depending on the interest of the organizations [52]. In particular, the outbreak of the Coronavirus Disease of 2019 (COVID-19) pandemic transformed discussion spaces from physical to virtual, as many people were compelled to embrace using online forums [88] [89] [90]. However, a major concern in leveraging online platforms for discussion purposes is how to foster users' engagement and enhance discussions outcomes [91] [92] [93]. Moreover, discussion through online forums is often associated with lack of interest on the part of the discussants, digression of discussions, and low participation and response rates [93].

Furthermore, recent scholarship argues that a publicly virtual presence and discussion without supportive means cannot guarantee meaningful discussions because it fails to harmonize views among all discussants [94] [95] [96] [97] [98] [99] [100]. They suggest that at a core of discussion platform support function should lie that help

proceeding discussion and decision-making at the end [101]. For example, Facebook as a digital social network does not provide support to facilitate discussions and the insights collected from it might not be used for policy making because policymakers might face a decision problem while integrating the unstructured voices of citizens collected through such platforms [49]. Some research argues that forums must provide supportive means like gamification [102] [103] and facilitation [101] to stimulate public deliberation [104] and involvement of every discussant to actively input on discussed related issues, ideas and arguments. In this background, large-scale online discussion based on supportive means are attracting great attention as approaches that overcome these shortcomings, and human-mediation facilitation support introduced to help these discussions to proceed more efficiently and productively [105].

1.3. Remarks on Human-mediated Crowd-Scale Deliberation Platform

The growing scale of content, lack of collaboration and facilitation in online discussion become an important subject because still there are a number of challenges such as human-mediated bias, predefined argumentation mining and time restriction that must be solved in online discussion. For example, in Deliberatorium [106] the discussion must be human-led structured around four types of discussion components (issue, idea, arguments), where it is not necessarily structured around issues at high level. Another issue within Deliberatorium is the lack of incentive mechanisms to promote interaction among human participants. The third issue (shown in Figure 1.3) is that participants in the Deliberatorium create their discussions according to a predefined argumentation map, and then it requires human-led moderator action to certify the post and make it visible to everybody.

Although, the issues mentioned above such as predefined argumentation map and argumentation approval solved in the COLLAGREE (Collective Agreement) [97], an online digital participatory and deliberation platform developed at the Nagoya Institute of Technology (NITech) [107]; which builds the argumentation structure automatically from their posts based on IBIS elements [108] and introducing incentive mechanism to stimulate interaction among participations. However, the systems facing the lack of efficient mediation mechanism to avoid human-mediated facilitation bias [52]. The COLLAGREE web interface is shown in Figure 1.4 [109].

Although due to the deliberative ideal's stance of human moderator in discussion, they can improve the quality of discussion, however, studies dealing with human-mediated research reveals that they may reduce fairness and legitimacy and thus, lead to self-censorship [110]. Furthermore, conducting such discussions with human facilitation biases the generation of citizen decisions that stimulates an atmosphere of confrontation, causing another decision problem for decision-making [111]. Also, they suffer from time and location constraints. But researchers-initiated studies [79] on how to lead efficiently online discussion suggests that it can be doctored by equipping online forums with support functions such as "autonomous facilitator" [111] [112].

Nonetheless, the human-mediated focus on small-size deliberation and do not focus on large-scale discussion support, because human-mediated can only provide support for small-size people (i.e., limited facilitation) and the bias of these functions cannot be avoided for discussion. Meanwhile, large-scale online systems that highlight automated facilitation (facilitated by AI) have become necessary in order to overcome these shortcomings [79]. Effective and efficient facilitation is, thus, one of the most important and challenging issues for digital participatory platforms [111]. Therefore, researchers initiated automated facilitation studies on automated facilitation and large-scale discussion based on automated facilitation support have been developed [112].

Human-mediated moderation workload becomes too high so some aspects of facilitation may need to be automated the facilitation process to not only increase democratic equity, equality, civility and inclusiveness between citizen involved in discussion [23] [24] [25] [27] but also support technologies should be given to widening the circle of people involved in deliberation to deal with tasks like opinion summarization or consensus building [67].

Incorporating different incentives and autonomous mechanisms [113] [114] such as discussion scoring, autonomous facilitation into discussion endeavour through online forums have often been suggested to be used to encourage users to participate and ensure that the discussions stay focused. Scholarship argues that such mechanisms with greater prospects of generating users' interests and facilitating robust meaningful discussions that both meet the mutual needs of the researcher and those of the research targets/subjects and sociocultural context of the research has received less empirical scrutiny [74].

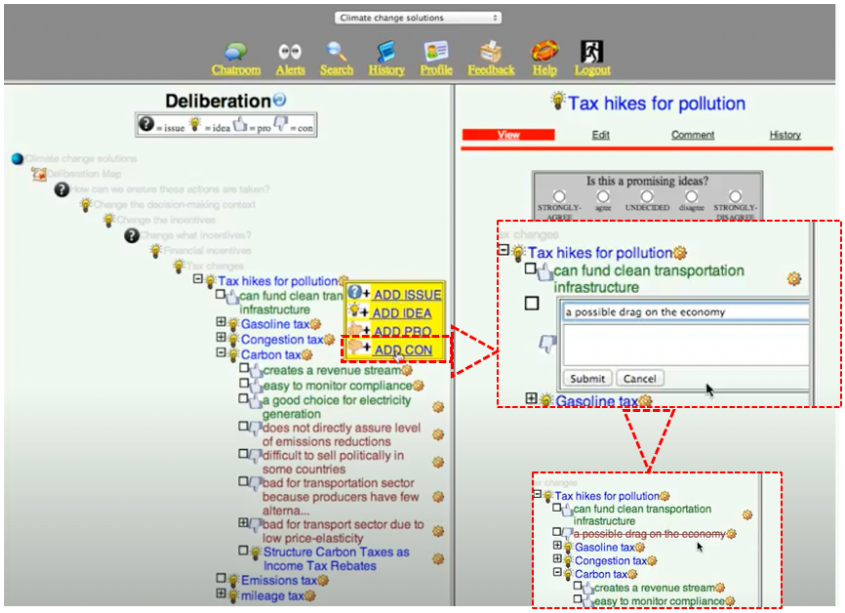


Figure 1. 3: User interface of Deliberatorium, where users are requested to submit their opinion based predefined argumentation map, and then moderator will check and certify it [115] [116].

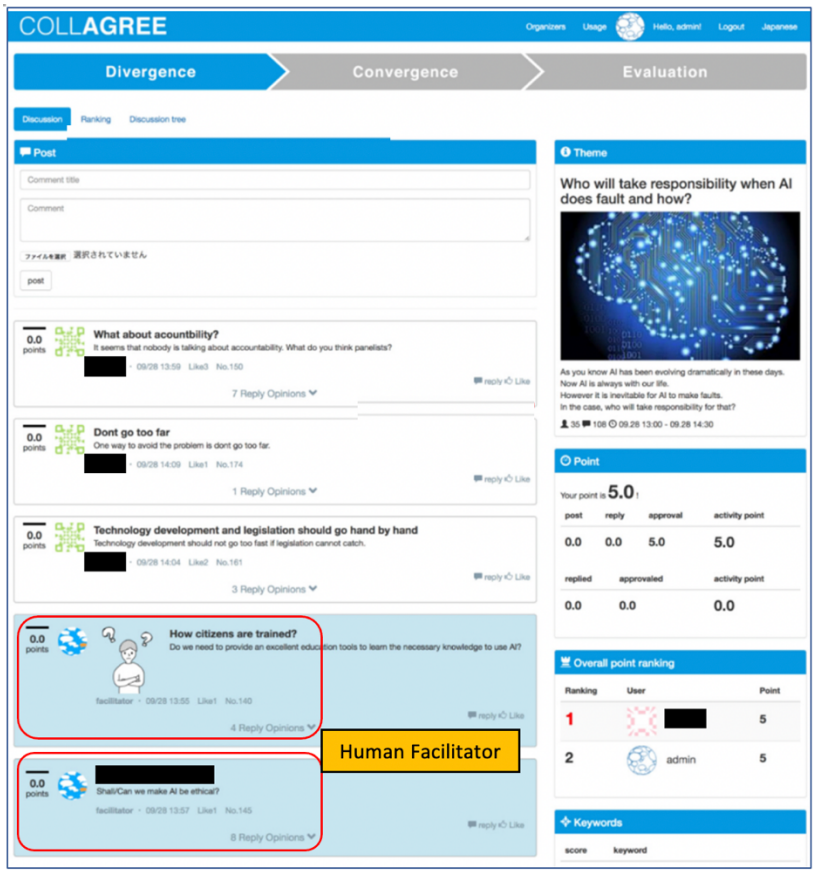


Figure 1. 4: User interface of COLLAGREE, where human facilitators are introduced to motivate online discussants to engage and collaborate with each other [109].

1.4. Agent-mediated Mass Deliberation Platform

Despite the hopes digital forums based on human-mediation support would revolutionize democratic participation, evidence suggests that digital participatory systems designed for often fail to achieve the expected objectives and levels of take-up [117]. Scholarship argues that complexity makes digital systems prone to fail and requires them to be managed as a process of learning and adaptation autonomous support for discussion rather than a static technological product for consultation that might lead to scale of content [95].

With the rapid development and advancement of digital participative process, researchers believed that some support by AI and multiagent systems should be used to ensure the diversity of ideas is adequately captured based on facilitated at scale [93] [94]. With the emergence of AI technologies [118] (technologies involving ML [119], DL [120], NLP [121] and NLG [122]), more intelligent systems have emerged with learning methodologies and knowledge-based models specifically automounts facilitation and their intermittent phenomena which has transformed the communication has recently become an important topic among research worldwide.

The integration of learning capabilities of support technologies such as, deep learning (DL) [120] and machine learning (ML) [119] in discussion have allowed for new means of facilitation for guiding web communities towards augmented democracy. Augmented democracy (AD) is the idea of using conversational agents to lead groups of people to communicate with each other on their common problem and at the end reach a democratic decisions [123]. This novelty in an online discussion system's form the digital participatory platform to be the next-generation platforms for democratic citizen involvement. Thus, conversational AI platforms have the capability to diverse, converge and then evaluate the discussion insights automatically. Reflecting this, design features suggested for online deliberation systems [124] and autonomous facilitation techniques becomes an important new avenue for mass deliberation research [97].

As a result, conversational AI is all about the automated tools, techniques, and programming that allow a computer to mimic and carry out conversational experiences with people using natural languages learning methodologies and knowledge-based models, while a chatbot is a program that can (but doesn't always) use conversational AI. For instance, Twitter Bots are agents [125], which are programmed to automatically

generate mass posts (tweet, retweet and follow other accounts) on Twitter but they do not directly take on the roles of facilitator in order to initiate human discussion.

Researchers presented an overview of conversational AI in which they discussed the published literature on conversational AI and overview of methodologies and applications [126]. Conversational agent receives natural language input, sometimes interpreted through speech recognition software, and executes one or more related commands to engage in goal-directed behavior (often on behalf of a human user). As intelligent agents, they are usually autonomous, reactive, proactive, and social.

Studies have shown that online forums-based on facilitation have become prominent in deliberative research as venues for infusing democracies with fully democratic participatory elements [127] [128]. Tavanapour et al. [93] reported a possible application of a chatbot as a facilitator to promote the process and documentation of citizens' idea generation for direct and active citizen participation initiatives. Researcher [129] found that artificial facilitators indeed enhance interaction and promote the collective reasoning within online asynchronous discussion, while users who had been engaged and interacted with agents only partially increased their knowledge gain. According to Alnemr [130], there are many blind spots of algorithmic facilitation and implementation of online deliberation with a focus on chatbots as facilitators. As described by Nardine Alnnermr [130], chatbots as facilitators in online deliberation are not in a manner consistent with democratic ideals and are amenable to scrutiny by citizens. However, her arguments were focus on chatbots as facilitator not conversational AI as facilitator, and effect of conversational AI as facilitator are generally acknowledge in the literature [94] [95] [96] [97].

Conversational AI platforms also enhance smarter and deliberative democracy [59]. According to Ito et al. [67], discussion is essential for democracy, thus, providing good support is critical for establishing and maintaining coherent discussions. This is because the public's opinion inclusion is critical in forging sustainable policies and developing a smart society [59] and without considering public insights development actions often fail [52]. As a result, public participation based on artificially facilitated online discussion promotes quality solutions through a meaningful participation and reasoning [37].

Evidence shows that artificial facilitation promotes collective argumentative reasoning within online discussion and ameliorates deliberative virtues by spurring interaction among the users [36]. Moreover, evidence shows that artificial facilitators within discussion improves the responsiveness of participants within multi-party discussions compared to that discussion without facilitation. However, facilitation based on agents are criticized as being unsuitable for fair facilitation and most human-like as

they predominantly set a range of facilitation ratio with little prospect of knowing the structure and differences of sociocultural backgrounds.

Mainly efficient crowd-scale deliberation. From a participatory democracy perspective, crowd-scale deliberation is coded as a decision-making procedure for groups of peoples to come together to discuss their common problems and make the best solution at the end. Despite the above-mentioned platform abilities to facilitate the discussion among people to discuss the better idea, evaluate solution, and select the best solution, they lack a fair and automated facilitator to lead large-scale groups of people to achieve their goal and reach agreement.

Therefore, to lead digital participatory platforms in crowd-scale efficient deliberation, agent-mediated support is required to proceed discussion in large-scale deliberation. Towards that end, our project team lead by Takayuki Ito at the NITech [107] developed an agent-mediated participatory platform in large-scale deliberation, called D-Agree [94].

1.5. D-Agree: A Participatory Support System based on Automated Facilitation Agent

D-agree [54], a scalable deliberation support system based on an automated facilitation agent, which is the main instrument proposed to use as digital society platform for this study and is a key part within our proposed participatory framework. D-Agree's newer version was born from AI and collective intelligence research and launched in 2018. Its objective is "to encourage the city-citizens relationship, involving them in the generation of innovative ideas for their common problem in order to improve their quality of life. The newer version available at: https://d-agree.com/site/en/. The newer versions is officially implemented only at Kabul city level, but the older version, COLLAGREE [81], has been implemented in city of Nagoya.

To create this system and its first version, some examples of digital participatory tools were reviewed, especially inspired from CoLab at MIT (USA) [24]. Participation in D-Agree is carried through online discussion. The platform is open to everyone with registration, but participation is limited according to discussion space types. We have two types: (1) close space; and (2) open spaces. For closed spaces, only registered and invited individual citizens can join the discussion but for open space everyone can join and make comments in all discussions.

The agent extracts semantic discussion structures from online discussion, analyzes them, generates facilitation messages, and posts facilitation messages to the discussion system. Technically, the system provides a vehicle that facilitates crowd-scale deliberation by automated facilitation agents to promote collective awareness and consensus building by harnessing collective intelligence for policies and decision making. D-Agree discloses aggregated statistics such as number of logged in users, number of posts, including number of issues, ideas, pros and cons, number of likes and discussion and post time in real-time.

System is composed of two modules: front-end and back-end architectures. The former is the system user interface (UI), which interacts with users through discussion websites or other social platform messaging services. The back-end hosts four agent modules: (1) a conversational agent; (2) a proactive agent; (3) an NLP engine; and (4) an argumentation engine. The top part of picture a in Figure 1.5 shows the front-end, and the bottom part shows the back-end architectures of our system. The right part of the bottom picture in Figure 1.5 shows the adopted discussion structure, and the left part shows the discussion development in our system [36] [52]. The bottom picture in Figure 1.5. shows back-end architecture which includes a conversational agent, labelled as agent no. 1.

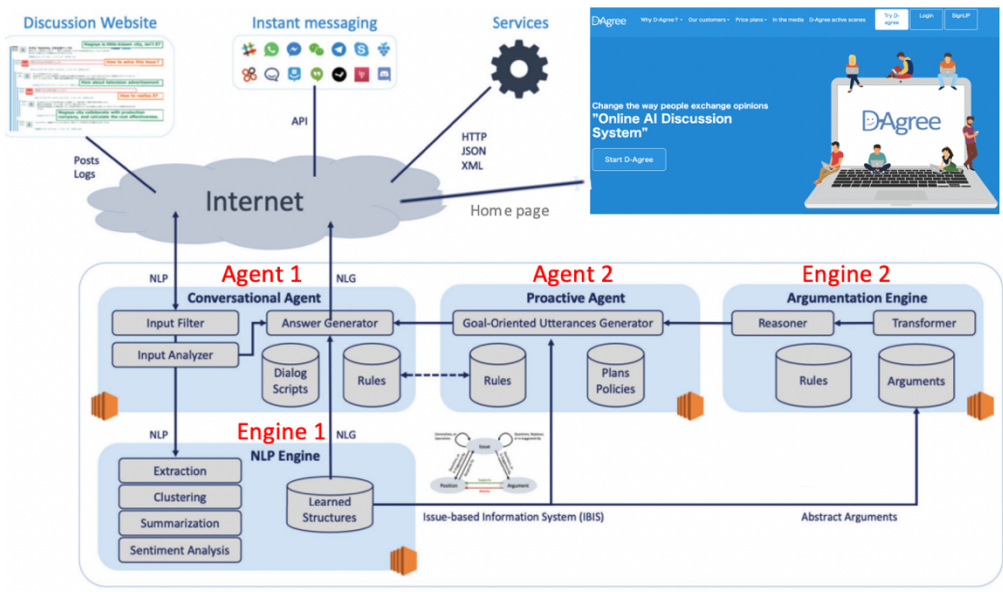


Figure 1. 5: (top) Outline of digital platform front-end structure, (bottom) outline of digital platform back-end hosting four types of agent modules [36].

1.11.1. Conversational Agent: An Agent that Facilitate Scalable Discussion

The key component in our system is conversational agent [36]. A conversational is an advanced software agent of chatbots that is designed to interact with users using AI-enabled natural language in ways that mimic human conversation [36] (shown in Figure 1.6). In practice, algorithmic techniques conduct NLP and then perform NLG to the query with human language which employs and extracts the posts of users using DL and ML methods [131]. For example, for all of the data posted by each user, a set of features is automatically learned by agent module using machine learning techniques and then apply one of predefined facilitation plans and policies (e.g., consensus, brainstorming, voting) to set agent's behavior before introducing a predefined facilitated message and the ratio [52].

Conversational agents, a class of dialog systems and sub-domain of AI that deals with speech-based or text-based agents which are capable of influencing public opinion about culture, products, and political agendas [132]. These system have been a subject of research in communications for decades [127] and effect of conversational AI as facilitator are generally acknowledge in the literature [36] [36] [94] [95].

A conversational agent's power to act autonomously as a facilitator to perform a task is determined by its AI functionalities such as NLP, NLG and argumentation engines which are based on ML and DL techniques. In other words, conversational agents depend on a variety of modalities (i.e., NLP engine, proactive agent, argumentation engine). NLP is defined as "the process of a machine extracting meaningful information from natural language input and/or producing natural language output" [133]. Conversational agent can initiate discussion at scale,

Research on the use of conversational agents as facilitator relates to either as facilitator assistance tools, which support human moderators in their roles, or agent-mediated discussion that completely replace human-mediated discussion. In D-Agree, completely replace the role of human facilitators in discussion [94].

D-Agree implements a conversational agent that is introduced to online discussions to interact with humans [36]. Such agents mediate discussions by posting facilitated messages and replying to user posts based on the number of facilitation policies and also complement humans to encourage reaching a consensus for solving problems on online communities by mediating and supporting human-generated posts. Such so-called agents moderate online discussions to develop argumentation-reasoning processes and generate opinions in online-discussion platforms. They help discussions proceed more efficiently and productively by removing human-based facilitation turn-taking biases and time

constraints. The agent adopts predefined facilitation messages based on some predefined policies with a specific semantic based on the post mining of users to decide whether to ask the author of the posted opinion to provide a support argument related to her posted opinion or to request other users to provide supportive arguments related to that posted opinion. The agent can summon other IBIS's elements, such as issues, ideas, or pros/cons. This process performed consistently well and improved the solicitation of opinions. More details on conversational agent introduction are described in section 1.4.
The conversational agent message is shown in Figure 1.6, while interacting with human participants to lead the discussion.

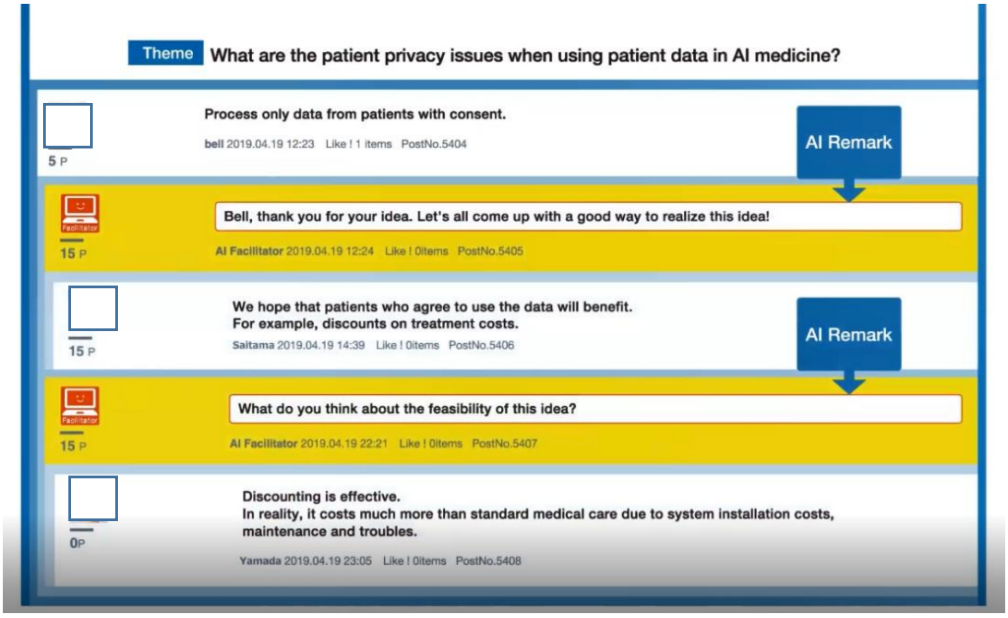


Figure 1. 6: Conversational agent understand opinions and post facilitated messages accordingly to lead the discussion.

1.11.2. AI-based Argumentation-based Approach: An Autonomous Diagrammatic Discussion Visualization using IBIS

Scholarship argues that the key goal of deliberation is rational dialogue, and rational dialogue is considered to be the basis of discussion [59] which might be achieved through argumentative discussion. Therefore, meaningful deliberative platform map discussion into a structured format [134].

There are different theories for the structured format such as Bipolar Argumentation Framework (BAF) [135] [136], Argument Interchange Format (AIF)

[137] and Issue-based Information System (IBIS) [108], but so far, no single model of argumentation exists which will be used and accepted by all.
However, scholarship suggests that issue-mapping remains as one of highly popular and successful argument mapping syntax which aims to achieve a clear understanding of argumentative discussion [82]. Thus, it is considered as a clear understanding of issue-mapping syntax that led discussion towards argumentative discussion to solve problems at hand in recent online mass deliberation platforms such as Deliberatorium [90] and COLLAGREE [81].

The IBIS is a practical model to structure arguments in textual discourse (issue-mapping) invented by Werner Kunz and Horst Rittel in the 1960s, is an argumentation-based approach to clarifying discussion structure based on issues, ideas and arguments (shown in Figure 1.7) which efficiently guides the identification, structuring, and settling of issues raised by problem-solving groups, and provides information pertinent to the discourse that involve large number of people. This is done by categorizing sentences into issues, positions, and arguments in a graphical manner. The root node (high level issue) is often the main question to be addressed by adding new ideas or arguments. The discussion trees in D-Agree, inspired by IBIS, contain a combination of four types of elements: issues, ideas, pros, and cons. The agent extracts a discussion's structure in real time based on IBIS, automatically classifying all the sentences (shown in Figure 1.8).

For argument information to be extracted from discussion, annotations were done using trained moderators and mappers. However, in the process of moderating, human-moderators may impose their own biases into the discussion while labeling other users inputted mapping or the users which inputted their opinions in the map which led to multiple cognitively challenging tasks such as the risk for human-led errors and moderation biases cannot be avoided as well [138]. In addition, human-mediated annotation scheme workload becomes too high and research estimates [50] require a human moderator for every 20 discussants while hosting a discussion, so some aspects of annotation scheme may need to be automated the argumentative mapping process to not only increase democratic. equity, equality, civility and inclusiveness between citizen involved in discussion [24] but also support technologies should be given to widening the circle of people involved in deliberation to deal with tasks like opinion summarization or consensus building [94].

Towards that end, researchers suggested that some support should be given by AI, such as NLP as a complement and transparent moderation mapping procedure. Autonomous argumentation is considered a most remarkable feature of large-scale online

deliberative discourse [139] [140], thus, recently researchers paid attention to autonomous annotation schemes adopted IBIS such as an autonomous IBIS notation is used in D-Agree. The remarkable feature of D-Agree is diagrammatic discussion visualization using IBIS in real-time. The discussion trees in D-Agree, inspired by IBIS, contain a combination of four types of elements: issues, ideas and arguments (pros, and cons), thus, in D-Agree, discussion is mapped out in terms of elements mentioned above.

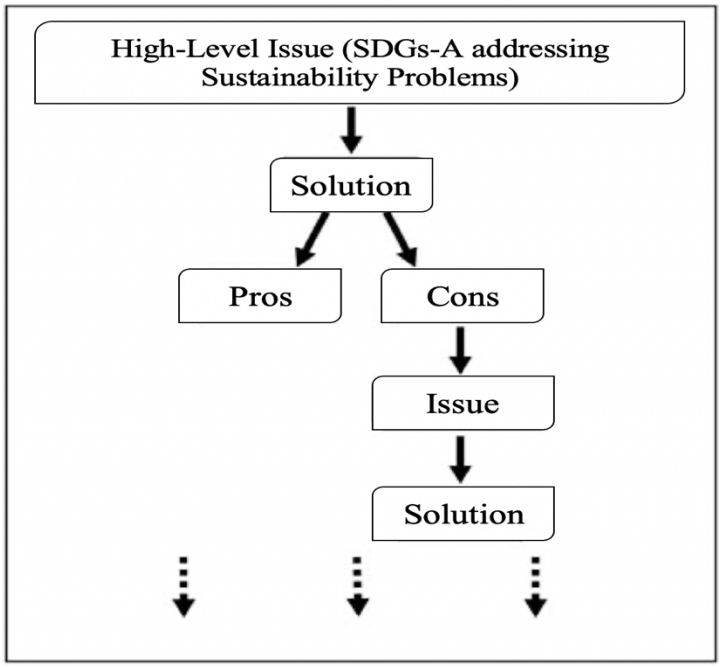


Figure 1. 7: Flow of discussion using by D-Agree [141].

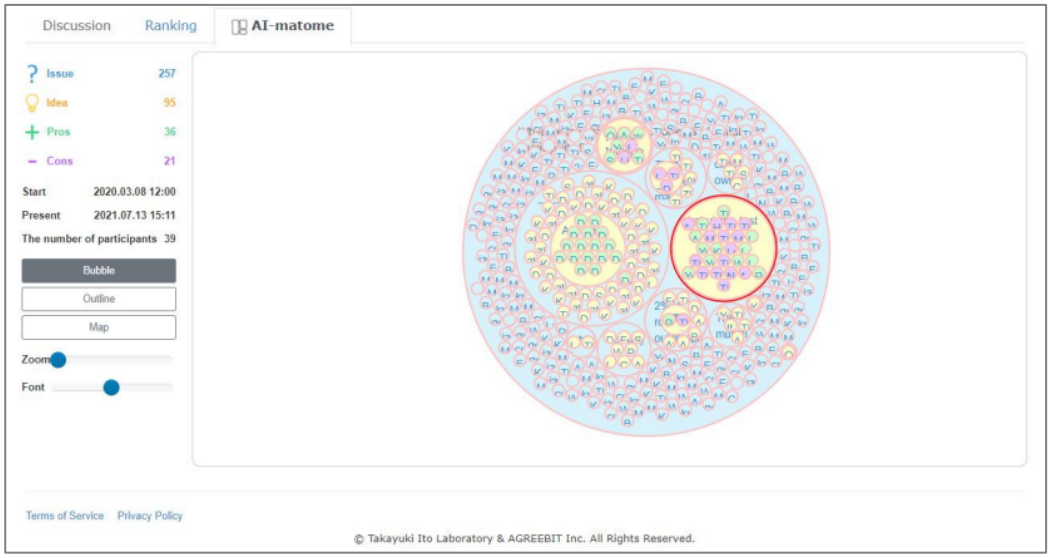


Figure 1. 8: The agent extracts a discussion's structure in real time based on IBIS, and automatically classifies and visualizes the balance of all the sentences and most influential opinions.

1.11.3. Possible Application of D-Agree

What is the possible real-world application of D-Agree? E-participation, specifically e-participatory planning [72]. Participatory planning, which is of central interest in urban development, is required to prevent conflicts by providing a broad acceptance of plans [70]. Other work extended participatory planning and added such terms as communicative planning with people [142], deliberative planning [143], and planning through public consensus building [144].

Participatory planning [145], incorporates more public participation in decision-making processes to promote quality solutions through reasoning and improves planning outcomes [146] [147]. As described in 1969 by Sherry Arnstein [70], urban planning needs a structural transformation in its hierarchical model, it moved toward a reticular model that allows meaningful input from every stakeholder. Thus, the participatory-planning paradigm emphasizes planning with people to harmonize views among all stakeholders. However, due to time, space, and gender restraints as well as security issues [148], most people cannot participate in consultation and planning processes, and implementing bottom-up participation theories is difficult. It is because planning a city is a systematic process, meanwhile it is a highly complex system that includes time, space, and groups of people who must communicate and finally reach an agreement related to social and urban-related planning and development processes. In terms of functional elements, the participative system can be divided into four key elements: time, space, facilitator and groups of people who must discuss. Thus, all elements of discussion are the key elements within participatory planning process; without efficient space and facilitation, genuine people participation and discussion cannot be maintained in participative process. It is because the public's inclusion might be possible if we provide a sustainable development space where we allow and facilitate anyone to connect from anywhere, and discuss at any time. This reappraisal of providing a scalable space with facilitation was epitomized by the ubiquitous concept of " sustainable development" which is widely accepted as "development that meets the need of the present without compromising the ability of future generations to meet their own needs" [149].

With the advancement of technology, researchers believed that planning with people using digital participatory platforms is important as an emerging digital society

tool for forging sustainable policies and developing a democratic society because participative development actions often fail without providing democratic support service for citizen involvement at scale [150]. Researchers argue that it is easy to inspire and inform citizens about related processes using internet-based technologies [151].

Researchers have been inspired by recent trends in information communication technologies (ICTs), which are analogous to Arnstein's ladder of citizen participation [70], and a new topology has been adopted to reframe participatory planning as participatory e-participation and planning. Participatory e-planning resembles e-participation using online participatory methodologies to empower citizens to climb the participation rungs in urban policy processes without time or space limits [152]. However, despite the hopes digital forums would revolutionize democratic participation, evidence suggests that digital participatory systems designed for often fail to achieve the expected objectives and levels of take-up [117]. Scholarship argues that complexity makes digital systems prone to fail and requires them to be managed as a process of learning and adaptation autonomous support for discussion rather than a static technological product for consultation that might lead to scale of content [117].

Research in e-participation can be classified as (1) barriers and facilitators; and (2) strategies for the adoption, implementation with institutionalization of e-participation. The methodology used to demonstrate e-participation using digital tools, nearly always used the case study. E-participation case studies consider the use of combined qualitative and quantitative methods. Most of the case studies published to date refer to a particular e-participation activity using web forums being the common tool (e.g., references [153] [154] [155]).

To that background, D-Agree conducted case studies has been attracting attention by several international organizations such as United Nations Human Settlements Programme (UN-Habitat) [156] and has been cited by several international journal such as Habitat International (IF: 5.3), Land (IF: 3.3), Symmetry (IF: 2.7), and Group Decision and Negotiation (IF: 2.6) as a digital society tool based on support for sustainable urban planning process recently. It is because D-Agree automatically facilitates large-scale meaningful and equal public consultation and participative process and meanwhile, automatically extract social insights and classifying all the sentences based on IBIS notation [108].. Due to such benefits, the system has been employed for hosting strategic discussion and planning on social and urban-related urban projects in Japan. Furthermore, many case studies were accepted and published as successful cases which achieved meaningful and equal public consultation.

1.11.4. Evaluation of D-Agree

In previous research [94], the evaluation of D-Agree (Japanese version) and its performance on discussion development has been evaluated in a stable city like Nagoya with short term collaboration of the local municipal government. However, the studies on the evaluation of the proposed system have not been sufficiently discussed in countries other than Japan to achieve accurate results.

1.6. Remarks on Evaluation of D-Agree

Even though the literature discusses the efficiency of D-Agree as representative application of conversational agent for digital participatory and society platform in large-scale deliberation in a stable country like Japan, less attention is paid to how these methods cope with digital participative process in countries other than Japan. Mainly, in least developed countries (LDCs) (such as Afghanistan) that cope with budgetary restraints as well as issues of space, security, and gender. How are these tools able to help these countries simultaneously promising to increase community participation and to understand the planning and to communicate in their societies while also increasing the interaction between public officials and their citizens at scale. This is because, due to the atmosphere of confrontation in war-ravaged countries like Afghanistan, enacting bottom-up participation theory without the support of large-scale deliberation is complicated.

Furthermore, the literature discusses the efficiency of crowd consultation in developed countries like Decidim in Spain, MeinBerlin in German (shown in Figure 1.9), Participate Melbourne in Australia, COLLAGREE and D-Agree in Japan towards promoting participatory process in developed countries, its status in least developed countries like Afghanistan pales in comparison to the of DCs, and less attention is paid to how LDCs cope with budgetary restraints as well as issues of space, security, and gender.

Although some progress has been made towards evaluating D-Agree's Japanese version, its real-world application status in practice in other countries is pals, mainly, in LDCs such as Afghanistan. In this study, we proposed to use a newer version other than the Japanese version of D-Agree which is relatively new in Afghanistan and needed more real-world practical field evaluation. This study inspires and aims to investigate the impact of D-Agree other than Japanese versions for the evaluation of participatory democracy using D-Agree. We proposed to employ D-Agree as key parts of our proposed applied framework in the practical digital participatory society platform in Kabul city.

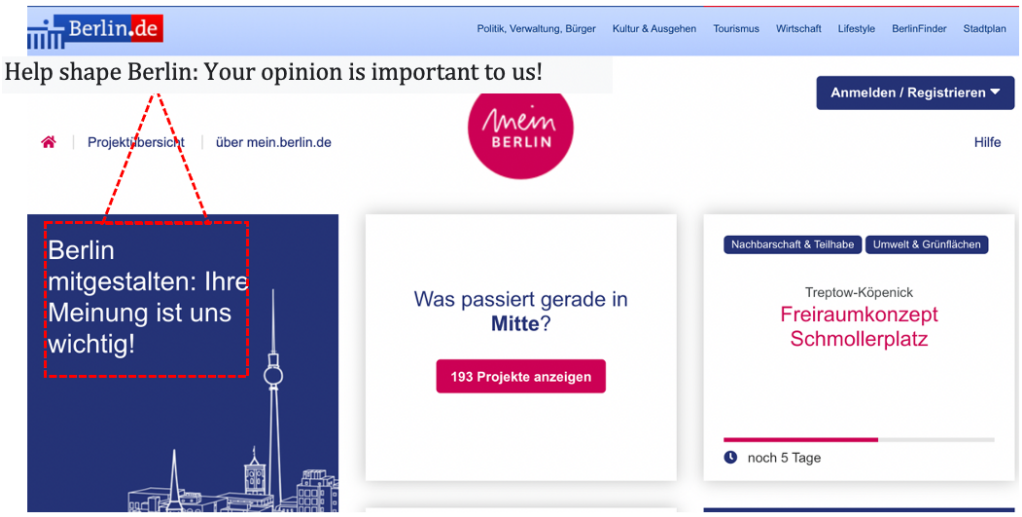


Figure 1. 9: Outline MeinBerlin main homepage asking citizens to submit their opinions. Adopted from [77].

1.7. The Previous Works

In previous studies [citations] by employing evaluation methodologies of COLLAGREE [79] and D-Agree (Japanese version) [94] the following result have been successfully obtained through conducting social experimental studies in a stable country like Japan:

a) Introduced facilitator-mediation discussion system for a web-based town-meeting in Nagoya city [71][144].
b) Introduced human facilitator and support functions for online discussion [112].
c) Incentivized participation with discussion points [113].
d) Measurement of a facilitator-mediated online discussion system for internet-based town-meeting in Nagoya city [144].
e) Measurement of human facilitator-mediation discussion versus agent-mediation discussions [35] [112].
f) Introduction of agent as facilitator for online discussion and conducting social experimental studies in Nagoya [95].

1.8. The Present Works

In the present work, the results of the conducted research is to extend real- world application of a newly version than Japanese version of “D-Agree” to establish a novel multi-method to evaluate efficiency of proposed method for “Participatory Democracy”

in war-ravaged and least developing country like Afghanistan are summarized and reported in chapters 2 to 8.

The current work is categorized into the seven main sections;

I. Introducing two new method (chapter 2), (1) a novel approach "reframing participatory using AI" as a social experimentation method to promote participative process in Kabul city and (2) a novel "developed and developing world" partnership is officially established to enable large-scale social experimentation studies in Afghanistan. The mentioned methods are reported in journals and international conferences and they were very interesting and welcomed and best paper awards from an international conference (KICSS20 [157]; KICSS21 [158]).

II. Introducing conversational AI in online discussion in Afghanistan, and also, investigation of conversational AI for empowerment of citizens and in implementing sustainable development goals (SDGs) in Afghanistan (chapter 3) [36] [157]. (Best Paper Award).

III. Measurements of cross-class areas "formal settlements vs informal settlements" of participatory process using conversational AI in Kabul city [52] [92] (chapter 4).

IV. Measurements of conversational AI for conducting large-scale discussion on COVID-19 in "collective intelligence" [71, 70], and also, measurement of cross-class of people "expert paradigm vs social paradigm" of participatory process using conversational AI in Kabul city [158] (chapter 5); (Best Presentation Award).

V. Experimental idea contest study using conversational AI as method to develop ideas for idea contest in Kabul city. Furthermore, based on the system's point ranking method, we awarded 3 good participants [73]. (Chapter 6).

VI. Measurements of conversational AI in support of planning process activity between people and city for policy making: A case study [52] [159](chapter 7).

VII. Measurements of conversational AI in support of online discussion activity between a developed country "Japan", and least developed country "Afghanistan": A case study (chapter 8)

1.9. Statement of the Problem

There were two statements behind our study: First, scaling up deliberation is challenging and literature is heavily focused on contributing for technical fixes for scaling up deliberation, with a heavy concentration on social experimental design at lab-setting. Therefore, there is a distinct lack of discussion on the nature of the design process that enable inclusion of stakeholders relating to real-world settings.

Second, despite enthusiasm regarding the issue in different countries, there were no studies characterizing the evolution of online tools for participation in LDCs to make up our understanding of how municipal governments and people collaborate with each other in LDCs like Afghanistan. Particularly, to study the impact of conversational AI platforms on discussion development for participatory democracy in least developed countries such as Afghanistan. To overcome the shortage of the previous studies, this study has formed a novel developed and developing world partnership by using our proposed methodology as an emerging-deliberation mechanism to reframe public participation, and confirmed with the experimental results in real-world setting.

The problem is discussed and overwhelmed during the present research work.

Problem 1. Establishing a democratic participation framework to process and define possible future for policy making in Kabul city.

Problem 2. Trusted facilitation for democratic participation process to provide meaningful and equal public consultation to support interactions among stakeholders to solve their shared problems together.

Problem 3. Introducing a fair facilitation entity to help crowd identify issues and its solution for policy makers in Kabul city.

Problem 4. Automated summarization of social insights and views to provide meaningful and equal public consultation to support interactions among stakeholders to solve their shared problems together.

1.10. Scopes of the Study

In the literature, many studies are reported that implemented and reported the determinants of digital participatory tools in promoting participatory democracy all over the world. However, most of these studies heavily focused on contributing for technical fixes for scaling up deliberation, with a heavy concentration on social experimental design at lab-setting. Therefore, there is a distinct lack of discussion on the nature of the design process that enables inclusion of stakeholders relating to real-world settings, mainly the inclusion of people to come together to discuss wicked problems in LDCs such as Afghanistan.

This study aims to investigate the impact of conversational AI platform for participatory democracy in a real-world setting promise of not only evaluate the system but also promise enhancing citizen participation in democratic participative process to serve as guides for the city planning and developments of the city of Kabul, including helping crowd identify issues and its solutions for policy makers. More specifically, this study deal with following issues:

(a) The use and real-world adaptation of D-Agree as a next-generation participatory platform for democratic citizen involvement in least developed countries such as Afghanistan, to study the impact of conversational agents in real-world settings other than Japan.

(b) Evaluations of conversational agents using both quantitative and qualitative methodologies across different fields for policy-decision-making as real-world case study to examine the validity of the method.

(c) Evaluations of conversational agents for online discussion, agent-mediated discussion versus non-mediated discussion. We looked at the discussion component development among the types of discussion; i.e., those from discussion with agent-mediated, versus those from discussion without agent-mediated.

(d) Evaluations of conversational agents for cross-class of areas online discussion, agent-mediated discussion with formal areas settlers versus agent-mediated discussion with informal area settlers. We looked at the discussion component development among the types of area; i.e., those from formal settlements area versus those from informal settlements areas.

(e) Evaluations of conversational agents for cross-class people online discussion, agent-mediated discussion with people having prior knowledge stance on discussion topic versus people having no prior knowledge. We looked at the

discussion component development among the types of people; i.e., those from people with good stance versus those from lower stance.

(f) Investigation of the relationship between quality opinion submission and discussion development, and also evaluation of discussion development as a result of the author of quality opinion submission.

(g) Evaluations of conversational agent for policy-decision-making as real-world case study to examine the validity of the method.

(h) Evaluations of conversational agents for policy-decision-making as real-world case study to examine the validity of the method.

(i) A comparative study on conversational agents' impact on discussion development across developed and least developed countries.

1.11. Purpose and Area of the Study

In view of section 1.10 above, this study aims to propose to use conversational AI as a social platform to guide participative processes for urban developments in Kabul city. The basic idea was how to connect Kabul citizens to their city officials in a secure and meaningful way, and also, motivate and support city-citizens involvement to devise city problems using AI-enabled civic technology. The usage of our proposed method is based on the official letter of agreement between NITech and KM. The proposed method is an attempt to enhance the city's solution through smarter human collective intelligence by facilitating discussions that address sustainability problems and devise the solutions within the Kabul city. This involved facilitating people's meaningful participative process, analyzing discussed items and annotating them as issues, salutations and pros and cons in real-time.

This study attempts to adapt D-Agree as a participatory digital platform to Kabul City in Afghanistan. To do this, the following procedures were undertaken: first, we proposed a digital participatory framework in which D-Agree is its key part as an instrument. Second, we submitted our framework to Kabul city, and the framework officially has been adopted as a novel framework through an official letter of agreement by Kabul City local government after accepting the effect of usefulness for participatory planning by Kabul city. The Kabul city local government agreed to use our methodology when city needs to make a plan with people; third we conducted social experiments on the existing online communities in Kabul City to examine the impact of conversational AI on discussion development; fourth we evaluated the conversational impact on discussion activities of cross- class of settlers in Kabul city; fifth, we explored the

conversational AI efficiency on cross-class of people in Kabul City; sixth, an experimental idea contest has been conducted to obtain the information needed for a deep understanding of the relation between “quality opinion submission” and “discussion development” in real-world idea contest; seventh, we present a detailed case study regarding the policy-decision-making and role our proposed method to devise solutions in Kabul city; and finally, we compared conversational AI impact on discussion development among a developed country (Japan) and least developed country (Afghanistan).

It is worth mentioning that in this study, we had three supreme actors: (1) NITech [107] Ito Lab, author affiliation; (2) Kabul city local government [160]; and (3) people of Afghanistan [161] [162], mainly Kabul residents [160]. They all played their parts to make this project successful.

1.11.1. Description of Study Area

Afghanistan is divided into 34 administrative provinces (*wilayat*), each of which is further divided into 5 to 29 provincial districts (*woloswali*). Currently, there are 364 provincial districts [163] (shown in Figure 1.10, picture a). Each province is governed by a governor, who is appointed by the President of Afghanistan.

Kabul Province with an area of 4,524 km^2, covers 0.69 percent of Afghanistan’s territory. It is composed of 14 provincial districts and the capital city, which is Kabul City. The city of Kabul, which encompasses an area of 1622 km^2, is the capital of Afghanistan in the country’s eastern section is the study area for this research (shown in Figure 1.10, picture d). It is home to about 4.4 million people, which contains 77.2 % of the total population of Kabul Province and hosts 16.7% of Afghanistan’s population which half of whom are women as of 2020 [164].

Kabul City is in turn divided into wards or municipal districts *(nahya)*, each of which is further divided into 8 to 113 subdivisions semi formal neighborhood governance units *(gozar),* the smallest urban subdivision units, which are institutionalized as subdivisions that have a representative called a wakil and have set or customary boundaries. Kabul city has 22 wards 911 Gozars,

The number of municipal districts in Kabul City increased from 14 districts to 22 districts (hereafter called as districts), in 2005 (shown in Figure 1.10, picture c), and Kabul city has 911 Gozars. Kabul City is governed by Kabul Municipality (KM).

KM as a local government organization are accountable to citizens and society at large, since they are responsible for safeguarding the interests of the general public in

Kabul city. KM uses the Internet and social media (SM) as a means to share huge amounts of information for a relatively low cost to enhance transparency and strengthen ties with the community. However, there is evidence that they cannot use the platform to frame participation and motivate people to engage with each to devise solutions and then use the insight for policy making. Thus, KM intended to solve this problem by our proposed framework, which D-Agree as a digital participatory tool is its key part.

(a)

- Kabul Province: One of the 34 provinces of Afghanistan

Area: 4,524 km^2 *1

(b)

- Kabul City

The capital district of Kabul Province

Area: 406 km^2 *2

Consists of 16 municipal districts *3

(c)

- Kabul City with new districts added in 2005*4

Area: 1,023 km^2 *4

Consists of 22 municipal districts

(d)

- Kabul Metropolitan Area

The existing city and the New City

Total area: 1,622 km^2 *5

New City area: 740 km^2

*1 CSO (Now NISA), Socio-Demographic and Economic Survey of Kabul, [165].
*2 Calculated according to the measures given in the NISA, Socio-Demographic and Economic Survey of Kabul [129] [130]
*3 Districts 1-17 excluding district 14
*4 JICA reports [166]

Figure 1. 10: Administrative divisions of Afghanistan, Kabul Province and Location of Case Study Kabul City [128] [167].

1.11.2. The Problem in Kabul City Urbanization

Kabul City has experienced many rises and falls in the course of its more than 3,500 years of history. Due to its strategic location along the major trade routes of South and Central Asia, there have been numerous inter-empires hostilities and conflicts over the valley [166].

Since 2001, the urbanization trend in the capital city is unprecedented, Kabul continued to grow, in population relevance (shown Figures 1.11 and 1.12). In order to guide and organize the spatial problems of the city, Kabul city adopted a planning process and up to now conducted four master plans [167]. Although the process of urbanization accelerated during these wars (Taliban 1.0: 1992-1996), it was mainly unplanned and characterized by land grabbing. During the Taliban period, (1997-2001), the population expanded from the central part of the city and shifted to the suburbs. By the establishment of the new government (president republic: 2001-2021), Kabul witnessed a large influx of migrants, comprising those who were fleeing from insecurity in the hinterlands, refugees returning from Pakistan and Iran, and laborers looking for better economic and social opportunities. However, the government's resources did not expand as fast as the population. Consequently, infrastructure and social services, including housing and land cost became out of the reach of many citizens, thereby leading to the escalation of informal settlements (shown in Figure 1.13).

Although informal settlements constitute a global urban phenomenon, they are more pervasive in poor cities such as Kabul, existing in various forms and typologies, dimensions, locations and taking on a range of names [167].There are some common factors behind their emergence and growth, but the number of effects associated with each factor vary from one region or country to another. In Kabul City, the most compelling factor fueling the growth of informal settlements is the inability of the formal sector to provide the public with a range of affordable housing options [167].

Within the context of Kabul City, the term "informal settlements" elicit different terminologies. More specifically, informal settlements are defined as settlements: (a) constructed in violation of the Kabul City Master Plan, zoning codes and regulations; or (b) illegally occupied land, without having a rightful title to it [168]. The upgrading strategies should not focus only on the current physical needs of the informal settlers, but it should also take into account the social upgrading of the settlers through raising literacy rates, women's capacity, employment opportunities, urban dialogue and so on in the long run. More importantly, strategies that work best must be employed based on some valuable social insights, which seek to devise solutions with a view to identifying how best to fulfill these goals. In view of the above, this study was conducted to promote

citizen involvement in order to harness the wisdom of the crowd in large-scale deliberation.

Currently, nearly half of the urban population of Afghanistan lives in Kabul City (Figure 1.14), and in terms of population size, Kabul City is roughly four times larger than the next largest cities (Herat and Mazar-i-Sharif) in Afghanistan [167]. Thus, Kabul City is an apparent case of a "primate city" in the world.

In an effort to establish joint research to solve the urban issues with people and evaluate the efficiency of our proposed method in the context of participatory process in Kabul city, in 2019, we proposed a conceptual framework. Consequently, in the same year, Kabul Municipality requested NITech to assist them in the digital consultation process with people, with a view to establishing a more realistic digital society for Kabul City [46]. NITech submitted the proposal in 2019, while the proposed proposal received approval from the KM management in the same year.

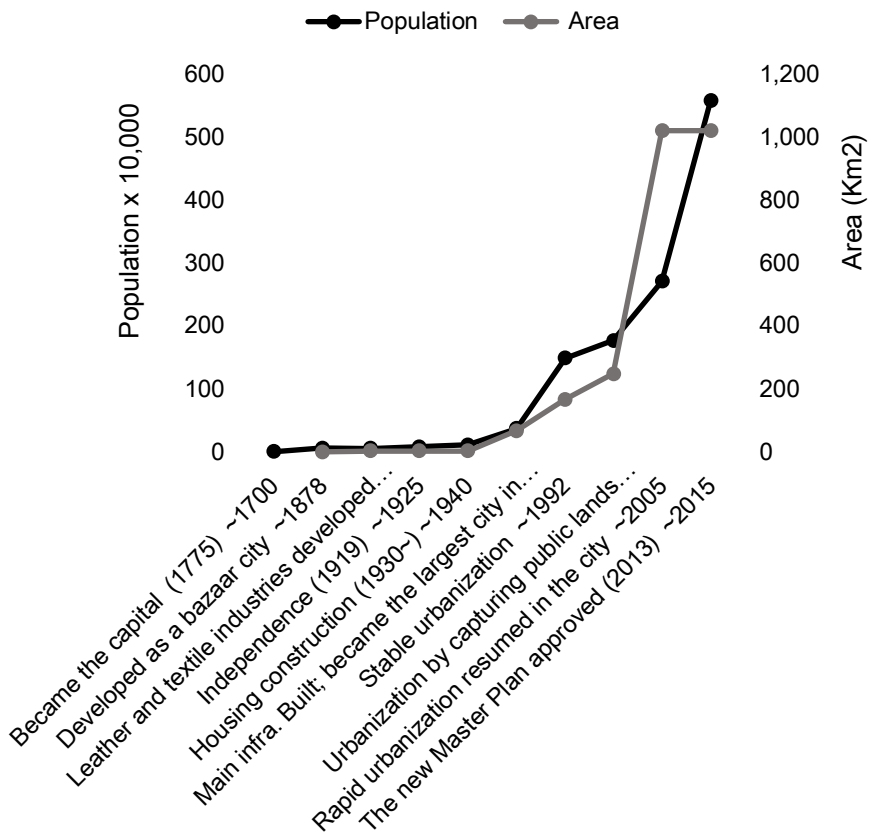


Figure 1. 11: Population growth and areal expansion of Kabul City [166] [167].

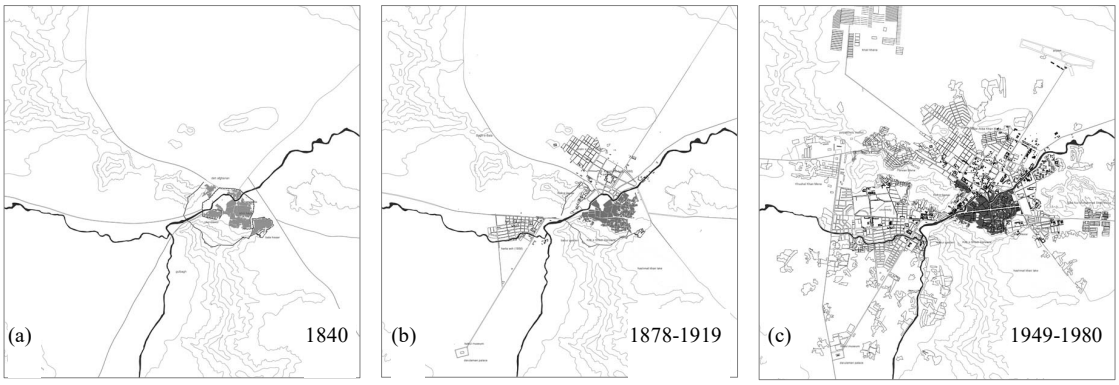


Figure 1. 12: Urban growth in Kabul City from 1840 to 1980; (a) the traditional development, (b) the partial extension of the city in a modernized way, and (c) the continuation of modernization and the development of the city according to the master plans. Adapted from [167].

Figure 1. 13: The informal settlements extended to the hillsides of Kabul City. Adopted from [167].

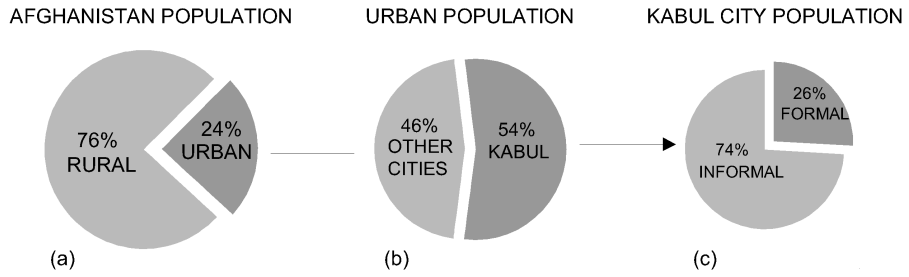


Figure 1. 14: The distribution of urban population in Afghanistan [167].

1.11.3. Urban Policy making in Kabul

In order to understand the local policies making on city planning, we studied forms of public participation in the planning process and the planning process itself. The approach which is nearly always used for policy making in Kabul city is one way (top-down). The one-way approach special interest is the focus of the planning process without direct involvement of the public in the planning process. On the other hand, planning with people, communicative planning, deliberative planning or planning through public consensus building is a process where public inclusion is a must for making decisions regarding planning aspects that may benefit or affect a community.

As described in 1969 by Sherry Arnstein [70] at the bottom rung of her proposed ladder, participation exists in an entirely passive movement without interaction among stakeholders; full interactivity exists at the top when public officials and citizens completely engage with each other. Her proposed planning method has shaped policies affecting the growth and changes in participatory methods. Because urban planning needs a structural transformation in its hierarchical model, it moved toward a reticular model that allows meaningful input from every stakeholder [170]. Thus, the participatory-planning paradigm emphasizes planning with people to harmonize views among all stakeholders and focus on policy making that is the result of the inclusive decision-making process.

Participatory policy making is normally perceived as methods to facilitate the inclusion of both the government and the people making endeavors for policy-making. In democratic societies, policy-making is normally might be a cycle of ideas and opinions that begins with a problem and ends with an implemented solution involving different numbers of stakeholders. It is a multi-stages process of participation of different stakeholders. However, due to constraints mentioned above in such war-ravaged countries

as Afghanistan, the traditional forms of public participation in the planning process are untenable.

The outcome of the author investigation shows that there is a good agreement between the observed field and the existing trend of urban expansion in Kabul city. Author findings suggest that due constraints such as security issues, gathering space difficulties and culture issues in Afghanistan, the capacity to steer the planning with public and implementation process is very weak and untannable. Thus, women and religious minorities are restricted from joining the process. Also, the existing trend of urban expansion in Kabul implies that the public were not involved in decision making and the traditional forms of public participation in the planning process are untenable.

Since 2001, nearly always the efforts were mainly focused on upgrading informal residential areas using one-way approaches that were carried out by KM. But recently, with significant support of the International Community, some new methods were introduced to mainly focus on upgrading informal residential areas using a two-way approach that decision is going to be made based on opinions of affected residents.
Among the programs, Afghanistan's Citizen Charter in Cities (2016–ongoing) [171] at the national level and the World Bank funded Kabul Municipal Development Program (2014–2021) [172] at the capital city level to promote inclusive development and were mainly focused on involving citizens into decision-making processes.

It should be noted that policy making is the result of the decision-making process. In addition, a central element of the critique that comes from people against the elected Kabul city local government order is that the process of decision-making by which the plan operates is undemocratic. Therefore, alternative approaches needed to be investigated such as adopting digital participatory platforms that can gather large-scale opinions and synthesize them to achieve good for society.

City planning is fundamentally intended to optimize efficiencies by integrating the number of stakeholders' opinions including citizens through democratic stakeholders' involvement by smart means, such as digital participatory platform [173]. In the last few decades, the public sector has evolved from government to governance, and a new policy framework with high levels of cooperation with external stakeholders in both policy design and service delivery using digital participatory tools has been adopted across many cities. Due to benefits of digital participation, such as communicating with a wider audience, increasing the knowledge of participants about public issues, allowing a more informed and deeper participation and improving the quality of public policies and citizens' trust in government. In any planning process, efficiency results in cooperation with the stakeholders when cities fuel their collective intelligence by providing

democratized communication channels. However, due to security problems in such war-ravaged countries as Afghanistan, the traditional forms of public participation in the planning process are untenable and currently, Afghanistan, mainly the capital city Kabul is facing problems regarding promoting secure participatory practices.

In particular, due to gathering space difficulties and culture issues in Afghanistan, women and religious minorities are restricted from joining male-dominated powerholders' face-to-face meetings which are nearly always held in fixed places called masjids. Therefore, institutions such as KM adopt e-participation as a citizen participation initiative on a voluntary basis using organizational theory. This theory intent to adopt e-participation through one of three structure types [174]: (1) adopt e-participation through coercive which institutionalize e-adaptation through legal framework; (2) adopt e-participation through mimetic which aims to use e-participation to achieve democratic recognitions; and (3) adopt e-participation through normative structure through social pressure for transformation and transparency. We found that the governmental organizations in Afghanistan such as KM nearly always adopt e-participation initiatives using social media such as Facebook and intended to share their activities with public to strengthen the ties among community, thus they nearly always tried to adopt e-participation through mimetic which aims to use e-participation to achieve democratic recognitions (through mimetic) rather than to achieve plan and framework (through coercive) transformation and transparency (though normative). This can be related to the findings by Pina et al. [175] that local governments nearly always implement e-participation to strengthen the ties among the local community rather than to achieve actual improvements in environmental programs, and also with Mergel [176] that nearly always government organizations adopt social media as means for citizen involvement.

However, recent scholarship argues that a publicly virtual presence and discussion without supportive means cannot guarantee meaningful discussions because it fails to harmonize views among all stakeholders [94]. They suggest that at a core of discussion platform support function should lie that help proceeding discussion and decision-making at the end, thus they suggest a new social network based on support "intelligent social networks" [177]. For example, Facebook as a digital social network does not provide support to facilitate discussions and the insights collected from it might not be used for policy making because policymakers might face a decision problem while integrating the unstructured voices of citizens collected through such platforms. Some research argues that forums must provide supportive means like gamification [102] and facilitation [94] to stimulate public deliberation [104] and involvement of every discussant to actively input on discussed related issues, ideas and arguments.

In this background, large-scale digital participatory platforms based on supportive means are attracting great attention as approaches that overcome these shortcomings, and implementing such technology plays a critical role in strengthening the ties between city-citizens [105[.

1.11.4. Proposed Tool for Urban Policy making in Kabul

Since the 2000s, the digitalization of administrative processes has been a priority in Afghanistan and ICTs sector had experience significant growth [178] [179] [180] [181] [182] [183]. However, despite digitization efforts, Afghanistan occupies low positions in e-government (169th position in 2020) and e-participation indexes (118th position out of 193 in 2020) [181]. Data for 2017 show that use and access of internet-enabled ICTs by citizens in Afghanistan 13.5% [183]. The use of internet-enabled ICTs by citizens in Kabul city exceeds the national average.

In the last few decades, the public sector has evolved from government to governance, a policy framework with high levels of cooperation with external stakeholders in both policy design and service. In Afghanistan, the possibility of direct citizen participation in public affairs and individuals is recognized in the 2004 Constitution [183], which transformed Afghanistan into a modern democracy.

Despite, the existing ICTs (Information Communication Technologies) infrastructure is relatively in good condition [145], although participatory technology are major constraints for poor cities like Kabul to tap into crowd knowledge for better smart and sustainable city goals. Currently, Afghanistan, mainly the capital city Kabul is facing problems regarding promoting secure participatory practices.

Toward this end, we propose a proposed framework, namely, crowd-based communicative and deliberative e-planning (CCDP), a blended approach, which is a mixture of using an artificial-intelligence-led participatory technology based on support, called D-Agree and experimental participatory planning in Kabul, Afghanistan. For the sake of real-world implementation, Nagoya Institute of Technology (Japan) and Kabul Municipality (Afghanistan) have formed a novel developed and developing world partnership by using our proposed methodology as an emerging-deliberation mechanism to reframe public participation in urban planning processes. In the proposed framework, Kabul municipality agreed to use our methodology when Kabul city needs to make a plan with people. The digital real-world case studies present in this study is the first practical example of using digital participatory support tools in the context of the city of Kabul.

In this study, we report examples of successful participatory activities, which were reported to academic journals and conferences and attracted great attention from the research community.

The main objective was to harness the wisdom of the crowd to innovative suggestions for helping policymakers making strategic development plans for Kabul city using open call ideas, and for responding to equal participation and consultation needs, specifically for women and minorities. Furthermore, evaluate the efficiency of acceptance and usefulness of such technology in LDCs such as Afghanistan.

Note that the field of communicative planning or community driven planning approach using digital participatory tools is quite young in Afghanistan and published empirical evidence is relatively rare yet. To the best of our knowledge, our proposed approach in this study is the first effective practical example that shows how LDCs can increase community participation by focusing on listening to citizens' suggestions, problems and needs using an AI-enabled digital participative platform.

1.12. Significance and Contribution of the Study to Computer Science and Society

One of the key arguments in this regard, which enforces this study and proposes a digital participatory support tool, is the constraints of traditional forms of public participation in the planning process in Afghanistan. Studies on how digital participatory democracy using digital participatory tools as a representative application of computer science constructs of a society in LDCs such as Afghanistan is investigated and framed in this study. We demonstrated and framed ways to connect and reconnect certain urban stakeholders, mainly city and citizens, to easily come together to devise urban solutions in a country, where the traditional forms of public participation in the planning process are untenable due to a number of constraints such as security and convenient physical gathering spaces issues.

The proposed framework can provide useful insights to complement the Kabul City Decade of action and Master Plan and for the development of more comprehensive plans in the future. Furthermore, the social insights gathered from the case studies, especially on people`s activities in the planning process can become good reference material of those involved in present and future planning and developments of the city with people using conversational AI as digital platform for participation based on facilitation.

One key point in this study is that it was not possible without computer science technology including the proposed framework in which D-Agree is its key part to get the results we presented in this study. Our proposed and used technology was officially adopted as a first ever digital participatory support platform in a meaningful and democratic participatory planning process in Kabul city by the Kabul local municipal government.

The findings of this research would not only help developing and poor cities like Kabul to take the initial steps towards becoming democratic cities by applying innovative, security and economically feasible participatory approach for democratic urban stakeholders including citizen involvement but also, can contribute to the computer science literature to become a good reference material of those researchers involved in present and future research and developments (R&D) of next next-generation platforms for democratic citizen involvement researcher with an interdisciplinary approach that reflect on the practical developments using AI-driven computer science technology.

It is worth mentioning that research in e-participation using digital participatory tools can be classified into two phases: First, study problems and barriers and facilitators for participation; and second strategies for the adoption, implementation with institutionalization of e-participation. In this study, both have been investigated and framed in this study.

In sum, the proposed framework has been used for both, front-and backchannels to promote city stakeholders including citizens, especially in public and urban policy decision-making. We can conclude our contribution as two-fold.

The first fold as follows: (1) introduce of a sociotechnical innovation for LDCs; (2) Fight against discrimination and promote meaningful participation in LDCs such as Afghanistan using ; (3) Promotion of participation through proposed official adopted framework by city; and (4) finally promote participatory decision-making.

The following are some specific (second fold) contribution of study to computer science field: (1) For the first time, evaluate the acceptance of newly introduced computer science participatory technology, called D-Agree through transdisciplinary approach including direct city-citizens and citizens-city involvement in LDCs like Afghanistan; (2) introducing a newly social innovative framework to reframe secure and meaningful participation in such war-ravaged and a very challenging context of urban planning in Afghanistan using computer science participatory technology as framework key component; (3) Our methodology as novel element of develop and developing world partnership is among the earliest adopted participatory e-planning crowdsourcing tools for urban and public policy in Afghanistan; (4) Our system, artificial facilitation is the

earliest adopted automated facilitation tool in municipal government urban development e-planning practices in Afghanistan; and finally (5) Our gamification of online discussion is among the earliest adopted extrinsic motivations in participatory e-planning in Afghanistan.

1.13. Structure of the Dissertation

In order to allow for easy navigation, this study is organized as follows:

Chapter 1 focuses on a digital platform for participatory democracy based on facilitation. The chapter also positions this thesis in the context of related research into the evolution of discussion systems for participatory democracy and lays out the major justifications and objectives that were set out to achieve in this study.

Chapter 2 presents the major methodological framework, governmental-academia partnership as a research program to study conversational ai platform for participatory democracy in Afghanistan, upon which this study is based. The chapter starts by introducing research framework and describes it as a novel design for participatory democracy in Afghanistan. The chapter also use this as methodology and subsequently proposes a research framework drawing from the premises of this methodology for the following chapters.

From there, Chapter 3-8 describes studies as case methods exploring the impact of conversational agents. These chapters include results of experimental studies and deployment to real-world settings.

Chapter 3 presents, describes and discusses the conversational AI for online discussion. The chapter finally conducts a large-scale online discussion to interrogate the characteristics of conversational AI on guiding groups of individuals within online discussion. Conversational AI is introduced for facilitating online participatory planning in Kabul city. This chapter is devoted to the analysis on the discussion structure that is accomplished considering conversational AI as the developing factor. Considering the conversational AI that has the highest probability of leading the discussion, the discourse analysis is performed in terms of identification of discussion elements. The online discussion is conducted with and without conversational AI using an online forum and its output has been investigated to find the efficiency of conversational AI. The findings of the online discussion process based on conversational agent facilitation are reported. First, discussions with and without conversational agents as facilitators are investigated and

reported. Next, from the measurement of discussion elements results with moderation of AI, the solutions for problems are more clearly collected with discussion with AI-based facilitation. In addition, discussions without agents, are clearly centered on raising issues and were observed.

Chapter 4 presents the analysis of conversational AI impact on the online discussion activities of cross-class of areas settlers. In this study, experimental and analytical studies have been conducted to obtain the information needed for a deep understanding of the differences between people participation from "formal settlements areas" and "informal settlement areas" in the Kabul city planning process. A difference between participation in formal areas and informal areas has been discovered in this study. People in informal areas were keener to participate and discuss in the planning process compared to people in formal areas. Using this finding, it is possible to suggest that conversational AI platforms are more successful for communities in crisis than stable communities.

Chapter 5 first conducts a detailed case study regarding the COVID-19 discussion and role of online discussion support system for promoting collective intelligence on COVID-19 related issues and ideas in Afghanistan. Second, the application of conversational AI is experimentally extended to identify cross-people participation in online discussion. An experimental study has been conducted between two class of people: (1) health workers as expert on COVID-19 discussion and (2) private citizens as social paradigm to obtain the information needed for a deep understanding of the relation between "participants with prior knowledge on discussion topic" and " participants without prior knowledge on theme" using conversational AI. The findings suggested that conversational agents as facilitators are more successful to moderate discussion with groups of individuals with prior knowledge on discussion themes compared to groups of people without prior knowledge on discussion themes. The discussion elements are investigated and reported.

In *Chapter 6* an experimental idea contest studies have been conducted to obtain the information needed for a deep understanding of the relation between "quality opinion submission" and "discussion development in the real-world online idea contest project. A "relationship" between active competitor and discussion development and its impact as extrinsic motive on discussion development has been discovered in this study. This method can be applied to develop ideas for online idea contests.

Chapter 7 presents a detailed case study regarding the policy-decision making and role of our proposed method. The application of the proposed method is extended to

identify the issues occurring in the planning process in Kabul city, and its solutions to help policy makers. A comparison is made between private citizens collected insights and people-representative insights analysis. This chapter finds its usefulness in selecting the real-insights based on the citizens' inclusion in societal activities and processes, and found that it is a critical component in the successful implementation of any plan in Kabul city. The study achieved contradiction among citizens and their representatives by comparing their collected insights regarding working and not working functions inside Kabul city. One of the main failures of implementation of the plan in Kabul city were not including the citizens in societal activities and processes, and their voices were manipulated by their non-elected representee. One of the major real-world contributions of this study was to convince Kabul city local government through gathered social insights to directly include its citizenry in societal activities and processes, and also change the non-elected representee to direct elected-representees.

Chapter 8 presents the comparison results of conversational AI for online discussion among Japan and Afghanistan. The developed and least developed countries have been selected for this case study. A comparison has been made between the threshold of *n* people facilitation between groups of individuals of both countries. The findings suggested that, people in least developed countries were keener to participate and discuss in online discussion compared to people in least developed countries. Using this finding, it is possible to suggest that conversational AI platforms are more successful to moderate discussion in least developed countries than developed countries.

Finally, *Chapter 9* presents chapters' summaries and highlights the implications of the major findings of this study. This chapter concludes the remark of the thesis, limitation of the study, and makes recommendations and lists for consideration as for further and future research works.

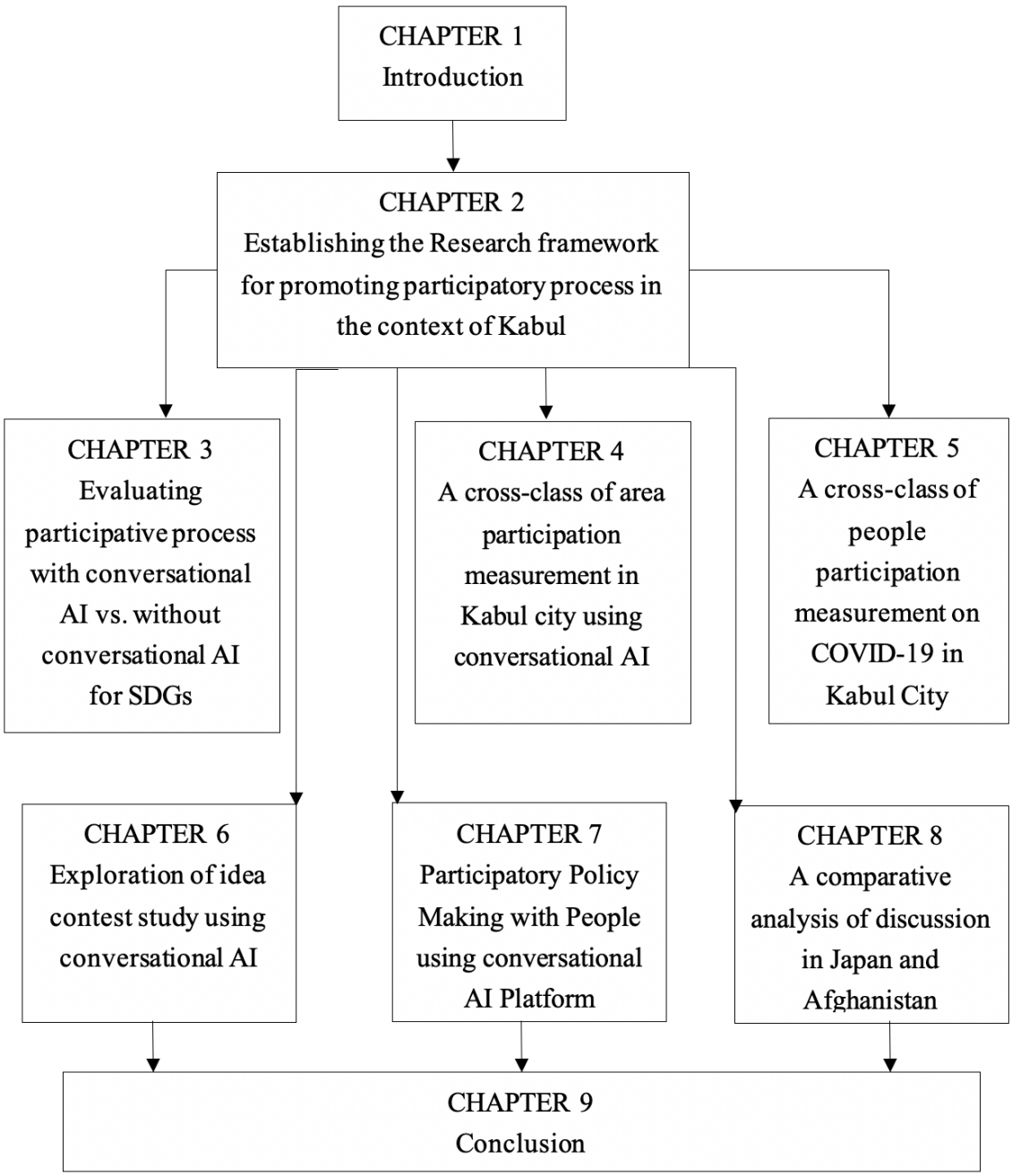


Figure 1. 15: Structure of the dissertation.

CHAPTER 2

A PROPOSED FRAMEWORK TO FRAME PARTICIPATORY PROCESS USING CONVERSATIONAL AI PLATFORM IN THE CONTEXT OF KABUL CITY

CHAPTER 2: A PROPOSED FRAMEWORK TO FRAME PARTICIPATORY PROCESS CITY USING CONVERSATIONAL AI PLATFORM IN THE CONTEXT OF KABUL

2.1. Purpose of the Chapter

This *Chapter* proposes a framework to not only frame participatory processes but also promote participatory democracy in the context of collective intelligence within Kabul city. Our general methodology is discussed along with the specific methodology and framework adopted for this study. A practical framework proposed to securely promote meaningful participatory planning democracy which was officially adopted by Kabul city local government. We evaluated the efficiency and acceptance of the proposed framework with city officials before introducing and hosting real-world participatory planning processes with citizens. Studies on how digital participatory support tools as a representative application of computer science constructs of a society in LDCs such as Afghanistan is investigated and framed in this study.

In sum, a novel framework established, and proposed framework successfully evaluated and adopted as a digital societal tool for democratic participatory planning in Afghanistan

2.2. The Spread and Acceptance of Digital Participatory Platform: Introduction

With the irruption of internet communication technologies (ICTs) and the crisis of representation in participatory approaches which were first raised in 1969 by Sherry Arnstein [70], many online platforms have been developed with the aim of improving participatory democratic processes and promoting direct democracy in the planning process.

Participatory e-planning resembles e-participation using online participative methodologies to empower citizens to climb the participation rungs in urban policy processes without time or space limits. For instance, today's town-related meeting, hosted by a digital participatory platform to promote direct involvement of city-citizen relationship whereby a municipality executes a managed process that seeks the bottom-up, open, and creative input of citizens in an online community, and task can create a productive process [184].

These platforms are normally perceived as the next-generation method for participatory democracy [23]. Such platforms can be used by governments to gather large-scale opinions and synthesize them to achieve good for society, since they are responsible for ensuring the interests of the general public through efficient policy making.

Various cities have addressed the use of online forums for public participation, consultation, and opinion gathering in urban planning. An online participation system was used in the Woodberry Down regeneration project in the United Kingdom [185] to collect citizen opinions in one of Europe's biggest regeneration projects. Another study [186] introduced an online-design collaboration system for public participation and experimented on planning and designing public parks in Japan. A similar study introduced an online-participation system that was applied to a railroad removal project in Korea [187]. In Indonesia [189], LAPOR, an online portal, gathered citizen opinions . Another work presented an e-participation tool that supported citizen e-participation in regional urban debates by gathering news and opinions published on the web for easy comprehension and commentary [190]. An e-participatory system supported decision-making processes using virtual reality (VR) technology to visualize citizen-submitted proposals [191] to support decision-making by encouraging citizen involvement. However, these projects were project-based and suffered from long term commitment for addressing sustainability problems and lacked a clear incentive mechanism to motivate involvement between cities and citizens in the long term. Most critically, some cannot support large-scale participation at the municipal level and were designed at small scale settings.

Towards this end, some platforms were designed to address the use of online forums for public participation, consultation, and opinion gathering in urban planning for the long term. Mainly, cities are using these platforms for consultation on local planning, public and urban policy-making. In Europe, online platforms such as Decidim Barcelona, MeinBerlin, and Decide Madrid used to allow the public to participate directly in governmental hosted processes, by collecting ideas and suggestions for the future of the city and voting on them. In Australia, Participate Melbourne used for the same purpose, and in Japan COLLAGREE and D-Agree to facilitate participative process. As a result, by this approach not only can the citizens' voices be heard but also, they can contribute to the city's strategic plan development, hence promoting participatory democracy. The digital participatory platform as an attempt to transpose the idea of traditional participation to modernized and smarter participatory platforms was utilized by different cities around the world.

However, online-discussion systems suffer from automated facilitation problems and lack a clear incentive mechanism to motivate involvement between cities and citizens. Most critically, some cannot support large-scale participation at the municipal level. A number of challenges remain, such as human biases and time restrictions that need to be solved in human-facilitator-based, online-discussion systems. As a result, AI-enabled automated facilitation is required to overcome these shortcomings within large-scale online discussions.

Even though the literature discusses the efficiency of crowd consultation in planning theory with the support of online-discussion support forums, less attention is paid to how least developed countries (LDCs) (such as Afghanistan) cope with budgetary restraints as well as issues of space, security, and gender. How are these countries simultaneously promising to increase community participation and to understand the planning using online tools to communicate in their societies while also increasing the interaction between public officials and their citizens at scale? As a result, participatory planning at scale remains unavailable in decision-making processes. Hence, it is important to understand, propose, design and evaluate a digital participatory platform as a society platform for Afghanistan.

Toward that end, we adopted *D-Agree* as a key instrument of our proposed framework to not only frame and promote participatory democracy but also, we wanted to test our hypotheses that if groups of individuals collectively do tasks, such collaboration will produce a collective intelligence that connects different types of individuals to produce a body of knowledge and easily devise solutions. In addition, we wanted to evaluate the efficiency of D-Agree ease of use and usefulness in a country other than Japan. And to demonstrate the effective practical example that shows how LDCs can increase community participation by focusing on listening to citizens' suggestions, problems and needs using our methodology as a society platform.

In this chapter, an exploratory systematic of our proposed framework was explained. The first was to understand the vulnerability and challenges related to participatory planning in Kabul city. Due to security problems in such war-ravaged countries as Afghanistan, the traditional forms of public participation in the planning process are vulnerable and untannable. In particular, due to gathering space difficulties and culture issues in Afghanistan, younger people, particularly women and religious minorities are restricted from joining male-dominated senior citizens and powerholders' face-to-face meetings which are nearly always held in fixed places called masjids (religious buildings). Furthermore, considering the nature of the discussion environment in Afghanistan, conducting such discussions with human facilitation biases the generation

of citizen decisions that stimulates an atmosphere of confrontation, causing another decision problem for urban policy-making institutions.

The second is to propose a framework. A framework, namely, crowd-based communicative and deliberative e-planning (CCDP), a blended approach, which is a mixture of using an artificial-intelligence-led technology, D-Agree and experimental participatory planning proposed to not only securely revolutionize participative processes but also provide meaningful and equal public consultation to support interactions among stakeholders in Kabul city to solve their shared problems together. This is our general methodology for this study.

The third is to evaluate the proposed framework at city government by hosting a real city high-level city official meeting. We both, NITech (author affiliated organization) and KM aimed to evaluate the acceptance and efficiency of the proposed framework of which D-Agree is its key part. There were two objectives behind the acceptance and evaluation of the proposed framework. First, the KM wanted to test the efficiency of the proposed framework tool by practically using it for city administrative meetings. Second, the author also wanted to verify the ease of use and usefulness of acceptance of proposed framework tools by using a quantitative method that combines statistical analyses of the argumentative data generated from the administrative meeting using D-Agree and post-questionnaires.

The fourth and final is large-scale real-world implementation of a proposed tool on promoting the involvement of stakeholders (mainly citizens) in city planning and development process. D-Agree is the instrumental tool of our proposed framework were used as digital society platform in order to i) evaluate conversational agent efficiency on leading discussion; ii) evaluate the efficiency of platform across areas, people and countries; iii) illustrative how these platform can be used to promote idea contest with crowd iv) illustrative how these platform can help policy-making with people by showcasing a real-world practical exploratory project in collaboration with city municipal government; and v) identify any important gaps in understanding the usage of these platform by comparing the efficiency of proposed framework tool in developed and least developed countries.

2.3. Kabul City Challenges Related to the Participatory Planning

Rapid urbanization is one of Kabul city issues that pushed the city to adopt community driven planning approaches, to come together with people and devise city solutions.

Since 2001, nearly always the efforts were mainly focused on upgrading informal residential areas using one-way approaches that were carried out by KM. But there has been nearly always a shortage of secure and meaningful participatory approaches in Afghanistan since 2002. However, in recent years, with significant support of the international community and donors' countries for Afghanistan [192] some new methods were introduced to mainly focus on upgrading participatory practices using a two-way approach that decision is going to be made based on opinions of citizens.

Among the programs, Afghanistan's Citizen Charter in Cities (CCAP: 2016–ongoing) [171], Reflect Effort for Afghanistan Communities and Household (REACH); UN-Habitat Afghanistan's Municipal Governance Support Program (MGSP) [193] at the national level and the World Bank funded Kabul Municipal Development Program (KMDP: 2014–2021) [171], Kabul Solidarity Program (KSP) [194], Support Kabul Municipality, UN-Habitat Kabul Strengthening Municipal Nahias Program (KSMNP), Kabul Municipality on the Clean & Green City (CGC) [195] at the capital city level to promote inclusive development and were mainly focused on involving citizens into decision-making process and stimulate a good governance.

It should be noted that policy making is the result of the decision-making process. In addition, a central element of the critique that comes from people against the elected Kabul city local government order is that the process of decision-making by which the plan operates is undemocratic. Therefore, alternative approaches needed to be investigated such as adopting digital participatory platforms that can gather large-scale opinions and synthesize them to achieve good for society.

Although the city intended to solve common problems and tried to implement traditional participatory processes with people such as those mentioned above, to improve the infrastructure and access to services through empowering communities, an efficient, secure, and meaningful participatory approach has not been exploited.

Planning driven approach with people is a systematic process that includes time, space, and groups of different urban stakeholders including citizens who must communicate. The caution that such a program should be used in tandem with digital participatory platforms, due to the possibility of risk of physical gathering in war-ravaged countries such as Afghanistan. In addition, the presence of senior citizens and bias in human-mediated processes, and most importantly lack of not truly representative of the population within the process has not been exploited.

It is because traditional participatory processes have been criticized for being not representative and risky implementation of said features without considering truly representative of population within process in Kabul city. Because it said the people who

join such processes are generally senior citizens, since such meetings are held in daytime and held in fixed places. In contrast, participatory democracy in planning suggests meaningful participation where the majority of people are allowed to join the process. The population pyramids in figure 2.3 shows that young people are in the majority in Kabul.

There is evidence that the age generation matters while attending these traditional meetings and younger people are restricted from joining mostly aging people meeting. Mainly, the people who attend such town meetings are generally senior male citizens. Afghanistan has a very young population and two thirds of the population is under the age of 20 [164]. The median age in Kabul is 17.7 years (as of 2013) which implies that more than half of the population in Kabul city is younger than 17.7 years (seen in Figure 2.3).

Furthermore, conducting such discussions with human facilitation biases the generation of citizen decisions that stimulates an atmosphere of confrontation, causing another decision problem for urban policy-making institutions.

Unfortunately, solutions for promoting participatory processes have not kept pace in Afghanistan. To devise better solutions, it was critical to find approaches that not only securely revolutionize participative processes but also provide meaningful and equal public consultation to support interactions among stakeholders to solve their shared problems together. Toward this end, we propose a joint research program, namely, crowd-based communicative and deliberative e-planning (CCDP), a blended approach, which is a mixture of using an artificial-intelligence-led technology, decision-support system called D-Agree and experimental participatory planning in Kabul, Afghanistan. The CCDP is explained in section 2.5, and the research procedure for this study is explained in sections 2.9-11.

The photos (seen in Figures 2.2) shows that due to culture issues women were restricted from joining male-dominated discussion, however, were allowed to join women-only discussion (seen in Figure 2.1).

(a) (b)

Figure 2. 1: (a) Men and (b) women using the same town hall but in different time to discuss city-related issue in district 5 Kabul city, 14th March, 2020 [160].

Figure 2. 2: Women were restricted from joining male-dominated face-to-face meetings organized in District 7, Kabul city (2012). Adopted from [167].

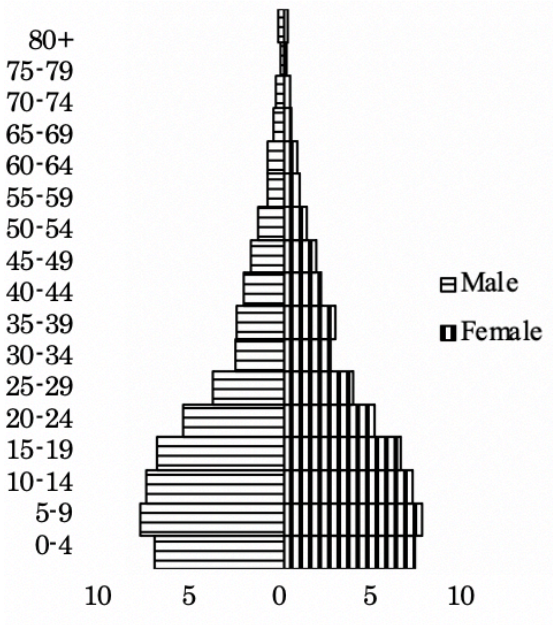


Figure 2. 3: Population Pyramid for Kabul in 2013 [164].

2.4. Framed to Promote Participatory Democracy: Conceptual to Applied Framework of this Study

Participatory democracy refers to the process of collective decision making, where government and citizens cooperate and co-create policy-making. This model of democracy is aimed for maximizing the participation of citizens in the public decisions. This form of participatory model or civic engagement is especially interesting at the urban level. As the closest form of government to the people, cities are well positioned to mobilize citizens, innovate and experiment.

There is evidence that democracy is where their decisions should be participative democratic, and where all voices are heard, and where discussions are vibrant. To the world of modern life including democracy, participatory process plays a vital role and specifically, in the most recent decades, participation practices are widely used both globally and locally to demonstrate people's opinions. Specifically, participatory democracy privileges to other types of democracies are the translation of collective intelligence into our life operative modalities.

A central element of the critique that comes from people against the elected governments order is that the process of decision-making by which the plan operates is

undemocratic. Participatory Policy Making (PPM) [196] is normally perceived as a method to facilitate the inclusion of groups of individuals of different stakeholders in the design of policies via participative means to achieve social sustainability. of participatory democracy. Such platforms can gather large-scale opinions and synthesize them to achieve good for society.

On the basis of our studies, we propose an experimental participatory framework for the participation in the planning process of Kabul city by analyzing and weighing the applicability of different options and using a conversational AI platform.
The following are some specific aims:

i. Ensure the ease of useability by conducting an experimental study with high level city official through adopting evaluation methodologies such as Technology Acceptance Model (TAM) [197, 198], Task-technology Fit (TTF) [199] [200], user satisfaction [202] [203] [204] [205], case study [76], quantitative and qualitative, and so forth.
ii. Ensure the usefulness of the proposed tool by conducting an experimental case study [70] with high level city officials, in order to encourage them officially adopt the tool as the earliest adopted digital participatory tool in Kabul city [160].
iii. Provide a secure and safe environment, especially for city and citizens to come together to devise the urban sustainability solutions [37].
iv. Evaluate the efficiency of conversational agents to promote participatory democracy in Afghanistan [36].

2.5. CCDP: The Framework Proposed

This is our proposed conceptual framework for actual participatory planning in the context of Kabul. To evaluate our system for participatory democracy in the real-world, we proposed CCDP, a blended approach, which is a mixture of using an artificial-intelligence-led technology, digital society platform called D-Agree and experimental participatory planning in Kabul. The proposed method is based on the concept of Sherry Arnstein proposed ladder of participation from 1969 [70], and D-Agree as city-citizens direct involvement tool based on facilitation. As it was stated by Arnstein that full interactivity exists at the top of her proposed ladder when public officials and citizens completely engage with each other, otherwise planning will be passive and development actions often fail without the participation of citizens. In that background, the term collective intelligence was first coined by Thomas W. Malone at the MIT Center of Collective Intelligence [26] [27]. He theorized that the participative process of the future

will look very different because of new discussion channels as a society platform. Malone subsequently argued that if groups of individuals collectively do tasks with the support of machines, such collaboration will produce a body of solutions. Thus, the participatory-planning paradigm emphasizes planning with people to not only harmonize views among all stakeholders but also achieve the above-mentioned theories.

The proposed method has been inspired from terms such as communicative planning with people [142], deliberative planning, and planning through public consensus building. Furthermore, our research was inspired by many other studies highlighting the importance of harnessing collective intelligence [26] through crowdsourcing [206] by using groups including both women and men in partnership with organizations [207] [208] [209] [210].

On the one hand, the aim of CCDP is to provide a practical framework as part of which all city officials can share their ongoing city planning and development items to obtain citizens opinions on lines of planned projects for policy decision-making process. The CCDP is intended to be useful for both city officials and citizens to come together and discuss city problems for the good of society using a digital participatory platform based on AI facilitation. On the other hand, our main objective was to extend and promote participatory democracy through direct crowd participation into city related planning and decision-making processes. In addition, we wanted to evaluate the efficiency of D-Agree to promote direct citizen participation on collective intelligence in least developed countries like Afghanistan.

The CCDP will then practically start to operate on the participatory process according to the following framework.

1. Evaluate the acceptance and usefulness of CCDP and its key instrumental tool within municipal government.
2. Support KM departments to collect public opinion by hosting participatory planning, when needed.
3. On behalf of related departments perform participatory planning based on predefined neutral facilitation to promote citizens' involvements by using NLG techniques.
4. Perform Technology-assisted classification of obtained social insights based on issues, positions, pros, or con by using NLP Engine. The NLP engine is described in section 2.6.
5. Construct the real-insights in real-time for policy making.
6. Go to step 1 and repeat when needed to host a participatory planning.

2.6. Natural Language Processing Engine

A natural language processing (NLP) engine employs and extracts the posts of users. For all of the data posted by each user, a set of features is automatically learned by a discussion-structure module using machine learning techniques. The engine performs content labeling, document summarization, and sentiment analysis. We extract the discussion's structure in real-time. These extractions include node (described in section 2.6.1) and link extractions (described in section 2.6.2) [131]. The former automatically classifies the sentences in the discussion into four classes: issues, ideas, pros, and cons. The link extraction predicts a relationship between sentences. These four classes are based on the IBIS structure [108]. The discussions in our system are modules in the IBIS style, which represents the discussions by a combination of trees types of elements: Issues, Positions (Ideas), and Arguments (Pros and Cons). The discussion trees in our system are represented by a combination of four types of elements: issues, ideas, pros, and cons. Issues denote the common questions that stakeholders (city and citizens) aim to solve. Subsequent issues generated after the other issues are generalizations or specializations about related issues. The discussion theme or the topic setting is a high level of an issue, which Kabul city sets to harvest the wisdom of citizens to find innovative solutions. Positions denote possible answers or Ideas generated in response to related Issues or problems. Arguments refer to the opinions generated in response to the related positions. Positive opinions are represented as Pros, which are the potential advantages of the related ideas. On the other hand, the negative opinions are Cons, which might be their shortcomings. Each of these elements is called a node, and a relationship between the elements is called a link. The automated facilitation agent uses the IBIS structure to manage the discussion. For example, it suitably facilitates the extracted nodes [131]. Our platform's discussion-summarization system uses the extracted node and link information [131] to generate real-time discussion trees [211]. This system reconstructs a discussion tree of the whole discussion according to the IBIS structure and displays it for users. The structured and real-time visualized trees help participants learn while looking at a discussion's flow. One tree with branches (nodes and links) is structured for each discussion theme.

In sum, this process helps policy makers to get the real social insights while making public and urban related policies with people.

2.6. 1. Node and Link Extraction Method and Training

Node and link extractions are based on a deep learning method [131]. As training data, we used our original dataset of discussions conducted in English using our system. These discussions, which included 27 different topics, such as social issues, were held by foreigners living in Japan (translators, English teachers, and NITech students). Each topic was discussed by four people. We used 2050 pieces of data for training the node extraction and 955 for training the link extraction. Annotation was done manually.

We used BERT [212] and Dense for the node extraction model and fastText [213] and bidirectional long short-term memory (Bi-LSTM) for the link extraction model. Bi-LSTM is a type of recurrent neural network (RNN) [214]. The evaluation results of the node extraction using three-fold cross-validation are shown in Figure 2.4, as are the evaluation results of the link extraction using leave-one-out cross-validation (LOOCV) are shown in Table 2.1 [213]. We found the following link extraction results: idea → issue; pros → idea and cons → idea: 0.488; 0.235 and 0.209 (shown in Table 2.1). We did not evaluate issue → idea and issue → pros/cons due to insufficient annotated data. Our team at NITech proposed a new method to improve the accuracy of the node extraction [131]. With a Graph Attention Network (GAT), we can train not only sentences but also graph structures [214]. A method using GAT has shown good results [131], and we are working on its implementation in our system.

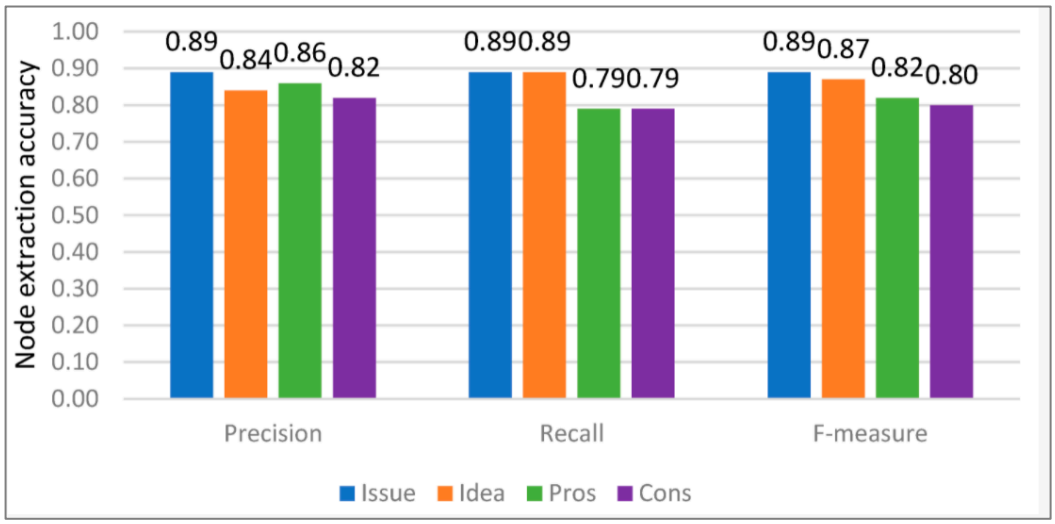


Figure 2. 4: Average precision, recall, and f-measure results of node extraction [52, 131].

Table 2. 1: Results of Link Extraction.

	idea --> issue	pros --> idea	cons --> idea
precision	0.488	0.235	0.209

2.6. 2. Node Labelling and Selection

A node is an element extracted from a user's generated and posted opinions. An opinion may contain a range of elements (1−n) depending on the quality and the stance of the generated opinions. In practice, in node extraction, we represent it in terms of natural language sequences composed of words. The input is the embedding of each word using fastText [213], and the output is a normalized probability. We consider a sentence and label it within a generated opinion as one node type out of four expected labeling types that require the highest probability among the three other labels. For example, to explain the real-time labeling further, we consider the discussion interaction among humans and AI in one of our conducted experiments. A participant asks, "How can we make neighborhood functions work well in Gozars?", AI labels it as Issue using node extraction [131], Another participant sees the message as issue and posts an answer (Idea): "How about strengthening the social relations among the Gozar residents?", the AI label it as Idea. Then a third participant joins their conversation and shows agreement (positive opinion) with the second participant opinion by posting: "That's a good idea.", AI label it as Pros (positive opinion in response to posted ideas). Now, based on the sentiment analysis of the previously posted opinions and predefined threshold of three people, the conversational agent introduces an idea into the discussion to advance it by collecting the arguments of the others on the proposed ideas by posting a facilitation message: "What are the merits of this idea?" Finally, the fourth participant sees the AI facilitator's post and posts a positive response to the proposed idea of the second participant: "Good social relations increase cooperation among Gozar residents." AI label the fourth discussant post as Pros (positive opinion in response to posted idea). This was one of the actual examples of discussion flow in our study.

Real-time node extraction was performed in our system, and all types of submitted opinions were extracted as nodes with labels in a tree structure [211] to establish relationships among them through link extractions [131]. For example, for the first participant, his posts are embedded using a fastText [212], and the output is a set of generalized probabilities: {cons: 0.00633775, ideas: 0.00077646505, issues: 0.99271494, pros: 0.00017085881}. Then the system normalized the set by acquiring and labeling it

as an Issue as the highest probability (0.99271494) of the submitted opinion. The average precision, recall, and f-measure of the node extraction (labeling) results with respect to the ground truths in our study are shown in Figure 2.4.

2.7. Assumptions in Proposing the Digital Participatory in Afghanistan

Definitely, many things have changed since 2001, and Kabul city has different characteristics. The face-to-face participatory planning solution to Afghanistan urban planning's issue has failed consecutively. Thus, the author assumes that now is the time to frame another approach. It's to maintain stability and change by hosting participatory processes using AI-assisted digital society platform. It can be functional towards deliberative democracy and by gradually functioning policy-making with people.
For this reason, we have been investigating alternative methods of participation to complementary traditional methods and tools. As a result, KM agreed and signed using D-Agree as a complement participatory tool to promote real-world e-participation and engage in public discussions at scale. We explore conversational AI as society platform to find out the assumptions, which the digital participatory platform was based on, and then conduct a couple of large-scale actual social experimental studies to find out the differences, so that we can propose suggestions, which best fits the current conditions of digital participatory platform for least developed countries good.

To evaluate our system for participatory democracy in the real-world, we proposed the framework mentioned above. This framework is made to learn the city issues through direct participation data input and then AI-enabled social insights will develop solutions for policy makers. It could potentially save time and money for communities involved in planning new neighborhoods.
We initially proposed the following three questions:

Research Question 1: Are online-participatory-support systems likely to increase participation in participatory planning process in Kabul?

Research Question 2: How might crowdsourcing solve Kabul’s complex urban issues?

Research Question 3: How can a complementary participative tool be adopted to propel e-communities forward?

Our hypotheses wondered whether KM's intention to collaborate through a platform would give citizens a greater level of engagement in the issues, harness solutions, and enable more active participation in municipal planning. Apart from those benefits, online participation allows for more organized and substantive participation from interested stakeholders and could lead to more social-collective awareness and intelligence in municipal planning. Because our system annotates submitted opinions into four elements based on deep learning links and node extraction, its elements with the highest confidence are labeled as discussion elements.
So we initially posited the following seven hypotheses:

Hypothesis 1 KM's official intention to collaborate through a digital society platform would give citizens a greater level of engagement in the issues, harness solutions, and enable more active participation in municipal planning (Chapter 2).

Hypothesis 2 Online participation allows for more organized and substantive participation from interested stakeholders and could lead to more social-collective awareness and intelligence in municipal planning (Chapter 2).

Hypothesis 3 The conversational agent can lead a group of individuals to submit more solutions to urban related issues, and lead consensus building among different stakeholders (Chapter 3).

Hypothesis 4 The conversational agent with scoring system can lead group of individual to easily understanding the quality of ideas within crowd and submission of quality of ideas stimulate participation (Chapter 7).

Hypothesis 5 The author of quality opinion with a scoring system can lead a group of individuals to easily understand the quality of ideas within a crowd and submission of quality of ideas stimulate participation. In additional, conversational agent help the development of conversation view as well (Chapter 6).

Hypothesis 6 The efficiency of the participants in the discussions facilitated by the agent in informal settlement areas (areas with more problems) is more than average of formal settlements areas (areas with less problems). This means that the participants were keener to participate in discussion facilitated by the conversational agent (Chapter 4).

Hypothesis 7 The efficiency of the conversational agent in discussion with participants who have prior knowledge on the discussion theme is more than average of participants without having prior knowledge. This means that the participants having prior knowledge were keener to posting in discussion facilitated by the conversational agent (Chapter 5).

The results of our real-world setting or actual experiments verify the above seven hypotheses. Moreover, in the experiment with the collaboration of the municipal government of Kabul City, the collected insights were later analyzed and used to elaborate upon social decisions and policies.

2.8. Application of CCDP in Real-world

For the sake of real-world implementation, we needed to establish a joint partnership with the local government in Afghanistan. Thus, we initiated a joint research partnership using our proposed framework.

In early 2019, for the first time, on behalf of Nagoya Institute of Technology (NITech) we discussed such issues and our hypothesis with Kabul's mayor and Kabul Local Municipal Government (KM), and also conducted a series of online presentations.

KM requested us to submit our proposal to the Kabul city municipal government, and then we submitted CCDP. We shared our proposed framework with Kabul city management through conducting a series of meetings and demonstrations. The basic background behind our idea was that the development action might fail, if the majority of people might not be involved in the planning process and deliberation of Kabul city. Our simple proposal to Kabul city management to make a plan with people but need to utilize our proposal to encourage citizen participants to engage in themed discussions.

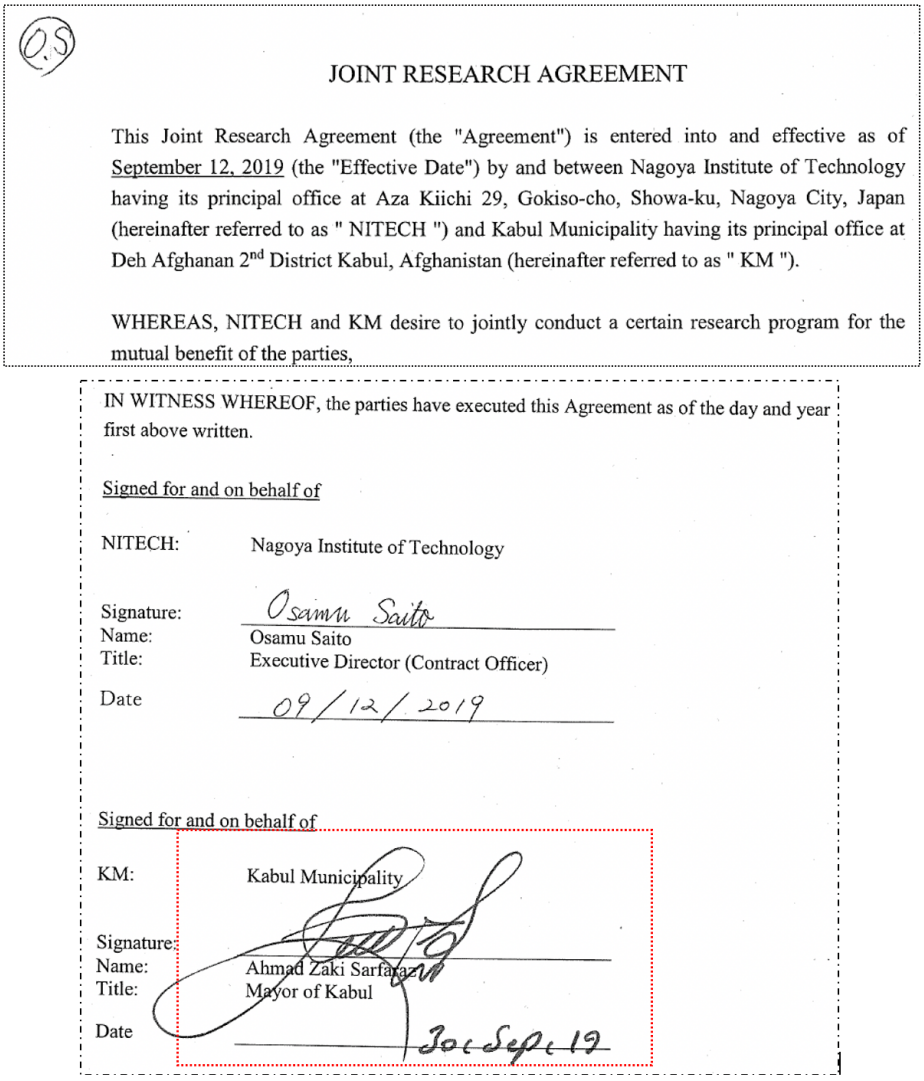
Fortunately, the administration welcomed our proposed method that advocated participatory planning and adopted such new methods as e-participation at scale because it lowers security constraints, time concerns, gender obstacles, and provides people with the opportunity to participate in democracy anywhere and anytime. We finally reached an agreement over a memorandum of understanding (MoU) of adopting our proposed method as a digital society framework (shown in Figure 2.5). KM agreed and signed using D-Agree as a complement participatory tool to promote real-world e-participation and engage in public discussions at scale. Therefore, Nagoya Institute of Technology (Japan) and Kabul Municipality (Afghanistan) have formed a novel developed and developing

world partnership by using our proposed methodology as an emerging-deliberation mechanism to reframe public participation in urban planning processes. The main objective was to harness the wisdom of the crowd to innovative suggestions for helping policymakers making strategic development plans for Gozars using open call ideas, and for responding to equal participation and consultation needs, specifically for women and minorities.

In the signed letter, Kabul municipality agreed to use our methodology when Kabul city needs to make a plan with people, and addition we made it clear that we utilize Kabul city as a society platform to evaluate the impact of our system for participatory democracy. From September 2019 until the fall of Kabul in August 2021, D-Agree was used and managed by Office of Mayor, Directorate of Plan, Policy, Monitoring and Evaluation (focal point), Directorate of Citizen Coordination and Affairs and Generate Directorate of Solid Waste Management and Cleaning on behalf of Kabul Municipal government to moderate (n = 306) actual Kabul city-related planning discussions. The related departments who used D-Agree as representative application for the planning are shown in Figure 2.6. In these discussions, more than 15,000 citizens participated in planning activities hosted by D-Agree and generated more than 71,000 opinions (catalogued into IBIS) related to urban-related thematic areas. The discussion themes were mostly regarding urban-related issues such as how sustainable development goals should be adopted effectively in Kabul city. The finding suggests that the system responded to municipality consultation needs by taking public insights and summarizing the innovative suggestions for helping policy makers.

This study presents the first practical example of using a conceptual and applied framework in which a digital participatory platform is its key part in the context of the urban planning and development process of Kabul city, Afghanistan.

Note that in this thesis, we do not present all of our conducted real-world and open experimental studies (n = 306). Its scope is focused on presenting a joint research initiative and the result of those experimental studies (Chapter 2 to 8) which were based on research-oriented hypotheses and settings. The goal is to promote participatory democracy and evaluate proposed methods at a cross-class of areas, people and countries.



JOINT RESEARCH AGREEMENT

This Joint Research Agreement (the "Agreement") is entered into and effective as of September 12, 2019 (the "Effective Date") by and between Nagoya Institute of Technology having its principal office at Aza Kiichi 29, Gokiso-cho, Showa-ku, Nagoya City, Japan (hereinafter referred to as " NITECH ") and Kabul Municipality having its principal office at Deh Afghanan 2nd District Kabul, Afghanistan (hereinafter referred to as " KM ").

WHEREAS, NITECH and KM desire to jointly conduct a certain research program for the mutual benefit of the parties,

IN WITNESS WHEREOF, the parties have executed this Agreement as of the day and year first above written.

Signed for and on behalf of

NITECH: Nagoya Institute of Technology

Signature: Osamu Saito
Name: Osamu Saito
Title: Executive Director (Contract Officer)
Date 09/12/2019

Signed for and on behalf of

KM: Kabul Municipality

Signature:
Name: Ahmad Zaki Sarfaraz
Title: Mayor of Kabul
Date 30 Sept 19

Figure 2. 5: An official joint research agreement letter has been between NITech and KM to adopt our methodology as earliest adopted digital society platform for participatory planning democracy and public policy in Afghanistan. Reprinted from "The joint research agreement letter between NITech and Kabul City,".

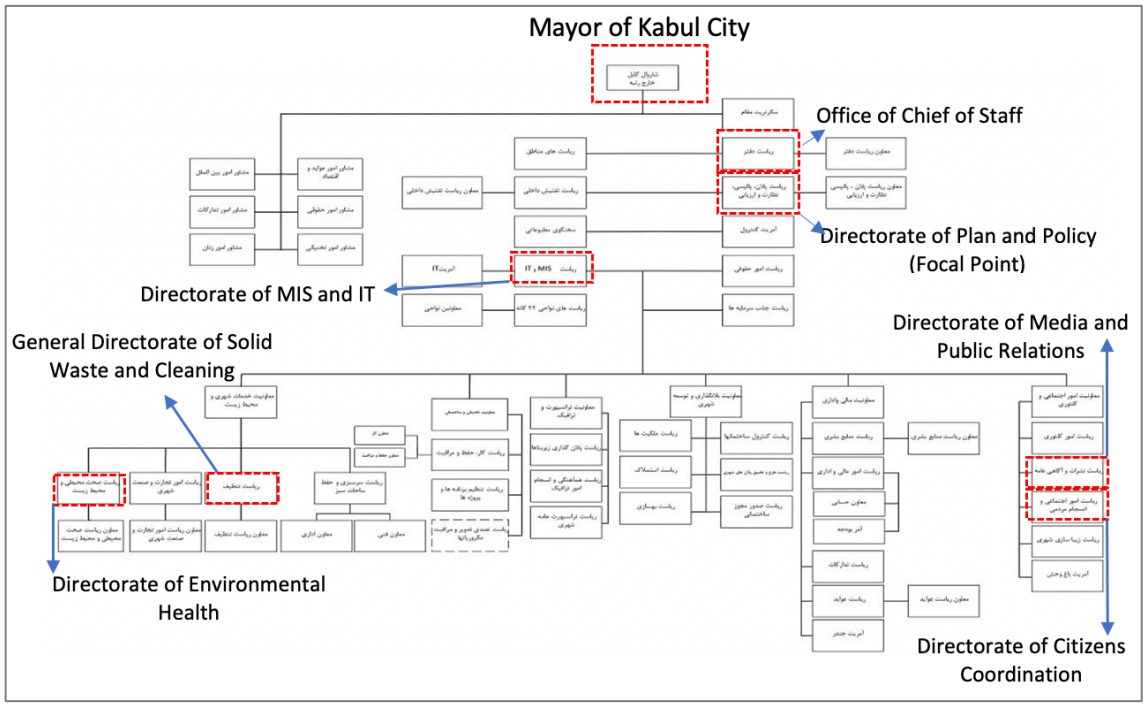


Figure 2. 6: Kabul Municipal Government Organizational Chart and departments (colored red) which managed to use D-Agree on behalf of city. Re-designed and adopted from [217].

2.9. How we Evaluated D-Agree Acceptance in the Context of Kabul City?

Kabul city agreed to adopt our methodology as Kabul city's official tool to in an attempt to achieve greater recognition, strengthen ties with people, and collect real insights to transform policy making. However, before hosting the planning process, we wanted to conduct a digital field study as the first practical example of investigating the city official's perception of ease of use and usefulness of the proposed method in the context of the town-planning in Kabul city.

In previous research, a couple of methods for the evaluation of startup system's ease of use and their usefulness performance on the ground has been developed and proposed such as TAM, TFF, user satisfaction, case study, quantitative and qualitative, and so forth as mentioned above. These methods can easily evaluate the ease of use and usefulness of startup systems before launching it at scale.

We adopted the TAM which is an information systems theory that models how users come to accept and use a technology, developed by Fred Davis in 1989, but due to nature of our experiment we used the concept of combined method of TAM, user satisfaction, case study, quantitative and qualitative to evaluate our proposed framework for participatory democracy.

Firstly, try to evaluate the key instrument (D-Agree) within our proposed framework with the municipal government. It is because municipal governments are in the center of the policy making system within the city and they have greater powers to affect societies but also at the same time themselves are affected by social discussions. This is actually a clear idea, especially for developing countries like Afghanistan, that if a democratic government adopts a system, society can easily adopt that system.

Our objective by testing our proposed method with the government was not only to assess their perception but also to consider our proposed method as an official efficient tool for social and participatory development inside Kabul city.

We evaluated the efficiency of D-Agree with a pre- and post-questionnaire method. It is because this method has better chances to evaluate the effectiveness of the system. This method of pre-using D-Agree questionnaire, Using D-Agree, and then Post-using D-Agree was designed for Kabul city officials because it was felt that this method will evaluate the receptive perception regarding D-Agree usefulness. Moreover, this method also helps to understand the attention of the city officials to adopt the system.

Our methodology to evaluate D-Agree with city officials (n = 65) is summarized in Figure 2.5. It includes the following steps: getting approval to test the system with city officials, conducting a pre- survey (prior using the D-Agree), hosting official city administrative meetings using D-Agree, and post-survey (after using D-Agree). Then steps are explained in more detail in the subsequent subsections.

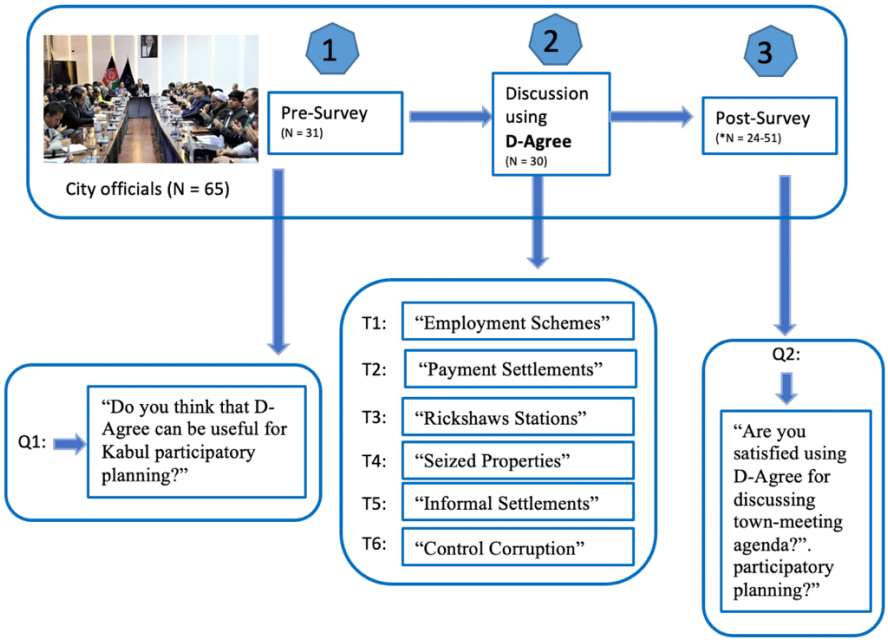


Figure 2. 7: Outline of our experimental study to evaluate our system efficiency with Kabul municipality management including mayor of Kabul [218].

(i) Hosting City Administrative Meeting:

We both (NITech and KM) decided to conduct an experimental study to evaluate D-Agree's usefulness with Kabul city officials before introducing D-Agree to Kabul citizens as a digital society tool. After discussing our application in a series of official meetings, the Kabul municipal government finally reached an agreement over testing the system, thus, for the first time, they welcomed an online soft solution to host their official administrative meeting. However before adopting such new methods as e-participation they would like to test its efficiency practically involving all city officials.

We thought that the municipal government was a relevant organization to study regarding acceptance of D-Agree as a digital society platform as their approval related usefulness of the system might be deliberated at large, and then their approval might be useful to stimulate D-Agree utilization by Kabul citizens. Kabul city decided to use D-Agree to host the Kabul city administrative meeting. A two-hours long meeting which is organized bimonthly and led by Kabul mayor to discuss city-related high-level issues (shown in Figure 2.7).

The objective of hosting the meeting was to conduct a pre-meeting survey (prior using D-Agree), and then use D-Agree to gather opinions on the six themes about city-

related high-level issues in the city of Kabul (Afghanistan), and finally conduct a post-meeting survey (after using D-Agree). The results of this real experiment will be the basis for the municipal administrative decisions to officially adopt D-Agree within the next two years in the city of Kabul (2019-2021). The experimental town meeting was conducted on November 13, 2019 from 10 a.m. to 12 p.m.

Figure 2. 8: An experimental study to evaluate our system efficiency with Kabul municipality management including mayor of Kabul (top) held on 13th November, 2019.

(ii) Pre-D-Agree Usage :

A questionnaire is the pre-D-Agree usage survey instrument [109]. It was chosen because we wanted to know the city officials' belief and behavior towards the usefulness of D-Agree as a digital participatory tool for Kabul city. Moreover, a questionnaire can also reduce interviewer's influence over the responses of the participants. Moreover, it can be relevant to achieve the objective of TAM mentioned above.

It is worth mentioning that due to the officially-defined nature of the experiment, we relied on asking only one question and choose a quantitative method that combines questionnaires and statistical analyses of the perception data generated from the pre-survey using convenience sampling [219, 220].

A questionnaire was used for this task and 5 min were provided to request city officials (n = 65; male = 63 and female = 2) who were present at the meeting for filling their answers. Following the nature and environment of administrative meetings. The selection of respondents was made using a non-probability sampling technique of convenience sampling [220]. Thus, any city official who agreed to participate and whose

head of department was supported to discuss during administrative meetings took part in the pre-D-Agree usage survey. Total of 31 city officials (male = 30 and female = 1) out of 65 people participated in a pre- D-Agree usage questionnaire. To explain the sampling technique further, the surveyor (Kabul city chief of staff) made a decision to choose any officials in the meeting whose department agreed to participate and discuss during the administrative meeting. in the survey. In case more than one respondent was available at the same house and decided to participate, they were included in the study. Since the author was a Ph.D. student at NITech Japan. It was difficult for the author to approach an official administrative meeting of the municipal government. Thus, the KM chief of staff was requested and officially assigned to facilitate this survey.

For the pre-discussion questionnaire we asked “Do you think that D-Agree can be useful for Kabul participatory planning?”. The participants had to select their level of satisfaction from strongly useful (5), useful (4), neutral (3), not-useful (2), and strongly not-useful (1). In the results, illustrated in Table 2.2, the average usefulness scores 3.03. This suggests that Kabul city official D-Agree-usage related perceptions were positive.

Table 2. 2: Pre-D-Agree survey.

Do you think that D-Agree can be useful?	Reponses	Sampled n = 31 (%)	Mean
Strongly useful	5 (16.12)	31 (47.69)	
Useful	10 (32.25)	31 (47.69)	
Neutral	4 (12.90)	31 (47.69)	3.03/5
Not useful	5 (16.12)	31 (47.69)	
Strongly not useful	7 (22.58)	31 (47.69)	

Chi-test*: $p < 0.05$

(iii) D-Agree Usage :

D-Agree is the main discussion instrument to be tested in this study [37]. It was chosen because we wanted to know the city officials’ experience towards the usefulness of D-Agree as a digital participative tool for Kabul city. Moreover, it can be relevant to use it

and then conduct a post-questionnaire in order to evaluate the satisfaction levels of the users.

To this end, city officials were invited by the KM chief of staff to use D-Agree to discuss pre-defined seven themes related to city issues and MoU related to NITech, which was pre-approved as the official agenda of the meeting by city management. Before the experiment, the KM chief of staff explained how to create IDs (signup and login) on D-Agree to city officials. The city official preferred to disclose their identity, so the city official's identity was disclosed to the participants up until the end of the meeting.

We conducted the experiment from 10:30 a.m.–12:00 p.m. on 13 November 2019. The discussion was conducted in English. Each theme was provided 15 min for discussion. City officials logged in D-agree via their own personal computers or smartphones to attend the discussion.

The meeting has seven main themes in total (shown in Figure 2.8).

*Theme*1 : Memorandum of Understanding (MoU to adopt D-Agree) (Figure 2.9)
Theme2 : The recruitment of KM employees (Employment scheme), (Figure 2.10)
Theme3 : Delivery of money and obtainment of land (Payment problems) (Figure 2.11)
Theme4 : Rickshaws and "Zarange" stations (City's rickshaws stations problems) (Figure 2.12)
Theme5 : Over-the-top and over-seized property (Seized properties inside Kabul city) Figure 2.13)
Theme6 : Demolition of two citizens' homes (Informal settlement problems) (Figure 2.14)
Theme7 : Payment of extra received money (Control of corruption inside Kabul city) (Figure 2.15)

As a result, 30 registered participants visited the system to discuss seven pre-selected themes (including D-Agree related MoU), and 302 submitted opinions.

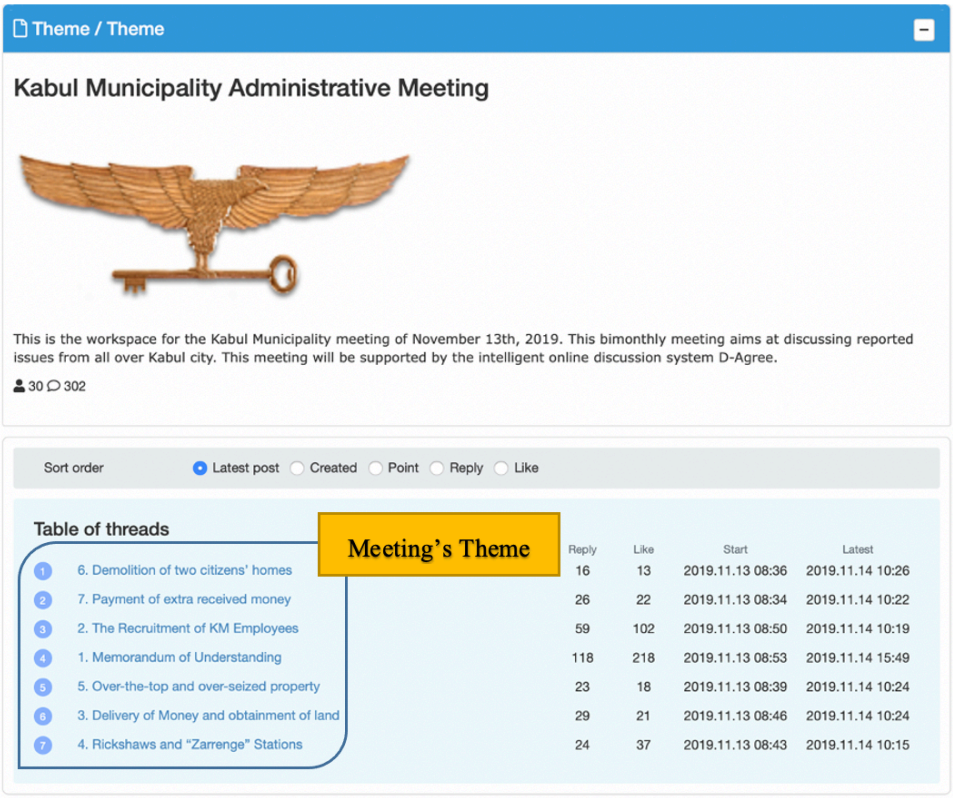


Figure 2. 9: Web interface of D-Agree during Kabul municipality administrative meeting experiment, dated 13th November, 2019.

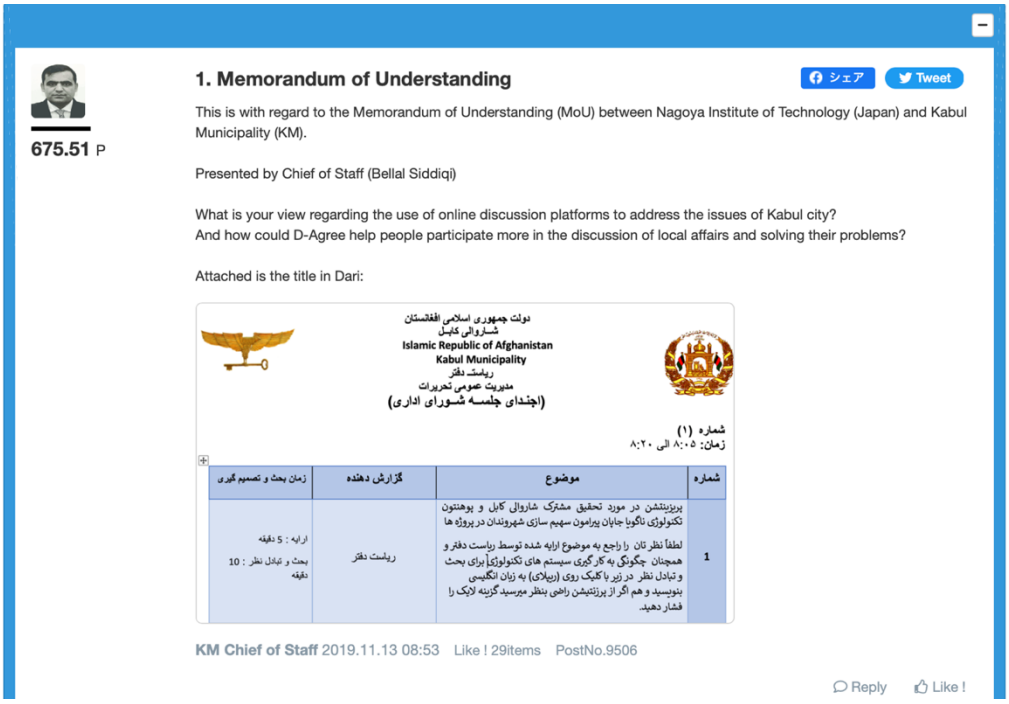


Figure 2. 10: Discussion space for theme no. 1.

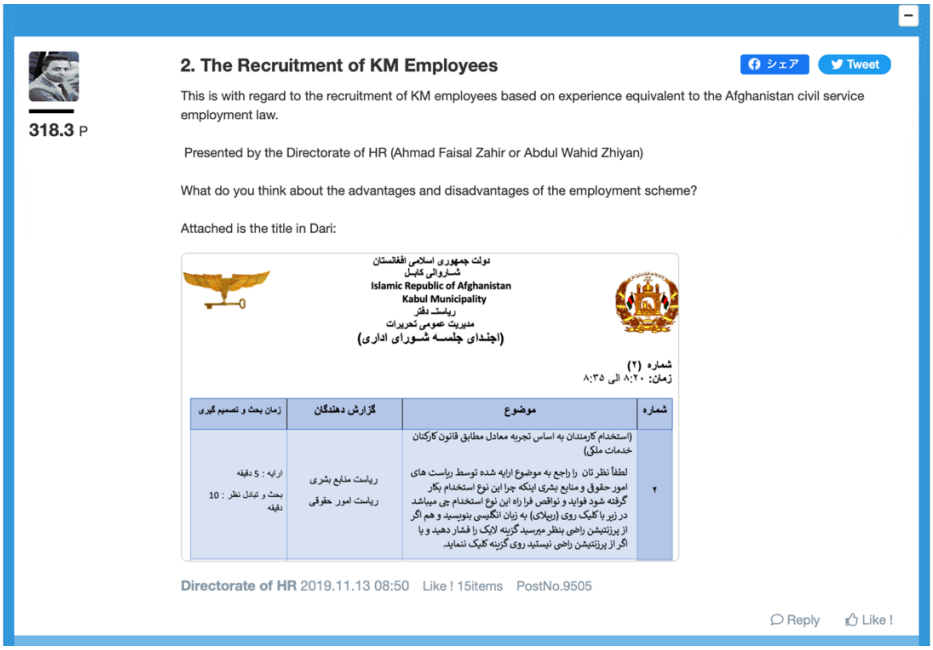


Figure 2. 11: Discussion space for theme no. 2.

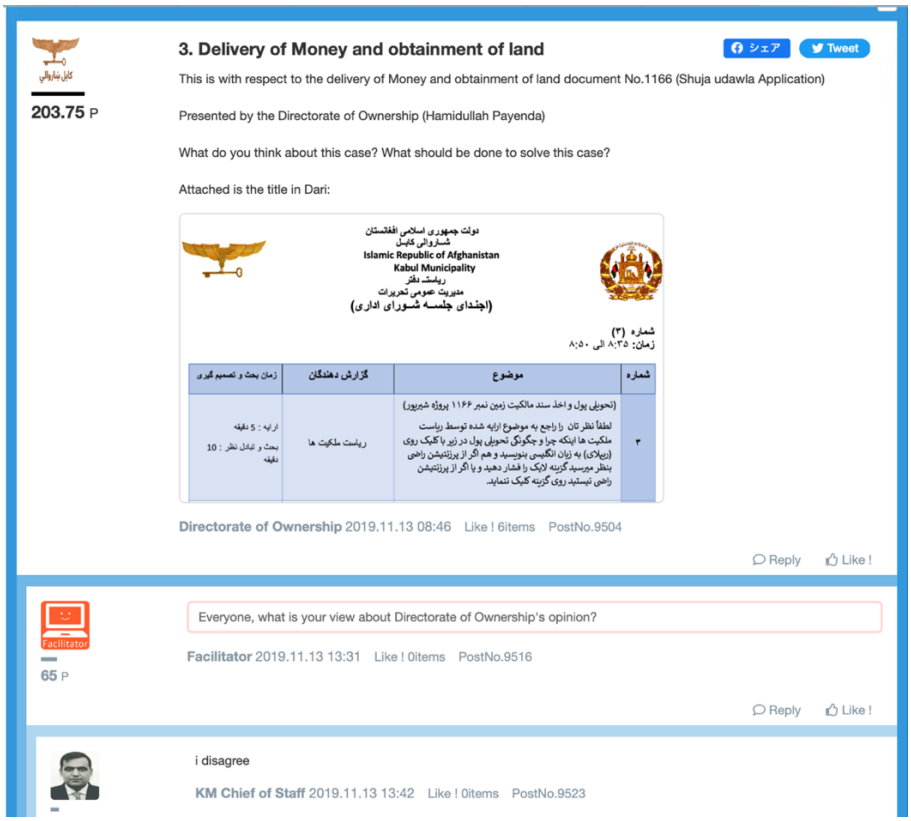


Figure 2. 12: Discussion space for theme no. 3.

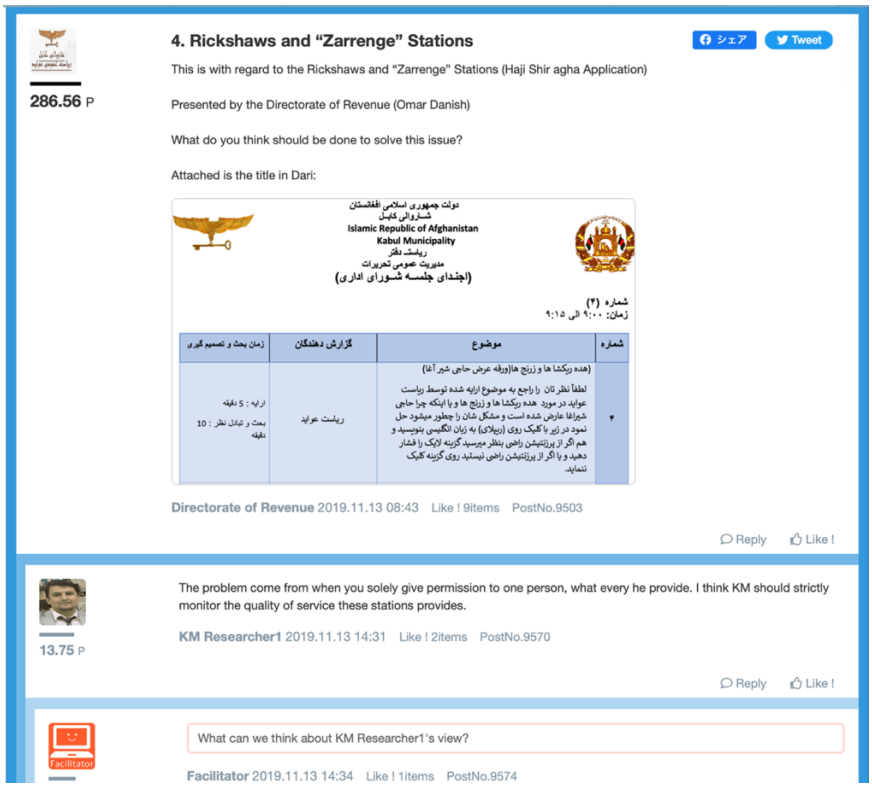


Figure 2. 13: Discussion space for theme no. 4.

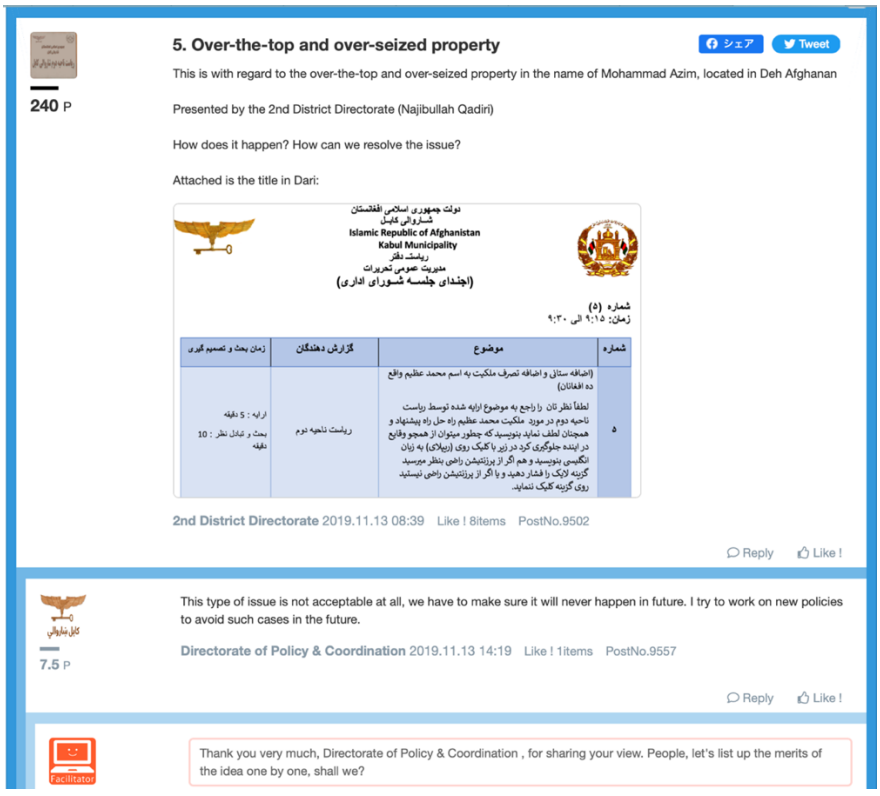


Figure 2. 14: Discussion space for theme no. 5.

Figure 2. 15: Discussion space for theme no. 6.

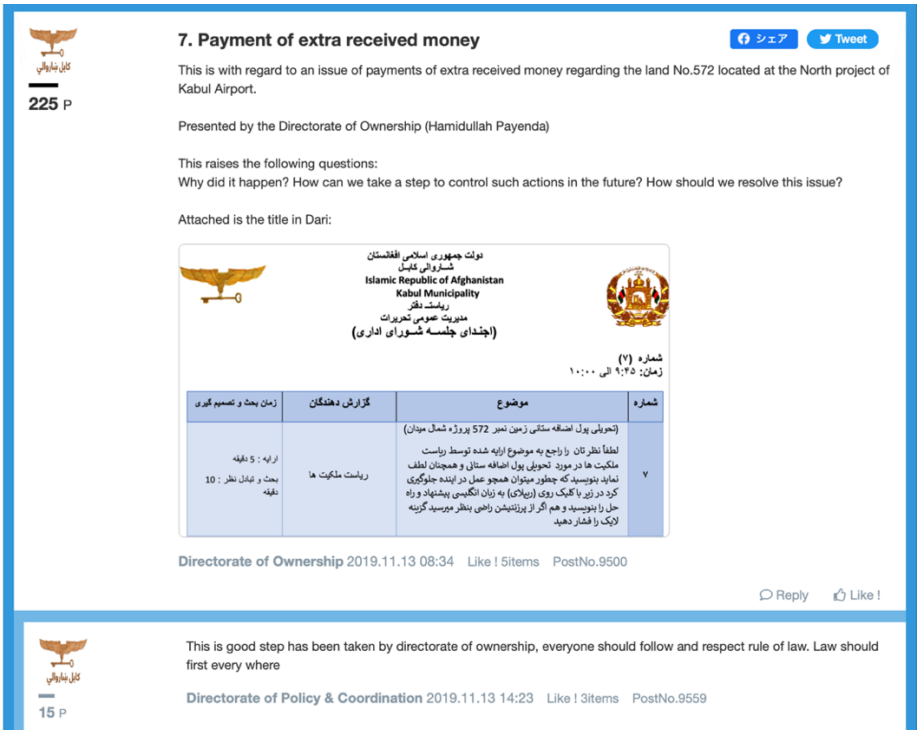


Figure 2. 16: Discussion space for theme no. 7.

(iv) Post-D-Agree Usage :

After the discussion (D-Agree usage), we conducted a post-D-Agree usage questionnaire [109]. A questionnaire is the post-D-Agree usage survey instrument [109]. It was chosen because we wanted to know and measure the city officials' belief and behavior towards the usefulness of D-Agree as digital participative and compare it with pre-D-Agree usage survey [35].

To this end, we used questionnaires that included only one question but addressed the discussed six meeting thematic agenda each time, as psychological measurement scales to evaluate the usefulness of D-Agree related hosting each theme.

For the post-discussion questionnaire, the general question asked was "Are you satisfied using D-Agree for discussing town-meeting agenda?" (shown in 2.16). However, we made it specific for example, "Are you satisfied using D-Agree for discussing town-meeting agenda, theme 1?"; "Are you satisfied using D-Agree for discussing town-meeting agenda, theme 2?" and so on till theme 6 (shown in Table 2.3). The participants had to select their level of satisfaction from strongly satisfied (5), satisfied (4), neutral (3), dissatisfied (2), and strongly dissatisfied (1) for each discussed theme. In the results, illustrated in Table 2.2, the average usefulness scores of six related theme responses were gathered as 4.38. The satisfaction scores had nearly the same scores, 4.5 to 4.7, across 4 themes (T2, T3, T4, and T7); except two themes, T5 and T6 (3.6 to 3.7). Theme one (T1) was about MoU among NITech and KM, and the author made his own decision to not include it in the survey. The seven themes, labelled as T1 to T7 and numbered as 1 to 7 in the table of threads (Figure 2.8).

Due to the officially-defined nature of the experiment, we relied on asking only one question and choose a quantitative method that combines questionnaires and statistical analyses of the perception data generated from the pre- and post-D-Agree usage surveys. The result suggests that users experienced satisfying discussions after practically using D-Agree. This suggests that using the actual instrument (D-Agree) has positively changed the perception of Kabul city management.

We also noted that the hosting discussion topic matters while using D-Agree because we achieved the highest satisfaction score for theme 2 (4.9). We believe this is due to the complementarity effect of discussion topics (the recruitment of KM new employees) in which Kabul city officials engage more replies and likes while using D-Agree compared with other five topics.

It is worth mentioning that, the Kabul city high-level administrative meeting adopted by consensus our proposed framework which D-Agree is its key part, pertaining

to complement participatory approach and digital participatory democratic tool for the Kabul city urban planning and development process (2019-2021).

Table 2. 3: Post-D-Agree survey.

	T1		T2		T3		T4		T5		T6		Mean
		Mean		Mean		Mean		Mean		Mean		Mean	
Strongly satisfied	45/47		19/24		25/32		11/41		15/30		42/52		**4.3**
Satisfied	2/47		2/24		1/32		20/41		2/30		7/52		
Neutral	0/47	**4.9**	3/24	**4.6**	5/32	**4.5**	0/41	**3.7**	5/30	**3.6**	2/52	**4.7**	
Dissatisfied	0/47		0/24		0/32		9/41		3/30		0/52		
Strongly dissatisfied	0/47		0/24		1/32		1/41		5/30		0/52		

Chi-test*: $p < 0.05$

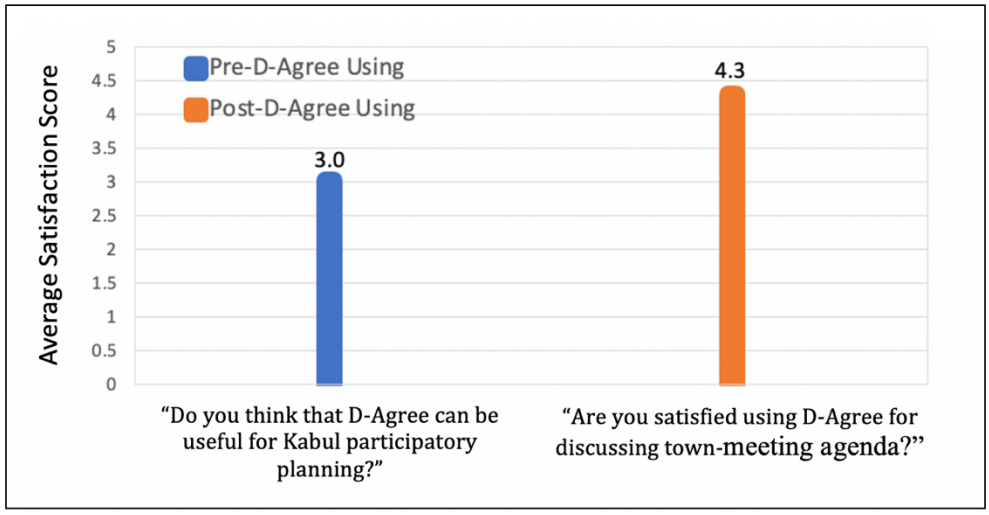


Figure 2. 17: Survey results for what city officials think before using D-Agree (where 1=Strongly not-useful, 5=Strongly Useful); and satisfied after using D-Agree (where 1=Strongly Dissatisfied, 5=Strongly Satisfied). Averages and standard deviations are reported (N=31, *t-test** $p < 0.05$).

(v) Discussion :

Looking at the participatory process over the course of nearly 20 years (2001-2020) during republic democratic of Afghanistan, we find that secure and meaningful direction engagement and participation into the planning process never get resolved. Through proposing an emerging framework, we uncover the major problems with Kabul city's current participation and deliberation resolution process.

Our proposed framework, which is a mixture of using an artificial-intelligence-led society technology, called D-Agree and experimental participatory planning in Kabul, Afghanistan has been submitted and discussed with Kabul city management.

We finally reached an agreement over a memorandum of understanding (MoU) of a joint research program called CCDP. Kabul city agreed and signed using D-Agree as a complement participatory tool to promote real-world e-participation and engage in public discussions at scale. But before its real-world application at scale, we both KM and NITech, would like to evaluate its efficient with city officials through hosting city administrative meeting using D-Agree that provides a hybrid (i.e., cyber-physical) environment in which city officials can discuss both in cyber and real spaces but mainly cyber (D-Agree).

Firstly, we conducted pre- survey (prior using the D-Agree), then we used D-Agree as cyber-physical to host official city administrative meeting as a first pilot case study to host a city meeting in Afghanistan, and finally conducted a post-survey (after using D-Agree).

In order to understand the differences in the usefulness of D-Agree and users' stratification, we conducted a pre and post questionnaire evaluation using a five-level Likert scale for the discussions and facilitators. City officials were requested by the KM chief of staff to fill a questionnaire before the hosting of the meeting using D-Agree. We received 31 out of 65 city officials. The averages of the responses were calculated.

In pre-D-Agree usage questionnaires, the Likert scale is used to precisely assess the level of usefulness of the D-Agree with respect to the hosting participatory planning process in Kabul, each evaluated separately. The users rate each D-Agree using the Likert scale method.

In post-D-Agree usage questionnaire, the same Likert scale is used but this time not for assess the usefulness but to precisely assess the level of satisfaction of the users with respect to discussing six meeting themes using d-Agree, each theme responses evaluated separately; and then the sum averages of the responses were calculated. The users rate their satisfaction to discuss each topic while using D-Agree by Likert scale method.

We used pre- and post-D-Agree usage questionnaires averaged of responses to compare D-Agree usefulness and user satisfaction while looking the effect information prior and after using the system. The evaluation of the criterion “Good digital participatory method?” in the pre-survey case it gave 3.0 average satisfaction score. The result suggests the city officials’ belief and behavior towards the usefulness of D-Agree as digital participative were “neutral = 3”. It is because city officials didn’t have priori experience of using such systems, but their stances change drastically under the effect of the using D-Agree and are even reinforced. The evaluation of the criterion “Good digital participatory method?” in the post-survey case it gave 4.3. The result suggests the city officials’ satisfaction towards the usefulness of D-Agree as a digital participative were changed drastically to above the “satisfied/useful = 4.3” level. Results of these pre- and post-D-Agree usage questionnaires are significantly different from each other.

To understand participation processes, we cannot simply examine the tools or rely on city officials; we must understand the role of all stakeholders including citizens, stakeholders and public administrators who are the tool users by conducting large-scale real-world experiments [221]. Towards that end, the conducted case studies with citizens are summarized and reported in chapters 3 to 8.

2.10. Research Experimental Method and Procedures for the Current Study

The procedure or methodology adopted from previous work at our Lab becomes comprehensible to describing the overall participative procedures of this work. The work is presented under a series of subjects logically connected to each other. Each part is a prerequisite to the next part. Therefore, the flow of sections and chapters somehow points to the procedure adopted for this work.

Our general methodology is multi-method and stage which is based on pragmatic and empirical experiments [222] and case studies [76] using conversational AI in partnership with governmental organizations [223]. Researchers reported that it is effective if we use an online forum for case studies [224]. As our methodology is multi-method, the author has been inspired by different researches [94] [95] [96] [97].

Our digital platform as a society method is inspired by representative projects such as MIT Climate CoLab [26], MIT Deliberatorium [50] and Decidim. Furthermore, our platform inspired from real-world digital platform for participation such as Climate

CoLab; Deliberatorium; Decidim Barcelona [75], Decide Madrid and Participate Melbourne [78], and mainly COLLAGREE [79] described in Section 1.3 (Chapter 1).

From a participation perspective, the author has been inspired by Sherry Arnstein [122] participatory-planning paradigm emphasizes planning with people. From a pragmatic experiment point of view, this work is influenced by the philosophy of John Dewey and James Bohman, which sees the citizen as the primary democratic inquirer and the social experimentation studies as the key organizer and creator of the "institutional space for deliberation. According to John Dewey's long-ago observation, democracy is constituted and formed through public opinions and discussion which is accomplished through meaningful communication.

The specific method of work is design case study, i.e., propose design for real-world experimental study using digital deliberation platform , or article analyses existing design .We relied on both qualitative and quantitative method that combines questionnaires, annotated data, and statistical analyses of the argumentative data generated from our proposed used digital participatory platform. We particularly looked at how many IBIS elements are generated in a discussion and how many of these are generated as a result of the facilitation messages.

First, the author conducted a detailed investigation inspired based on TAM. We then conducted design case studies to evaluate efficiency of conversational AI platforms across, people, areas, countries.

In sum, in all conducted social experimental studies in this thesis, from chapter 3 to 8, the author relied on case studies using both qualitative and quantitative method that combine questionnaires, annotated data, and statistical analyses of the argumentative data generated from the discussion's web-spaces.

In this thesis, chapter 3 to 8, the author's methodology to conduct digital participation experimental case studies as an empirical case of social experimentation in partnership with local government, one which seeks to reach a compromise between democratic legitimacy and political effectiveness, and also to illustrate and evaluate the efficiently of the approach proposed in this work for LDCs such as Afghanistan.

Figure 2. 18: KM, agreed to advertise a unified call for participation in the planning process with people using our method when Kabul city wanted to make plans with people. Designed by KM for Kabul residents [160].

2.11. Research Procedure for the current Study

The procedures for this study are shown in Figure. 2.18 and 2.19 below. Firstly, we develop some framework options and discuss their applicability acceptance with 65 city officials in Consequently, we (NITech and KM) reached an agreement letter in which KM agreed to adopt D-Agree as a backchannel and main e-participatory tool to promote participatory democracy and engage in public in planning process at scale.

After that, we conducted the efficiency of autonomous facilitation in online participatory process through a series of real-world comparative experimental studies while looking the effect of conversational AI on cross-area and people cases to investigated cross-class of people and areas in online planning activities to determine the efficiency of conversational agent across people and areas and to gather the needed data for the predefined threshold of facilitation setting in the future process. By finding out the neighborhood functions, we set standards for them in terms of travel distances, location area and so on, considering the local characteristics and standards. Consequently, we develop some neighborhood unit options and discuss their applicability in Kabul City.

First, a conceptual framework for promoting actual participatory democracy proposed to local governments in Afghanistan such as Kabul city and Capital Region Independent Development Authority (CRIDA) [227] (shown in Figure 2.20). Second, an experimental study was conducted to identify the ease of use and usefulness of proposed methodology for participatory planning with Kabul city management. Third, a couple of experimental studies conducted to investigate: (1) conversational agent impact on discussion development (Chapter 3); (2) a quantitative comparison of conversational AI platform on discussion development across class of areas in Kabul city (Chapter 4); (3) a quantitative comparison of conversational AI platform on discussion development across class of peoples (Chapter 5); (4) an experimental idea contest to evaluate the relation between " author of quality of opinions" and " discussion development" (Chapter 6); (5) present a case study regarding the policy-decision making and role of our proposed method (Chapter 7). Consequently, a quantitative comparison of conversational AI platforms on discussion development across class of countries and their applicability is explored. The outline of the whole research and abstracted process are shown in Figures 2.18 and 2.19.

It is worth mentioning that as a result of our jointly conducted actual experiments to collect social insights for policy making, KM made a decision to select each wakil through organizing a *wakil* election and call each *Gozar* resident to vote for their candidate in the future. Previously, KM directly appointed wakils without public consultation. The mentioned change in policy decision making in Kabul city is reported in a journal [52]. Furthermore, this initiative has influenced other local Afghan governments, including the cities of Kandahar (Kandahar-M) [228] (shown in Figure 2.22) and Herat (Herat-M) [229] as well as the country's central government's Ministry of Urban Planning and Land (MUDL) [230] (shown in Figure 2.21), which has officially expressed its intention to collaborate with us.

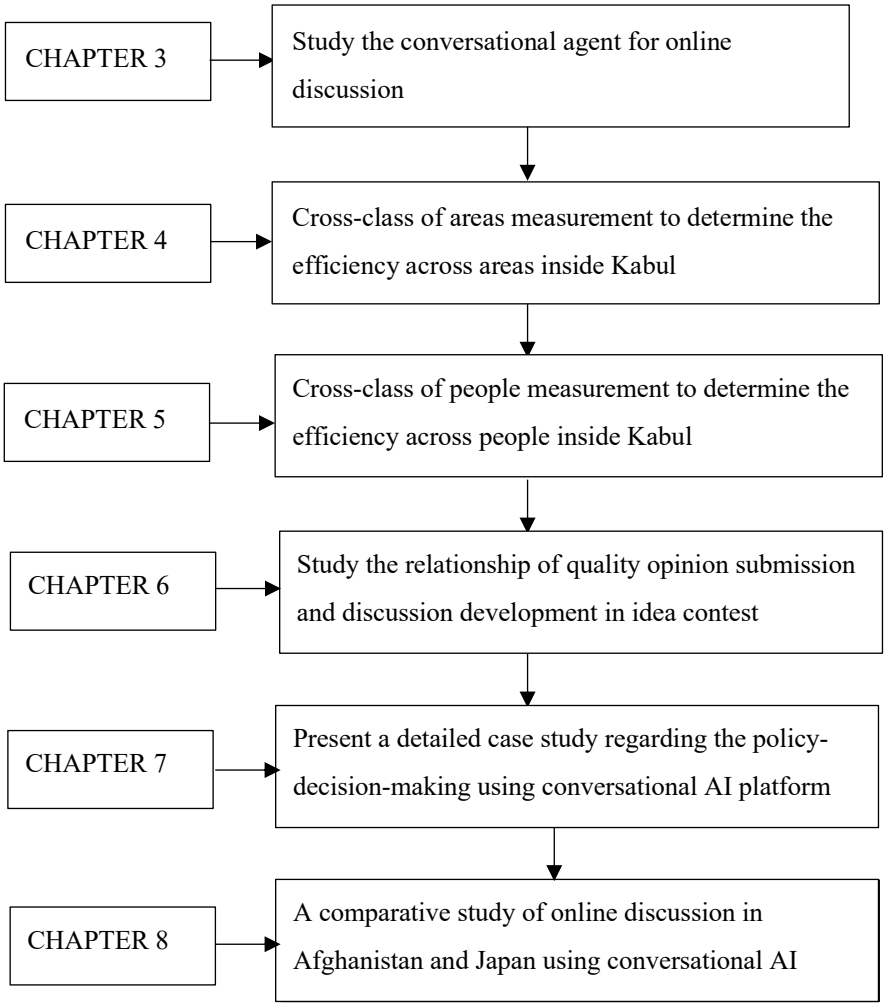


Figure 2. 19: Outline of all research process for this study.

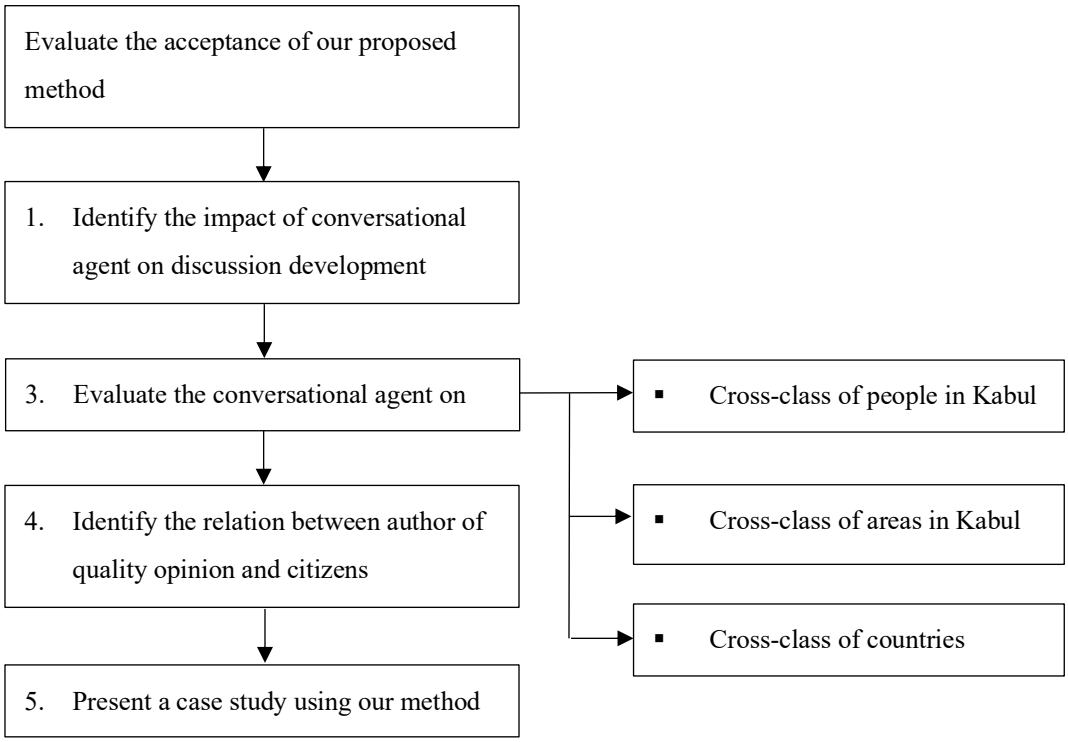
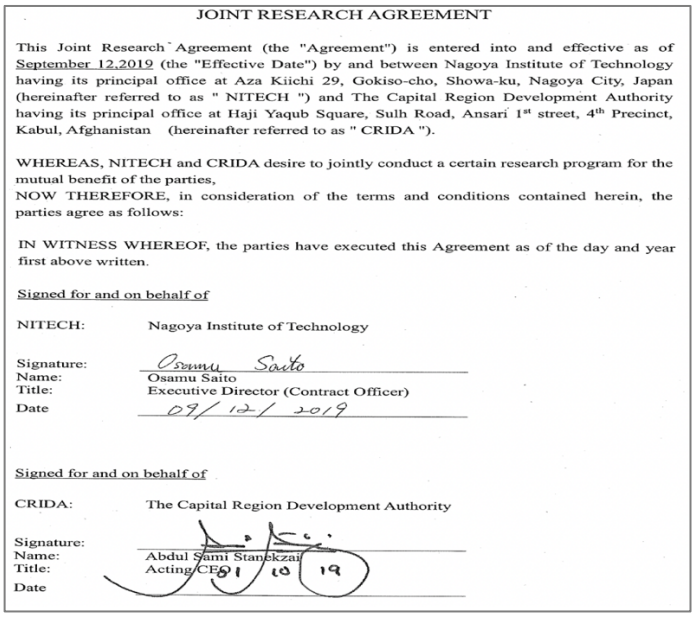


Figure 2. 20: The abstracted research process for this study.



JOINT RESEARCH AGREEMENT

This Joint Research Agreement (the "Agreement") is entered into and effective as of September 12,2019 (the "Effective Date") by and between Nagoya Institute of Technology having its principal office at Aza Kiichi 29, Gokiso-cho, Showa-ku, Nagoya City, Japan (hereinafter referred to as " NITECH ") and The Capital Region Development Authority having its principal office at Haji Yaqub Square, Sulh Road, Ansari 1st street, 4th Precinct, Kabul, Afghanistan (hereinafter referred to as " CRIDA ").

WHEREAS, NITECH and CRIDA desire to jointly conduct a certain research program for the mutual benefit of the parties,
NOW THEREFORE, in consideration of the terms and conditions contained herein, the parties agree as follows:

IN WITNESS WHEREOF, the parties have executed this Agreement as of the day and year first above written.

Signed for and on behalf of

NITECH: Nagoya Institute of Technology

Signature: Osamu Saito
Name: Osamu Saito
Title: Executive Director (Contract Officer)
Date 09/12/2019

Signed for and on behalf of

CRIDA: The Capital Region Development Authority

Signature:
Name: Abdul Sami Stanekzai
Title: Acting CEO
Date 01/10/19

Figure 2. 21: Reprinted from "The joint research agreement letter between NITech and CRIDA". [227]

Ministry of Urban Development and Land
Deputy Ministry of Construction Affairs

Date: 11.03.2021

To: Dr. Takayuki ITO, Professor at Department of Social Informatics, Kyoto University.

Subject: Letter of intent for Memorandum of Understanding (MoU)

This letter shows the deep interest and preliminary intention of the Ministry of Urban Development and Land (MUDL) to have an MoU and carry out a joint research collaboration with Kyoto University.

Desiring to further strengthen the scientific and technological cooperation which the full content will be drafted and agreed by both parties. Hence, the details of the MoU and joint research program need to be negotiated and executed.

The primary objective of this MoU is to create a means for cooperative efforts between Kyoto University and MUDL. As a general principle, this joint research program with support of Kyoto University will seek approaches to promote and develop:

- Participatory e-planning in urban development in Afghanistan with support of crowd decision support system and AI technology
- Collaborative Joint Laboratories Research
- Joint workshops and Urban Symposium

Other specific areas may be agreed by mutual agreement between parties. The two parties maintain close mutual exchange of information and ensure that the cooperation will bring real benefits to the development of scientific research in both counties.

Your cooperation would be highly appreciated.

Sincerely,

Sahar Hamdard
Deputy Minister of Construction Affairs
Phone: +93 20 2300 730, +93 78 896 1419
Email: hamdard.sahar786@gmail.com

Figure 2. 22: Reprinted from "MUDL letter of intent". [230]

Deputy Ministry of Municipality
Kandahar Municipality

March 15, 2021

To: Dr.Takayuki Ito, Professor at Kyoto University

Subject: Intent to collaborate for a joint research program

Kandahar Municipality is hereby officially requesting for bilateral agreement with Kyoto University. Therefore, it is our pleasure and intent to have a Memorandum of Understanding (MoU) in Capacity Building and joint Urban Planning program between Kyoto University and Kandahar Municipality.

Sincerely,

Eng. Mohammad Rafi Hayat
Mayor of Kandahar Municipality

Mob#: +93 (0) 700320814
Email: r.hayat123@gmail.com
Web: www.kandahar-m.gov.af

Address: Arg Bazaar, 4th District, Kandahar City, Kandahar, Afghanistan

Figure 2. 23: Reprinted from "City of Kandahar letter of intent". [228]

2.12. Chapter Concluding Remarks

In this chapter, the state of our proposed framework was framed, introduced and investigated in terms of technology acceptability and usefulness for participatory planning in the context of Kabul city. By evaluating the efficiency of the proposed framework of which D-Agree is its key part. The findings suggests that the proposed method has the potential for leading participatory planning in Kabul.

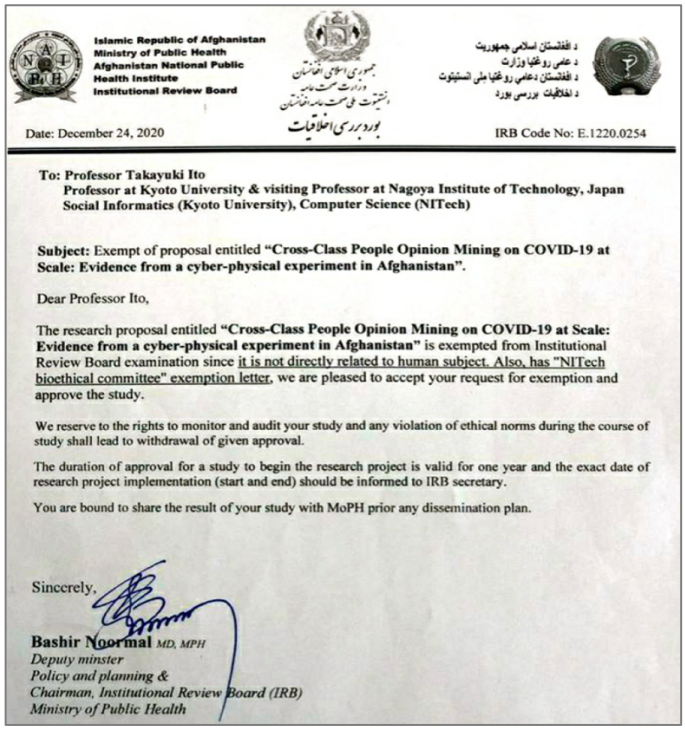
This chapter aimed to present the proposed framework, evaluate the usefulness and adaption of the D-Agree for promoting participatory planning-related discussion. The following summary can be made:

- The present investigation on acceptance of our proposed framework as representative application of technology revealed that satisfaction was achieved from its usefulness by city officials. Among the urban stakeholders, city officials' satisfaction levels were investigated using a quantitative method that combines pre-survey questionnaire, online discussion, and post-survey questionnaire. We then compare the pre-survey average satisfaction level of city officials with post-survey satisfaction level Further evaluation is needed.
- The city officials were keener to participate and use D-Agree.
- The outcome of present study clearly showed that, city officials were satisfied with using D-Agree as digital participatory tool. Hence, it is possible to easily apply D-Agree to host participatory planning process with citizens as well.
- We studied problem and barriers and facilitators for participation
- In the previous chapter, the strategies for the adoption, implementation with institutionalization of e-participation were reviewed and investigated. The author found that government organizations nearly always use social media to share and strengthen the ties with the community rather than to solve their common problem and strengthen two ways city-citizens and citizens-city ties. Towards that end, we proposed this framework to frame secure participation in collective intelligence.

2.13. IRB and Informed Consent Statement in this Study

This instrument for this study and related projects was reviewed by the Nagoya Institute of Technology and Afghanistan's ministry of public health institutional review board (IRB code No.E.1220.0254) and, due to lack of individual human subjects, found to be

exempt. In addition, informed consent was obtained from all subjects involved in the case studies, when needed.



Islamic Republic of Afghanistan
Ministry of Public Health
Afghanistan National Public Health Institute
Institutional Review Board

د افغانستان اسلامي جمهوريت
د عامې روغتيا وزارت
د افغانستان د عامې روغتيا ملي انستيتوت
د اخلاقياتو بررسي بورد

Date: December 24, 2020

IRB Code No: E.1220.0254

To: Professor Takayuki Ito
Professor at Kyoto University & visiting Professor at Nagoya Institute of Technology, Japan
Social Informatics (Kyoto University), Computer Science (NITech)

Subject: Exempt of proposal entitled **"Cross-Class People Opinion Mining on COVID-19 at Scale: Evidence from a cyber-physical experiment in Afghanistan".**

Dear Professor Ito,

The research proposal entitled **"Cross-Class People Opinion Mining on COVID-19 at Scale: Evidence from a cyber-physical experiment in Afghanistan"** is exempted from Institutional Review Board examination since it is not directly related to human subject. Also, has "NITech bioethical committee" exemption letter, we are pleased to accept your request for exemption and approve the study.

We reserve to the rights to monitor and audit your study and any violation of ethical norms during the course of study shall lead to withdrawal of given approval.

The duration of approval for a study to begin the research project is valid for one year and the exact date of research project implementation (start and end) should be informed to IRB secretary.

You are bound to share the result of your study with MoPH prior any dissemination plan.

Sincerely,

Bashir Noormal *MD, MPH*
Deputy minster
Policy and planning &
Chairman, Institutional Review Board (IRB)
Ministry of Public Health

Figure 2. 24: An official exempt letter from IRB of Ministry of Public Health (MoPH) that approve the method of experimental study in this study. Reprinted from "MoPH IRB letter of exempt". [231]

CHAPTER 3

A STUDY ON CONVERSATIONAL AGENT AS A FACILITATOR FOR ONLINE DISCUSSION ON THE SUSTAINABLE DEVELOPMENT GOALS

CHAPTER 3: A STUDY ON CONVERSATIONAL AGENT AS A FACILITATOR FOR ONLINE DISCUSSION ON THE SUSTAINABLE DEVELOPMENT GOALS

3.1. Purpose of the Chapter

In this chapter, for the first time, we propose to study the phenomenon of introducing conversational agents as facilitators who replaced the position of human facilitator for online discussion in Afghanistan using a constructed large-scale agent platform. We conducted a large-scale online discussion related to city Sustainable Development Goals (SDGs) in Kabul, which was divided into two equal phases. (1) a non-mediated large-scale discussion; (2) and an AI-mediated large-scale discussion, to determine factors affecting discussion and the influence of the agent on the evolution of an online discussion. For this purpose, we analyzed the dataset of both discussions to analyze the factors affecting online discussion by conducting statistical tests.

3.2. Introduction

Artificial Intelligence (AI) [118] and its notable branch such as Deep Learning (DL) [120], Machine Learning (ML) [232] Natural Language Processing (NLP) [121], and Natural Language Generation (NLG) [122] is a most remarkable invention of humankind method of invention that led to largest and fastest growing artificially solution platform in the world affecting not only the full spectrum of social relationship [233, 234, 235, 236, 3] but also others such healthcare [5, 237, 90, 158, 238, 239], shopping [240], crime investigation [241], political activity [4, 5] [6], support speaking skills [242], education [243, 244], religion practices [245] and even the most intimate decision-making tool for solving sustainability problems [191] through internet and AI-led deliberative democracy.

Researchers agree that civic tech (civic technology) based on AI-based facilitation support such as autonomous agent as facilitator are essential part for next-generation mass participatory platform and can vastly improve the quality of online discussion, since presence of machine as facilitator has the ability to enforce deliberative

ideals at scale [94]. The global market of this technology is forecast to reach $5.63 by 2023 [247].

Researchers studying the impact of human facilitation on discussion development in online platforms suggest that human moderation can be applicable for mini-public deliberation and mass deliberations can be challenging for human moderators to lead the discussion. In addition, there are a number of challenges that human moderators suffer from such as human bias, as well as scaling the time and opinions. Hence, it remains a challenge to facilitate the wider population with human-mediated support. Thus, researchers argue that it may be scaled and remedied by moving deliberation online using autonomous techniques such as ML, DL, NLG and NLP methods [248].

Civic engagement which must include its citizenry in societal activities and processes using civic digital tools. However, as the growth of online discussions continues to rapidly accelerate, concern over the retention of the online collaboration-related problems is increasing, such as low level of interaction among users arise due to the absence of mutual interests in the design of some civic tech tools. There is evidence that a facilitator's role is a significant factor for meaningful interaction in an online environment.

In the literature, many studies report the use of automated facilitation techniques as facilitator tools to promote and support online deliberation [76, 101, 29, 124] while studying human interaction with AI [249]. The objective was to counter constraints mentioned above by increasing the equity and inclusiveness through facilitating at scale. Promoting discussion with AI-based facilitation [36] is arguably essential to build greater understanding of diverse issues, while contributing to widely accepted solutions among participants. However, most of these studies heavily focused on contributing for technical fixes such as argumentation tool [250] [251] [252] [253] [254] [255]; autonomous facilitation [94]; autonomous incentive and gamification [113] for scaling up design deliberation [256], with a heavy concentration on social experimental design at lab-setting. Therefore, there is a distinct lack of discussion on the nature of the design process that enables inclusion of stakeholders relate to real-world settings, mainly the inclusion of people to come together to discuss sustainable problems such as SDGs [257]. In addition, agent as facilitator has been evaluated at lab-setting with a small number of experiments while comparing human and agent as facilitators. Comparison between discussion with and without agent as facilitator is needed at large-scale and real-world settings.

In this case, conversation AI is required to be effective to perform discussion facilitation and insight extraction for large-scale discussion. However, to date, there is no

published study systematically assessing the extent to which conversational agents might impact the development of SDGs-related discussion. This is a critical research gap, as we find that conversational agents may influence the ability to meet all SDGs.

In this chapter, we propose to study this phenomenon using a constructed large-scale agent platform. At the heart of the platform lies an artificial agent that can moderate online discussions using supportive messages. We investigate the influence of the agent on the evolution of an online discussion involving human participants. The agent will dynamically react to their messages by moderating and supporting the discussion.

We conducted an actual experiment to evaluate the platform while looking at the effects of the conversational agent. The experiment is a large-scale discussion with 1076 citizens from Afghanistan discussing SDGs related urban policy-making in the city of Kabul. The actual goal of the experiment was to increase citizen involvement in implementing SDGs in partnership with Kabul city and the Ministry of Economy of Afghanistan (MoE) [257]. The experiment was conducted from January 20th to March 18th divided into two equal phases. The discussion themes were the following. To the best of my knowledge, the research in this chapter is the first to study this phenomenon using a constructed large-scale agent platform and to make comparison between SDGs-related discussion with and without agent facilitation in LDCs such as Afghanistan.

3.3. The Concepts of Introducing Autonomous Facilitator for SDGs-related Online Discussion

Local governments are changing from government to governance [258 [259] to better achieve the SDGs [260] using digital technologies such as web forums, called e-governance [261]. This type of governance, online technology "involves government-citizen relationship whereby a government executes a managed process that seeks the bottom-up, open, and creative input of citizens in an online community," and such management with the support of technology creates a productive process [262]. This aimed to promote civilian engagement and enabling local stakeholders to contribute to the localization and implementation of the SDGs is key for their achievement [263] [264].

Furthermore, effective facilitation should be provided to civilian and local stakeholders throughout the discussion in crowd-scale deliberation. Insights need to be identified and mined by using smart tools such as AI technologies for a more sustainable localization of the SDGs and policy-making [52]. In other words, the linking of public insights collected in different fields is effective. Discussion platforms are considered to

be the next generation democratic platforms for citizen deliberation in collective intelligence required for sustainable localization of the SDGs.

The emergence of AI is shaping an increasing range of sectors [246].For instance, AI is expected to revolutionize our communication practices and the ways in which we interact with each other [36]. Another study, suggested that insights collected by AI-based technologies enable SDGs. This revolution does not only impact how we communicate, but it affects the nature of the partners with whom we communicate.

With recent development of AI technology, humans are now enabled to communicate with artificial agents in the form of socialbots. Such agents have the potential to moderate online discussions and even manipulate and alter public opinions [29]. Examples include chatbot for customer support, newsbots in messenger applications [4], socialbot in Facebook, Twitter [263], Amazon [264] [264] [265] and TikTok or conversational agent as facilitator for large-scale online discussions in D-Agree [94].

Chatbots [266] or Chatter Robot [267], conversational agent or autonomous facilitator agent are software entities which can carry out facilitation actions on behalf of clients with some degree of autonomy and can mimic human conversation by utilizing artificial intelligence and machine learning.

A conversational agent is an advanced software agent of chatbots that is designed to interact with human participants using AI-enabled natural language in ways that mimic human conversation [36]. In practice, conversational agent are a dialogue system that conduct NLP and then perform NLG to the query with human language, and these agents are based on natural language processing algorithmic methods and machine learning techniques implemented in online platforms which employs and extracts the posts of users using deep learning method [131]. For example, for all of the data posted by each user, a set of features is automatically learned by agent module using machine learning techniques and then apply one of predefined facilitation plans and policies (e.g., consensus, brainstorming, voting) to set agent's behavior before introducing a predefined facilitated message and the ratio [52]. All these facilitation methods can potentially stimulate online discussion activity and improve opinion solicitation in large-sale online discussion.

In general, these agents possess five common properties which are autonomy (e.g., some level of self-control); adaptivity (e.g., the ability to learn and improve performance); proactivity (e.g., the ability not only to act simply but also exhibit goal directed behavior by taking the initiative); and sociability (e.g., the ability to interact and communicate with other). Research on these agents mainly focus on improving existing

approaches to improve agents' effectiveness and efficiency in those five aspects mentioned before.

In this context, as a notable branch of AI, DL and ML has been broadly used to improve agents' effectiveness in those five aspects for advanced autonomous problem-solving abilities in online platform using NLP and NLG techniques, such as automated deliberation system to support and summarize discussion of scale. These so-called agents, which facilitates discussion activities and processes, is regarded as effective medium that could facilitate online discussions, thus, predefined facilitation plan and ratio as a critical component of group decision support system (GDSS) [57] in promoting collective reasoning and user engagement within online discussion.

The most important goal in introducing agents within online discussion is to promote the development of the discussion by integrating ideas and opinions though her posted facilitated messages, and help the group to build consensus [94]. Moreover, these entities are also interesting topics for promoting deliberative democracies through medium the of internet and support provided through AI which offer innovative solutions for improving the community in line with the United Nations' SDGs [246]. The impact of both positive (left) and negative (right) impact of AI on various SDGs are shown in Figure 3.1.

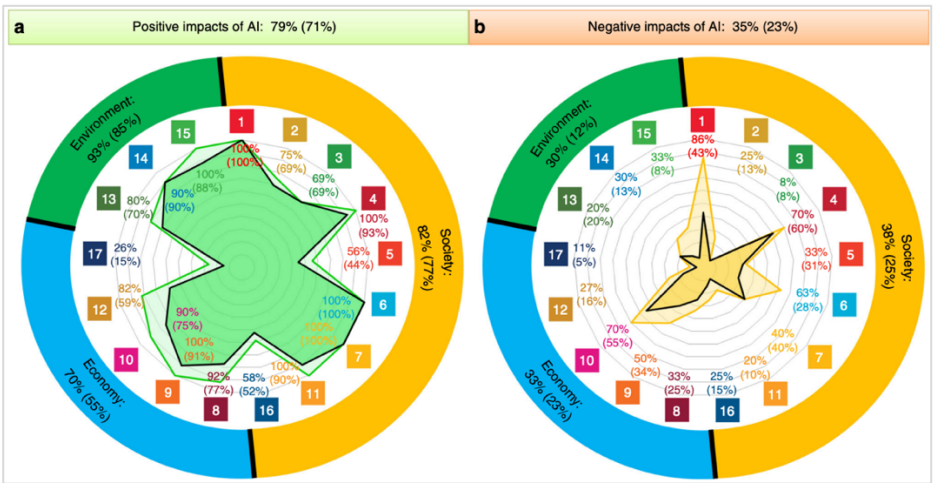


Figure 3. 1: The impact of both positive (left) and negative (right) impact of AI on various SDGs. Adopted from [246].

3.4. Objective

First, the Afghanistan's Ministry of Economy (MoE) [268] which is the country focal point of Afghanistan's Sustainable Development Goals (A-SDGs) in partnership with KM wanted to promote public engagement by collecting insights from the citizens for Afghanistan's commitment to achieve the SDGs. Second, we wanted to verify the effect of our conversational agent in online discussions by conducting a large-scale social experiment with and without a conversational agent as facilitator.

3.5. Problem Statement for Human Facilitator-mediated large-scale Discussion

Currently Afghanistan's SDGs-related discussion is hosted by social media (SM) platform such as Facebook and Twitter [269]. But in a general scenario, the problem has been highlighted that due the scale of discussion, it will be difficult for participants to get agreement and also for human facilitators to moderate the discussion.

For example, Facebook helps to allow mass participation and sharing of common problems in discussion process [16, 221] but it does not provide meaningful support to facilitate discussion process [48], and discussion via it are of significantly low deliberative quality [49]. Furthermore, human facilitation bias cannot be avoided. In this part of research, the author realized that the implementation of the hypothesis that discussion without moderation can lead to flaming. In addition, the structure of comments not help deliberative quality of discussions, and also, posts are more difficult to navigate and connect to each other, thus, discussion often involve in an atmosphere of confrontation, particularly in least developed countries and the of ability of social media to promote fair and transparent discussion is debatable. So, in that angle, the efficiency of agent as facilitator should be investigated in a real-world setting, specifically for leading sustainability issues such as SDGs and the insights from these platforms cannot be used because policymakers might face a decision problem while integrating the unstructured voices of citizens collected through such platforms [52].

Based on real-world satiation, we introduced conversational AI as a facilitator to lead the discussion, and then investigated the efficiency of leading the discussion [157].

3.6. Evaluation Methodology

Our general methodology was to conduct a real-world large scale web societal experimentation between online users in Kabul city and then introduce a conversational agent to mediate the discussion. In this method, we relied on open-idea-call and using quantitative methods that are based on discussion components which are generated by human participants from the discussions.

The open-call idea is a convenient open sampling that might be unified as an invitation for anyone to participate in online tasks by contributing information or knowledge [184]. We used convenience sampling [219] [220] to collect a large sample size. Thus, online open-call links were widely disseminated, and anyone interested was allowed to join the discussions (seen in Figure 3.2) following the login procedure (illustrated in Figure 3.3).

We particularly looked at how many discussion components (Issue, idea, pros, and cons) are generated in discussion with and without conversational agents. We then conducted a quantitative comparison among these two-discussion settings (discussion with and without agent).

Figure 3. 2: A unified-call for participation in SDGs related discussion using our method posted by Afghanistan's Ministry of Economy's Twitter page [269], the country focal point for SDGs-Afghanistan.

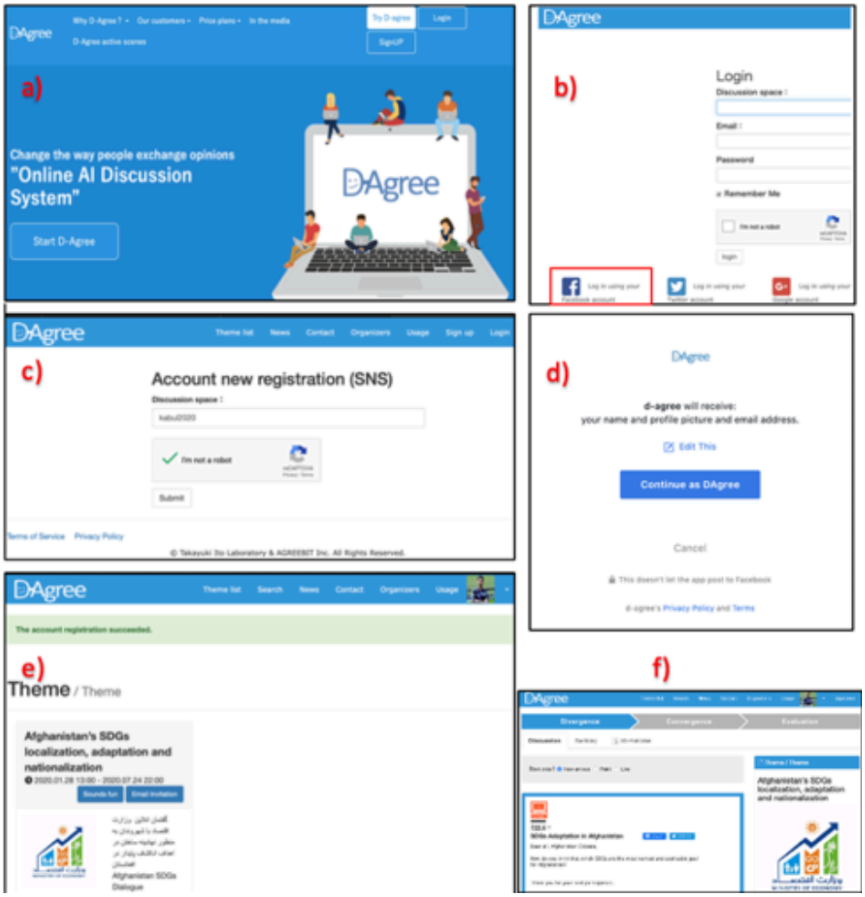


Figure 3. 3: Social login demo, used during this experiment.

3.6.1. Non-mediated Online Discussion Experiment

The method was to conduct a discussion between human participants without introducing any mediating support.

3.6.1.1. Characterization and Setting

The non-mediated discussion is almost everywhere in social platforms [270] [271], discussion between human participants without facilitation support. However, it is very difficult to get consensus and agreement on that platform. Furthermore, discussions are not led within these platforms. The main cause of discussion is to devise solutions [94]. We hypothesize that discussion without facilitation support such as using social media are not successful compared to that with discussion with facilitation support.

The platform was deployed on Amazon's EC2 [272] infrastructure with each module being allocated to a separate EC2 instance. The web interface of the system is shown in Figure 3.3. All components of the interface were activated except conversational AI.

The participants are invited to discuss SDGs related topics for the period of 30 days without any mediation support (shown as in Figure 3.4), same as when citizens use their Facebook account to discuss city issues. We just opened a discussion workspace and participants used their social media such as Facebook, Twitter and Gmail to login to the discussion workspace. We set the discussion space as "*kabul2020*".
The general discussion theme was the following.

Theme : How Sustainable Development Goals (SDG-1~17) should be adopted effectively in Kabul city?

Figure 3. 4: An example of generated experimental web overview of non-mediated online discussion related SDGs (Goal no.2) adaptation in Kabul city using our system.

3.6.2. Agent-mediated Online Discussion Experiment

The method was to conduct a discussion between human participants with introducing mediating support (an example are shown in Figure 3.5). The same participants (n = 1076) were invited to discuss related to SDGs related topic for the period of 30 days with mediation support provided by AI (shown as in Figure 3.4), We aimed to combines humans and artificial agents to identify generalizable mechanisms that might give rise to emergent properties of hybrid social systems [273]. The methodology benefits from computational tools such as agent-based simulations, machine learning, and large-scale web experimentation [37].

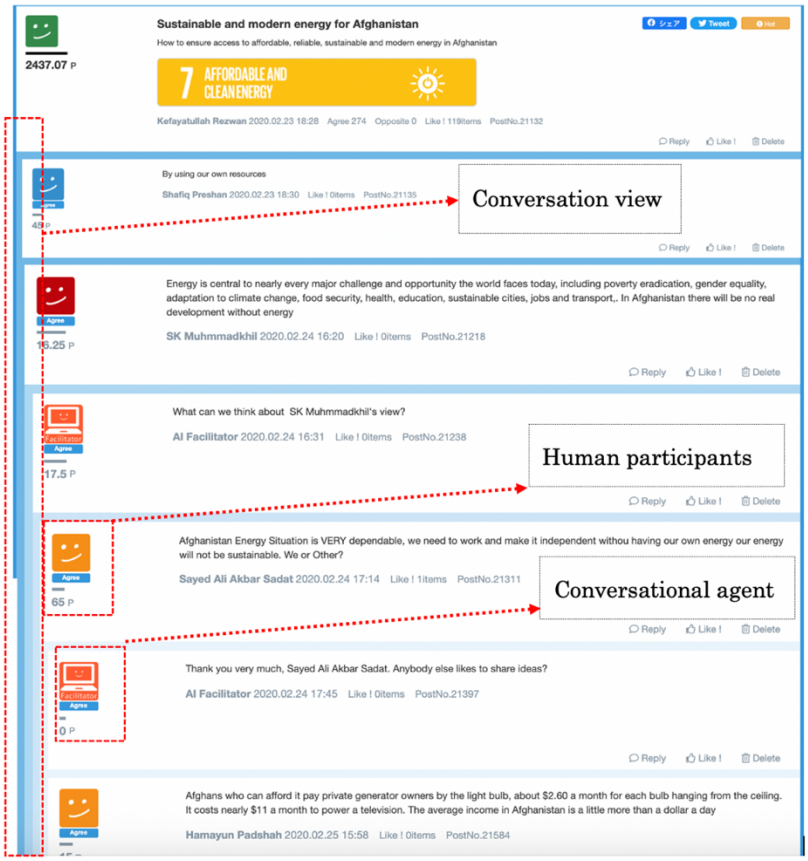


Figure 3. 5: An experimental web overview of AI-mediated online discussion related SDGs (Goal no. 7) adaptation in Kabul city generated from our system.

3.6.2.1. Characterization and Setting

After the non-mediation discussion (Figure 3.4), we activated AI-mediated discussion (Figure 3.5). Kabul city reinvited the same undefined network of people (n =1076) as open calls to use the proposed method as society digital platform, to discuss city sustainability problems (Figure 3.6).

The platform used the same components of the interface including conversational AI. The participants are invited to discuss the same topic for the period of 30 days with AI-mediation support.

The generation of the AI-mediated facilitation messages to interact with human participants were managed with two parameters: (1) we set a period of 1-minute specific to Amazon CloudWatch [274] and a threshold of 3 human participant messages. This threshold sets the number of messages that the agent should count before taking part in

the discussion. That is, the agent will wait before extracting the node types of the last message and then selecting an adequate message.

We employed a discussion progress method based on the IBIS approach (seen in Figure 3.7) to lead discussion as *issues*, *ideas*, *pros* and *cons* as components of discussion for problem-solving. The messages are selected based on rules that map each IBIS type to a random sentence. Participants used their social media platform IDs such as Facebook, Twitter and Gmail to login to discussion workspace.

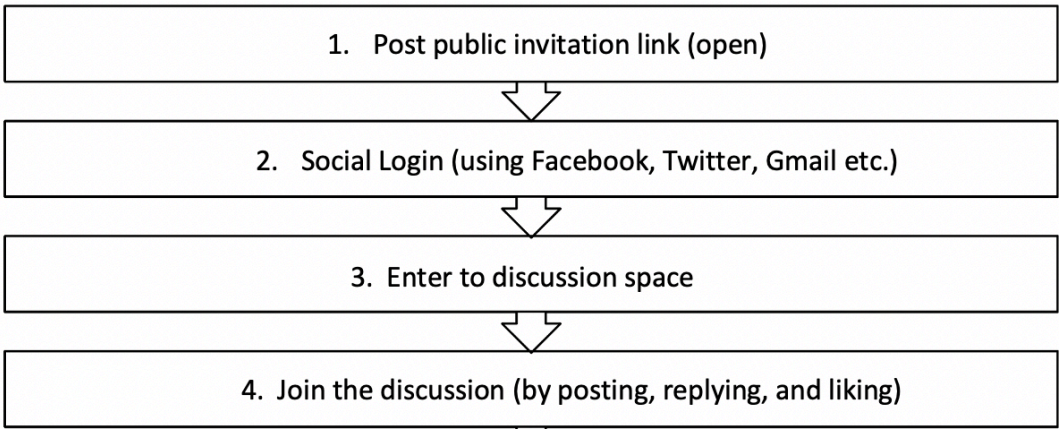


Figure 3. 6: Social login demo, used during this experiment.

3.6.3. Discussion Datasets

The content and thread [275] of the discussion were extracted and processed based on IBIS from the web platform and were converted into cvc/excel format [276]. The discussion flow used in D-Agree is inspired by IBIS notation (Figure 3.7). The IBIS is a discussion tree containing a combination of four types of elements: issues, ideas, pros, and cons. The software extracts a discussion's structure in real time based on IBIS, automatically classifying all the sentences.

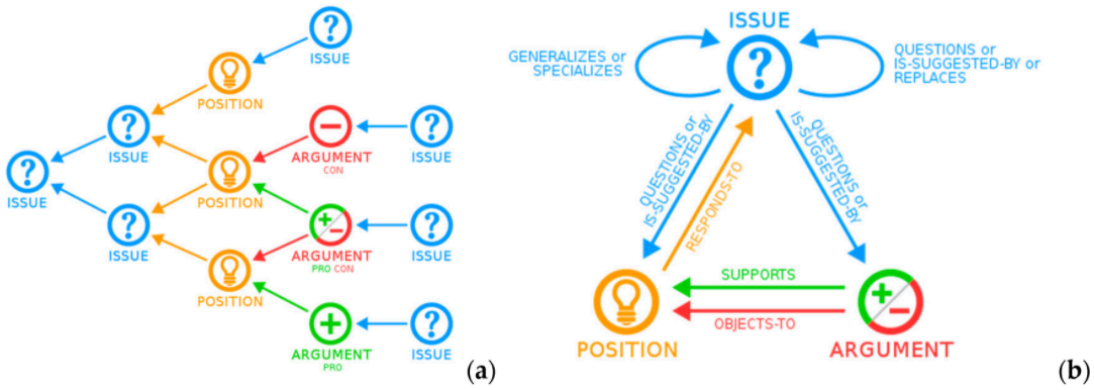


Figure 3. 7: Outline: (a) IBIS-based reasoning process and (b) IBIS-based discussion argumentation structure flow adopted by our system [108].

3.7. Comparison of Generated IBIS by Considering Two types of Discussion Setting

A quantitative comparison of the generated IBISamong two discussions setting clearly shows (shown in Figure 3.8) that the leading of the positive-oriented discussion (discussion with more ideas than issues) can be improved to a certain extend by using conversational agent as facilitator for agent-mediated discussion [37]. The higher *ideas* and *cons* were achieved from agent-mediated discussion. Which is due to the adopted consensus policy of our system's proactive agent.

A proactive agent is a software entity that sets the conversational agent's behavior based on three predefined plans such as a consensus policy. The consensus is amid an outcome-based discussion. If we see in Figure 3.8, the total number of two discussion components (*issues* and *cons*) were higher than the second half of discussion, when the conversational AI has been introduced. Furthermore, the number two other discussion components (*ideas* and *pros*) were increased after the introduction of the conversational agent.

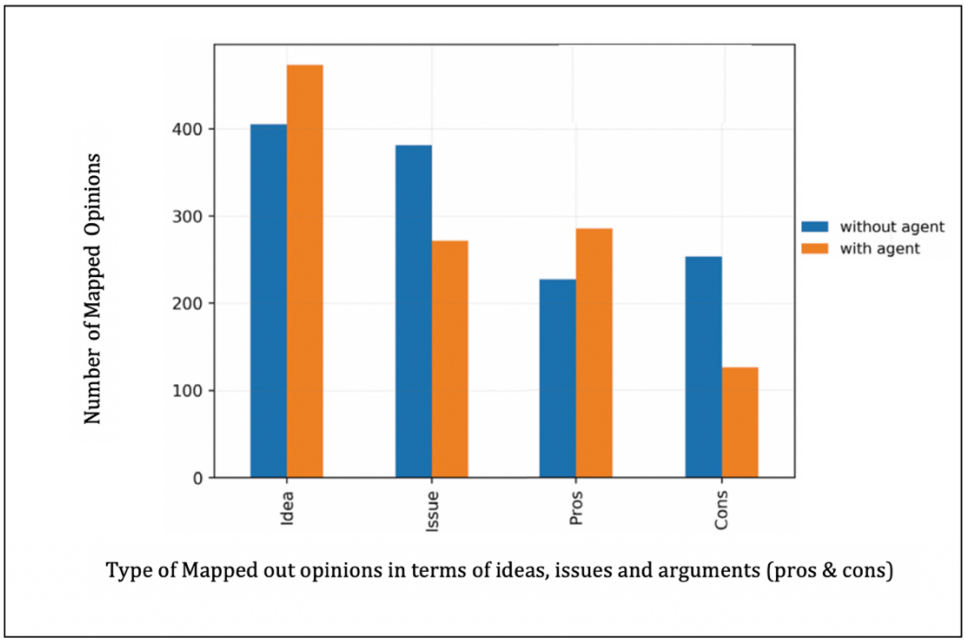


Figure 3. 8: Count of the discussion elements with and without AI-based mediation.

Additionally, the average responsiveness time in Figure 3.9 corresponds to the average waiting time of the same day. If at day *d* there were n messages posted by the participants and if message *i* was posted at time *ti* then the average responsiveness *rd* of day *d* is computed as equation below:

$$r_d = \frac{1}{n-1} \sum_{i=1}^{n-1} (t_{i+1} - t_i) \quad (3.1)$$

For instance, the peak of the sixth day refers to a day during which the participants' interactions were scattered in the absence of the agent as shown in Figure 3.9.

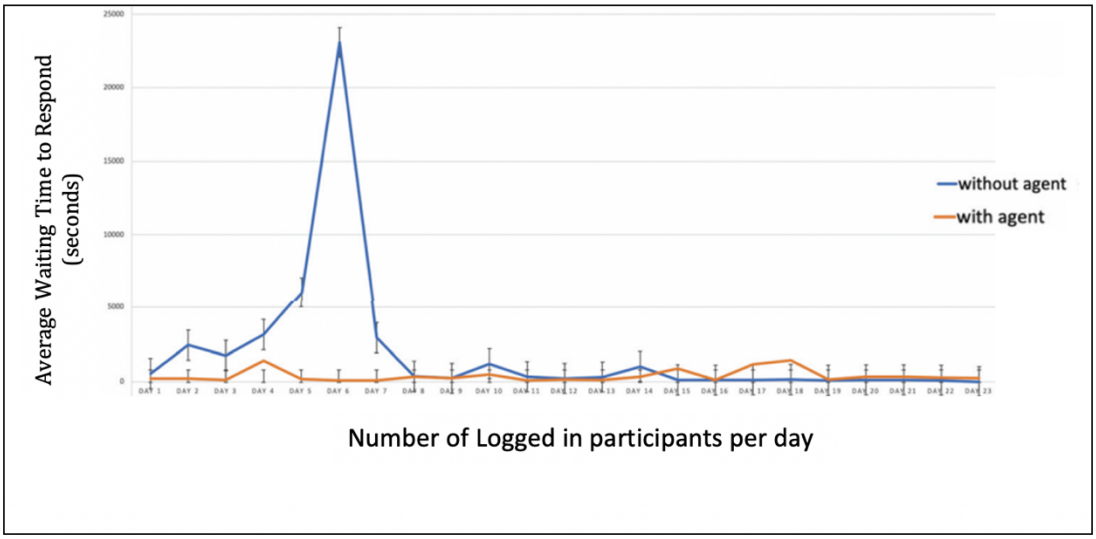


Figure 3. 9: Superposed responsiveness of the participants with and without the agent.

3.8. Discussion

Practically, our work is the earliest adopted automated facilitation tool in online participation practices in Afghanistan. The evolution of discussion component counts in figure 3.7a suggests that the discussion without the conversational AI were centered around raising issues (issues and cons), and that once the conversational AI as facilitator is introduced, the discussion evolved to find solutions for the problems. This is because of the consensus policy of our agent. This policy supervises a discussion flow based on a time plan and a discussion phase, including posting startup messages, moves for mediating a main discussion (divergence) [277], proceeding to deliberation (convergence and evaluation) [278] and ending with a conclusion. In each discussion phase, a proactive agent forces the conversational agent to proceed by the categories of the sentences generated by the agent as post messages to interact with the participants. The proactive agent can be equipped with an agenda to lead a discussion toward its desired outcomes.

This evolution could be a precondition on how discussions evolve towards a general consensus with the predominance of ideas and cons, or towards a divergent deliberation with the predominance of issues and cons. Second, the responsiveness rate of figure 3.b suggests that the agent increased the reactiveness of the participants to the messages. Here, the total responsiveness time without the agent was 2017 seconds and 381 with the agent.

Furthermore, AI-based mediation helped to elicit conversational threading than non-mediated discussion. In practice, conversation threading or “conversation view” is a feature used by online discussion forums in which software helps group topics with their replies, called topic thread or simply a thread [275]. Conversation threading was adopted in January 2015. A discussion thread is split into sentences while preserving the hierarchical links between its posts. For instance, in D-Agree, messages can be grouped in this manner, and have a “conversation view”. Typically, discussion threads using data visualization techniques.

In discussion without threading, sometimes a user does not identify the relationship of a new message with previous one but conversation threading allows readers to quickly grasp the overall structure of a conversation, thus creating facilitation of knowledge construction [279].

It is worth mentioning that the work reported in this chapter has received Best Paper Award (as shown in Figure 3.10) in international conference [280].

3.9. Chapter Concluding Remarks(as shown in Figure 3.10).

In this study, the author introduces the conversational AI for automatically facilitating discussion related to sustainability issues in Afghanistan. An agent-mediated discussion has the potential for leading SDGs-related discussion. This chapter aimed to evaluate the use and adaptation of the agent-mediated discussion method for promoting SDGs-related discussion, and the conversational agent for facilitating discussion was proposed in Afghanistan as a case study.

The following summary can be made:

- The present investigation revealed that more solutions for SDGs-related discussion were achieved from discussion in the case of agent-mediated discussion compared to that non-mediated discussion.
- The outcome of the present study clearly showed that more solutions were adopted using AI. Hence, it is possible to easily obtain the insights towards SDGs related action plan implementation in Afghanistan.
- Regarding IBIS type generation, a higher number of ideas and pros were achieved for agent-mediated discussion compared to non-mediated discussion. That is, the efficiency of conversational agent consensus policy which aimed to lead discussion towards agreement.

Figure 3. 10: The work reported in this chapter has received Best Paper Award in International conference [280].

CHAPTER 4

A STUDY ON THE CITIZENS INVOLVEMENT IN FORMAL AND INFORMAL SETTLEMENT AREAS USING CONVERSTIONAL AI PLATFORM

CHAPTER 4: A STUDY ON THE CITIZENS INVOLVEMENT IN FORMAL AND INFORMAL SETTLEMENT AREAS USING CONVERSATIONAL AI PLATFORM

4.1. Purpose of the Chapter

In accordance with the methodology listed in chapter two for investigating conversational AI, in this chapter, we conduct a cross-class of areas measurement of participatory process using conversational AI platform. We conducted two large-scale online social experimental studies related to urban unit problem (*Gozars*) in Kabul, (1) a societal experiment with settlers in formal settlement areas; (2) and another societal experiment with settlers from informal settlement areas, to determine factors affecting discussion and the influence of the agent on the evolution of an online discussion across two types of settlements. Primary data on settlers in discussion is generated from each type of settlers' experimental web discussion sites. The data is analyzed considering residence characteristics as formal areas and informal areas.

4.1. The Informal Development Overview in Kabul City

Following the fall of the communist government, the civil wars (1992-1996), resulted in widespread destruction of both physical and social infrastructure of the Kabul city. Although the process of urbanization accelerated during these wars, it was mainly unplanned and characterized by land grabbing [167]. During the Taliban period, (1997-2001), the population of informal urbanization accelerated and expanded from the central part of the city to the suburbs as well. By the establishment of the new government (post-2001), Kabul witnessed a large influx of migrants, comprising those who were fleeing from insecurity in the hinterlands, refugees returning from Pakistan and Iran, and laborers looking for better economic and social opportunities. This caused another problem, the over population in Kabul city (as seen in Figure 4.1).

The overpopulation is enforcing an ill impact on the growth of the society with an increasing trend of unemployment, overcrowding of infrastructure and depletion of the natural and manmade resources, which exactly made it into Kabul city. Kabul city wanted to solve these issues by means of different soft approaches like participatory planning consultation process. However, the government`s resources did not expand as fast as the

population. Consequently, infrastructure and social services, including housing and land cost became out of the reach of many citizens, thereby leading to the escalation of informal settlements. In addition, less attention has been paid by the municipal government to those areas due to budgetary restraints as well as issues of space, and security might be able to consult citizens to come together and solve their problem.

To promote meaningful consultation and participation process to devise urban related solution, we proposed to conduct an actual social experimental study within both formal and informal areas with the collaboration of the local municipal government to understand the settlers' perception towards coming together to devise their solution using digital participatory platform based on facilitation support, D-Agree.

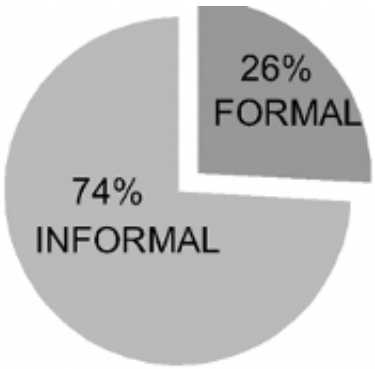


Figure 4. 1: The Distribution of Urban Population in Kabul City [167].

4.2. What is Informal Settlement?

Informal settlements in the context of Kabul City, are generally defined as settlements: (a) constructed in violation of the Kabul City Master Plan, zoning codes and regulations; or (b) illegally occupied land, without having a rightful title to it [281, 282, 163]. These settlements are often distinguished by irregular street and plot layouts, narrow street patterns, poor dwelling conditions and services, especially water and sanitation services (as seen in Figure 4.3).

Proliferation of informal settlements is a predominant feature of urbanization in Afghanistan. Kabul, the capital city of Afghanistan is home to more than 43% of urban dwellers in the country. However, 74% of this urban population clustered in informal settlements (as of 2008) [166]. Initially, the government's policies towards informal settlements focused on eradication and rebuilding. However, considering the huge volume of informal settlements and the notion and success stories of international aided

participatory upgrading of informal settlements [194], the government shifted these policies towards in-situ upgrading, with resident's participation. Although participatory in-situ upgrading is considered to be the most appropriate approach towards upgrading of informal settlements, there are budget, time and security limitations towards traditional participatory approaches in less developed countries like Afghanistan. Therefore, it is essential to find and use other alternatives of participatory approaches for the planning process in Kabul city [284]. The map generated from Google Earth [283] shown both types of settlements in Figure 4.2.

Figure 4. 2: Arial View of the Plots in the Formal settlements (left, circled red) and Informal Settlements (right) [282] (Google Earth) [283].

Figure 4. 3: The Informal Settlements Extended to the Hillsides of Kabul City [167].

4.3. Research Hypotheses

We initially posited the following three hypotheses:
Hypothesis 1 The settlers in informal settlement areas are keener to participate in planning process, thus, agent can incentivize the informal settlers to submit more postings.

Hypothesis 2 If we quantitatively compare a community with lower socioeconomic levels that is a community in crisis with many challenges such as informal settlement in Kabul with communities with middle or higher socioeconomic levels or slightly stable like formal settlement areas in Kabul, the overall performance of the agent-mediated facilitation increases towards diversifying informal settlers' postings which is centred towards solutions compare to formal settlers posting. This means that the participants in communities with lower socioeconomic levels like informal settlement areas having more social and urban issues, thus they are more willing to provide more positive opinions and are keener to come together to devise their solutions for formalizing their neighborhoods.

Hypothesis 3 The number of participation and number of IBIS in the discussions with informal settlement areas is more than the average in the discussion with formal settlements areas. This means that the participants in informal settlement areas were motivated to engage with more-write more characters in the discussion facilitated by the agent.

4.4. Scope and Objective

Firstly, in this experiment authors aimed to investigate citizen's participation, and the characteristics of their discussions in formal and informal areas of Kabul city, using the D-Agree [94].
Why were we considered a cross-class of areas measurement? It is because we wanted to include both formal and informal settlements, in order to know how conversational agent work across settlements.

Secondly, Kabul city aimed to narrow down the problem of settlement area facing today by harnessing the wisdom of the crowd for policy making. Mainly, the informal settlements.
KM wanted to gather opinions on the decade of action planning in the city of Kabul (Japan) including settlers of both types of settlement areas. The resulting comprehensive plan will be the basis for the policy making decisions within the next decade of the action

plan in Kabul city. The D-agree system was used for this task to allow settlers to discuss urban-related issues about their settlement areas.

By using the D-Agree platform as a participatory tool by which the constraints mentioned are narrowed down considerably, we examine participation in the informal settlements of Kabul City by comparing quantitative and qualitative parameters of engagement between formal and informal settlers. We analyse overall participation and inclusivity as quantitative parameters and interactivity and innovativeness as qualitative parameters. Findings show statistically significant difference between quantitative parameters of overall participation but no significant differences between inclusivity, interactivity and innovativeness parameters.

4.5. The Necessity of Studies on Formal Settlement Types

Currently, more than half of the urban population of Afghanistan lives in Kabul City, and in terms of population size (Figure 4.1), in which more 74% of this population live in informal settlements. Kabul City is roughly four times larger than the next largest cities (Herat and Mazar-i-Sharif) in Afghanistan [169]. Kabul city is an apparent case of a "primate city" in the world. Thus, the study to know people's engagement in online participative process have received considerable attention over the years in the developed countries, such studies have been comparatively scarce amid data reliability challenges in developing countries such as Afghanistan. However, there is no study to compare the people's perception to engage in participatory processes in terms of settlement types using a digital platform as an instrumental tool. Therefore, studies such as this are highly anticipated in Kabul City to provide systematic frameworks upon which development and spatial planning of the settlements can be predicated by harnessing the wisdom of crowds in those sites.

Furthermore, as mentioned above, informal settlements accommodate the majority of Kabul population and regularizing or formalizing of that vast mass of land has been a huge challenge and a top priority for the Afghan government. Consequently, various initiatives, including surveys and feasibility studies have been conducted with a view to exploring measures to address this challenge.

These initiatives have mainly focused on the built environment and physical elements in the urban context. However, in conceptualizing and planning a framework for the development of informal settlements, the social aspects such as residents' preferences and activities to be involved in participative process are just as important as the physical aspects, but for too long the social aspects have not received adequate

attention from policy makers and development planners. According to Horgas et al., (1998) [285], activities are not only an expression of needs, preferences, and motivations, but also reflect external constraints and opportunities and the meaning attached to activities vary from one person to another depending on such characteristics as age, gender and education and settlement type. Therefore, it is essential to find soft approaches to study their perception and social insights within these communities facilitate the

4.6. Experimental Setting

Kabul City was selected as the case area for this experiment. It comprises 22 urban districts, which stretch across an area of 1,622 square kilometers (Km^2). The city is home to approximately 4.4 million people [164], about 74% of whom are informal settlers [282]. The districts are selected as formal and informal based on the majority of their formal and informal settlements. As such, Districts 11, 12, 17 and 21 are considered as formal, while Districts 1, 2, 7, 9, 14, 15, 16, 18, 19 and 20 are considered as informal (as shown in Figure 4.4; and Table. 4.1). Around 68% and 83% of the total areas of the selected formal and informal districts are categorized as formal and informal settlements, respectively.

We set a separate experimental space for each of the above-mentioned districts and participants were allowed to join the experimental spaces based on the location of their residences. The district city official supervises and confirms the residency of consented participants to take part in each experimental study. Solid waste management remains a major challenge for residents in both formal and informal settlements of Kabul city. Therefore, the topic of discussion focused on solid waste management, as was also suggested by KM [160].

To boost the participation the experiment began with an inauguration ceremony, organized by KM. Participants in the event on zoom webinar which was broadcasted live on the municipal government's Facebook page included the Mayor of Kabul city and the Head of sanitation department. The call for participation was announced at the program and a demo video on how to participate in the discussions was created and posted using Kabul city official Facebook page link bellow: https://www.facebook.com/KabulMunicipality/videos/2932476556980195, (as shown in Figure 4.5) along with the link (as shown in Figure 4.6), which directed the participants to D-Agree Discussion Platform. A discussion code to access the discussion spaces on D-Agree was also given at the event.

We set a 1-minute period response time specific to Amazon CloudWatch [272]that interacts with the individual participants by posting a predefined threshold of

facilitated-messages in the ratio of 3:1. We considered a consensus policy for proactive agent [52]. The objective was to collect more positive opinions about the thematic discussion of urban issues.

Seven discussion themes covering different issues related to solid waste management in Kabul city were considered of high priority, as suggested by the KM. These include:

Theme 1:	Solid Waste Management Issues in Kabul
Theme 2:	Environmental impacts of improper solid waste management
Theme 3:	Waste Management Concept in Kabul
Theme 4:	Waste Separation at Source
Theme 5:	Citizens' Participation in Solid Waste Management
Theme 6:	Imposing Fees for Waste Management Services
Theme 7:	Municipal Solid Waste Collection System

The discussion of each of these 7 thematic areas lasted for one week. Anyone could register with the platform and post comments on the discussion based on their residential areas. For example, district one resident should log into D1. We created a virtual room for 14 districts, labelled based on their district numbering. For example, D11, D12, D17 and D21 for Districts 11, 12, 17 and 21 which are considered as formal, while created D1, D2, D7, D9, D14-D20) for Districts 1, 2, 7, 9, 14, 15, 16, 18, 19 and 20 which are considered as informal in this study. To register, participants need to login through their social media account such as Facebook, Twitter or Gmail.

The collected information was secured by KM administrative staff to protect the privacy of the participants. The social experiment took place during a period of 51 days between August 13 and October 02, 2020. Two hundred and fifty-two respondents living in the formal districts and 757 respondents living in informal districts took part in the online discussions. All themes and their experimental site were facilitated by conversational agents.

The choice of settlement type and difference between themes are paramount to conducting significant evaluations of the system's output in terms of number of participation and posting (IBIS generation). Data collection method was through a discussion website. In our case, settlement type difference, informal settlement areas, could in fact give rise to distinct distributions of IBIS, mainly solutions (ideas and pros). Here we were mainly focusing on comparing the discussion component, and our goal was the behavior of conversational agents on discussion development across settlement types in Kabul while looking at performance metrics of settlers.

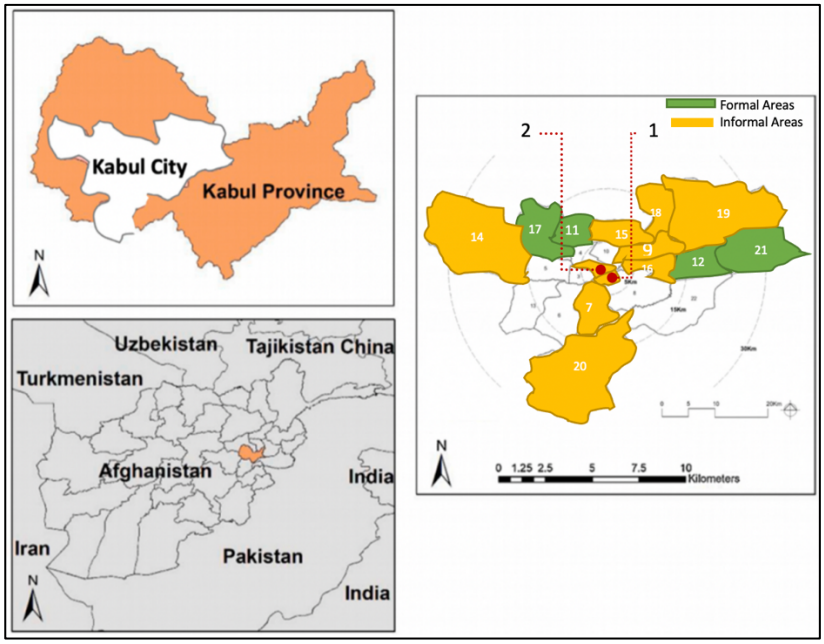


Figure 4. 4: The location of the study, sampled District by Settlement Types in Kabul City (left).

Figure 4. 5: One of unified call for participation in planning process. Source: KM Facebook page.

Figure 4. 6: The unified call for participation and demonstration video on how to join the experimental participatory website was advertised and posted on the Facebook Page (picture a), and homepage (picture b) of the Kabul municipal government.

Table 4. 1: Characteristics of Participation and their Submitted Opinions in Formal and Informal Districts of Kabul City.

Type of settlements	District No	Total Dwellings	No. of formal dwellings; Percentage	No. of informal dwellings; Percentage	No. of participants	Participation percentage	No. of posts; Mean	Post percentage
	D1	4,757	0; 0%	4,757; 100%	127	12.6%	170; 1.37	13.7
	D2	8,397	1,250; 14.8%	7,148; 85.1%	97	9.6%	122; 1.25	9.8
	D7	33,754	945; 2.8%	32,809; 97.2%	87	8.6%	103; 1.18	8.3
Informal	D9	17,787	5,680; 31.9%	12,107; 68%	110	`10.9%	132; 1.2	10.6
(average	D14	7,156	90; 1.26%	7,066; 98.7%	57	5.6%	63; 1.1	5.1
post/particip	D15	21,427	8,293; 38.7%	13,134; 61.3%	66	6.5%	105; 1.59	8.5
ant = 1.25)	D16	19,897	3,576; 17.9%	16,321; 82%	52	5.2%	60; 1.15	4.8
	D18	1,903	0; 0%	1,903; 100%	50	5%	55; 1.1	4.4
	D19	2,647	786; 29.6%	1,861; 70.3%	44	4.4%	54; 1.22	4.4
	D20	5,212	620; 11.9%	4,592; 88.1%	67	6.6%	81; 1.2	6.5
Formal	D11	28,666	20,254; 70.6%	8,412; 29.3%	60	5.9%	80; 1.33	6.5
(average	D12	20,476	14,912; 72.8%	5,564; 27.1%	55	5.5%	58; 1.05	4.7
post/particip	D17	26,267	15,537; 59.1%	10,730; 40.8%	66	6.5%	77; 1.16	6.2
ant= 1.17)	D21	3,806	3,475; 91.3%	331; 8.7%	71	7%	80; 1.12	6.5

4.7. Analysis of Characteristics Affecting Participative Activities

To analyze the characteristics that might affect engagements in online participative activities, we compiled a list of characteristics and activities. Such characteristics included overall participation, inclusiveness, interactivity, and innovativeness. The quantitative comparison is shown in Figure. 4.7.

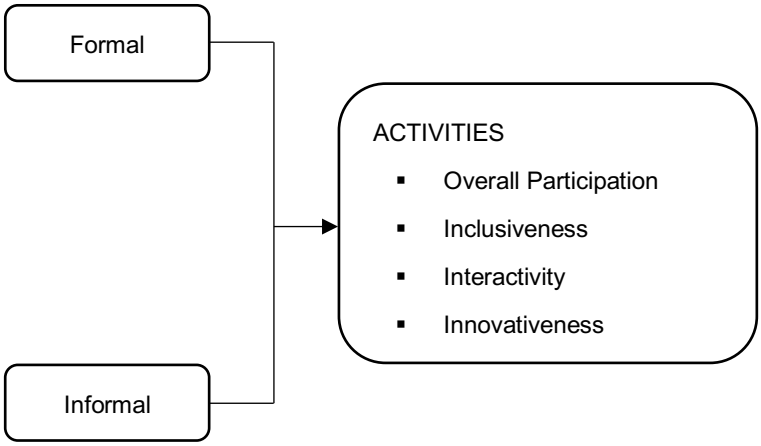


Figure 4. 7: Characteristics affecting online participative activities.

4.8. Comparison of Overall Participation by Considering two types of Settlement Areas

To address the overall participation, we compared the rate of participants and frequency (rate) of opinions according to the below formulas between formal and informal districts, and used a z-test to examine if the differences between them are significant. The *p* demonstrates the number participants in district *i*, *d* the number of dwellings in district *i*, *o* number of opinions in district *i.* number of joining discussion space and posting an opinion computed as equations below:

$$\text{Rate of participants} = (\sum pi)/(\sum di) \tag{4.1}$$

$$\text{Rate of opinions} = (\sum oi)/(\sum pi) \quad (4.2)$$

As could be seen in Fig. 4.8, the rate of participation was higher in the informal settlements (n = 757; 75.02%, mean=75.7) than that of formal settlements (n = 252; 24.98%, mean=63.0). The statistical test results show a significant difference. The number of posts in the informal settlements (n = 945; 76.2%, mean= 94.50) was also higher than that of formal settlements (n = 295; 23.8%, mean = 73.75).

This finding aligns with that of French [2018] in Afghanistan, which reported that residents in informal settlements demonstrate a higher likelihood of engaging in activities and investing more time in discussing common issues. This may be explained by the fact that residence in informal settlements tends to be associated with greater developmental challenges that necessitate community-wide collaborative efforts to address than residence in formal settlements.

Furthermore, the proportion of posts per participant was slightly higher in informal settlements (mean value = 1.25) than in formal settlements (mean value = 1.17) (shown as Figure. 4.9).

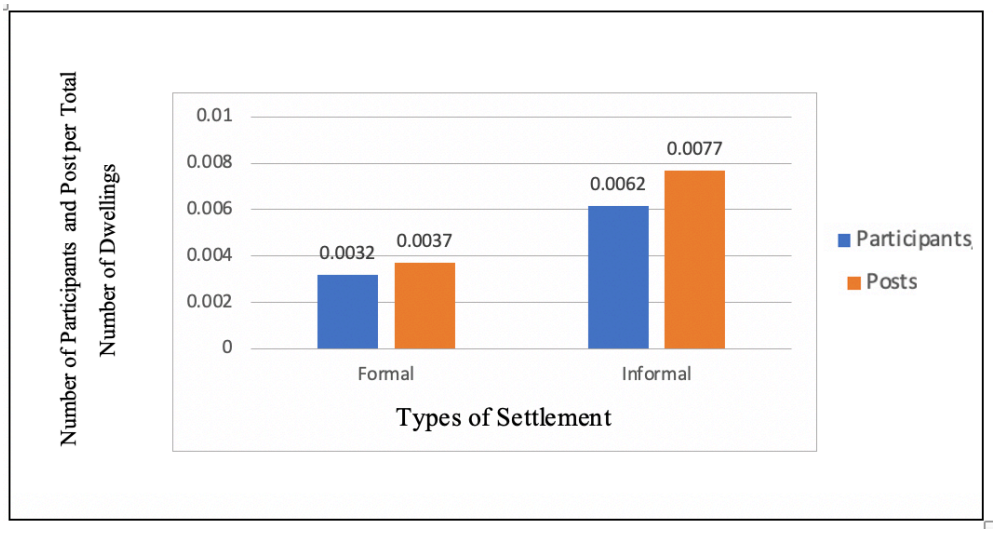


Figure 4. 8: Distribution of participation in formal and informal settlements.

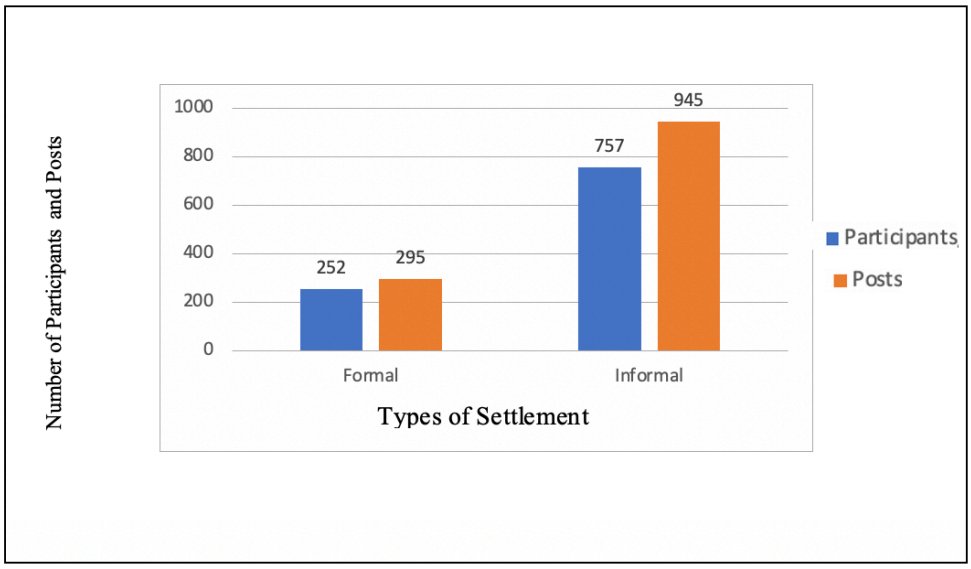


Figure 4. 9: Number of posts in comparison to participants in formal and informal settlements.

4.9. Comparison of Inclusiveness by Considering Two types of Settlement Areas

To measure inclusiveness, we compared women participation in the formal and informal settlements. We identified the gender based on participants' registered information. Among 1009 participants, 65 were female, while we were not able to identify the gender identity of 90 subjects who had 99 posts by their registered information, therefore they are excluded from the inclusiveness analysis (as shown in Table 4.2).

Table 4. 2: Gender Parameter of Participants in Formal and Informal Districts

		Count	Average	% of Total
Formal	Female participant	14		5.93%
	Female post	14	1.00	5.04%
	Male participant	222		94.07%
	Male post	264	1.19	94.96%
Informal	Female participant	51		7.47%
	Female post	67	1.31	7.76%
	Male participant	632		92.53%
	Male post	796	1.26	92.24%

4.10. Comparison of Interactivity by Considering Two types of Settlement Areas

To measure interactivity, we are examining the discussion tree among formal and informal settlements. The discussion tree consists of threads or first posts, reply to threads (reply to first posts) and reply to reply or more. The higher the number of replies, the more interactive a discussion. Figure 4.10 shows the discussion tree elements among formal and informal settlements. It could be seen the percentage of reply to thread is slightly higher among informal settlers while the number of threads and reply to reply is slightly higher among formal settlers, however, the overall interaction among formal and informal is not very different.

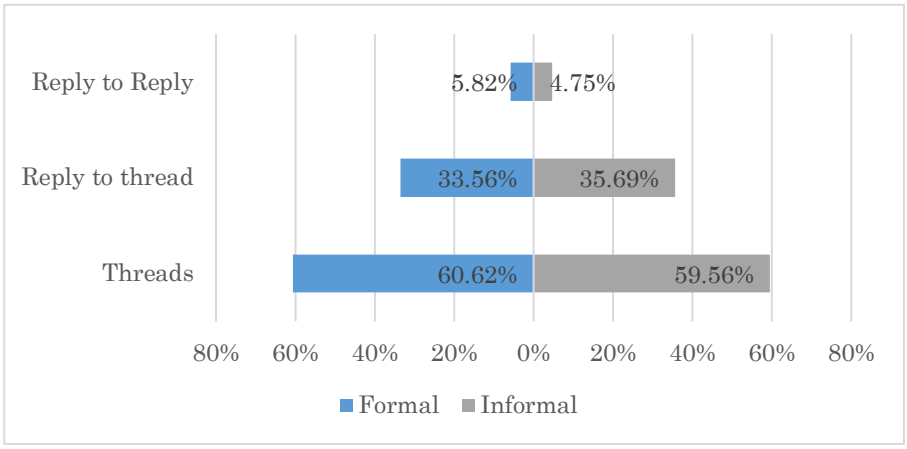


Figure 4. 10: Comparison of obtained discussion insights (threads; reply to threads; reply to reply) between formal and informal settlers.

4.11. Comparison of Innovativeness by Considering Two types of Settlement Areas

To measure innovativeness, we are examining the number of classified ideas compared to issues with formal and informal settlers. Figure 4.11, below shows the percentage of classified elements. Although not significant, the percentage of ideas given by informal settlers is higher than the percentage of ideas given by formal settlers, while the percentage of issues given by formal settlers is higher in the percentage of issues given

by informal settlers. This is in contrast to the reality that the issues faced by informal settlers are far more than formal settlers, however informal settlers tend to give more ideas or solutions to the issues they have.

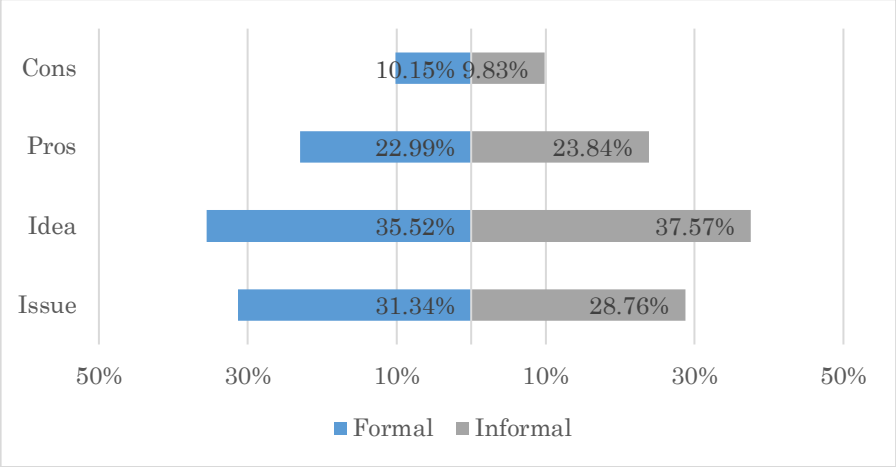


Figure 4. 11: Comparison of generated discussion insights (issues, ideas, pros and cons) between formal and informal settlers.

4.12. Discussion

The combined statistical analyses of the argumentative data generated from discussion and their evolution of IBIS counts while looking to participation in figure 4.10 and 4.11 suggests statistically significant differences were found in participation between formal and informal settlements (as shown in Table 4.3). Although there were no significant differences in terms of other three variables such as inclusiveness, interactivity and innovativeness. This shows that informal settlers are as good as formal settlers in terms of these variables although they are faced with different kinds of constraints and limitations mentioned earlier.

This evolution could be a precondition on how participative planning should evolve towards a general consensus and a divergent deliberation with the people in informal settlement to devise their solution.

Second, the other three variables such as inclusiveness, interactivity and innovativeness in Table 4.3 suggest that the informal settlers are as good as formal settlers in terms of these variables although they are faced with different kinds of constraints and limitations mentioned earlier.

Table 4. 3: Outline of obtained statistical results from formal and informal settlers.

Participation	Z = -9.2698, p <.05*
Inclusiveness	X^2 (1, N = 919) = .63, p = .43
Interactivity	X^2 (2, N = 1197) = .83, p = .66
Innovativeness	X^2 (2, N = 1413) = .98, p = .81

The results were found by comparing two settlement types participation and other three variable means using two proportions z-test. Chi-test*: $p < 0.05$

In summary, as the statistical tests shown in Table above, statistically significant differences were found in participation between formal and informal settlements. There were no significant differences in terms of other three variables such as inclusiveness, interactivity and innovativeness. This shows that informal settlers are as good as formal settlers in terms of these variables although they are faced with different kinds of constraints and limitations mentioned earlier.

4.13. Chapter Concluding Remarks

This chapter sets out to provide a clear picture of the composition of conversational agent impact on participative activities development of the formal and informal settlers in Kabul City. In particular, we set a virtual discussion space for each targeted formal and informal settlements' district and collected their opinions through open calls on our platform.

To this end, (1) a detailed quantitative comparison of overall participation performance of the formal and informal settlers in the online participative process were presented; (2) an explicit inclusiveness of the formal and informal settlers in online participative activities were examined; (3) how the activities engaged in by the formal and informal settlers relate to urban-related discussion were presented; and (4) the innovativeness within and discussion with formal and informal settlers discussion were explored.

The following summary can be made:

- The present investigation revealed that compared to the participation of formal settlement, conversational agents were found successful in terms of motivating settlers to actively engage in thematic discussion. This means both participation of formal settlements, informal settlements were found to be actively engaged in thematic discussions.

- Regarding IBIS type generation, a slightly higher number of ideas and pros were achieved for agent-mediated discussion in informal settlement compared to agent-mediated discussion in formal settlement. It means that with respect to the participation parameters between formal and informal settlements, the study revealed that residents of informal settlements are slightly keener to participate and share their opinions than those in formal settlements.
- Despite different kinds of constraints and limitations mentioned in informal settlements, informal settlers are as good as formal settlers in terms of inclusiveness, interactivity and innovativeness variables. Therefore, people in formal areas were keener to come together to discuss their common problem.
- Finally, the outcome of the present study clearly showed the potential of such platforms to empower informal settlers. Furthermore, with respect to the participation parameters between formal and informal settlements, the study revealed that residents of informal settlements are keener to participate and share their opinions than those in formal settlements.
- The level of participation and engagement (inclusiveness, interactivity and innovativeness) in the planning process of both formal and informal areas are influenced using conversational AI platforms as a complement to traditional approaches. Thus, designing a digital participatory platform based on facilitation support is important to encourage participative process in Kabul city.

The above findings provide evidence for the Kabul Municipality that conducting such experimental participative process not only devise social as well as physical/spatial policies for development of informal settlements. The study discussed the peculiar social valuable insights through online participative activities of settlers in Kabul City against the background that the development of an appropriate framework to harness these social sights and mitigate the challenges will be based on this understanding.

CHAPTER 5

A COMPARATIVE STUDY OF PEOPLE WITH AND WITHOUT HAVING EXTENSIVE KNOWLEDGE ON COVID-19 DISCUSSION

CHAPTER 5: A COMPARATIVE STUDY OF PEOPLE WITH AND WITHOUT HAVING EXTENSIVE KNOWLEDGE ON COVID-19 DISCUSSION

5.1. Purpose of the Chapter

In this *chapter*, we aimed to study the efficiency of conversational agents in leading discussion with people having different knowledge stances on discussion topics while considering two types of facilitation threshold of people using conversational agent. In view of the above, we selected COVID-19 as a case topic while assuming COVID-19-related health workers as a experts and private citizens as non-expert on mentioned discussion topic. In this study, we assumed that both types of samples are not to equal in terms of having extensive knowledge on discussion topics. Finally, a comparative analysis was done on discussion dataset and results generated from discussion websites using student' t-tests.

5.2. Introduction

Several studies have investigated the effects of using AI-enabled digital technologies and social platforms insights for fighting the COVID-19 outbreak from info-epidemiology and info-veillance perspectives [286] [287]. An infectious disease caused by the SARS-CoV-2 virus (WHO) [288]. For instance, Twitter data tracked public behavior and examined health-seeking and public reactions toward outbreaks [289]. Another work collected data from three social platforms in China to assess public concerns and risk perception and tracked public behavior in response to COVID-19 outbreaks [290].

Scholarships believe that COVID-related governance with collective intelligence can make massive efforts to easily understand crowd discussion trees and find the social insights related to COVID-19 using Al-based discussion-support systems [290] [291] [292] [293]. Crowd discussion is a primary data collection source that finds COVID-19 solutions from a perspective based on info-epidemiology and consulting with governments about potential actions. Al-based, large-scale discussion support systems

are also promoting citizen awareness and collecting real-world insights [291]. For instance, a smart discussion platform was used in collaboration with a government to fight COVID- 19 by collecting and analyzing a vast amount of social data to increase public awareness and suggest actions to public health makers [88] [89] [90].

People with a knowledge stance on discussion themes are commonly deemed as the major factor on discussion development and could in fact give rise to distinct distributions of ideas, issues, and arguments. In the literature [157], there are different definitions of the term “knowledge”. One good example was given for a term that can refer to a theoretical or practical understanding of a subject [89]. It can be implicit or explicit [90].

Recent scholarship, argued that discussions without knowledge or interest are meaningless, and participation without discussion is passive. It is because the engagement consists of four elements: (1) interest, (2) knowledge, (3) discussion, and (4) participation elements in activities and processes. Discussions without knowledge might be passive [52]. Also, it is necessary to consider the interest. Lack of interest has been widely accepted as one the most important barriers to success of well-maintained discussion. Thus, public knowledge and interest are two elements which are required to maintain and lead the discussion. The use of large-scale digital platform based on facilitation support function are often associated with the promotion and enhancement of community collective intelligence, particularly the conversational AI platform, promote online interaction, responsive, thus, promote the distribution of knowledge among users

Although systematic research has been conducted to evaluate the efficiency of conversational agent in online discussion a cross age, gender and areas, a cross-class of people measurement using conversational agent, has not been exploited and cross-class of people are not taken into account while evaluating the efficiency of conversational agent in terms of IBIS generation. For example, there are many studies exploring links between conversational agent and discussion development while examination variables used include gender, age, and dwelling type using quantitative approach that relied on questionnaires, and statistical analyses of the argumentative data generated from the discussions. The major observations in terms of gender, that both genders contribute equally to online discussion, thus conversational agents are equally successful to lead discussion. Mixed gender (male and female) are more willing to lead discussion development [citation], thus conversational are slightly more successful to lead discussion within these groups. Observation on the relationship between participants age and discussion development are equivocal. However, young people are more willing to contribute to discussion. Ironically, the observation on settlers living in different dwelling

types (settlers in different settlement types) and participation interest and discussion development are interesting. Informal settlers (people in informal areas) are slightly more likely to participate and discuss in online participative processes and are keener to invest their time.

In order to smoothly proceed COVID-19 discussion across people without prior knowledge, a facilitation innovation needed to be carried out [89]. For example, autonomous agents as facilitators can be effective to stimulate the responsive among them by facilitating messages [89]. The effect of conversational agents are three-fold. One the one hand, it has been widely accepted that conversational agent 1) can lead discussion; 2) is an important complement to help discussion reach conclusion; and 3) provide meaningful opportunities for all participant involved in discussion. On the other hand, the conversational agent may stimulate responsiveness; 2) promote knowledge gain; and 3) interest among users in online discussion. This public knowledge can be promoted by improving public involvement in participative processes. The absence of facilitation support services in online discussion results in passive discussion, which can lead to not collaborating and engaging in discussion. The importance of conversational agents for leading discussion, responsive, and consensus building was confirmed by researchers. [89] [158] [90].

Here, in this chapter, we aimed to conduct a comparative experimental study of people with and without having an extensive knowledge stance on discussion topics while using a conversational agent as an incentive mechanism to efficient communication and collaboration among individuals of both groups. The public participation in this study consists of two classes of people: health workers, and private citizens [158].

We considered health workers as experts on COVID-19 (hereafter called as experts), and private citizens as without having extensive knowledge on discussion (hereafter called as public). We were mainly focusing on comparing the discussions and the resulting IBIS data while looking at the facilitation threshold number of people among both groups, since they revolve around completely different themes. For example, people with extensive knowledge on discussion stance could naturally lead to more opinions, while people without prior knowledge on discussion might not.

We selected two equal groups of participants: (1) health workers (n = 16) and private citizens (n = 16) as public. Initially the health workers were selected using a non-probability sampling technique of convenience sampling survey in collaboration with Afghanistan national public health institute (ANPHI) [231], and the private citizens were selected using convenience sampling, and then we used stratified random sampling to select 16 people from each class. We created 8 online groups, four for each class namely,

A~D, and randomly assigned subjects of each class to a group based on a female and three male members (n = 4; female = 1 and male = 3) (as shown in Figure 5.1).

The agent will dynamically interact with participants of each group of class of people based on a predefined facilitation threshold of two people (1:2 = A & C groups) and threshold of three people (1:3 B & D groups). For the sake of experimental evolution, we used discussion annotated datasets that contain human and AF posts, and the number of human posts towards AF posts. We initially posited the following two hypotheses:

Hypothesis 1 (H1). The agent can incentivize both classes of people to submit postings, however, compared with the people without extensive knowledge on discussion themes (private citizens), the conversational agents are more successful with people having knowledge on discussion themes. This means that people with extensive knowledge on discussion themes have a more significant impact on the development discussion, hence, agent-mediated discussions with them were successful.

Hypothesis 2 (H2). Compared with the facilitation threshold of three people, agent-based facilitation threshold of two people has a more significant impact on the development discussion both in terms of modulating the distributions of the IBIS elements and also increasing the number of posted characters within the cross-class of participants debate. This means that the agent-mediated discussion with less threshold of people in Afghanistan were most successful at engaging more-write more characters.

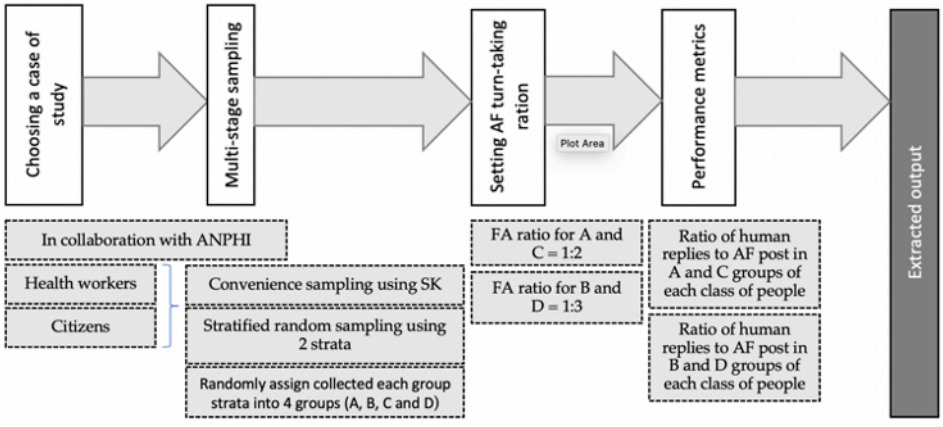


Figure 5. 1: Summary of sampling process, study instruments and experiment setting.

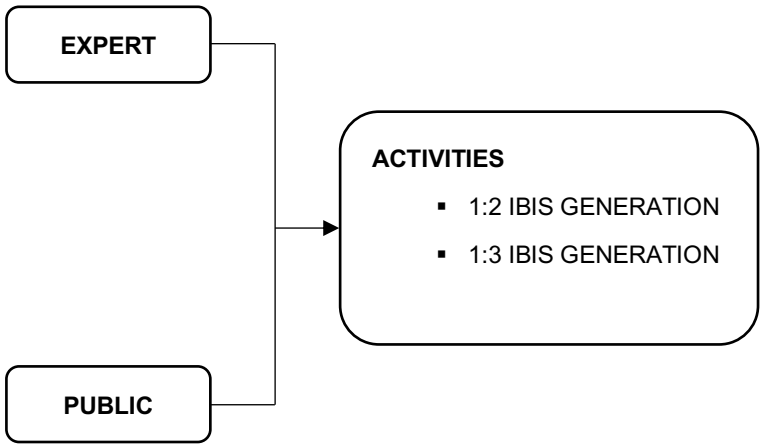


Figure 5. 2: Characteristics and performing metrics.

5.3. Objectives and Scopes

We tried to conduct a cross class of people control experiments using online discussion support systems based on facilitation, with the objective of verifying discussion structures and investigating the phenomenon and efficiency of agent-based facilitation threshold in the discussion among groups of people with and without prior or extensive knowledge on discussion topics.

We quantitatively assess a cross class of people related discussion metrics (number of IBIS and posted characters), where the discussions are reinforced by different ratios of agent-based facilitation. We aimed to investigate how agent-based facilitated posts affect discussion development across class of people, while considering a group of individuals with prior knowledge on discussion topics as experts; and other groups of individuals without prior knowledge on discussion topics as public.

5.4. Study Area

Kabul (Figure 5.3) is Afghanistan's capital and home to the largest share of total urban population, and also, is one of fastest-growing cities which made Kabul the world's 75 largest city [167] [52]. According to estimates in 2021, the population of Kabul is 4.6

million [164]. All consented subjects living in Kabul city and wanted to debate on COVID-19 crisis management in Afghanistan had taken part in the study. The fifth participant is the agent who can objectively observe conversational situations, and then post facilitation messages accordingly.

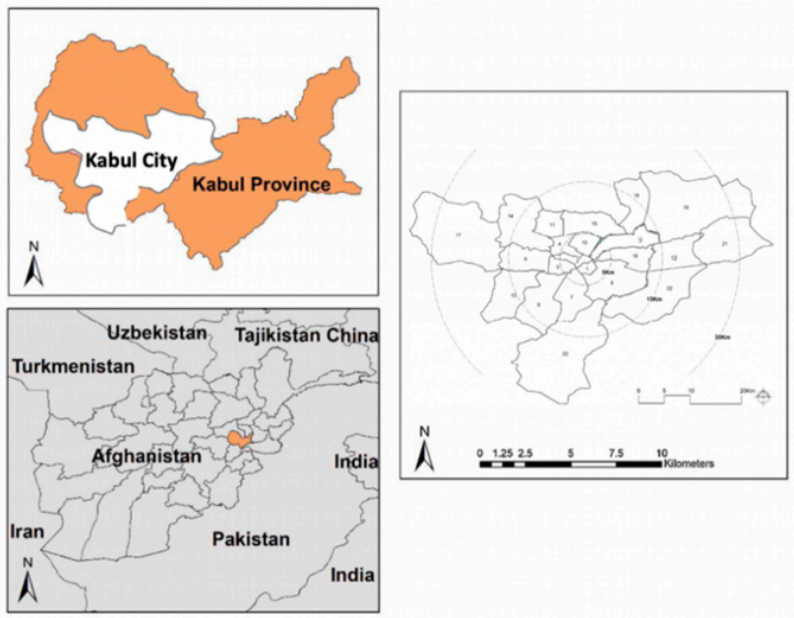


Figure 5. 3: Location of the Study, Kabul city.

5.5. Sample and Sampling

Since it was difficult for authors to approach health workers. Thus, we recruited them from Afghan-Japan Communicable Disease Hospital (AJCDH) in collaboration with ANPHI [231] using an online survey called, SurveyMonkey [294] of Momentive Inc. (formerly SVMK Inc.). The survey procedure and methods in this study have gone through multi-stage sampling. In statistics, multistage sampling is the taking of samples in stages using smaller and smaller sampling units at each stage [219].

A nomination questionnaire is used as a survey instrument to collect two samples' responses and support the experimental process. They were chosen based on their availability using convenience sampling, and were recruited through the support of ANPHI as mentioned before. The request for open call participation for the second class, private citizens, was boosted using a Facebook ad. Thus, to whom online survey links

reached and anyone who agreed took part in the surveys. The health workers (n = 565) , and citizens (n = 1,085) responded to our survey and consented to participate in the study. We then used the gathered samples and set the two strata as female and male groups by using stratified random sampling to select 16 candidates from each sample to take part in a control experiment for this study. The authors choose to select four participants from female strata and 12 from male strata for each class of people out of consented subjects. Since we wanted to compare cross-people discussion, authors made a decision to randomly assign 12 male and four female candidates of each sample into four groups, namely A to D, to make a group of four people (a female and three male). We selected four human participants plus conversational agent per group because four is the special number in multiparty conversations. The sampling of the subject is shown in Figure 5.1.

5.6. Experimental Procedure and Setting

In this section, we introduce the experiment of using the proposed case studies to investigate variance of agent-based facilitation in online discussions by offering predefined facilitation ratio suggestions for cross class of people with (experts) and without prior knowledge (public) regarding theme stance. In this regard, a series of experiments (n = 8) are conducted with four groups of each class of people in order to demonstrate the effectiveness of the agent-based facilitation. First, we created eight discussion working spaces, one for each group of people.

The invited subjects can join the discussion by entering the discussion code. A request to participate in the group, along with a link directing assigned participants to the D-Agree platform. In addition, a code is required to participate in the group discussions. Then, we sequentially choose facilitation ratio 1:2 for A and B groups and regard the groups (C&D) as the groups based on agent facilitation with 1:3 ratio.

Then, we verify the ability of all participants by conducting a pilot experiment to ensure the functionality of our system, and make sure that subjects can login and post on the system. Finally, we conducted the actual experiment. All the participants discussed the following discussion topic:

- Challenges of COVID-19 in Afghanistan

We set an issue-giving, or non-creative, topic rather than an issue-solving, because we want to check the effect of our agent facilitation policy which is based on issue-solving-stance.

Note that the agent identity was disclosed as “AI Facilitator” to the participants up until the end of the experiment, and also, the individual’s identity was disclosed as their real names. We simultaneously ran separate online experiments for four groups of two classes of people using the same tool, topic and time.

5.7. Data Collection

We used D-agree to hold online discussions. The actual experiment took place online from December 7 to 28, 2020 for a 20 days period. The agent-based on two predefined facilitation ratios were set to facilitate the discussion.

The content of the discussion is extracted from used discussion instruments and lightly processed as human-led study. We used discussion annotation files datasets that contained the thread of the discussion; the posts including replies; the IBIS label which contains a combination of four types of elements: issue, idea, pros, and cons; and each submitted posts obtained/evaluated points. In practice, a post is split into sentences while using IBIS as part of its automated categorization of sentences.

In total, 192 posts (1,388 IBIS elements) were generated from the four expert groups discussions (A~D), and 121 posts (961 IBIS elements) were generated from public groups (A~D). The number of post characters by all expert and social groups and were separately totaled (expert= 75,508; public= 50,493).

5.8. Results

I. Intra and Inter Class Comparison on Average of IBIS Generation

In Figure 5.4 and 5.5, we compare automated categorization of submitted sentences which were created based on IBIS between all public and expert groups (A~D). Then an Independent-samples t-test was conducted to compare their means (Table 1). Firstly, we compared and test public with 1:2 vs public with 1:3, and we found that public groups with threshold of 2 people ($M = 53.75$, $SD = 12.18$) had a significant impact on discussion development in terms of average number of IBIS elements compared with public groups with 1:3 ($M = 28$, $SD = 11.80$), $t(14) = 2.976$, $p=0.000$ ($< .01$) (two-tailed).

Secondly, we compared and tested expert with 1:2 vs expert with 1:3, and similarly to the above, we found that expert groups with threshold of 2 people ($M = 64.75$, $SD = 11.01$) also had a significant impact on discussion development in terms of average

number of IBIS elements compared with expert groups with 1:3 (M = 47.25, SD = 3.32), t(8) = 3.355, p=0.000 (< .01) (two-tailed).

Thirdly, we compared and tested the public with 1:2 vs expert with 1:2, and the results were not significant at p < .01 (two-tailed). However, we found that expert groups with threshold of 2 people (M = 64.75, SD = 11.01) had a significant impact on discussion development in terms of average number of IBIS elements compared with public groups with 1:2 (M = 53.75, SD = 12.18), t(14) = 2.976, at p < .05. Hence, the results obtained through this observation are in a good agreement with H1 and H2 (in terms of increasing IBIS) and confirm the validity of hypothesis 1 and 2.

Finally, we compared and tested public with 1:3 vs expert with 1:3, and we found that expert groups with threshold of 3 people (M = 47.25, SD = 3.32) had a significant impact on discussion development in terms of average number of IBIS elements compared with public groups with 1:3 (M = 28, SD = 11.80), t(8) = 2.976, at p=0.000 (< .01). This observation is also, in a good agreement with H1 and confirmed the validity of hypothesis 1.

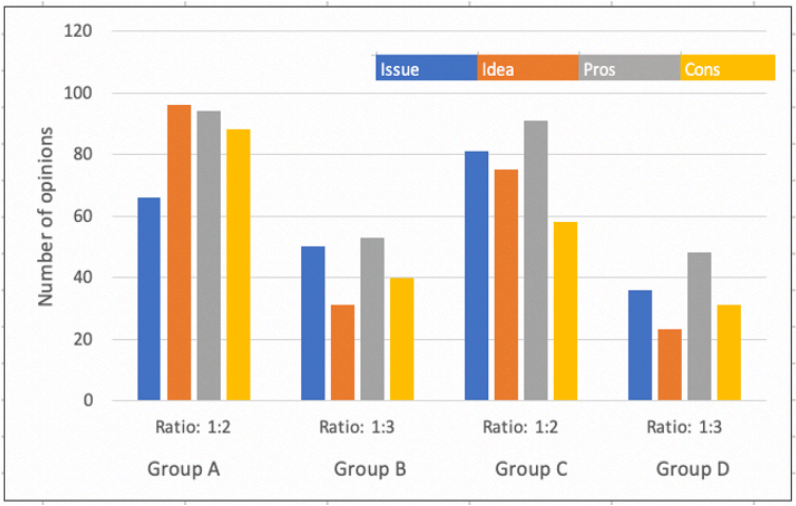


Figure 5. 4: Number of issues (colored blue), ideas (colored orange), pros (gray) and cons (yellow) coming from the expert paradigm (public).

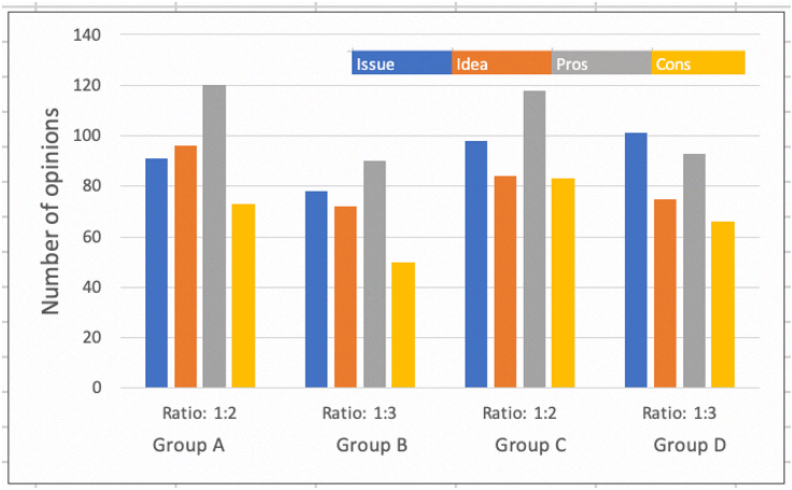


Figure 5. 5: Number of issues (colored blue), ideas (colored orange), pros (gray) and cons (yellow) coming from the expert paradigm (expert).

II. Intra and Inter Class Comparison on Average of IBIS Posted Characters

In Table 5.1 and 5.2, we compare and tested average number of posted characters based on: (1) public with 1:2 vs public with 1:3; and (2) expert with 1:2 vs expert with 1:3; (3) public with 1:2 vs expert with 1:2; and (4) public with 1:3 vs expert with 1:3. An Independent-samples t-test was conducted to compare their means.

Firstly, we compared and tested public with 1:2 vs public with 1:3, and we found that the total number of posted characters based on threshold of 2 people (M = 4427.75, SD = 1191.60) had significant compared with the total number of posted characters based on threshold of 3 people (M = 1883.87, SD = 881.41), t(13) = 3.0122, p=0.000 (< .01) (two-tailed). Hence, the results obtained through this observation are in good agreement with our H2 (increasing number of posted characters) and confirmed the validity of hypothesis 2.

Secondly, we compared and tested experts with 1:2 vs experts with 1:3, and we did not find any significance at $p < .01$. Thirdly, we compared and tested the public with 1:2 vs experts with 1:2, and the results were not significant at $p < .01$.

Finally, we compared and tested public with 1:3 vs expert with 1:3, and we found that the total number of posted characters based on threshold of 3 people in expert groups (M = 4165.12, SD = 641.67) had significant compared with the total number of posted characters based on threshold of 3 people in public groups (M = 1883.87, SD = 881.41), t(13) = 3.0122, p=0.000 (< .01) (two-tailed).

Table 5. 1: The Characteristics of Testing on Intra and Inter Class Comparisons on Average IBIS Development.

		Public		Expert	
		1:2	1:3	1:2	1:3
Public	1:2	1.000			
	1:3	0.001***	1.000		
Expert	1:2	0.079*	N.T	1.000	
	1:3	N.T	0.002***	0.003***	1.000

N.T = Not tested for significance

***p<0.01, **p<0.05, *p<0.1 for

Table 5. 2: The Characteristics of Testing on Intra and Inter Class Comparisons on Average Posting Characters.

		Public		Expert	
		1:2	1:3	1:2	1:3
Public	1:2	1.000			
	1:3	0.000***	1.000		
Expert	1:2	0.170	N.T	1.000	
	1:3	NT	0.000***	0.036**	1.000

N.T = Not tested for significance

***p<0.01, **p<0.05, p<0.1 for

5.9. Discussion

Specifically, four types of elements (issue, idea, pros, and cons) are fundamental in the discussion structure to clarify discussion mapping (tree) [94]. Although the discussion is classified into four elements, they are in fact interconnected and complement each other. Issue means the common questions that debate participants aim to solve and the theme stance is called a high-level issue. The issues generated after other issues could be generalization or specialization of the related issues. In addition, the issues may be questions, sub-issues, or replacements that are generated after other related elements. Issue plays the role of problem statement of discussion. Idea means possible answers that are generated in response to the related issues. Argument means the opinions that are

generated in response to the related ideas. The argument might be in forms of positive opinions which are represented as pros. On the other hand, the argument might be in forms of negative opinions which are represented as cons.

First, the evolution of four elements of discussion: IBIS counts and metrics on contents in figure 4 and 5 suggests that an agent with threshold of both 2 and 3 people is to solicit people's positive opinions (ideas and pros). This finding is aligned with our agent consensus policy, where the agents are more willing to demonstrate a higher likelihood of engaging human participants in solving common issues by posting more ideas and cons to ideas.

The total number of ideas and pros were higher for both expert and public groups with both 1:2 and 1:3 setting (n= 591; 381) than the total number of issues and cons for both expert and public groups with both 1:2 and 1:3 setting (n= 387; 273) (Figure 4 and 5). This finding aligns with the fact that our agent adopts consensus policy, where the agents are more willing to demonstrate a higher likelihood of engaging human participants in solving common issues by posting more ideas and cons to ideas.

This encourages humans to encourage reaching a consensus for solving problems on online communities by mediating and supporting human-generated posts [12]. Hence, the results obtained through this observation are in a good agreement with our agent consensus policy and confirmed the validity of the agent-based facilitation of consensus-building method.

This evolution could be very helpful for a complex society like Afghanistan, where people need to focus on solving more issues than raising the issues itself which help to avoid confrontation and help reach agreements. Second, our findings suggest that the more people know about the discussion topic or having prior knowledge about the discussion theme, the higher significance it might have on discussion development. For example, we have collected more IBIS elements (n= 978) from expert groups than public groups (n= 654). In this work, we believe that a class of experts like health workers have prior knowledge about COVID-19 related discussion themes, and another class of public people might don't have the prior knowledge compared to expert groups.

From the experimental results, we find that the threshold of 2 people-based discussion facilitation can be used to support online discussion facilitation in least developed countries like Afghanistan. From the detailed comparison of the two thresholds, we find that the threshold of two people needs to be considered for conducting discussion facilitation tasks that aim to encourage participants to generate more posts in communities where people are keener to discussion like Afghanistan.

This finding aligns with that of French in Afghanistan [194], which reported that communities with lower socioeconomic levels, such as Afghanistan, are more willing to demonstrate a higher likelihood of engaging in activities and investing more time in discussing common issues. Furthermore, this may be explained by the fact that the AI threshold of 2 people tends to be associated with much more facilitation support that stimulates people to engage with each other than the threshold of 3 people. This is considered as one reason that leads to higher likelihood of engaging in activities with agent facilitation threshold of 2 people than 3 people.

Second, comparison on evolution of four elements of discussion between expert and public suggests that conversational agents have the ability to increase discussion elements, particularly positive opinions (ideas and cons) with groups of people having prior knowledge about discussion themes than people with non-prior knowledge. This finding is aligned with the fact, health workers are more willing to demonstrate a higher likelihood of knowledge in discussing COVID-19-related issues than public (private citizens).

It is worth mentioning that the work reported in this chapter has received Best Presentation Award in International conference [295] (as shown in Figure 5.6). Furthermore, this initiative has influenced other local Afghan government departments, including the Directorate of Environment and Environmental Health, which has officially expressed its intention to collaborate with us (as shown in Figure 5.7).

5.10. Chapter Concluding Remarks

In this chapter, conversational AI as a representative application of Artificial Intelligence that revolutionizes our communication practices has been proposed to host community collective intelligence on COVID-19 discussion. We investigated and compared the influence of conversational agents as facilitators on the evaluation of COVID-19-related online debate involving two classes of people: expert versus public paradigm. To this end, we compared the effect of agents on guiding each group of people by setting two types of thresholds of facilitation (threshold of 2 people versus threshold of 3 people). From the present study, the major conclusion from the statistical analyses of the argumentative data generated from the discussions are summarized and can be made as follows:

- The conversational agent with 1:2 facilitation ratio (threshold of 2 people) had an effect on the discussion development in terms of average number of IBIS elements as well as average number of posted characters.
- The persuasive effect of conversational agents modulated the distributions of the IBIS elements in the first example by reducing the issues and cons while increasing ideas and pros among all groups of people
- We found that the conversational agent has the ability to increase discussion elements, particularly positive opinions (ideas and cons) with groups of people having prior knowledge about discussion themes.

Figure 5. 6: The work reported in this chapter has received Best Presentation Award in International conference [295].

دولت جمهوری اسلامی افغانستان
شاروالی کابل

د افغانستان اسلامی جمهوری دولت
د کابل شاروالی

Islamic Republic of Afghanistan
Kabul Municipality

معینیت خدمات شهری و محیط زیست
ریاست صحت محیطی و محیط زیست
مدیریت عمومی اداری

شماره ع ۲۷
تاریخ ۱۳۹۹/۱/۱۸

☐ عاجل☐ عادی☐ اطمینانیه☐ ابلاغیه☐ سایر

پیشنهاد	حکم
به مقام محترم شاروالی کابل ! **با تقدیم احترامات فایقه،** طوریکه مقام محترم نیک می دانند، برگزاری کنفرانس های حضوری در شرایط فعلی به دلیل شیوع ویروس کرونا مناسب نیست قرار است به روز های سه شنبه و چهارشنبه مورخ ۱۹و۱۳۹۹/۰۱/۲۰ ویدیو کنفرانسی تحت عنوان گفتمان صحت شهری با همکاری انستیتوت تکنالوژی ناگویای کشور جاپان در دو پنل برگزار گردد: پنل اول : موضوع بحث شهروندان و بیماری کرونا و راه های پیشگیری از شیوع این ویروس است. که این موضوع را با شهروندان افغان مقیم در کشور های مختلف مورد بحث قرار خواهیم داد. پنل دوم : متخصصین، داکتران و فعالان حوزه شهری تجربیات علمی و عملی خویش را به منظور جلوگیری از شیوع ویروس کرونا به اشتراک خواهند گذاشت. مدیریت این کنفرانس ویدیویی از سوی دیپلوم انجنیر حسن غلامی رییس صحت محیطی و محیط زیست صورت خواهند گرفت. موضوع به مقام محترم نگاشته شد، خواهشمندیم تا در زمینه پخش مستقیم این ویدیو کنفرانس از طریق صفحه فیسبوک شاروالی کابل بالای ریاست محترم نشرات هدایت لازم داده ممنون سازید. **با احترام** **دیپلوم انجنیر حسن "غلامی"** **رئیس صحت محیطی و محیط زیست**	

آدرس: ناحیه چهارم، چهارراهی سرسبزی، تعمیر ریاست، تنظیف منزل سوم، ریاست صحت محیطی و محیط زیست
شماره تماس مدیریت عمومی اداری: ۰۹۳۷۴۴۳۱۶۱۹۱

Figure 5. 7: An official letter shows the intention of Directorate of Environment and Environmental Health, Kabul city to host COVID-19 related online discussion using D-Agree. Reprinted from “EEH Letter”.

CHAPTER 6

A STUDY ON CROWD ENGAGEMENT IN ONLINE IDEA CONTEST USING CONVERSATOINAL AI PLATFORM

CHAPTER 6: A STUDY ON CROWD ENGAGEMENT IN ONLINE IDEA CONTEST USING CONVERSATIONAL AI PLATFORM

6.1. Propose of Chapter

In this *chapter*, a real-world experimental idea contest studies have been conducted to obtain the information needed for a deep understanding of the relation between "quality opinion submission" and "discussion development in the real-world online idea contest project. A "relationship" between active competitor and discussion development and its impact as extrinsic motive on discussion development has been discovered in this study. This method can be applied to develop ideas for online idea contests.

6.2. Introduction

In the subject of smart online collaboration [26], the underlying incentive mechanism are a foundation for civic engagement in online platforms [97]. Moreover, scholarly research in the field of sustainable crowd collaboration operates out of the understanding that advances in the underlying knowledge necessitate pursuing multifaceted questions that can only be resolved from the vantage point of interdisciplinarity research. Indeed, research problems in this field are inherently too complex to be addressed by single disciplines [53]. The motivation study addressing the topic of smart collaboration development falls within the broad research field of sustainable motivation where quality opinion submission is seen as a salient factor given its transformational effects as an enabling an integrative element to stimulate crowd engagement [94]. In light of this, this study [73] is of an applied practical kind of interdisciplinary, and its aim is to investigate and analyze how to advance and sustain the crowd collaboration with support of incentive mechanisms. The results are published in a rigorously refereed international conference, 9th ACM Collective Intelligence 2021 [296].

6.3. Background

There is evidence that crowds with support of machines and without space-time constraints can more efficiently engage and solve soft problems through their generated content than traditional crowd engagement techniques [297] [298] [299]. However, due to the distributed and asynchronous nature of online communities and citizen-initiated platform usage, their collaboration and communication may be challenging [93]. Evidence suggests that extrinsic and intrinsic motivators are fundamental to crowd engagement [297] [298]. Thus, providers of crowd platform and crowdsourcers have to consider extrinsic and intrinsic motivation to facilitate collaboration among the crowd. The foregoing is premised on the fact that civic engagement may be impacted by the type of platform support and crowdsourcer motivation [299]. Moreover, there is evidence that platform supportive means like artificial facilitation, incentive mechanism, ranking system, content visualization, and crowdsourcers monetary and social rewards, which represent extrinsic motivators, play key roles in engaging crowd in activities and processes [113, 211, 35] [74]. Conversely, personal interests and hobbies are examples of intrinsic motivation, while extrinsic motivation delivers some compensation for work [296]. Extrinsic motivation can be financial (e.g., monetary reward), social (e.g., fulfilling the desire to learn and improve one's abilities, knowledge gain, experience), and organizational (e.g., society's ranking prospects) motivators. However, we are inspired to theorize that there would be a silent motive or motivator between extrinsic and intrinsic motivation in an engaging crowd which should be noted. We consider this effect as a complement of gamification [114] of crowd platform providers and the extrinsic motive of crowdsourcers. Therefore, this experiment extends the scope of engagement motive beyond extrinsic and intrinsic motivation for a real-world domain, such as an idea contest project [73].

6.4. Contribution of Chapter

The main contribution of this study to the literature is that we uncover a silent effect as a proxy for societal motive within societal elements, which facilitates engagement with the crowd.

6.5. Problem Statement

While extrinsic and intrinsic motivators are fundamental to crowd engagement. Indeed, research problems in this field are inherently too complex to be addressed by single disciplines. For instance, using virtual incentive mechanisms to stimulate crowd collaboration or introduce some monetary incentives within online communities.

The motivation study addressing the topic of smart collaboration development falls within the broad research field of sustainable motivation where quality opinion submission is seen as a salient factor given its transformational effects as an enabling an integrative element to stimulate crowd engagement.

6.6. Research Hypotheses

Previous empirical societal studies suggested that supportive means like artificial facilitation, incentive mechanism, ranking system, content visualization, and crowdsourcers monetary and social rewards, which represent extrinsic motivators, play key roles in engaging crowd in activities and processes [113, 211, 35]. Conversely, personal interests and hobbies are examples of intrinsic motivation, while extrinsic motivation delivers some compensation for work [Hossain, 2012]. Extrinsic motivation can be financial (e.g., monetary reward), social (e.g., fulfilling the desire to learn and improve one's abilities, knowledge gain, experience), and organizational (e.g., society's ranking prospects) motivators.

However, we are inspired to theorize that there would be a silent motive or motivator between extrinsic and intrinsic motivation in an engaging crowd which should be noted. We define it as the author of quality opinions, and consider this effect as a complement of gamification [114] of crowd platform providers and the extrinsic motive of crowdsourcers. Therefore, this experiment extends the scope of engagement motive beyond extrinsic and intrinsic motivation for a real-world domain, such as an idea contest project.

Therefore, to evaluate our hypothesis, we conducted a real-world incentivized idea contest within the city of Kabul (Afghanistan) with the collaboration of the Kabul city local municipal government [160]. We initially activated and introduced supportive means like artificial facilitation, incentive mechanism, ranking system, content visualization, and crowdsourcers monetary and social rewards.

We listed the following three hypotheses for our study:

Hypothesis 1 The author of the quality of opinions which we call an active competitor within the idea contest can incentivize the participants to submit more postings and to diversify these postings.

Hypothesis 2 When an active competitor works collaboratively with the other member of a group contest, the overall performance of the discussion development increases.

Hypothesis 3 The development of the discussion in the contest group led by the female competitor is more than average. This means that the participants were actively engaged with the discussion lead by the female competitor.

6.7. Research Objective

We aimed to validate the effect of active participation as proxy motivators beyond crowd platform and crowdsourcer extrinsic motivations in engaging crowds across the idea contest project at scale. Our research was inspired by many other studies highlighting the importance of harnessing collective intelligence [27] through crowdsourcing [206] by using groups [207, 210].
We listed the following three research question for our study:

1) How do we know who are real competitors?
2) Can these competitors act as proxy motivators in engaging the crowd?

To address these question and test hypotheses mentioned above, we design a real-world idea contest project in collaboration with Kabul Municipality [160] as a crowdsourcer, to collectively engage crowd work and offer innovative solution for improving the city in line with the United Nations sustainable development goals (SDG-3, 6,11~13) [73].

6.8. Research Design

We used an open call idea [91] to an undefined network of people to conduct an incentivized idea contest for our targeted subjects using an online discussion support platform based on incentives and facilitation support [37].

6.8.1. Study Area

We selected Kabul city [160] as our primary area. Located in Kabul province, the city of Kabul, which encompasses an area of 1622 square kilometers, is the capital of Afghanistan in the country's eastern section. It is home to about 4.4 million people, almost half of whom are women as of 2020. and it has 22 urban districts.

City of Kabul [160] made a decision to make a strategic development plan for solid waste management of Kabul city based on the smarter human collective intelligence of public insights by opening an idea contest using our system as a society platform and harnessing citizen-organized suggestions offered in response to the seven themes related to Kabul municipal solid waste management.

6.8.2. Sample and Sampling

Due to the nature of our experiment, we used an open call idea to send invitations to an undefined network of people [206] to conduct an incentivized idea contest for our targeted subjects using an online discussion support platform based on incentives and facilitation support [37].

The experimental idea contest was conducted from August 13 to October 2, 2020. The whole campaign was advertised on Facebook Ads, on the homepage of the Kabul city municipal government, on the Facebook page of the Kabul city municipal government [160], and on the Facebook page of the D-Agree Afghanistan [300]. The outline of idea contest process shown in Figure 6.1.

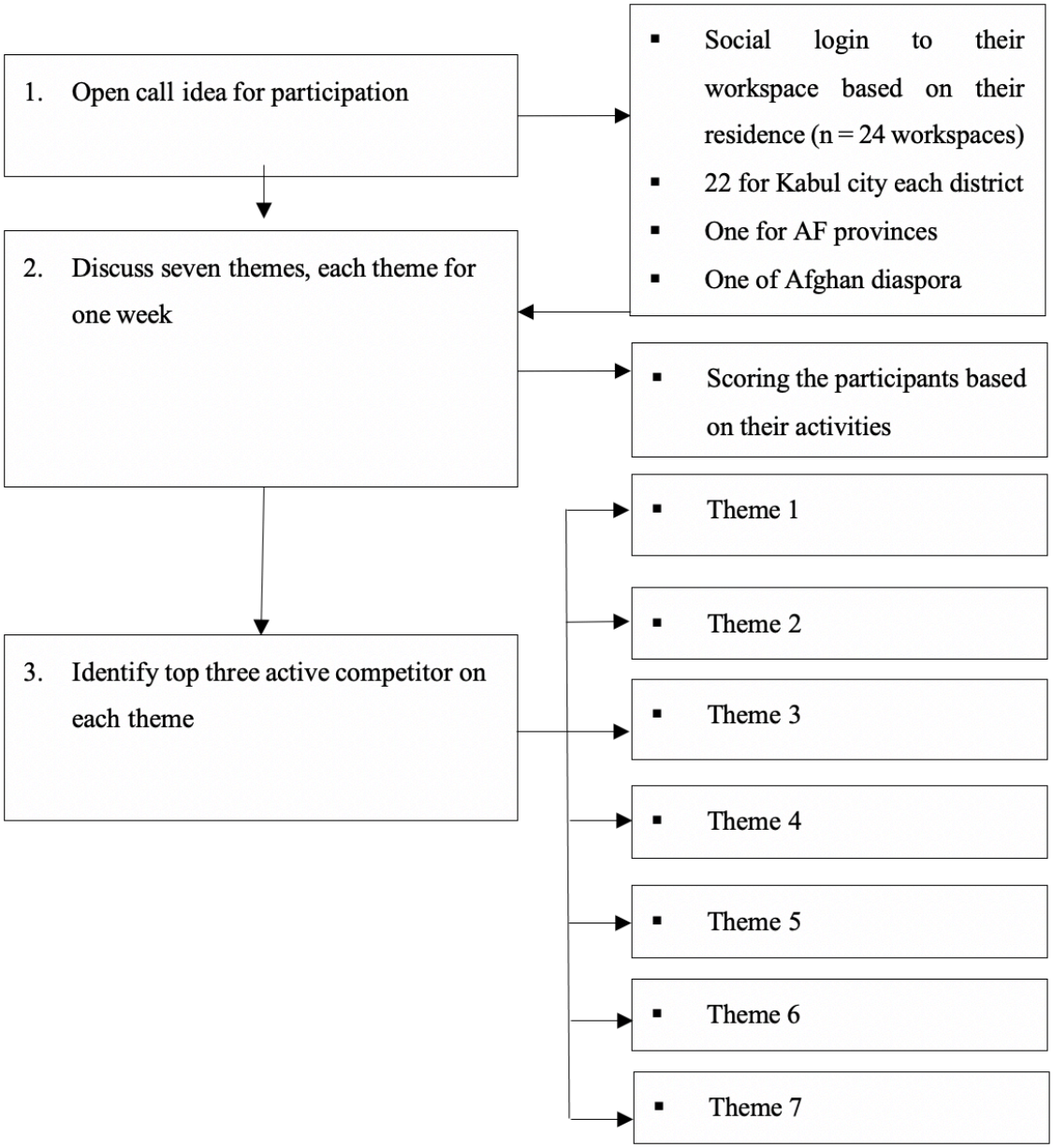


Figure 6. 1: Outline of Idea contest process.

6.9. Experimental Idea Contest Setting

We used an open call where Afghan residents in Kabul city and around the world joined specific discussion spaces based on their residential areas and preferred time.

As with the D-Agree's scoring system [113], participants can get points for posting, replying, liking or receiving likes and replies from others. We linked the ranking system

to social and monetary rewards of KM to stimulate motivation. KM had set cash prizes of 30k, 20k and 15k Afs (≈ 385, 257 and 192 USD) for top three and certificates to top ten participants, respectively at the end of the contest project.

The project commenced with an inauguration ceremony organized in KM. The Mayor of Kabul and the General Director of Cleaning and Waste Management Directorate participated at the inauguration, which was broadcasted live on KM and D-Agree Facebook Page. A request to participate in the program was posted on KM Facebook Page, along with a link directing interested participants to the D-Agree platform. In addition, a list of discussion codes required to participate in the idea contest spaces was provided along with a demo video on how to participate in the discussions. The request for participation was further boosted, using a Facebook ad [300].

6.9.1. Idea Contest Spaces Setting

We had created 24 online discussion spaces based on the geographical areas, including the 22 municipal districts of Kabul City, one for interested participants from the provincial districts of Kabul and 33 other provinces of Afghanistan and one for Afghans in the diaspora. We provided 7 themes covering different aspects of solid waste management and had discussions on each theme, which lasted for one week. Based on participants' engagement with these themes, they were scored and ranked by the system in real-time within their related groups.

They all discussed the same topics within the same time while using different spaces. After the weekly discussion of each theme, we announced the top three participants with the highest scores among all the groups on the D-Agree platform and Facebook Page, which attracted about 20,000 followers (see Table 3.3). Our experiment, which generated 14,587 opinions from 3,892 registered participants took place from August 13 to October 02, 2020 [73].

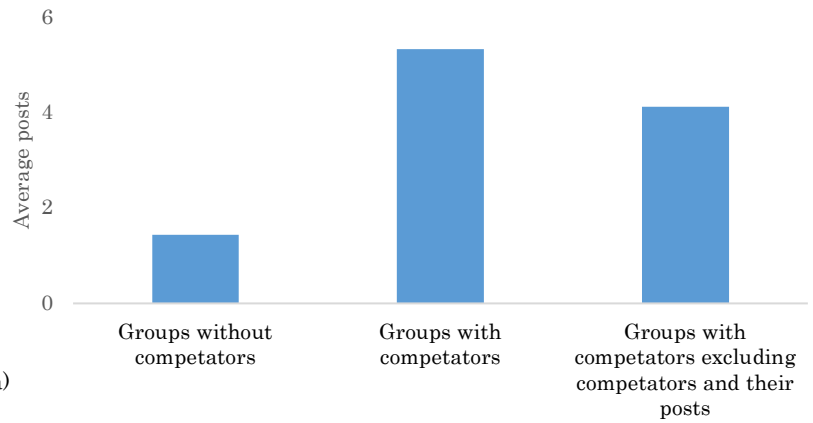
Table 6. 1: Ranking of top three participants across 24 groups per theme.

Topic	First rank	Second rank	Third rank
Theme 1	D13-P1	D5-P1	Dias-P1
Theme 2	D13-P1	D5-P2	D5-P1
Theme 3	D8-P1	Dia-P2	D13-P1
Theme 4	Dia-P2	D8-P2	D8-P1
Theme 5	D8-P1	D8-P2	Dia-P2
Theme 6	D8-P2	D3-P1*	D8-P1
Theme 7	D3-P1*	D8-P2	Dia-P3

Note: D stands for District, P for participant and Dia for Afghan Diaspora, *female

6.10. Results

The results of the experimental idea contest are shown in Figure 6.2. In sum, 0ur first finding is that active competitors with quality of opinion exist but not in all contest groups. Our findings show that each post by a competitor increases the likelihood of group participants' posts by 4 (as shown in Figure 6.2a). We also show that the effect of competitor is uncorrelated with population (as shown in Figure 6.2b), although we did not test its relation to gender, age, education and ethnicity. Furthermore, the number of participants and posts were higher in groups with competitors even if the competitors' posts were excluded (Fig. 6.2a).



(a)

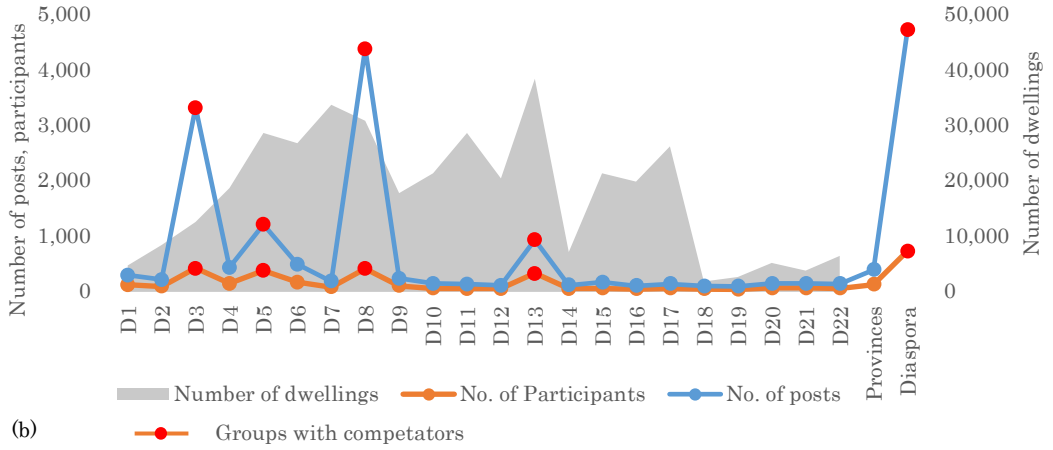


Figure 6. 2: (a) Comparison of average posts in groups with and without competitors, (b) number of participants and posts coming from groups and dwelling (D1~D22), and effect of group with competitor in engaging the crowd (colored red dot).

6.11. Discussion

First, the comparison of average posts in groups with and without active competitors suggests that the discussion with active competitors is centred around raising participants and posts, even if the competitors' posts were excluded. This evolution could be a precondition on how discussions evolve towards a divergent deliberation with the groups having active competitors.

Second, the number of participants in 22 municipal groups did not correlate with the population or number of dwellings in a district (Figure 6.2b). We assessed top three ranked competitors across 24 spaces per theme. Spaces with competitors who secured top 3 positions were, D8 (8 times), Diaspora (5 times), D5 (3 times), D13 (3 times) and D3 (2 times) (Table 3.3). Ironically, but interestingly, in most cases (19 times), male competitors secured top 3 positions, while females secured only two in D3, but looking at the overall performance, D3 (2) female competitors exceeded the performances of D5 (3) and D13 (3).

This finding aligns with Woolley's study [302], which report that women play a positive role in crowd engagement. Indeed, looking at the ranking of competitors across 7 themes, a woman competitor recorded the highest score (42,000 points) among all the competitors.

Our research was inspired by many other studies highlighting the importance of harnessing collective intelligence [27] through crowdsourcing [206] by using groups [207]. Our findings are also consistent with that of Weidmann's study [303] who examined the effect of team players with higher scores of social intelligence on the team performance. However, his study most often estimates team players within team performance in a controlled lab setting, but did not directly link the correlation of team players' presence with team performance at scale. In contrast, in this study, we conducted a real-world experiment, using open call in collaboration with local government to study the effects of silent motive within crowd engagement while looking at both competitors' presence and the correlation of their contributions with crowd engagement.

Table 6. 2: Outline of obtained statistical results from groups with competitors and groups with competitors excluding competitors and their posts.

	Groups without competitors
Groups with Competitors	$t(4) = 2.63$, $p < 0.05$, $d = 1.65$
Groups with competitors excluding competitors and their posts	$t(4) = 2.28$, $p < 0.05$, $d = 1.43$

The results were found by comparing multiple composition types means using Independent-samples t-tests. Chi-test*: $p < 0.05$

As shown in the table above (Table 6.2), the statistical test results show significant differences in average post (post/participant) between groups with competitors, groups with competitors excluding competitor's posts and groups without competitors. Cohen's d (1.65 and 1.43) shows a large effect size.

6.12. Chapter Concluding Remarks

To conclude, the active competitor had an effect on the leading nature of the discussion as well as the interactions between the participants. We examined the effects of competitors on crowd engagement. We found that competitors can play key roles in facilitating crowd engagement although not in all contest groups.

The improvement of online discussion for the evaluation of authors of quality opinion was investigated using a real-world incentivized idea contest which was hosted by an online discussion support platform based on incentive and facilitation support. As the evaluation of motivation due to quality opinion submitters was discussed using online

discussion platforms in this chapter, thus, it is necessary to consider the effect of quality opinion into the discussion development, because the active societal element increases the social network due to quality of opinion characteristics and their presence affect the discussion development.

Users with quality content have a crucial important role to other online activities, the exchange of quality opinions between author of quality opinions and users can promote the discussion development as well. In this study, incentivized idea contents which were hosted by online discussion were employed to invite an undefined network of people into the 24 contest groups and their activities and performance metrics were compared.

The investigation revealed that the active competitor with quality of opinions, promoted discussion development. It means, that this experiment extended the scope of engagement motive beyond extrinsic and intrinsic motivation for a real-world domain, such as idea contest project, and we uncover a silent effect as a proxy for societal motive within societal elements, which facilitates engagement with the crowd. Further, the evaluation among active competitors were conducted, and their results were compared. From this chapter the following summary can be made:

- For the evaluation of groups with and without active competitors, we found that discussion development due to active competitor quality of opinions submission and other related activities.
- For evaluation of the male active competitors with the female active competitors, for mountainous areas, ironically, but interestingly, in most cases (19 times), male competitors secured top 3 positions, while females secured only two in D3, but looking at the space overall performance, D3 (2) female competitor exceeded the performances of D5 (3) and D13 (3). This finding aligns with Woolley's study [300], which report that women play a positive role in crowd engagement. Indeed, looking at the ranking of competitors across 7 themes, a woman competitor recorded the highest score (42,000 points) among all the competitors.
- Online discussion forum and social network focus on extrinsic motivation such as financial (e.g., monetary reward), social (e.g., fulling the desire to learn and improve one's abilities, knowledge gain, experience), and organizational (e.g., society's ranking prospects) motivators. However, for online and social network development the authors of quality opinions as a main contributor towards discussion development should be considered.

- The online discussion support platform based on facilitation support modified and incentivized idea contest integrated into the platform. The modification process of incentivized idea contests to online platforms in this chapter, helped to devise solution development and the validity of the idea contest within online platforms was confirmed using real-world idea contest projects.

CHAPTER 7

IDENTIFYING KABUL CITY NEIGHBORHOOD ISSUES AND ITS SOLUTIONS FOR POLICY MAKERS USING CONVERSTIONAL AI PLATFORM

CHAPTER 7: IDENTIFYING KABUL CITY NEIGHBORHOOD ISSUES AND ITS SOLUTIONS FOR POLICY MAKERS USING CONVERSATIONAL AI PLATFORM

7.1. Purpose of the Chapter

This chapter, drawing from conversational AI platform impact on discussion development across class of discussion, people, and settlement areas discussed in the previous chapter 3 and 4, we propose to host the first ever actual participatory planning using digital platforms to help policy makers in Kabul city. In this chapter, we investigate people's online participative activities in the context of the neighborhood functions of Gozars, which are Kabul's social and spatial urban units. The main objective was to harness the wisdom of the crowd to innovative suggestions for helping policymakers making strategic development plans for Gozars using open call ideas, and for responding to equal participation and consultation needs, specifically for women and minorities. Primary data on settlers' online participative activities is generated from online users residing in 22 District of Kabul City. The data is analyzed considering both quantitatively and qualitatively such a number of opinions generated and their sentiment analysis. Based on the analyzed data, the distribution of the facilities within and beyond the neighborhood is explored.

In view of the above, the discussion characteristics, as well as the sentiment of submitted of opinions are examined.

7.2. Introduction

Participatory democratic planning, which must include its citizenry in societal activities and processes, is a critical component in the successful implementation of any city planning [301]. In addition, planning a city requires a participative process that includes time, space, and people who communicate to identify innovative solutions and reach conclusions [305]. This is because the public's inclusion is critical in forging sustainable policies and developing a smart society, and development actions often fail without the participation of citizens [306]. This planning method promotes quality solutions through

reasoning and improves planning outcomes [307]. Furthermore, participatory planning, which is of central interest in urban development [306], is required to prevent conflicts by providing a broad acceptance of plans [10].

As described in 1969 by Sherry Arnstein [70], at the bottom rung of her proposed ladder, participation exists in an entirely passive movement without interaction among stakeholders; full interactivity exists at the top when public officials and citizens completely engage with each other [70] [146]. Her proposed planning method has shaped policies affecting the growth and changes in participatory methods. Because urban planning needs a structural transformation in its hierarchical model, it moved toward a reticular model that allows meaningful input from every stakeholder [146]. Thus, the participatory-planning paradigm emphasizes planning with people to harmonize views among all stakeholders. Other work extended participatory planning and added such terms as communicative planning with people [166], deliberative planning [167], and planning through public consensus building [71, 144, 53, 100, 112].

Participatory planning [145] incorporates more public participation in decision-making processes. However, due to time, space, and gender restraints [307] as well as security issues [148], most people cannot participate in consultation and planning processes, and implementing bottom-up participation theories is difficult, especially in war-ravaged countries like Afghanistan. For example, challenges remain that how participation should be ensured: (1) inclusivity, (2) transparency, (3) interactivity, and (4) continuity [308].

Even though the literature discusses the efficiency of crowd consultation in planning theory with the support of digital participatory platforms [144] [71] [275] [75] [40] [76], less attention is paid to how least developed countries (LDCs) (such as Afghanistan) cope with budgetary restraints as well as issues of space, security, and gender. As a result, participatory planning at scale remains unavailable in decision-making processes.

Toward that end, this chapter reports the first effective practical example that shows how LDCs can increase community participation by focusing on listening to citizens' suggestions, problems and needs using an AI-enabled participative platform [52].

7.3. Chapter Contribution

This chapter makes two contributions to the literature:

I. We propose for Kabul city to practically use a digital participatory platform centered around a conversational agent that uses AI technologies to interact and

help urban stakeholders including citizens reach agreements in an actual urban development planning process in Kabul city.

II. We conducted a qualitative content analysis as a human-led study on extracted social insights to understand the chain of thought of Gozar residents and to draw meaningful conclusions. Our perspective is based on sharing the valuable catalogued insights of citizens with Kabul city policymakers who must officially consider their insights while forging future, strategic policies for the Gozars.

7.4. Objective

The objective of this chapter is to describe the process of using an online participatory platform as a tool for a strategic urban development plan-creating process at the Kabul city municipal level. As an actual case study, we used our tool to enable crowd identification within a specific case of Kabul Gozar issues for strategic planning.

7.5. Problem Statement Planning with Gozar People

Kabul city has 911 Gozars, the smallest urban subdivision units, which are institutionalized as subdivisions that have a representative called a wakil and have set or customary boundaries [282]. These century-old, social and physical units are also found in surrounding cities as well as other Islamic countries [163, 309].

These traditional neighborhoods, which are organized around a religious building, include bazars, community gathering places, and other daily facilities. Around them, strong social ties and relations have been forged among residents enmeshed in the social order, security, and identity of their communities [284].

Currently, a Gozar's residents nearly always discuss their common problems at meetings held in masjids that exclude the participation of women and religious minorities. Next the wakil reports the meeting's conclusions to the KM [284]. However, this approach obviously restricts consultation and participation to just a few people, creating bias. Such biased representative reporting cannot be avoided because each wakil may be influenced during the facilitation process and when reporting insights to the KM.

In addition, the scale of voices (needs and suggestions), their content labeling, and organizations using man-power are critical problems for policymaking institutions. Most critically, based on Kabul's current security situation, embracing the traditional

forms of participation for collecting policymaking insights is dangerous and untenable because the government cannot ensure the safety of large-scale gatherings.

7.6. Research Question

KM made a decision to make a strategic development plan for Gozars based on the ground truths of public insights by opening a deliberative communication line using our system to promote equal consultations and harness citizen-organized suggestions offered in response to the following questions:

(1) What functions do citizens and Gozar representatives believe are successful in Gozars?
(2) What is their opinion of these units?
(3) Can their functions be strengthened?
(4) What policy changes should be initiated regarding these units?

7.7. Hypotheses

Our hypotheses merging top-down and bottom-up processes needs collaboration through which local governments and communities work together through online interaction with technology support.
So we initially posited the following three hypotheses:

*Hypotheses **1***. Whether KM's intention to collaborate through a platform would give citizens a greater level of engagement in the issues, harness solutions, and enable more active participation in municipal planning.

*Hypotheses **2***. Online participation allows for more organized and substantive participation from interested stakeholders and could lead to more social-collective awareness and intelligence in municipal planning.

*Hypotheses **3***. With the use of our proposed method, the crisis of representation in traditional participatory approaches can be validated by examining the submitted opinion of representatives and citizens. Hence, the developed method aims to improve

participatory democratic processes and promote direct democracy. It means that it can be easily identified if we have a contradiction between representative opinions and the citizens' responses related to decision-making by using participatory democratic processes and promoting direct democracy.

7.8. Experimental Setting

First, Kabul city selected the discussion topics. Two objectives shaped KM selection of a discussion theme as a high level for Kabul city urban issues. First, the KM theme is related to the issue of whether the function of Gozars work well or unsatisfactorily for promoting public engagement by collecting insights related to Gozars for policy-making. Second, we wanted to verify the effect of our system-node extraction in discussion themes by setting different stances for the same themes. Based on our decisions while considering the suggestions from the KM theme, we set three discussion themes to collect public insights and analyzed the discourse structure and sentiment of three themed discussions. Although the discussion themes were closely related, their stances are different.
The citizens discussed the following three themes using an open-call method:

- Theme 1: What are the satisfactory functions for the Gozars?
- Theme 2: Which functions from the list of 18 are satisfactory/unsatisfactory and why?
- Theme 3: What are the expected solutions to improve the Gozar functions?

Theme 1 was discussed for three days (May 12 to 14), and seven days were allocated for theme 2 (May 15 to 21) and theme 3 (May 22 to 28). The first theme collected the level of citizen satisfaction regarding Gozar functions and indirectly performed participation-sentiment analysis to identify the satisfaction from the public participation in the themed discussion. While looking at the theme stance, our proposition for Theme 1 argued that as more people participated and discussed, the more satisfactory the Gozar functions might be. The structure of Theme 1 was satisfactory-giving.

Theme 2 collected the level of the satisfactory or unsatisfactory functions by addressing specific functions from a list of 18 functions and asking the participants how to build an issue-giving consensus at the collective level. Our proposition for Theme 2 was a more specific one that addressed a question and asked about the reasons for failure. We thought that more people might be motivated to participate and discuss. The structure

of Theme 2 was closed-ended and issue-giving + why. One of the author collaborator collected 18 functions during her previous research studies in 2013 [282] [284] and these functions were divided into four sections: (1) governance, (2) social, (3) physical, and (4) safety. These functions and their performance percentages are described in Section 5.9j.

Theme 3 collected the expected solutions to improve the unsatisfactory functions at the collective level. The structure of Theme 3 was open-ended problem-solving. We assumed that the flow of themes would explore a managed process, such as defining what works, what fails and why, and finally, to find solutions to the failures at the collective level. Furthermore, the discourse-centric collective intelligence of each theme helps us perform sentiment analysis and social behaviors related to functions from obtained discussion structures. The three themed discussion experiment was carried out online for 18 days from 12 to 28 May 2020.

Second, the city wanted to engage not only urban experts but also the public to identify Gozar issues and gather their policymaking suggestions, and thus KM decided to use D-Agree.

Third, we created a virtual room for all 22 districts of Kabul city, labelled as D1–D22 to collect opinions from residents of each district. Based on their residences, Gozar citizens could join their virtual discussion rooms using discussion codes. The server management side of our system was deployed on Amazon's elastic compute cloud (EC2) infrastructure, and each module was allocated to a separate EC2 instance. The interaction between the participants and the agent was controlled with two parameters: a 1 min period specific to Amazon CloudWatch [272], and a threshold of three people. This threshold sets the number of human messages that the AI facilitator (agent) must count before joining the discussion. Fourth, Based on KM suggestions, we set the annotation discussion data for the system as shown in Table 7.1.

Finally, KM started by posting an open call [206] for participation on the Kabul municipality's homepage (HP) [160] and Facebook page. This was the first time that Kabul's municipal government had asked its residents to join a large-scale online participatory planning process (as shown in Figure 7.1). All the opinions of the citizens were collected by D-Agree using the following Kabul city official HP link: https://km.gov.af/3657/ (accessed date 12 May 2020).

The KM joint task team was comprised of representatives from the office of the mayor, the planning and policy directorate, the publishing and media directorate, and the directorate of citizen coordination and social affairs, Kabul city. This team invited Gozar citizens to participate in our social experiments. KM posted daily invitations to participate

for 18 days. The collected and annotated data from 22 municipal experimental participatory shown in Table 7.1.

Table 7. 1: Collected and annotated data from 22 municipal digital experimental participatory using conversational AI.

Items	Description
Entry ID	Integer that identifies parent post
Title	Title of post
Body	Original posted opinion
Thread ID	Integer that identifies post as a thread
Parent ID	Integer that identifies a post and links it to a parent
Name	Author of post
User group	Integer that identifies a group
Labeling confidence	Node extraction result
Entry ID	Integer that links a child post to a parent post
Post time	Time of opinion's submission
Text	Extracted node contents
Node ID	Integer that identifies a node
Type	Type of label
Type confidence	Set of node extraction results
Point	Evaluated points from user activities

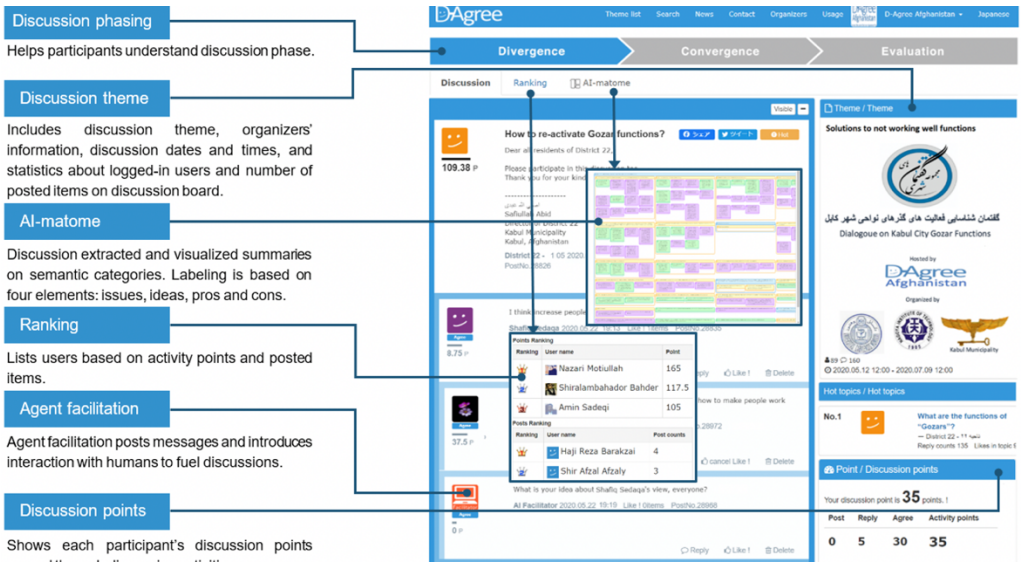


Figure 7. 1: Snapshot of web interface during municipal participatory planning of Gozars.

7.9. Results

The results of the quantified data of the three discourse themes are shown in Table 7.2; the results of the general experimental participation are shown in Figure 7.2, IBIS generation shown in Figure 7.3, distribution of average post shown in Figure 7.4, the results of the performance percentage of the neighborhood functions are shown in Figure 7.5 and results of the qualitative data and insights shown in Figure 7.6; and the results of the formal and informal settlements locations comparisons are shown in Figure 7.7.

Participant Distribution:

In our first finding, we found no correlation between the number of participants in the 22 municipal online discussions and a district's population or the number of dwellings in it (Figure 7.2).

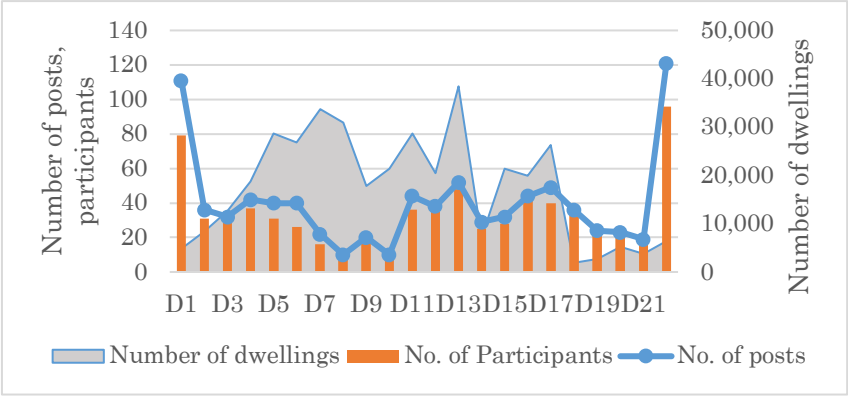


Figure 7. 2: Number of participants and posts from districts and dwellings (D1~D22).

Discussion Components Distribution:

We analyzed the discussion data and labeled all of the postings in the discussions based on their IBIS structure. Table 7.2 shows the number of IBIS nodes obtained in each discussion theme. Our second finding is that the total number of Ideas (n =576, 30.4%) and Pros (n = 474, 25%) exceeded the total number of Issues (n = 599, 31.6%) and Cons (n = 244, 12.8%) for all three themes (Figure 7.3.).

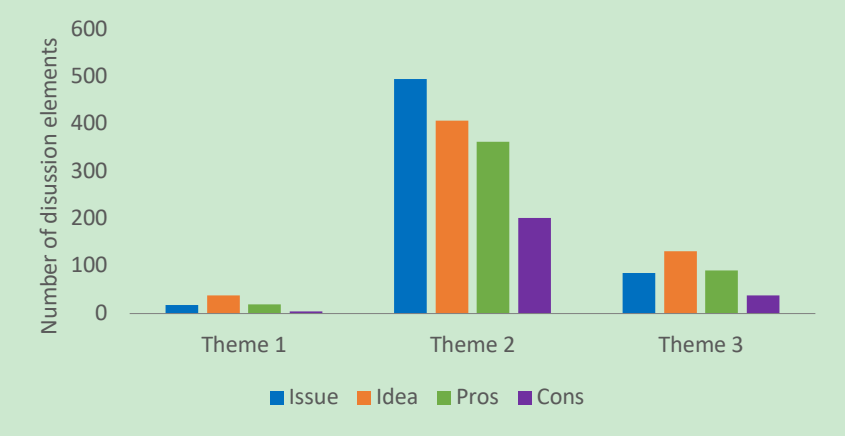


Figure 7. 3: Distribution of IBIS elements for three discussion themes.

Theme with Problem-solving vs. Issue-giving Stance:

The results are illustrated in Table 7.2. Our third finding suggest that the average responsiveness rate was slightly higher in Theme 3 (posts per user = 1.4) than for the other two themes (posts per user 1.1). In addition, discussion with problem-solving stance (T1 & T3), are clearly centered on raising solutions (n = 169) than issues (n =104), and discussion with issue-giving stance (T2), were centered on raising problems (n = 495) than solutions (n = 407). This implies that the conversational agent were successful to incentivize participants to submit more solutions in discussion with problem-solving (as shown in Figure 7.4).

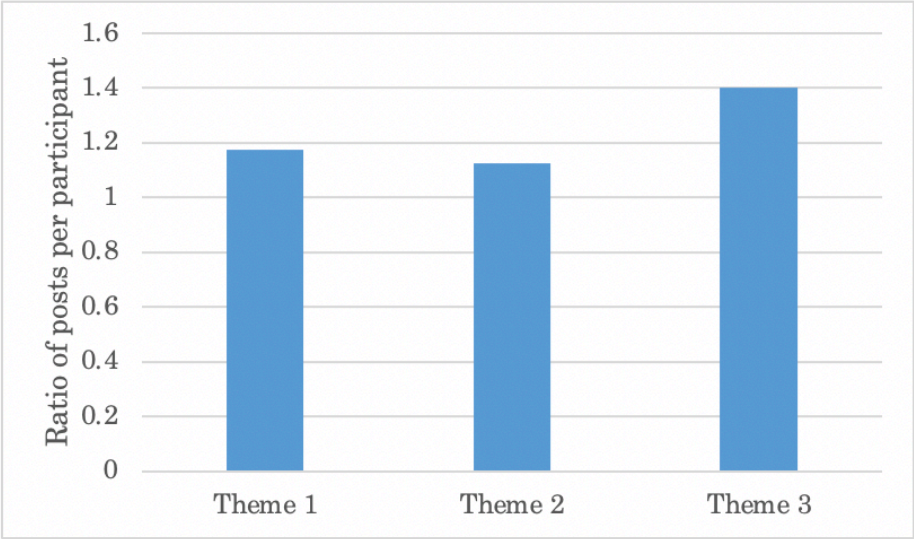


Figure 7. 4: Distribution of average post per participant for three discussion themes.

Agent-mediated vs. Human-meditated Discussion Component Generation:

As a general measure of performance of the -human-mediated versus agent-mediated discussion, we computed the ratio of the participants replies versus the number of mediated facilitation messages of both conversational agent and human facilitator. The finding suggests that response rate to human facilitator (63.3%) is slightly lower than that of response rate to agent facilitators (64.2%). This implies that the performance of agent-mediated discussion is at the same level as of the of human facilitator.

Comparison of Responses of Private Citizens and their Representatives :

The results are illustrated in Figure 7.5. We compared the responses that specifically mentioned the satisfactory functions in Theme 2 with those made by wakils from the same list of 18 functions collected during our questionnaire survey [309]. Except for dispute resolution (function no. 5) and community market events (function no. 8), which are listed in Figure 7.5, the Gozar functions seemed more satisfactory from the viewpoint of the wakils (wakils' viewpoint in response of working functions, n = 16), although only these two functions seemed satisfactory from the citizens' viewpoints (residents' viewpoint in response of working functions, n = 2). We identified a huge contradiction between their opinions and the wakil responses related to the Gozar functions. Table 7.2 shows the number of IBIS nodes obtained discourse summary of each theme's IBIS annotated discussion data.

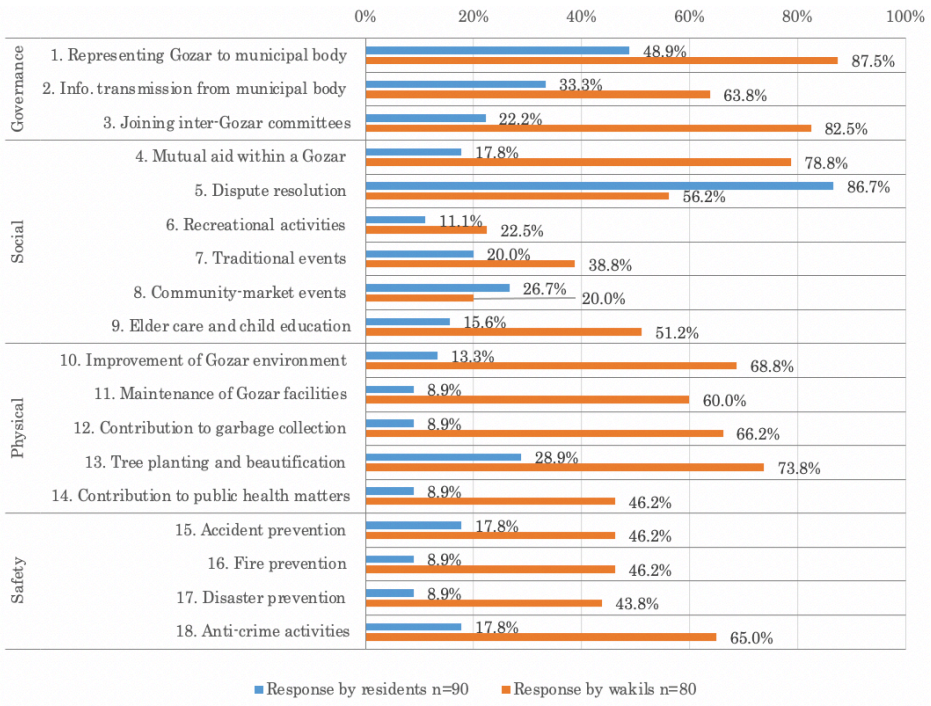


Figure 7. 5: Most discussed topics based on AI-led extracted discourse summary of each theme's IBIS annotated discussion.

Qualitative Analysis of the Discussions Components :

We as a human-led study qualitatively analyzed the discussion summaries (each theme of IBIS components) with the goal of identifying the real catalogued social insights. The results are illustrated in Figure 7.6. This result can be used a supporting tool for policy-making.

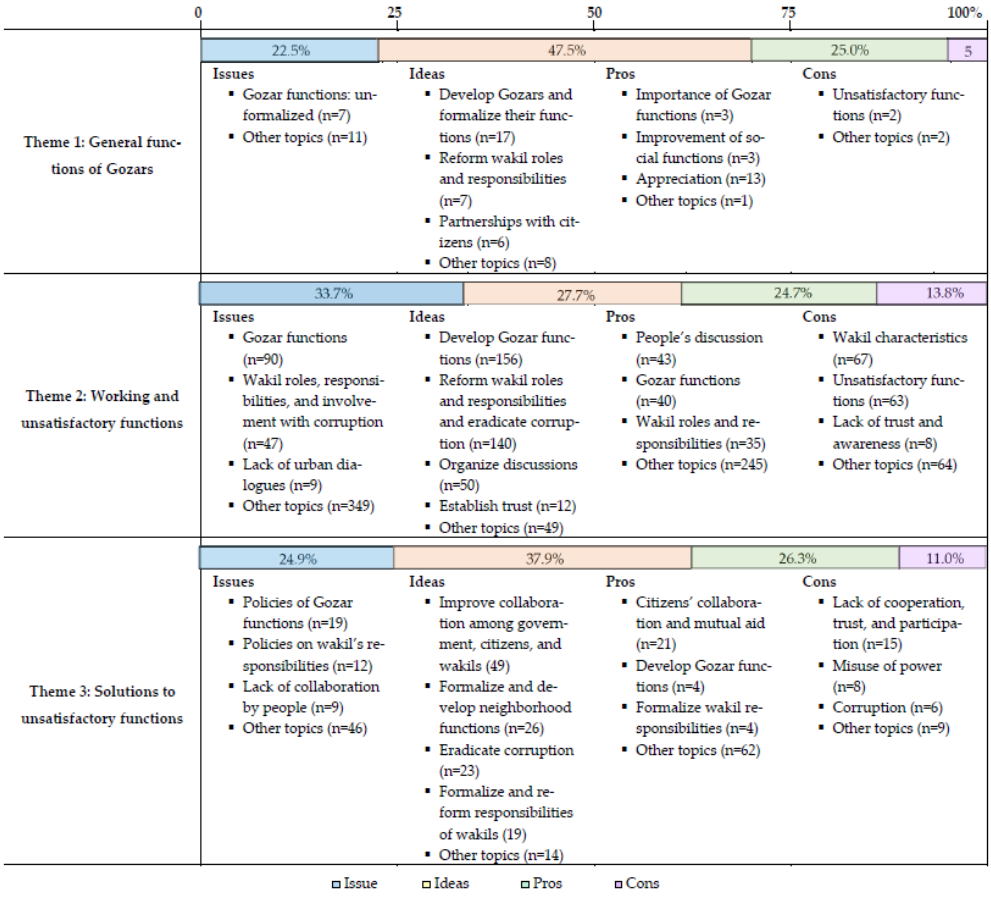


Figure 7. 6: Most discussed topics based on AI-led extracted discourse summary of each theme's IBIS annotated discussion data: blue (Issues), orange (Ideas), green (Pros), and purple (Cons).

Comparison of Formal and Informal Areas Settlers Participation:

Figure 7.7 compares the performances of the resident's participation and posting in the participatory planning of the formal and informal settlements areas. The districts are labeled D1~22. Most of the registrants (n = 566, 77.2%) came from districts where more than half of their dwellings are informal (number of districts = 17, 78.6%).

Our finding suggests that informal areas settlements discussed more Ideas than formal area settlements. We collected 192 posts from 167 registrants of five districts, where more than half of the dwellings are formal, and 682 posts from 566 registrants from 17 districts, where more than half of the dwellings are informal settlement area

A total of 482 Ideas came from the informal areas, in which almost a registered resident from informal areas settlements posted an idea (participants = 566; number of ideas =482; ratio = 0.86) compared to that of formal areas (participants = 167; number of ideas =94; ratio = 0.5). As a result, an average 28.3 Ideas per district came from each district with most informal settlement areas to that 18.8 Ideas of formal areas. This finding aligns with Mathew French's [194] study stating that communities with lower socioeconomic levels like Afghanistan are more willing to provide more positive opinions in formalizing their neighborhoods.

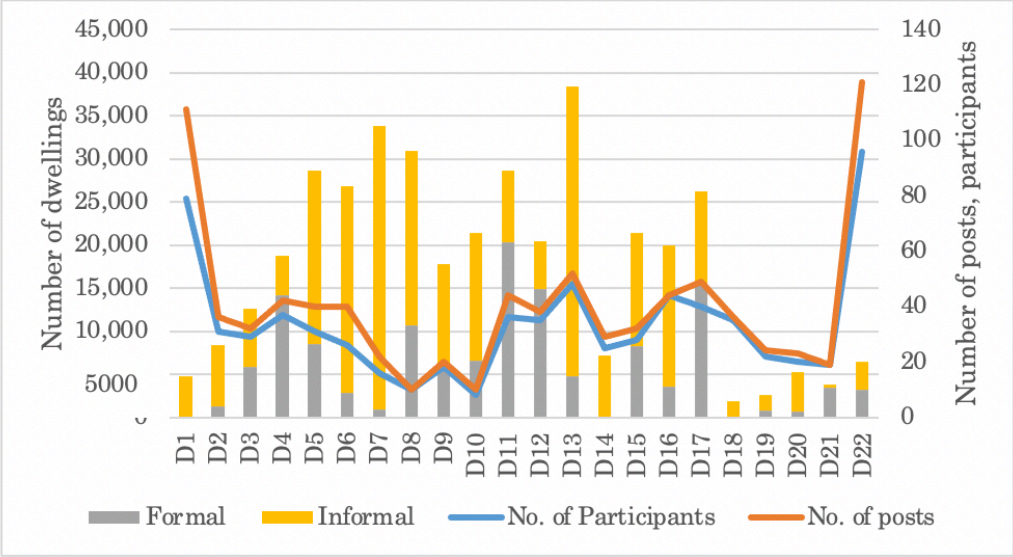


Figure 7. 7: Number of participants and posts from 22 municipal districts dwellings with formal settlements (D4, D11, D12, D17, and D21) and informal settlements (17 other districts).

7.10. Discussion

Kabul city, for the first time in history, has been actively engaged with sustainable urban development goals (SDG-11) through conducting experimental participatory planning at scale. The main goal was to promote citizen-inclusive urban planning and harness the wisdom of the crowd for policy making. The collected organized insights will be expressed in Gozar plans, projects and activities in the areas of sustainability. In essence, the Kabul city municipal government will translate a vision into Gozar strategic sustainable urban development priorities via a strong participatory planning approach and the joint AI and human-led analysis of the city's main challenges and solutions. In this regard, the proposed approach, the CCDP contributes to implementing this strategic vision by focusing on stimulating participatory development via a securely sustainable participation approach for responding equally to consultation needs of all the population and to "leave no one behind".

This study conducted the first experimental participatory planning on behalf of the Kabul municipal government using a decision-support platform based on AI supportive means to help policymakers collect actual extractions and identify the classified discourse-centric collective of social intelligence for the policymaking of Gozars. We found that Kabul's municipal government's open-call idea that stimulated planning with people may influence the crowd (online communities) into collaborating with the city to find innovative solutions for their common urban problems. The following are some specific findings:

An online experiment at Kabul city municipal level offers curious insights from a blended experience that is a mixture of AI technologies and experimental participatory planning in a very challenging context of urban planning in Afghanistan. This methodology as a novel element of develop and developing world partnership is among the earliest adopted participatory e-planning crowdsourcing tools for urban and public policy in Afghanistan.

Our system, artificial facilitation, is the earliest adopted automated facilitation tool in municipal government urban development e-planning practices in Afghanistan. Our gamification of online discussion is among the earliest adopted extrinsic motivations in participatory e-planning in Afghanistan.

The evaluation of participation and discussion response rate for Theme 1 suggests that most functions are unsatisfactory within Gozars. After the second and third themes were introduced, the participation and discussions evolved to address them. The evaluation of Theme 2 suggests that most of its listed functions were deemed unsatisfactory by the participants. Therefore, the response type as Issue was higher in

Theme 2. Thus, most functions are unsatisfactory. This sentiment analysis later aligned with comparison of wakils and residents' opinion.

The responsiveness of the people suggests that the number of quality opinions increased in Theme 2 because in it we specifically addressed discussion questions, and perhaps when the theme specifically addresses an issue, it becomes easier for people to participate and post their opinions. Thus, the more simply we define a problem as a high-level issue, the better responses we will collect. This approach might also stimulate argumentation and discussion development in crowdsourcing technologies.

In Theme 2, the average daily number of opinions was 87.3, which exceeds the average daily number of opinions for Themes 1 (n = 15.7) and 3 (n = 30.9). However, the average responsiveness rate was slightly higher in Theme 3 (posts per user = 1.4) than in the other two themes (posts per user 1.1) (Figure 7.4). In Theme 2, the average IBIS elements from posts (IBISs per post = 2.4) exceeded Theme 1 (1.7) and Theme 2 (1.6) (Figure 7.3).

The number of Pros was higher than the Cons in all three discussion themes because the agent facilitated messages encouraged participants to support posted Ideas rather than objecting to them. This is because we adopted a consensus policy for proactive agent and implemented a proactive agent to set the conversational agent's behavior based on consensus policy.

The number of participants in the online discussion of 22 municipal districts did not correlate with population or the number of dwellings in a district (Figure 7.2). However, we assumed that districts with more informal areas are more likely to have unsatisfactory Gozar functions, and therefore, the residents in such areas will be more interested in participating, discussing and sharing their needs and suggestions. This assumption was proven through collecting more suggestion (Ideas and arguments, Pros and Cons) from them compared to the formal area. However, we found no significant difference between the number of registrants which came from formal and informal settlements areas. Still, the level of participation from communities with lower socioeconomic levels like informal settlements deserve admiration.

The support of internet services like installing Wi-Fi zones [310] in informal settlements locations must be provided to them if KM is willing to harness their wisdom in formalizing their neighborhoods in the future.

We found no statistically significant numbers for participation and posts between the formal and informal areas of Kabul city (Figure 7.7). However, gender and type of response labeling are significant; more ideas and suggestions were received and more women participated from districts with more informal settlements areas.

Unlike traditional Gozar gatherings from which women are banned, female participants joined our experiment. We also had many participants from ethnic/religious minorities and achieved meaningful and equal public consultation.

We faced no security or health issues. Gathering people for urban dialogues and large-scale social experiments is risky in an unsafe city like Kabul. By using D-Agree, our participants faced no security problems. We also conducted our experiment during the COVID-19 pandemic where lockdowns are one main solution to restrict the spread of the virus. Conducting research using traditional techniques remains complicated during such difficult times. Unlike conventional in-person town meeting from human facilitation, bias and interest of groups having key position cannot be avoided; AI fair facilitation (automated facilitation) of participatory e-planning and meeting and the real-time discussion extraction and visualization includes all the urban stakeholders and their varied interests and backgrounds to democratically participate, discuss, argue, evaluate and makes a plan that is comprehensive, acceptable, and more easily implementable.

7.11. Chapter Concluding Remarks

We introduced conversational AI platforms as digital participatory platform to gather, analyze, and facilitate the online participatory planning process in Kabul. We then analyzed the contents of the machine-led, extracted opinions that were collected using qualitative content analysis methods to shape policymaking for urban units. The discussion insights revealed that an e-participatory supportive tool encouraged effective participation based on gender equality and can promote communicative planning. This step makes opinion collection more reliable and increases the transparency and legitimacy of the decision-making and policymaking processes. After comparing part of the submitted opinions on the satisfactory functions in Theme 2 with those collected from the wakil responses on satisfactory functions, we found that most Gozar functions are seen as unsatisfactory by the citizens.

Another main contribution of this study is that our system is raising solutions for social issues, and many people outlined the reasons and suggested solutions for fixing them. Thus, our system led discussions toward outcome-based consensus building and achieved a consensus not only on issues but also on ideas at the collective level. These valuable, annotated, and classified insights help policymakers make appropriate and efficient decisions related to urban planning.

It is worth mentioning that as a result of our jointly conducted actual experiments to collect social insights for policy making, KM made a decision to select each wakil through organizing a *wakil* election and call each *Gozar* resident to vote for their candidate in the future.

Table 7. 2: Summary of the quantified data, which shows relations between the discussion topic stance, number of posting, discussion component and human and agent-mediated facilitated post.

District Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**Total**
Posts on theme 1	5	1	1	2	0	0	1	2	0	1	0	2	1	3	1	2	1	4	1	4	4	12	48
Posts on theme 2	71	19	27	29	29	16	10	5	13	7	39	30	44	18	21	33	36	22	17	12	11	101	610
Posts on theme 3	35	16	4	11	11	24	11	3	7	2	5	6	7	8	10	9	12	10	6	7	4	8	216
Totals (themes 1–3)	**111**	**36**	**32**	**42**	**40**	**40**	**22**	**10**	**20**	**10**	**44**	**38**	**52**	**29**	**32**	**44**	**49**	**36**	**24**	**23**	**19**	**121**	**874**
Issues	99	24	23	17	45	13	14	9	6	6	41	10	38	22	6	20	73	21	15	11	3	83	599
Ideas	81	18	28	15	31	18	14	3	17	8	26	20	29	15	28	29	24	30	8	14	9	111	576
Pros	61	19	22	24	28	24	17	6	11	7	29	14	39	9	8	23	15	15	14	12	7	70	474
Cons	34	6	9	11	9	5	2	0	10	4	12	13	16	9	11	15	12	6	5	8	5	42	244
Ideas, issues, pros, and cons	**275**	**67**	**82**	**67**	**113**	**60**	**47**	**18**	**44**	**25**	**108**	**57**	**122**	**55**	**53**	**87**	**124**	**72**	**42**	**45**	**24**	**306**	**1893**
Participants	79	31	29	37	31	26	16	10	18	8	36	35	48	25	28	44	40	35	22	20	19	96	733
Human-facilitator posts	14	6	8	5	7	7	6	4	7	5	8	6	6	6	5	7	7	6	6	5	7	18	156
AI facilitator posts	25	9	8	10	10	10	6	3	6	3	11	9	12	7	8	11	12	9	6	6	6	28	215

CHAPTER 8

A COMPARATIVE STUDY ON CONVERSATIONAL AGENT AS A FACILITATOR ON GUIDING DISCUSSION IN DEVELOP AND LEAST DEVELOPED COUNTRIES

CHAPTER 8: A COMPARATIVE STUDY ON CONVERSATIONAL AGENT AS A FACILITATOR ON GUIDING ONLINE DISCUSSION IN DEVELOPED AND LEAST DEVELOPED COUNTRIES

8.1.Purpose of the Chapter

This *chapter,* drawing from the cross-class of areas and cross-class of people discussed in the previous chapter 4 and 5, inspired to propose the cross-class of countries comparative societal experiment between developed and least developed countries. In view of the above, the impact of conversational agents on discussion developed in terms of cross-class of areas and cross-class of people at country level are examined. Note that in chapter 4 and 5 we have examined this at local (country level). In addition, a number of assumptions are used to determine the efficiency and predefined agent-mediation facilitation threshold of people setting that these platforms can accommodate to proceed discussion more efficiently and productively.

8.2. Background

While conversational agent as a support tool to facilitate online discussion and imitate human interaction has been widely documented, discussed and individually evaluated at country level [112] [79, 97]. However, they have not been comparatively evaluated relative their facilitated post and threshold towards humans' query defending the majority view regarding effective artificial facilitation ratios variation across different countries [37]. Hence, this study aims to measure the effects of agent-mediated different facilitation threshold of people on quality of argumentation development at cross-country level.

This paper use three types of facilitation threshold: 1:1; 1:2; and 1:3 to study the impact of each threshold on discussion development while looking to the ratio of facilitation threshold on discussion development at country as well as cross country level. The recommendation for setting an efficient facilitation ratio, which may constitute to understating to set an efficient artificial facilitation ratio for online discussion, and also use it for facilitation learning models, further explore the discussion components

correlation with topic stance and participants preference discussion topics across participants, groups and countries.

In addition, we study the effect of conversational agent on cross-class people at cross-country level. To the best of our knowledge, no other quantitative or qualitative research and scientific literature have documented to verify artificial facilitation and discussion component elicitation among cross-countries so far in this regard. This study purports the first-ever cross-country experiment using a conversational AI platform to quantitatively evaluate the impact of agents on discussion development.

8.3. Research Hypotheses

Drawing on the "efficient facilitation within argumentative reasoning," we hypothesize that an efficient artificial facilitator ameliorates different deliberative virtues with sociocultural background by setting an efficient turn-taking to spur interaction and promote solution generation to problems. In a bilateral online control experiment, we show that artificial facilitators with different turn-taking indeed have a variable effect on enhancing interaction, developing reasoning, and more interestingly generating solutions to problems. It was found through a post-experiment survey that the factor of agent facilitation influences subject motor skills to generate more opinions, and growth of opinions within discussion. Discussion is a common approach which is conducted to find the discussion thematic area's solution. Based on the above description, this research will propose the following seven hypotheses:

Hypothesis 1 (H1). Agent-mediated discussion has a more significant impact on discussion with groups of people having extensive knowledge on discussion topic (A & B; high KAGS score) (hereafter called as experts), compared with groups of people having moderate knowledge on discussion topic (C & D; low KAGS score) (hereafter called as public), in both DCs (Japan) and LDCs (Afghanistan).

Hypothesis 2 (H2). Compared with DCs expert groups, LDCs expert groups have greater impact on discussion development with AI facilitation.

Hypothesis 3 (H3). Compared with DCs social groups, LDCs social groups have a more impact on discussion development with AI facilitation.

Hypothesis 4 (H4). Compared with DCs, LDCs have a more significant impact on discussion development with AI facilitation (average post character).

Hypothesis 5 (H5). Compared with DCs, LDCs invest more time in discussing thematic area (average posting time, avg waiting time)?

Hypothesis 6 (H6). Compared with the discussion tree of DC, LDC shares more discussion threads, elements (average post and elements).

Hypothesis 7 (H7). Compared with the discussion tree of DC, LDC shares more issues and ideas (average IBIS generating).

Hypothesis 8 (H8). Compared with agent-mediated discussion in DCs, LDCs share more ratio of reply for facilitation post (difference in reply rate by ratio). It means, agent-based facilitation is successful with LDCs compared to DCs.

8.4. Contribution of this Chapter

The major contributions from this study are summarized as follows:
We conducted a novel cross-country control experiment with a developed country (Japan) and a developing country (Afghanistan) using a platform centered around a conversational agent in order to measure the effect of AF on quality of argumentation and verify discussion trees across two countries. In particular, we used open call for large-scale subject collecting, where 16 selected subjects which came from each country and were the same age generation (their 30s), having postgraduate degree assigned into 4 groups of four that two groups within each country shared the same knowledge assed scores. All groups discussed the same topic within the same time.

To further ensure the user motivation across countries from collusion of adversaries, we used monetary reward for all recruited subjects in order to keep the same extrinsic motivation across countries.

8.5. Scope and Objective

The objective of this study is to quantitatively and qualitatively assess the effect of agent-mediated facilitation threshold of n-people (e.g., 1:1; 1:2; and 1:3) at cross-country level

using Afghanistan and Japan as a case study by conducting a bilateral online control experiment on recruited subjects, in which all subjects were requested to perform similar mandatory tasks within the same setting and time using the same discussion tool.

The study quantifies the participants' replies in agent's posted facilitated messages and each threshold towards humans' query defending the majority view regarding effective artificial facilitation ratios across different countries. The human reply in agent's posted facilitated messages correspond to the posted opinions of humans in the discussion process, including issues, ideas and arguments (pros to idea and cons to idea).

We assess how the likelihood of occurrence of a facilitation attempt from an agent increases linearly with the number of cues conjointly displayed by the human. Our results are important for improving the coordination and introduction of agent turns in multiparty online discussions, so that systems can correctly estimate when the agent is willing to yield the conversational floor, and so that they can produce efficient turn-yielding cues appropriately from the people.

8.6. Study Area

We selected two countries with a different sociocultural background (Figure 8.1), Afghanistan as a least developed country and Japan as a developed country. These two countries were chosen due to their accessibility and relative partnership to carry out the online social experiment project. The current study sheds light on verification of online discussion structures and effect of artificial facilitation within online discussion.

Figure 8. 1: Location of case study, Japan (left) and Afghanistan (right), image generated using Google Maps.

8.7. The Sample and Sampling

Since conducting comparative experiments among two countries was time consuming, and it was difficult for authors to approach large-size participants. Thus, we outsourced the recruiting service to subject recruiting agencies. In Afghanistan, we outsourced to Jobs.af [312], while in Japan, we outsourced to ASMARQ [313], both companies are subject recruiting service agencies. The survey procedure and methods in this study have gone through multi-stage sampling [219]. In statistics, multistage sampling is the taking of samples in stages using smaller and smaller sampling units at each stage.

In this study, firstly, we have used online nomination surveys as convenience sampling [52]. It was chosen because we wanted to collect a large sample size, also it was because we wanted to send the link to an undefined network of people as open calls [206]. The open-call idea might be unified as an invitation for anyone to participate in online tasks [206]. Thus, to whom online survey links reached and anyone who qualified and agreed took part in the surveys. Here qualified subject means that we controlled the subject collection by some mandatory attributes such as people in their 30s, have a postgraduate degree, good at writing language skills and access to stable internet connection.

In Japan, the survey link reached 100,314 people and 9107 responded to our survey. However due to user missing information and after cleaning the data based on our predefined mandatory attributes (subject in their 30s; have postgraduate degree; access to stable internet connection) only 2303 are considered as eligible samples. Since conducting comparative experiments among two countries, we create two stratums of 140 (female strata and male strata) from 2303 list.

To explain the sampling techniques further, the author made their own decision to control the stratum selection-based knowledge assessment gained a score (KAGS) range of 49 to 71. It means those subjects who gained score between 49 and 71 during nomination survey were listed first and then used stratified random sampling to select 280 subjects in stratums (n = 280; female = 140 & male = 140). The range of each stratum (n =140) is based on conditional person (female consented number in Japan side).

Finally, we used stratified random sampling to select 8 from each stratum for our study. Note that we followed the same step except the final subject selection, for Afghanistan, it was author decision to select 8 from each strata who shared KAGS with Japan side For Afghanistan, an online survey link reached 66,723 people and 2,564 responded to our survey (explained in Fig 1, step 3 and 4). Second, we used the gathered

sample and set the two strata as female and male groups by using stratified random sampling.

We used a stratification process to divide consented members of the population into two homogeneous male and female subgroups before simple random sampling is applied within each stratum to select a set of 140 subjects from each stratum. Although there is no general method for determining the optimal size for online control discussion experiments, researchers have considered 16-46 sample sizes when performing content analysis towards facilitated messages of conversational agents [36] [158].

We scored the knowledge assessment part and selected a range of participants who scored 49-71, and then the classified samples into two strata, male and female and conducted stratified random sampling to select 140 subjects from each stratum. The author chooses to set 140 samples from each stratum (male and female). Since we wanted to compare among two countries, authors made a decision to select 8 subjects from each gender group on both sides which gained equal scores. Finally, authors decided to assign 16 (females = 8 and males = 8) candidates of each side into four groups, namely A to D. We selected four human participants (females = 2 and males = 2) plus an artificial facilitator per group because four is the special number in multiparty conversations. The fifth participant is the conversational agent who can objectively observe conversational situations, and then post facilitation messages accordingly.

The author set two other conditions while assigning subject into groups to ensure the subjects had internal and external consistency: (i) while assigning make sure that the collective member score of group A is equal to group B, and C is equal to D; and (ii) while assigning subjects make sure that collective score of similar groups among two countries should be equal. In addition, the collective score of group A in Japan should be equal to the collective score of group A in Afghanistan and so on. We created four virtual discussion spaces for each side. The discussion spaces were jpn2021a, jpb2021b, jpn2021c and jpn2021d in Japan, and afg2021a, afg2021b, afg2021c and afg2021c in Afghanistan, namely as group A-D. All 32 participants (Table 1), who averaged 30.1 years of age were upper graduate educated, first time D-Agree's community users. Based on their groups, subjects could join their virtual discussion rooms using discussion codes.

Apart from that, since our system's computational algorithms [131] work based on two natural languages (English and Japanese), we add one more mandatory attribute, as English writing skill for the Afghanistan side to post their opinion as text. The outline of methodology used in this study are shown in Figure 8.2 and 8.3.

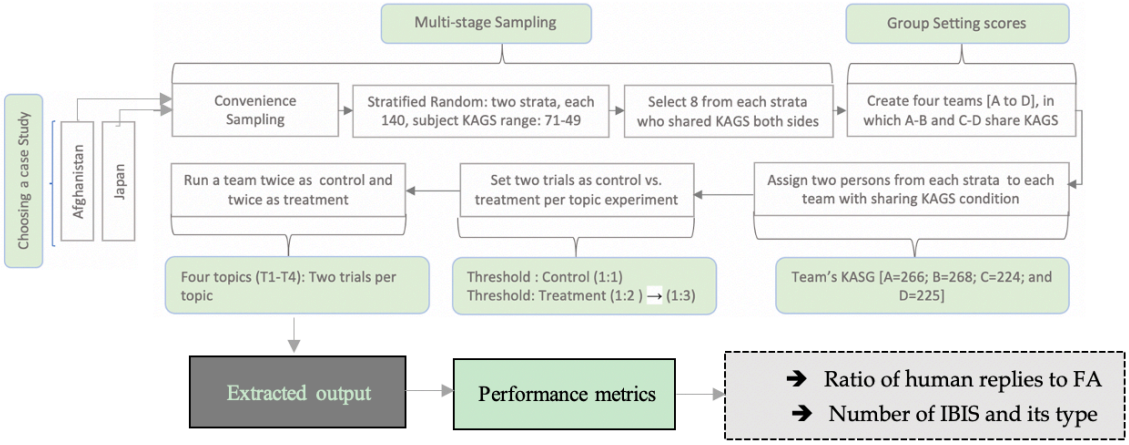


Figure 8. 2: Method employed in the quantification of turn-taking effect of conversational agent at cross-country level (Source: Author's illustration).

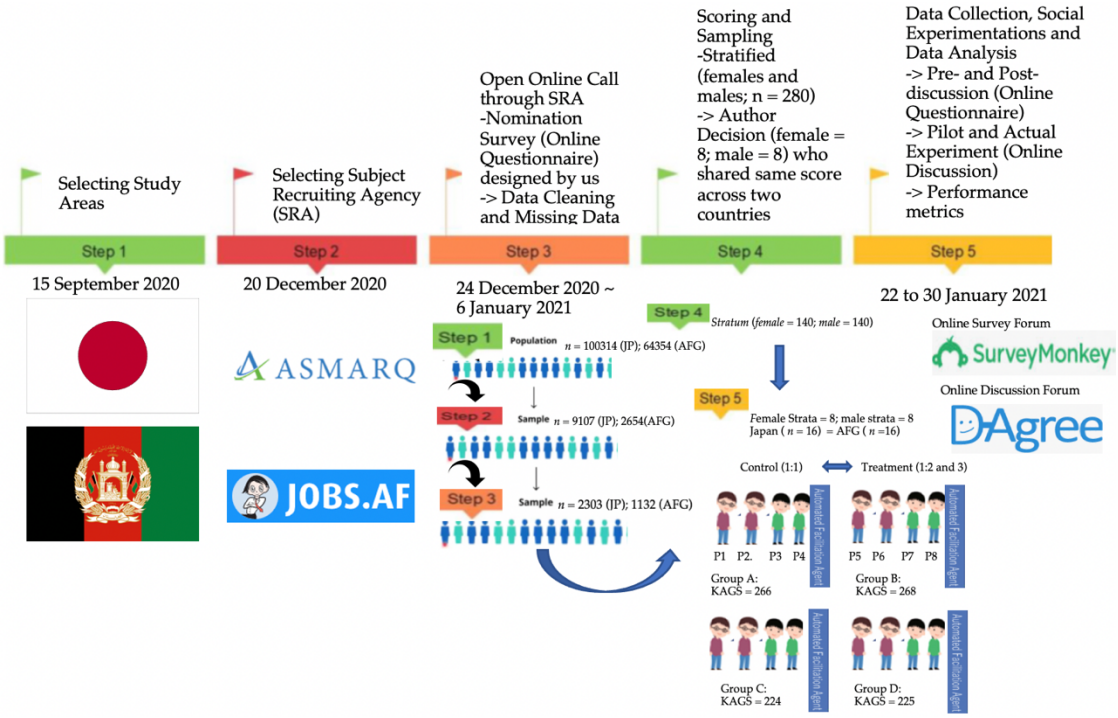


Figure 8. 3: Outline of overall methodology used for this study.

8.8. The Survey Instrument

An online survey instrument for our surveys.
First, an online questionnaire is the survey instrument for our surveys [95]. We used and conducted three types of online surveys: (i) a nomination-survey; (ii) pre- discussion experiment survey; and (iii) post-discussion experiment survey with subjects to analyze their general knowledge and their intention and consent for participation in our study. All questionnaires contained close-ended questions to help support the main instrument of this study which is the online discussion support system.

I. Nomination Survey

In order to collect a larger sample size, we conducted an online survey as a nomination instrument [292]. A nomination-survey is used to support the selection process. It was chosen because we wanted to select our samples from a large population and wanted to score knowledge of each participant gained through a nomination-questionnaire survey. The process started by posting an open call [206] for participation on the recruiting agencies homepage (HP) and Facebook page. All the opinions of the citizens were collected over a 2-week period around the time of participant's survey completion by SurveyMonkey [294].

Five conditions were set while designing nomination questionnaire: (1) age (the subjects must be in their 30s); (2) education (the subjects must be with postgraduate); (3) access to stable internet and PC; (4) good writing skills (For Japanese side, the subject must write in Japanese, and for Afghanistan side, the subject must write in English). We set these two languages because our system NLP (natural language processing) and document summarization system can only understand English and Japanese as a natural language, and our system's node and link extractions are based on a deep learning method [9].

A knowledge assessment gained score (KAGS) can also help us to make final candidates' assignments. There are four parts/sections of the nomination questionnaire: (i) consent form and personal information; (ii) discussion theme preferences and (iii) general knowledge about preferred activities/services. Section 1 included consent to agreement and personal information included email ID, gender, age and education. Section 2 contained one question and included 10 elements as ten topics. This is because we wanted to know the candidates' preferences theme and select the themes with similar preference among subjects. As a result, four topics were selected among 10 topics based on mutual interest and preferences of all subjects across subjects of two countries. Section 3 included 18 questions.

Section 2 and 3, questions for dependent variables were presented using Likert scale. Section 2 of the questionnaire included one question and contained 10 topics and each topic included 5 items. Section 3 contained 18 questions and contained 90 items. The Likert scale was distributed in five points, namely 0"strongly dislike", 1"dislike", 2 "don't like", 3"like" and 4"strongly like". The section three are considered as KAGS, and based on 72 scores. The top score was 71 and the low score was 49 out of 72. Each subject for this study. The participants from each country were selected uniformly based on their gender and KAGS. For Japan, the participants were randomly assigned into four groups based on their collective KAGS. For Afghanistan, the subjects were grouped based on Japan side grouping.

II. Pre-discussion Survey

This survey recruited 32 subjects to assess if the subjects understand mandatory tasks and are ready for the actual experiment. The mandatory task was to perform basic tasks.

I. Post-discussion Survey

Finally, we conducted a post-discussion experiment survey. This survey was conducted to test how subjects performed the tasks and prefered our system functionalities, such as the effect of agent, ranking, point system and over all our platform. The post-survey questionnaire was divided into three sections: (i) consent form and personal information; and (ii) performed and preferred tasks; and (iii) evaluate and rating effect of artificial facilitator.

We used SurveyMonkey of Momentive inc. (formerly SurveyMonkey Inc.) [292] for all conducted surveys. The questionnaire was in English for the Afghanistan side, and translated into Japanese language for the Japanese side.

8.9. The Discussion Instrument

An online discussion system based on AF facilitation is the discussion instrument for our study. An online discussion with AF is the online discussion instrument for our social experiments. We conducted two types of online discussion as social experiments: (i) a pilot experiment; and (ii) an actual experiment recruited 16 subjects to analyze their general knowledge and their intention and consent for participation in our study. The main discussion instrument is D-Agree.

I. Pilot Discussion Experiment

Before conducting the actual experiment, we need to perform a pilot experiment where all the participants log into the D-Agree and prove that they can use it smoothly and post meaningful content in the English language. For this task, they can log into the system based on their group assignment. Thus, a pilot experiment was conducted with all recruited participants to ensure the functionality consistency of our system, and make sure that subjects can login and post (comment, like and reply) on the system, and check if the subjects are ready for the actual experiment. We got visits from all participants and they successfully performed all required tasks (e.g., posting, replying to humans and AF and liking).

I. Actual Discussion Experiment

The actual experiment was conducted with the participants (n = 32) over a period of two days. The participants were divided based on their gender assigned to their groups *(n* =4) based on trial setting. As illustrated in Figure 8.2 and Table 8.1, a group contains 4 participants (females = 2; males = 2) and will be assigned to predefined discussion space on D-Agree. Each group will discuss four topics, each topic for an hour.

A trial consisted two groups, based control and treatment. For each topic, there were two trials, as control and treatment groups. For topic one, group A and C were placed as trial 1 and 2 of control groups ,and group B and D set as treatment groups of trial 1 and 2. For topic two, the position of groups has changed from control to treatment and treatment to control groups. This is because we wanted to find the effect of topics by changing the control to treatment for the second topic. For topic 3 and 4, we applied the same strategy. Thus, each group set twice as control and twice as treatment groups while comparing it with other treatment and control groups. Apart from that, all control groups' facilitation ratio is set to 1:1 ratio, while the treatment facilitation ratio is set as 1:3 and 1:5, once per group. All participants start the discussions around the same time, evening time on weekends.

There was expectation that core mechanism time encouraged participation of discussion at that timing [256]. Thus, weekends chosen as days of experiment, and two hours timing set from 19:00 to 21:00. The time for one topic discussion was 60 min. Topics discussed online by participants inside their houses using online platform during pre-defined times. The authors decided to not disclose real names and face photos of subjects due to privacy concerns. Thus, we decided to use profile names which are based on the top 10 female and male preference names of the past 30 years among both communities. Apart from that, we used female and male avatar photos as face photos for

all subjects. All the opinions of the citizens were collected over a 4-hours period around the time of participant's discussion completion by D-Agree.

8.10. Motivation and Incentive of Research Subjects

Motivation is mainly divided into two categories, intrinsic and extrinsic [297]. Intrinsic motivation refers to the motivation that is driven by the task and individuals do not rely on external pressure (extrinsic motivation) such as hobbies and personal interest [296]. However, extrinsic motivation is correlated to external pressure [73], however, it has significantly correlated and has an effect on promoting intrinsic motivation. Thus, the type of motivation impacts civic engagement.

To support it, we have to consider monetary reward as extrinsic motivation for participation. Payment reward is given to subjects as remuneration for time and inconvenience of participation, as well as an incentive to participate. Compensation includes remuneration that is monetary, and after careful consideration [297], we decided that the amount of payment should be reasonable across countries, based on the complexities and inconveniences of the study. Higher incentive does improve performance often, typically judgment tasks that are responsive to better effort. In order to avoid the bias of financial incentive across countries, we had set a conditional cash prize of 30 USD per hour and 120 USD for four hours compensation for each research subject. A conditional remuneration per hour means that we have to submit evidence of their works to the accounting office after closing experiments. So it needs to be calculated from the achievements of each subjects. For example, if some of subjects don't achieve minimum requirement (500 chrct./1discussion x4discussion + answer 2 surveys) , we cannot pay full amount of payment to them. Thus, in total we had set payment rewards of 3840 USD as compensation for 32 research subjects of both countries. Note that in our study, subjects paid through recruitment agencies for participating in a research study, and it is recruitment incentive; it is not a benefit of study participation.

8.11. Ethnics Approval and Consent to Participate

Our data collection method compiled with Afghanistan's ministry of public health (MoPH) Institutional Review Board (IRB) committee's ethics board by applying and receiving MoPH exemption letter (IRB no. E.1220.0254). In addition, the ethics

committee at Nagoya Institute of Technology (NITech) issued an exemption letter to this paper's methodology. Apart from that, all respondents gave consent for taking part in an online nomination survey, and we have obtained written informed consent from all 32 respondents before enrolment in two-days experiment and pre- and post-experiments surveys.

Table 8. 1: Characteristic of sampling and sample for the current study.

	Afghanistan	**Japan**
Name of outsourced agency	Jobs.af	Asmarq
Convenience sampling		
Reached audience	64,354	100,314
Responded subject	2,654	9,107
Cleaned data	1,132	2,303
Stratified random sampling		
Conditional subject	280 (female = 140; male = 140)	280 (female = 140; male = 140)
Number of KAGS questions	18	18
Distribution of Likert scale	Five points (0-4)	Five points (0-4)
Gained KAGS for conditional subject	49-71	49-71
Subject selection		
Number of hired subjects	16 (female = 8; male = 8)	16 (female = 8; male = 8)
Breakdown	4 groups (A to D); 1 group (2 men and 2 female); groups with shared KAGS (A B; C&D)	4 groups (A to D); 1 group (2 men and 2 female); groups with shared KAGS (A B; C&D)
Demographics of sample		
Group KAGS	A&B (266; 268); C&D (224; 225)	A&B (266; 268); C&D (224; 225)
Age average	30	33.9
Upper graduate level (%)	100	100
Language	English	Japanese
Number of residence state	16 subjects came from 12 states	16 subjects came from 8 states
Mandatory tasks		
Online discussion forum	D-Agree	D-Agree
Number of discussion hours	4 hours (an hour for each topic)	4 hours (an hour for each topic)
Timing of discussion	19:00~21:00	19:00~21:00
Number of days	Two-days	Two-days
Number of thematic areas	4	4
Minimum characters to post	500 per topic	500 per topic

8.12. Results

The results of the statistical of eight hypothesis are shown in Table 8.16; the results of hypothesis 1 are shown in Table 2-5; the results of hypothesis 2 are shown in Table 8.6 and 8.7; the results of the hypothesis 3 are shown in Table 8.8; the results of the hypothesis 4 are shown in Table 8.9; the results of the hypothesis 5 are shown in Table 8.10; the results of the hypothesis 6 are shown in Table 8.11; the results of the hypothesis

7 are shown in Table 8.12 and 8.13; and the results of the hypothesis 8 are shown in Table 8.14 and 8.15.

I. Hypotheses

As mentioned in the Introduction section, we proposed to study the following seven hypotheses:

We relied on independent-samples t-tests, ANOVA tests, and post-hoc tests-when required- were conducted to compare group and multiple groups means.

Hypothesis 1 (H1). Agent-mediated discussion has a more significant impact on discussion with groups of people having extensive knowledge on discussion topic (A & B; high KAGS score) (hereafter called as experts), compared with groups of people having moderate knowledge on discussion topic (C & D; low KAGS score) (hereafter called as public), in both DC (Japan) and LDC (Afghanistan).

When compared group A (experts) with D (social group) in all four themes combined, group ‘A’ (M = 22.31, SD = 8.50) showed a significant difference from group ‘d’ (M = 10.06, SD = 3.45) in DC, t (30) = 2.042, p = .000 (two-tailed) (Table 8.1). LDC, similarly, showed significant results, t (30) = 2.042, p = .022 (two-tailed), when the means of group ‘a’ (M = 16.56, SD = 12.12) and ‘d’ (M = 9.12, SD = 2.41) were compared (Table 2). The replies were similarly more for the expert group (b) when compared with non-expert (c) in both DC and LDC, but they were not significantly different (Table 3 and 4). Thus, parallel to the hypothesis, it can be concluded that AI facilitation in DC and LDC encourages more discussion within expert groups than public groups. The results of the quantified data of the three discourse themes are shown in Table 8.2, Table 8.3, Table 8.4, and Table 8.5.

Table 8. 2: Comparing Group A with Group D (Japan).

	Group a	*Group d*
Mean	22.3125	10.0625
SD	8.506615073	3.453862572
Variance	72.3625	11.92916667
Observations	16	16
Pooled Variance	42.14583333	
Hypothesized Mean Difference	0	
df	30	
t Stat	5.337080575	
P(T<=t) one-tail	4.49605E-06	
t Critical one-tail	1.697260887	
P(T<=t) two-tail	8.99E-06	
t Critical two-tail	2.042272456	

Significant at p < .05 (2-tailed)

Table 8. 3: Comparing Group A with Group D (Afghanistan).

	Group a	*Group d*
Mean	16.5625	9.125
SD	12.12693284	2.418677324
Variance	147.0625	5.85
Observations	16	16
Pooled Variance	76.45625	
Hypothesized Mean Difference	0	
df	30	
t Stat	2.405832989	
P(T<=t) one-tail	0.011252465	
t Critical one-tail	1.697260887	
P(T<=t) two-tail	0.02250493	
t Critical two-tail	2.042272456	

Significant at p < .05 (2-tailed)

Table 8. 4: Comparing Group B with Group C (Japan).

	Group b	*Group c*
Mean	9.8125	9.375
SD	3.390550594	2.62995564
Variance	11.49583333	6.9166667
Observations	16	16
Pooled Variance	9.20625	
Hypothesized Mean Difference	0	
df	30	
t Stat	0.407832347	
P(T<=t) one-tail	0.343146381	
t Critical one-tail	1.697260887	
P(T<=t) two-tail	0.686292763	
t Critical two-tail	2.042272456	

Significant at $p < .05$ (2-tailed)

Table 8. 5: Comparing Group B with Group C (Afghanistan)

	Group b	*Group c*
Mean	20.52631579	14.94736842
SD	8.203403765	3.77657252
Variance	275.374269	131.2748538
Observations	19	19
Pooled Variance	203.3245614	
Hypothesized Mean Difference	0	
df	36	
t Stat	1.205921796	
P(T<=t) one-tail	0.117856897	
t Critical one-tail	1.688297714	
P(T<=t) two-tail	0.235713794	
t Critical two-tail	2.028094001	

Significant at $p < .05$ (2-tailed)

Hypothesis 2 (H2). Compared with DC expert groups, LDC expert groups have greater impact on discussion development with AI facilitation.

Two groups of experts from Japan were compared with two groups from Afghanistan, considered as DC and LDC respectively, regarding their posts and replies (Table 5). The results show a significant difference at the $p < .05$ in discussion development by expert groups in DCs and LDCs (Table 6), F (3, 60) = 2.75, $p = .001$. A Post Hoc test showed that a significant difference existed in group A-Jpn with B-Afg and A-Afg with B-Jpn. In contrast with the hypothesis, DCs expert groups-Jpn had more overall posts-plus-replies than LDCs. The results of the quantified data of the three discourse themes are shown in Table 8.6 and Table 8.7.

Table 8. 6: ANOVA test for comparing Expert (AFG: A&B) with Expert (Japan: A&B)

Groups	*Count*	*Sum*	*Average*	*Variance*		
Column 1	16	265	16.5625	147.0625		
Column 2	16	229	14.3125	67.29583		
Column 3	16	357	22.3125	72.3625		
Column 4	16	157	9.8125	11.49583		
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1296.75	3	432.25	5.797798	0.001506892	2.758078296
Within Groups	4473.25	60	74.55416667			
Total	5770	63				

Significant at p < .05 (2-tailed)

Table 8. 7: Post-hoc test for Expert group difference in AFG and JPN.

Groups	p-value (T test)	Significant
afg a v afg b	0.543379	NO
afg a v jpn a	0.130984	NO
afg a v jpn b	0.0402378	YES
afg b v jpn a	0.0110744	YES
afg b v jpn b	0.051539	NO
jpn a v jpn b	6.356E-06	YES

Significant at p < .05 (2-tailed)

Hypothesis 3 (H3). Compared with DCs social groups, LDCs social groups have a more impact on discussion development with AI facilitation.

Similar to hypothesis two, hypothesis three also compared posts and replies of DC and LDC but this time within social groups (Table 8.8). However, the ANOVA test did not show any significant difference at the $p < .05$ in posts and replies of DC and LDC within social groups, (Table 9), $F(3, 60) = 2.75$, $p = .553$. Thus, a Post-hoc test was avoided. The results of the quantified data of the three discourse themes are shown in Table 8.8.

Table 8. 8: ANNOVA test for comparing number of social groups post and replies (AFG and JPN).

Groups	*Count*	*Sum*	*Average*	*Variance*		
Column 1	16	169	10.5625	14.2625		
Column 2	16	146	9.125	5.85		
Column 3	16	150	9.375	6.916666667		
Column 4	16	161	10.0625	11.92916667		
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	20.5625	3	6.854166667	0.703743316	0.553521351	2.758078296
Within Groups	584.375	60	9.739583333			
Total	604.9375	63				

Significant at $p < .05$ (2-tailed)

Hypothesis 4 (H4). Compared with DCs, LDCs has a more significant impact on discussion development with AI facilitation (average post character).

The number of post characters by all groups in DCs and LDCs were separately totalled (Table 8.10). Then an Independent-samples t-test was conducted to compare their means. According to the results, AI facilitation in LDC (M = 14083.12, SD = 4061.55) had a

significant impact on discussion development in terms of average post character compared with DC (M = 5340.06, SD = 1090.91), t (30) = 2.042, *p* = .000 (two-tailed) (Table 8.9). That means Afghans engage more-write more characters than Japanese with AI facilitation.

Table 8. 9: Compare AFG and JPN posted characters difference.

	Jpn	*Afg*
Mean	5340.0625	14083.125
SD	1090.914202	4061.559239
Variance	1190093.796	16496263.45
Observations	16	16
Pooled Variance	8843178.623	
Hypothesized Mean Difference	0	
df	30	
t Stat	-8.315806549	
P(T<=t) one-tail	1.39162E-09	
t Critical one-tail	1.697260887	
P(T<=t) two-tail	2.78E-09	
t Critical two-tail	2.042272456	

Significant at p < .05 (2-tailed)

Hypothesis 5 (H5). Compared with DC, LDC invest more time in discussing thematic area (average posting time, avg waiting time)?

The average posting time, in minutes, by all groups in DC and LDC were separately totaled (Table 8.12). No significant difference was found between DC (M = 180.68, SD = 27.45) and LDC (M = 181.56, SD = 28.84) average posting time invested in discussing thematic area, t (30) = 2.042, *p* = .930 (two-tailed) (Table 8.13). In other words, the time invested by DC and LDC were not significantly different. The total waiting time for DC was more than LDC (Table 8.14), however, similar to posting time, no significant difference was found between DC (M = 18.23, SD = 3.24) and LDC (M = 17.67, SD = 3.87) average waiting time in discussing the thematic area, t (30) = 2.042, *p* = .657 (two-tailed) (Table 8.10).

Table 8. 10: Compare average posting time between AFG and JPN.

	Jpn	*Afg*
Mean	180.6875	181.5625
SD	27.45109287	28.84202663
Variance	753.5625	831.8625
Observations	16	16
Pooled Variance	792.7125	
Hypothesized Mean Difference	0	
df	30	
t Stat	-0.087901279	
P(T<=t) one-tail	0.465269643	
t Critical one-tail	1.697260887	
P(T<=t) two-tail	0.930539286	
t Critical two-tail	2.042272456	

Significant at p < .05 (2-tailed)

Hypothesis 6 (H6). Compared with the discussion tree of DC, LDC share more discussion thread, elements (average post and elements).

Issues, ideas, pros and cons were totalled for both DC and LDC (Table 8.16). No significant difference was found between the DC (M = 127.62, SD = 104.43) and LDC (M = 16, SD = 67.56) in sharing issues, ideas, pros and cons-all combined, t (30) = 2.042, p = .277 (two-tailed) (Table 8.17). Posts and replies for DC and LDC were separately calculated (Table 8.18). Independent-samples t-test was conducted and no significant difference was found between posts and replies by DC (M = 48.06, SD = 44.57) and LDC (M = 50.62, SD = 22.21), t (30) = 2.042, p = .838 (two-tailed) (Table 8.11).

Table 8. 11: Compare AFG and JPN in sharing IBIS.

	Jpn	*Afg*
Mean	127.625	162
SD	104.4304	67.56528
Variance	10905.71667	4565.066667
Observations	16	16
Pooled Variance	7735.391667	
Hypothesized Mean Difference	0	
df	30	
t Stat	-1.105468943	
P(T<=t) one-tail	0.138871707	
t Critical one-tail	1.697260887	
P(T<=t) two-tail	0.277743415	
t Critical two-tail	2.042272456	

Significant at p < .05 (2-tailed)

Now, the most interesting results comes as bellow:
Hypothesis 7 (H7). Compared with the discussion tree of DCs, LDCs shares more issues and ideas (average IBIS generating).

There was a significant difference in the mean of DC (M = 57.62, SD = 21.92) and LDC (M = 177.37, SD = 81.94) in sharing issues and ideas, t (14) = 2.144, p = .001 (two-tailed) (Table 8.20 and Table 8.21). The results show that LDC (Afg) shared more issues and ideas during the discussions than DC (Jpn) (Table 8.12).
On the other hand, although Japan showed higher total of pros and cons (Table 8.13), no significant difference was found between the number of pros and cons shared by DC (M = 197.62, SD = 108.11) and LDC (M = 146.62, SD = 50.27), t (14) = 2.144, p = .246 (two-tailed) (Table 8.12 and 8.13).

Table 8. 12: Compare mean of shared issues and ideas between AFG and JPN.

	Jpn	*Afg*
Mean	57.625	177.375
SD	21.92153	81.94064
Variance	480.5535714	6714.267857
Observations	8	8
Pooled Variance	3597.410714	
Hypothesized Mean Difference	0	
df	14	
t Stat	-3.993102937	
P(T<=t) one-tail	0.000666986	
t Critical one-tail	1.761310136	
P(T<=t) two-tail	0.001333972	
t Critical two-tail	2.144786688	

Significant at p < .05 (2-tailed)

Table 8. 13: Compare mean of shared pros and cons between AFG and JPN.

	Jpn	*Afg*
Mean	197.625	146.625
SD	108.1149	50.2762
Variance	11688.83929	2527.696429
Observations	8	8
Pooled Variance	7108.267857	
Hypothesized Mean Difference	0	
df	14	
t Stat	1.209813091	
P(T<=t) one-tail	0.123191594	
t Critical one-tail	1.761310136	
P(T<=t) two-tail	0.246383189	
t Critical two-tail	2.144786688	

Significant at p < .05 (2-tailed)

This finding aligns with that of French [2018], which reported that residents in least developed societies demonstrate a higher likelihood of engaging in activities and investing more time in discussing common issues. This may be explained by the fact that residence in informal settlements tends to be associated with greater developmental challenges that necessitate community-wide collaborative efforts to address than residence in formal settlements.

Hypothesis 8 (H8). Compared with agent-mediated discussion in DCs, LDCs shares more ratio of reply for facilitation posts (difference in reply rate by ratio). It means, agent-based facilitation is successful with LDC compared to DC.

The average ratio of reply for agent facilitated post, by all groups in DC and LDC were separately and collectively totalled (Table 8.12). Significant difference of human in reply rate for facilitated post was found between DC (30.5 for 1:1; 38 for 1:3; and 36.6 for 1:5) and LDC (30.4 for 1:1; 71.6 for 1:3; and 88.2 for 1:5). In other words, the ratio of human reply for facilitated posts by DC and LDC were significantly different. The ratio of total replies for facilitated posts for LDC (63.4%) was more than DC (35%). However, in DC (Table 8.14), ratio of reply for facilitated post were not different across facilitation threshold of people, but it was significantly different in LDC. It shows that the performance and automated facilitation agent threshold of people matter in LDC (Table 8.16). The results are shown in Table 8.14 (DCs) and 8.15 (LDCs).

The average ratio of reply for agent facilitated post, by all groups in DC and LDC were separately and collectively totalled (Table 8.12). Significant difference of human in reply rate for facilitated post was found between DC (30.5 for 1:1; 38 for 1:3; and 36.6 for 1:5) (as shown in Table 8.14) and LDC (30.4 for 1:1; 71.6 for 1:3; and 88.2 for 1:5) (as shown in Table 8.15).

Table 8. 14: Ratio of reply for facilitation post (JPN).

	Group A	Group B	Group C	Group D
theme1	86.6666667	14.2857143	25	5.40540541
theme2	46.875	25	16.2790698	20
theme3	57.1428571	15.7894737	16.6666667	21.7391304
theme4	53.5714286	14.2857143	27.9069767	9.09090909
Difference in reply rate by ratio				
1:01	30.5851064			
1:03	38			
1:05	36.6666667			

Table 8. 15: Ratio of reply for facilitation post (AFG).

	Group A	Group B	Group C	Group D
theme1	50	31.25	50	30
theme2	31.372549	70.5882353	40.625	100
theme3	92.3076923	23.6363636	66.6666667	33.3333333
theme4	28.8888889	91.6666667	30.6122449	92.3076923
Difference in reply rate by ratio				
1:01	30.4123711			
1:03	71.6981132			
1:05	88.2352941			

Table 8. 16: Summary of the study proposed hypothesis (H1-H8) results between the Developed and Least Developed Countries using Conversational AI Platform.

	(HI)	(H2)	(H3)	(H4)	(H5)	(H6)	(H7)	(H8)	
(HI)	(+)*								
(H2)		(+)*							
(H3)			(–)						
(H4)				(+)*					
(H5)					(–)**				
(H6)						(–)**			
(H7)							(+)*		* p<=0.05
(H8)								(+)*	

(+) positive, (–) negative are found (mentioned in the text). The results were found by comparing internal groups and multiple groups means between developed country (Japan) and least developed country (Afghanistan) using Independent-samples t-tests, ANOVA tests, and post-hoc tests-when required.

II. User Satisfaction from Agent Performance and Expression of Facilitated Comments

We used post-discussion questionnaires to evaluate the satisfaction of the system's users in terms of agent performance [35]. Typical questions were of the form "How the facilitation characteristics (expression of facilitated agent's comments) influence engagement in your group?". The participants had to select their level of satisfaction from a great deal (5), a lot (4), a moderate amount (3), a little (2), and none at all (1). In the results of LDC (Afg) and DC (Jpn) users satisfaction score, illustrated in Figure. 8.4. The satisfaction scores had a significant difference, 4.18 for LDC (Afg) users and 2.11 for DC (Jpn) users. This suggests that users in LDC experienced satisfying discussions managed by the automated facilitation agent compared to DC users.

We also noted that the LDC users achieved the highest satisfaction score, and the effect of agent and the percentage of feeling effect of agent was very low in Japan compared to Afghanistan. This is very interesting findings.

We believe this is due to the consensus policy effect in which the agents support and motivate people to post well-thought-out comments. The studies reported that residents in least developed countries demonstrate a higher likelihood of engaging in activities and investing more time in discussing common issues [194], and if we set the conversational agent's behavior based on consensus policy then it engages people in communities in crisis to have a positive impact towards the facilitator [37]. These results support and are in a very good agreement with Hypotheses 1.

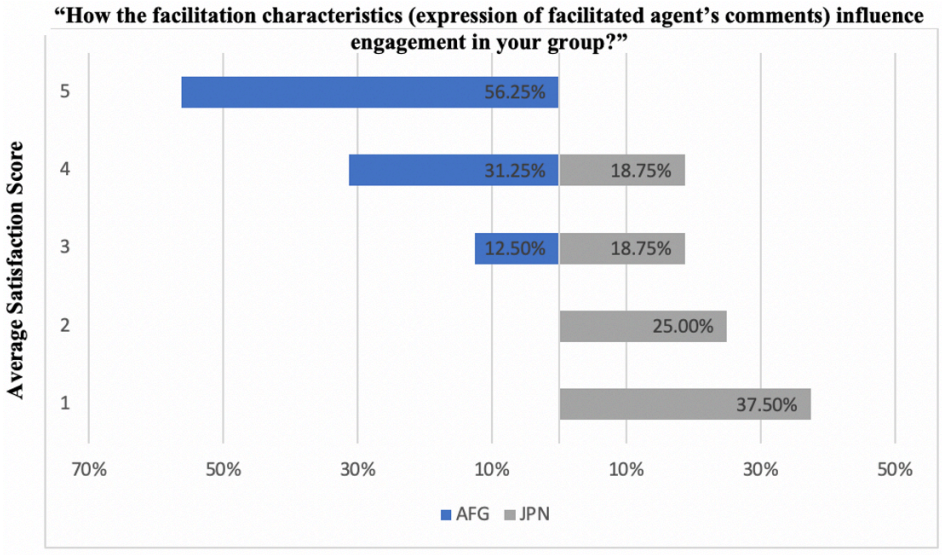


Figure 8. 4: Comparing users satisfaction score between AFG and JPN.

III. User Satisfaction from usefulness of System

We also used post-discussion questionnaires to evaluate the satisfaction of the system's users in terms of system performance and usefulness [35]. Typical questions were of the form "How would you rate the usefulness of D-Agree platform?". The participants had to select the system level of usefulness from a range of 1-100.

In the results of LDC (Afg) and DC (Jpn) system usefulness score, illustrated in Figure 8.5. The system usefulness scores had significant differences among users of LDC and DC, 92 for LDC (Afg) users and 68 for DC (Jpn) users. This suggests that users in LDC experienced the satisfaction of using D-Agree as a digital participatory platform compared to DC users. This is very interesting as well, and correlated with results mentioned above.

We believe this is due to the residents in least developed countries demonstrating a higher likelihood of engaging in activities and investing more time in discussing their common issues compared to DCs. The results support and are in a very good agreement with Hypotheses 1.

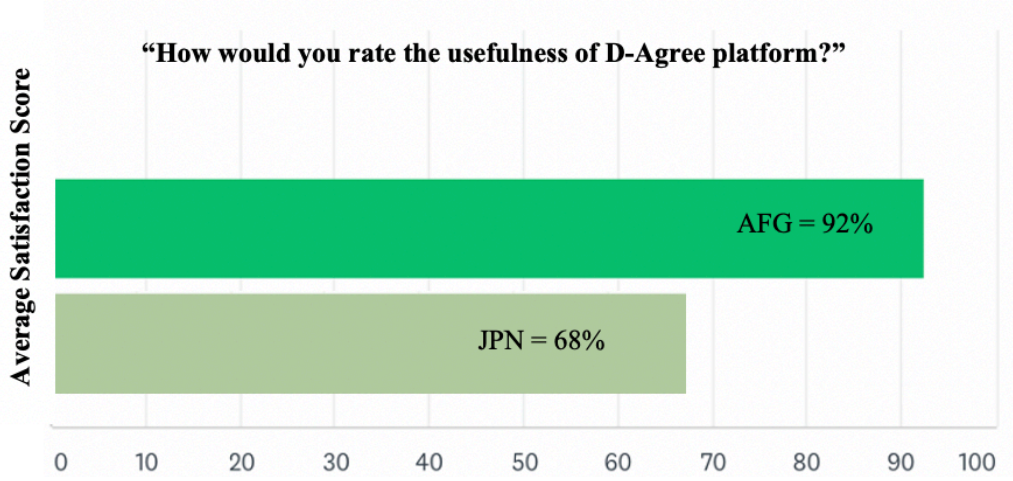


Figure 8. 5: Comparing system's usefulness satisfaction scores between AFG and JPN.

8.13. Discussion

First, the comparison of average discussion components with DC and LDC suggests that the agent-based mediation in LDC were compared to DC both in terms of IBIS generation (number of ideas) and ratio of reply to facilitated post. This evolution could be a precondition on how discussions evolve towards a divergent deliberation with the groups

having agents as facilitators in online discussion with social culture differences. Second, the discussion in LDC were centred around issues and solutions and in DC were centred around arguments (pros and cons). This is very interesting and in fact align with the fact on the ground.

This finding aligns with that of French [194] in Afghanistan, which reported that residents in least developed countries demonstrate a higher likelihood of engaging in activities and investing more time in discussing common issues. However, here discussion in LDC, were centred both around raising issues and its solutions.

The number of solutions (ideas) increased because the agent facilitated messages encouraging participants to devise solutions rather than objecting to them. This is because we adopted a consensus policy for proactive agents and implemented a proactive agent to set the conversational agent's behavior based on consensus policy. Based on findings, it is possible to suggest that conversational agent for online discussion in LDC is successful to solicit more solutions compared to DC.

In the discussion tree, blue is Issue, yellow is idea, green is pro, purple is con, facilitator comment is red, other (Startup Message) is grey. The blue square at the top is the theme topic. In group A both AFG and JPN side, females labelled as P1 and P2; and male labelled as P3 and P4 (as shown in Figure 8.6 and 8.7). In group B, females labelled as P5 and P6; and male as P7 and P8 (as shown in Figure 8.8 and 8.9). In group C, females labelled as P9 and P10; and male labelled as P11 and P12 (as shown in Figure 8.10 and 8.11). And finally, in group D, females labelled as P13 and P14 and male labelled as P15 and P16 (as shown in Figure 8.12 and 8.13).

8.14. Chapter Concluding Remarks

To conclude, the agent-mediated discussion had an effect on the leading nature of the discussion as well as the interactions between the participants in both DC and LDC, however, agent performance in LDC were successful in terms both encourage participants to devise solution rather than objecting to them, and also ratio of reply to facilitated post.

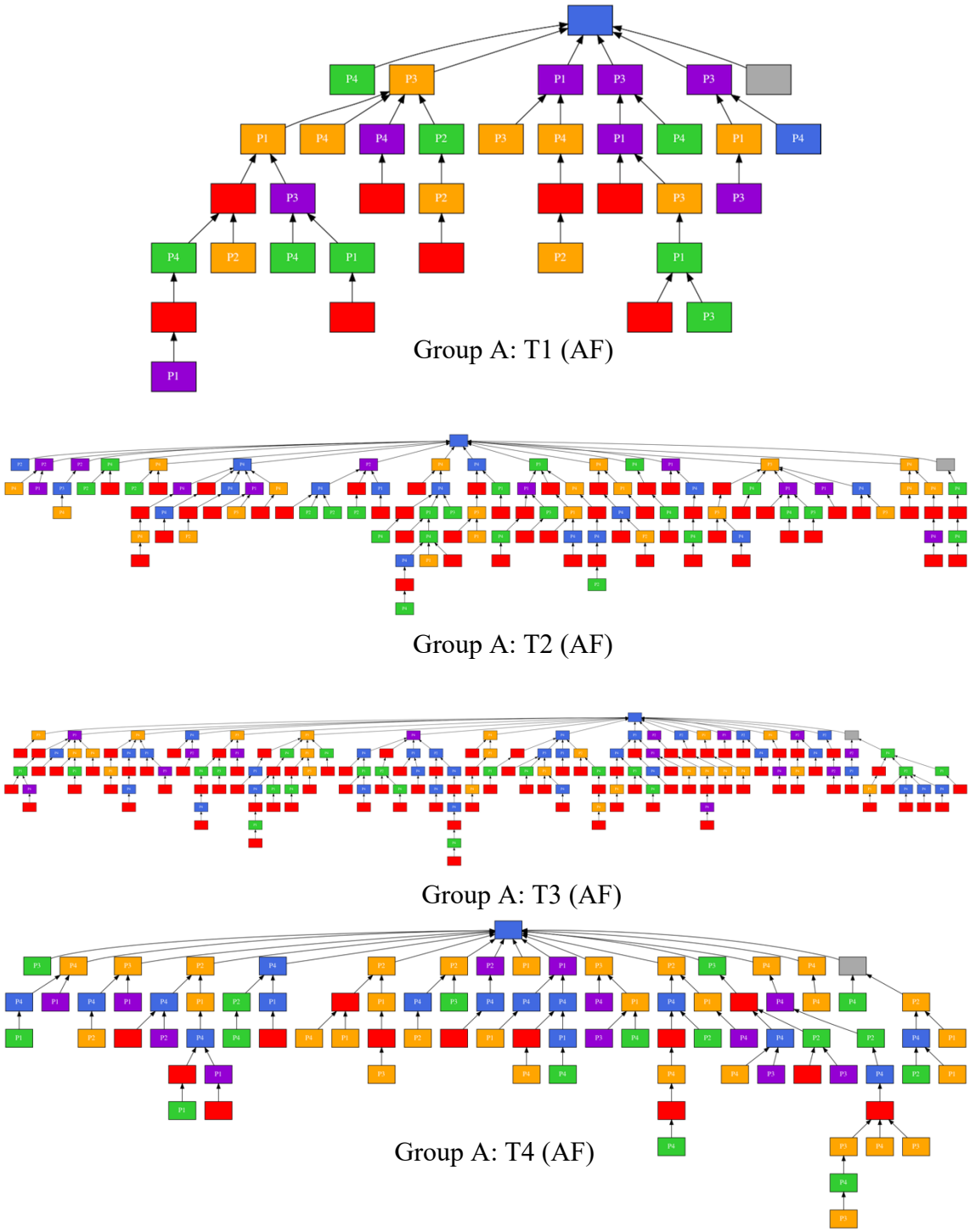
The investigation revealed that the discussion with facilitation, promoted discussion developing in least developed countries compared to developed country. It means that this experiment extended the scope of empowering communities in crisis with agent-based facilitation, and we uncover a silent effect as a proxy for devising sustainable issues within online discussion in least developed communities.

From this chapter the following summary can be made:

- For the evaluation of groups with extensive knowledge and groups with moderate knowledge on discussion theme, we found that agent-mediation discussion was successful with groups of having extensive knowledge compared to moderated knowledge on discussion theme.
- For evaluation of the ratio of human reply for facilitated posts, we found that agent performance was successful in LDC compared to DC. For LDC, we cannot find an especially efficient ratio. No matter which threshold of people (ratio 1:1; 1:3; or 1:5) is used, the effect of the facilitator does not change much on the Japanese side. Interestingly, and ironically, the facilitation threshold of people matters on the LDC side.
- Indeed, looking at threshold of people, threshold of 1:5 recorded the highest ratio(88.2) points) among other two facilitation thresholds of people (71.6 for 1:3; and 30.4 for 1:1).

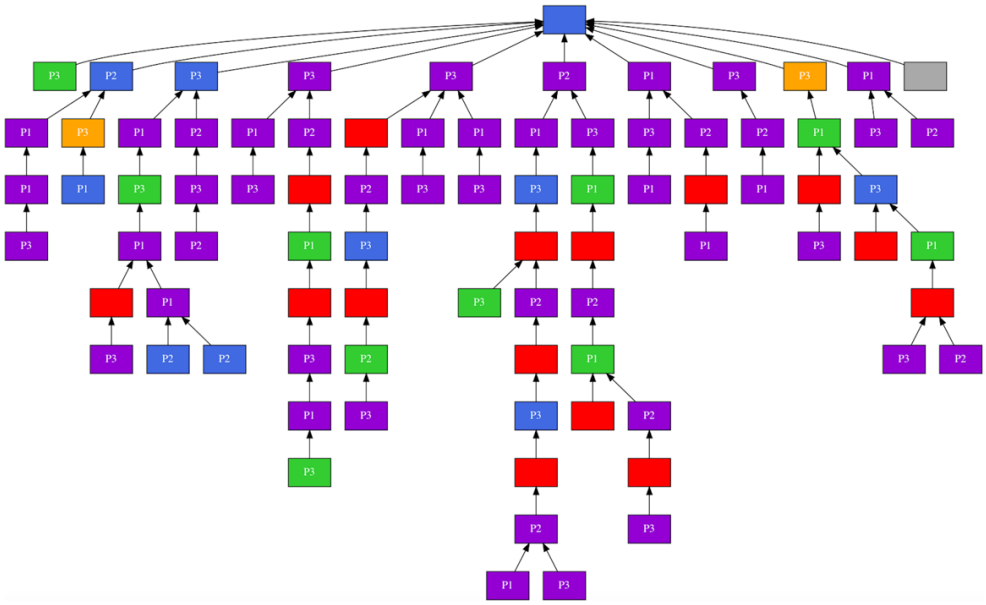
- Conversational agent's behavior based on consensus policy were successful in LDC compared to DC. This means that agents can motivate groups of individuals to engage and come together to devise solutions on LDC side compared to DC. As a result, the number of solutions were higher in LDC compared to DC.

If you check the discussion element while looking to obtained discussion trees from LDC and DC, you can observe the obtained discussion trees from LDC, and it contains more issues and ideas compared to DC.
Demonstrated, the obtained discussion trees as bellow:

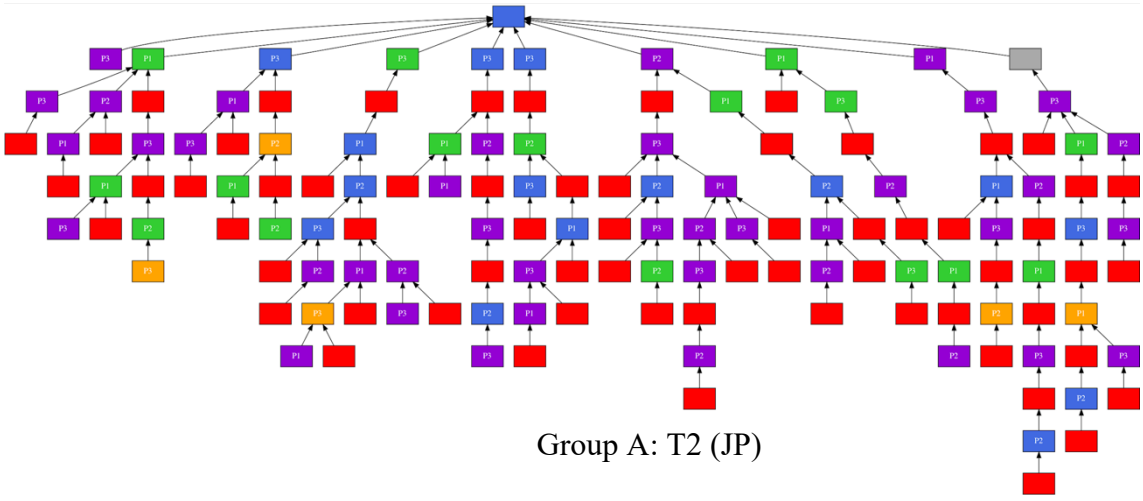


Note: T stands for Topic; female labelled as P1 and P2; and male as P3 and P4. In the discussion tree, blue is Issue, yellow is idea, green is pro, purple is con, AI facilitator comment is red, other (Startup Message) is grey. The blue square at the top is the theme topic.

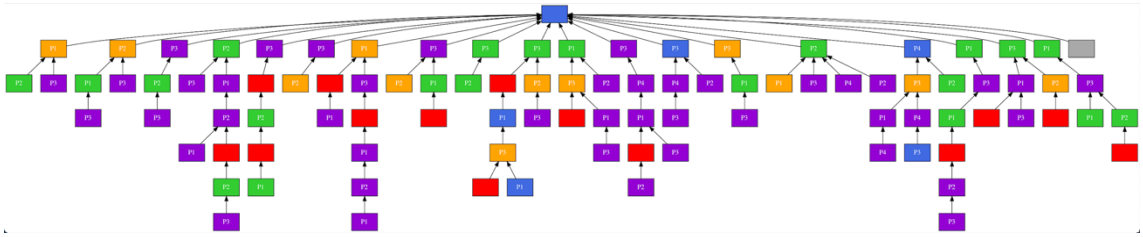
Figure 8. 6: Obtained discussion trees from group A (AFG).



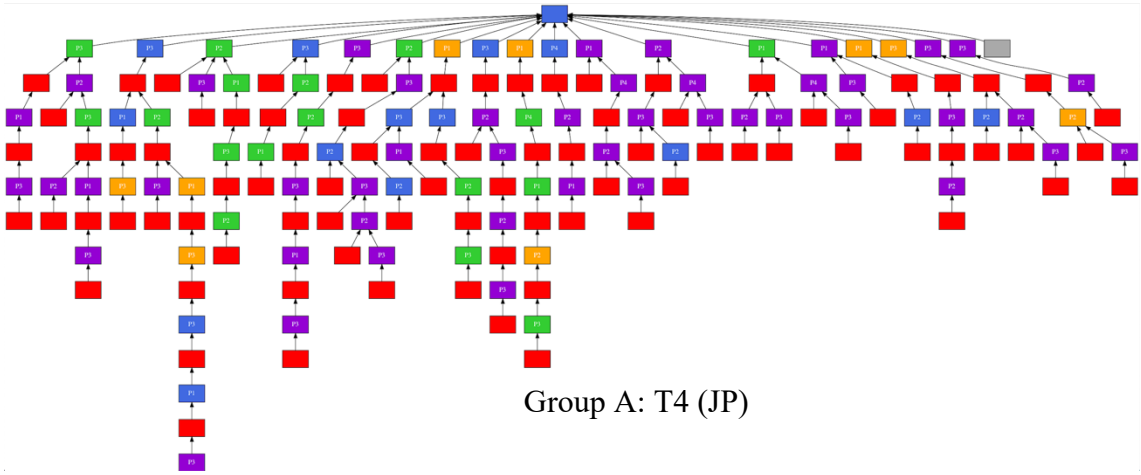
Group A: T1 (JP)



Group A: T2 (JP)



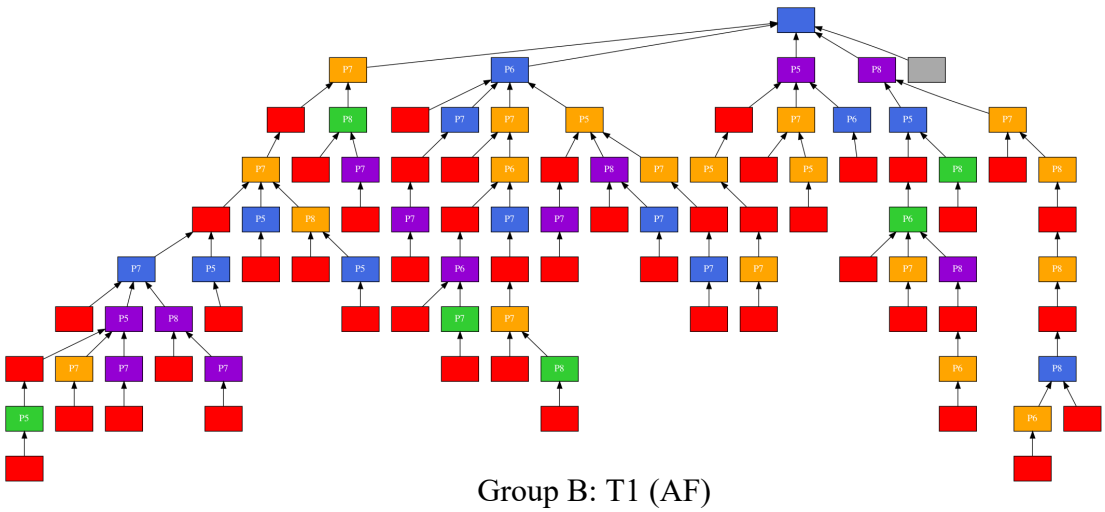
Group A: T3 (JP)



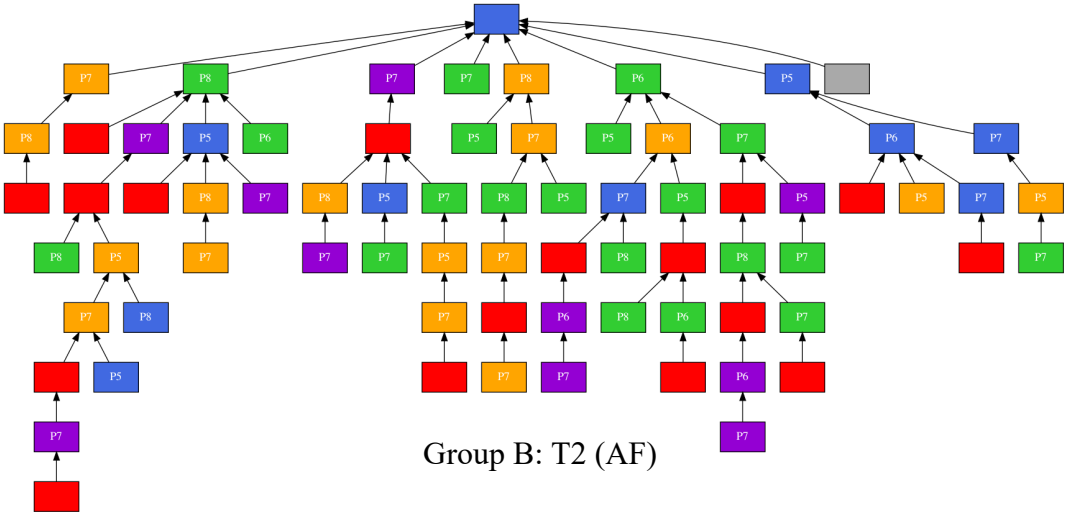
Group A: T4 (JP)

Note: T stands for Topic; female labelled as P1 and P2; and male as P3 and P4. In the discussion tree, blue is Issue, yellow is idea, green is pro, purple is con, AI facilitator comment is red, other (Startup Message) is grey. The blue square at the top is the theme topic.

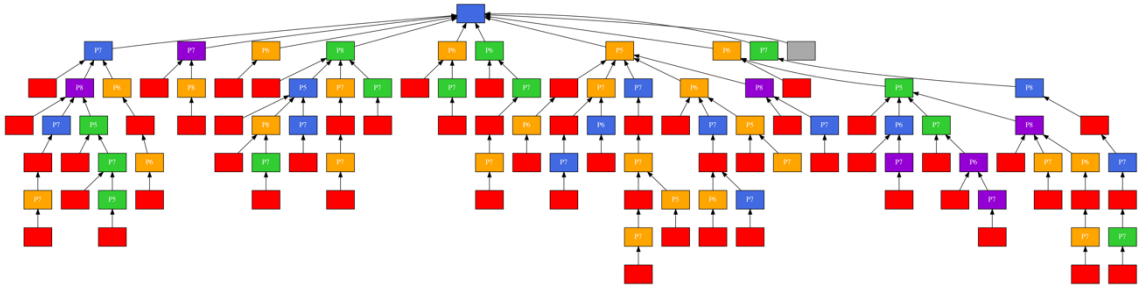
Figure 8. 7: Obtained discussion trees from group A (JPN).



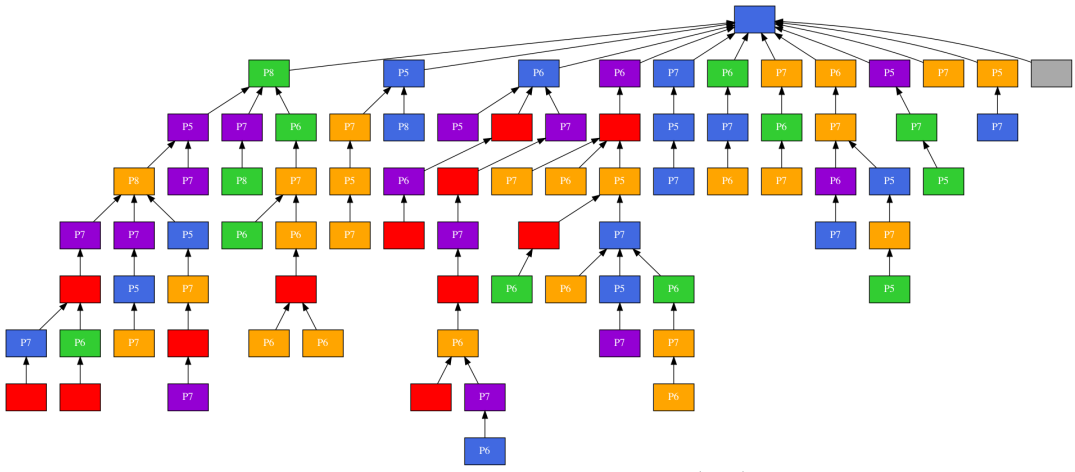
Group B: T1 (AF)



Group B: T2 (AF)



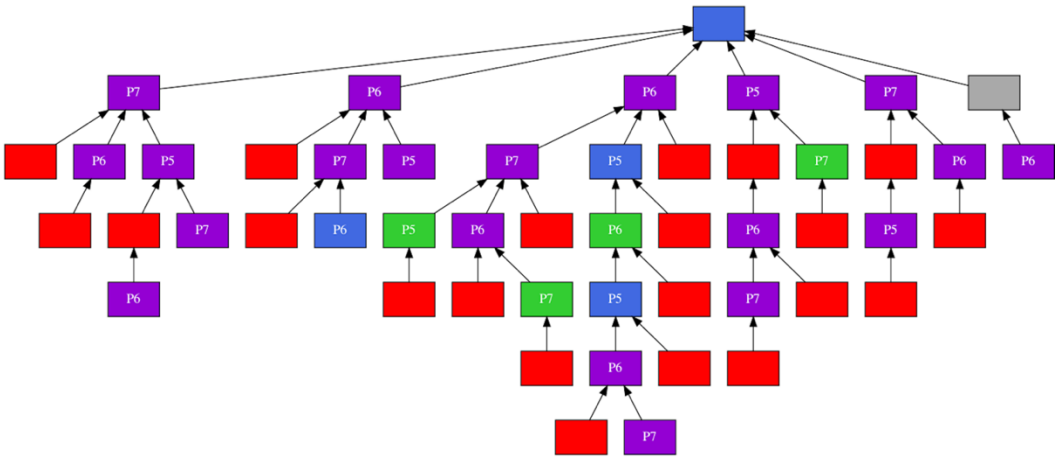
Group B: T3 (AF)



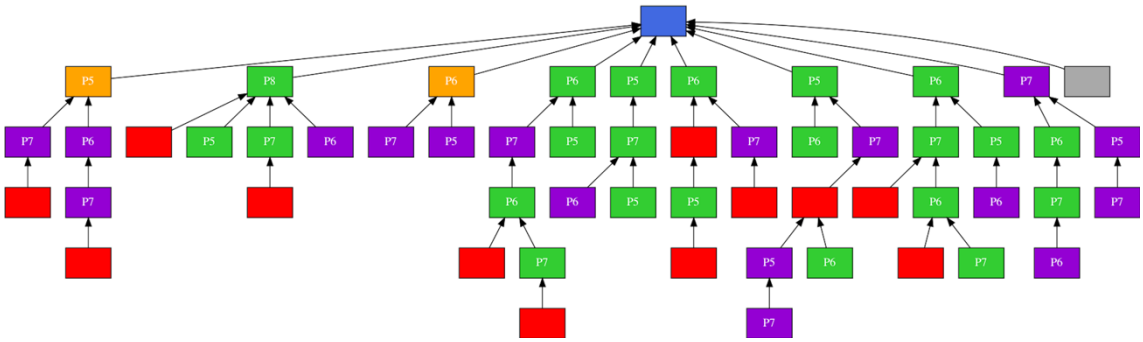
Group B: T4 (AF)

Note: T stands for Topic; female labelled as P5 and P6; and male as P7 and P8. In the discussion tree, blue is Issue, yellow is idea, green is pro, purple is con, AI facilitator comment is red, other (Startup Message) is grey. The blue square at the top is the theme topic.

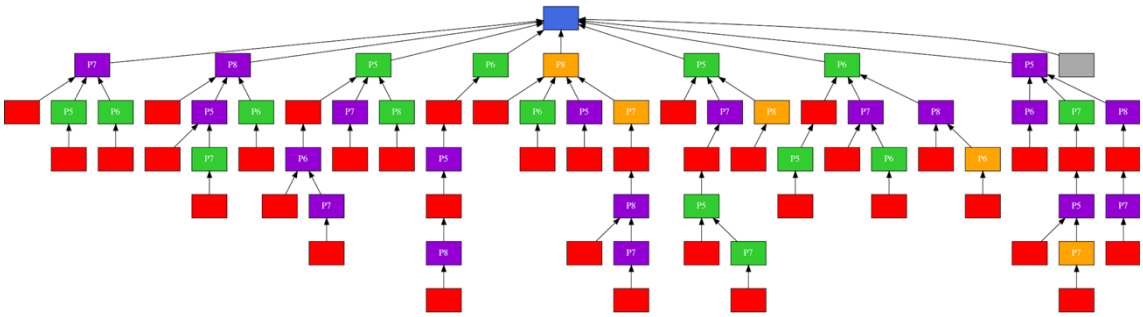
Figure 8. 8: Obtained discussion trees from group B (AFG).



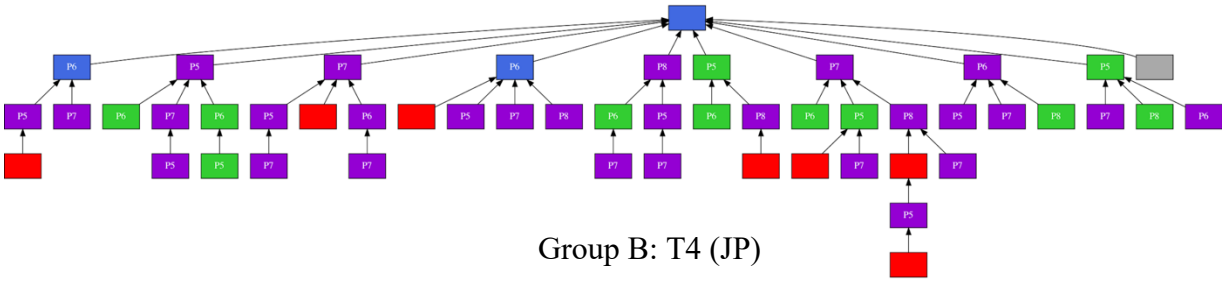
Group B: T1 (JP)



Group B: T2 (JP)



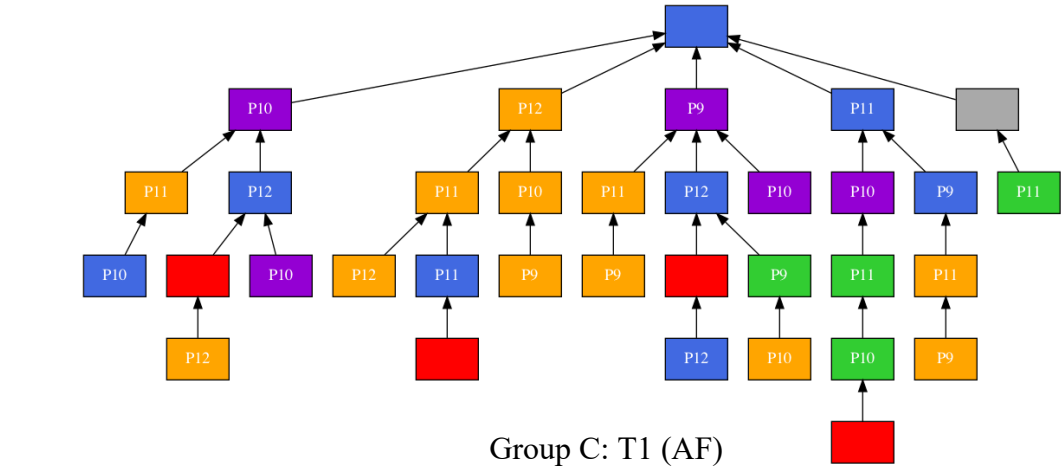
Group B: T3 (JP)



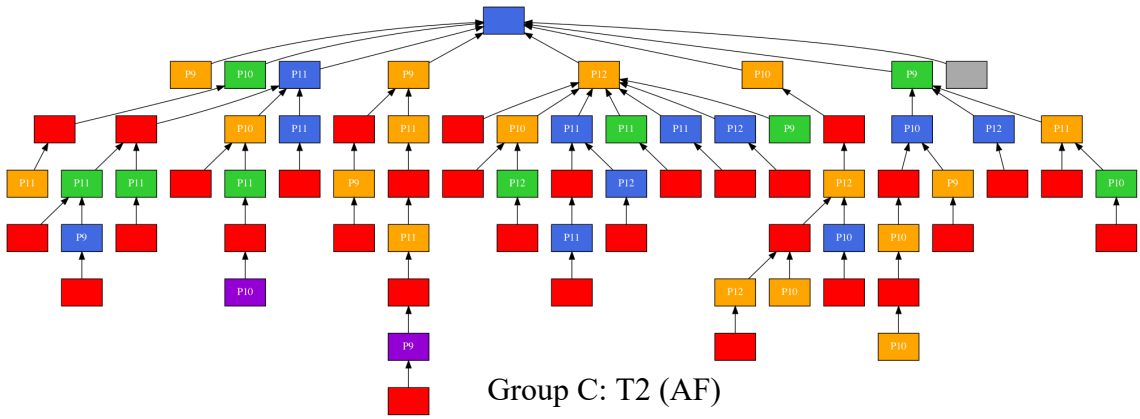
Group B: T4 (JP)

Note: T stands for Topic; female labelled as P5 and P6; and male as P7 and P8. In the discussion tree, blue is Issue, yellow is idea, green is pro, purple is con, AI facilitator comment is red, other (Startup Message) is grey. The blue square at the top is the theme topic.

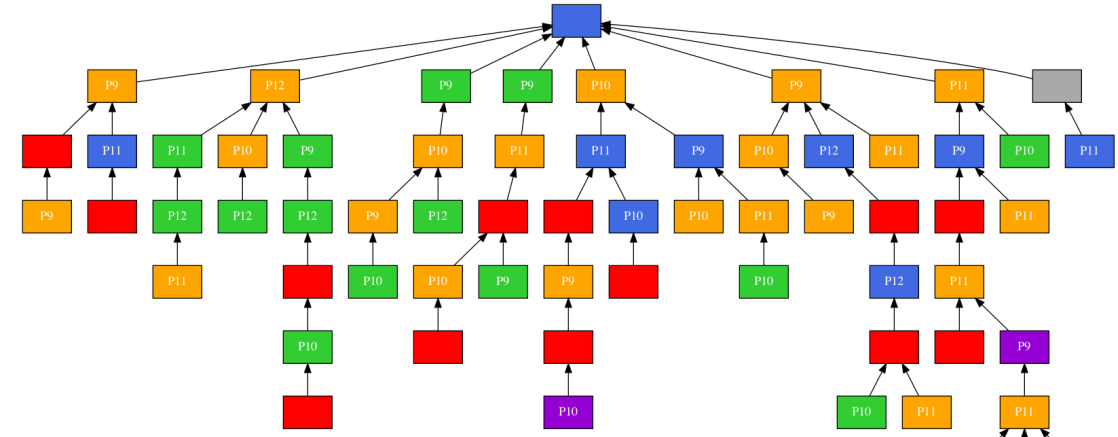
Figure 8. 9: Obtained discussion trees from group B (JPN).



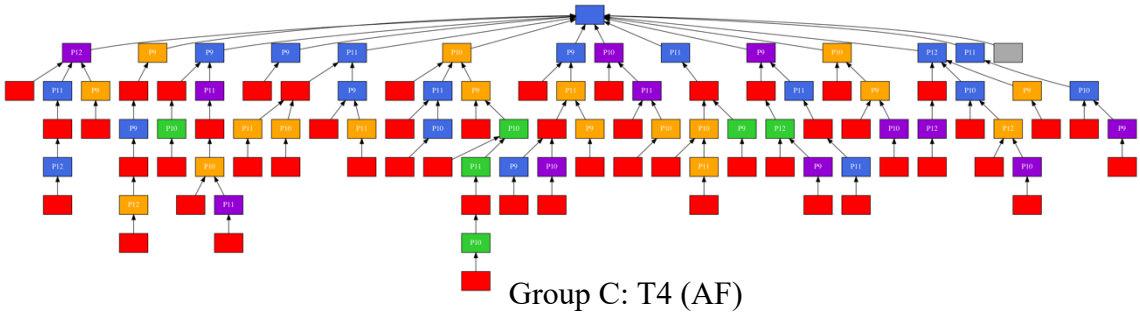
Group C: T1 (AF)



Group C: T2 (AF)



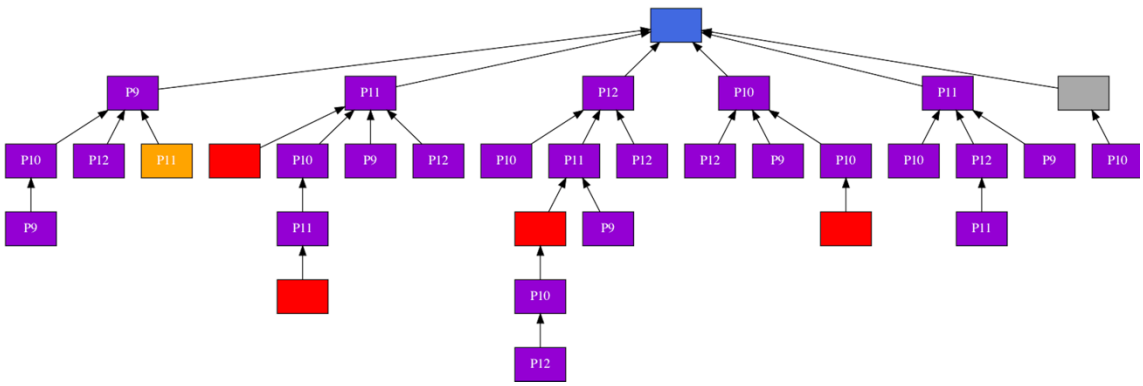
Group C: T3 (AF)



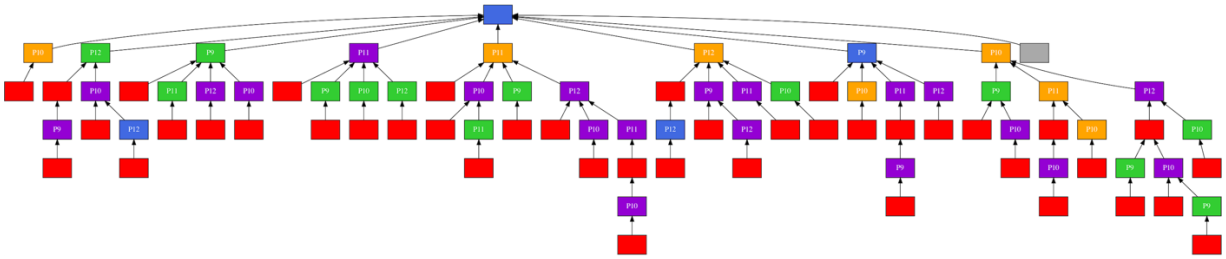
Group C: T4 (AF)

Note: T stands for Topic; female labelled as P9 and P10; and male as P11 and P12. In the discussion tree, blue is Issue, yellow is idea, green is pro, purple is con, facilitator comment is red, other (Startup Message) is grey. The blue square at the top is the theme topic.

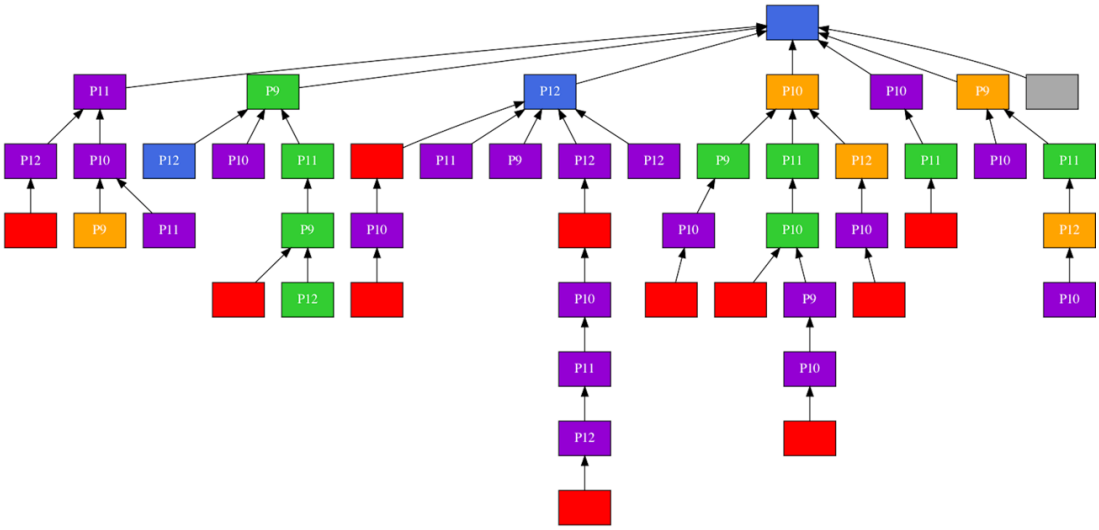
Figure 8. 10: Obtained discussion trees from group C (AFG).



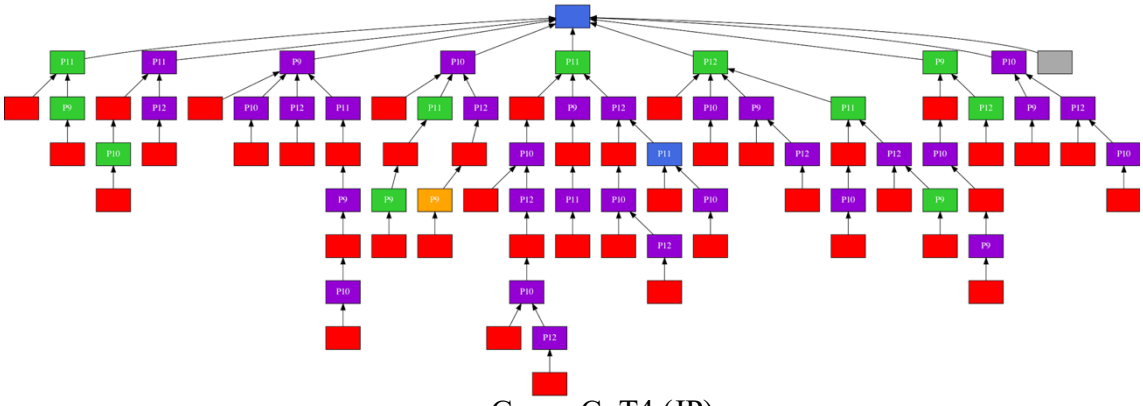
Group C: T1 (JP)



Group C: T2 (JP)



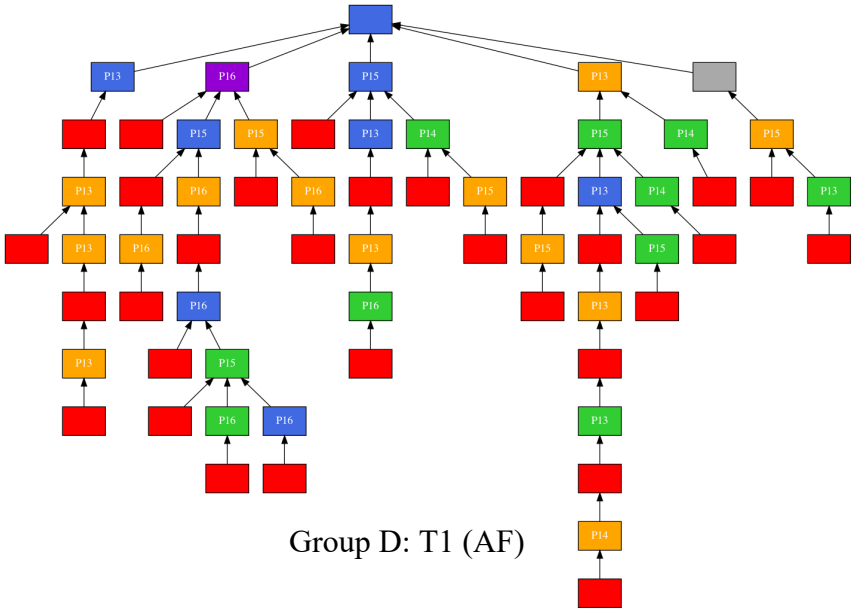
Group C: T3 (JP)



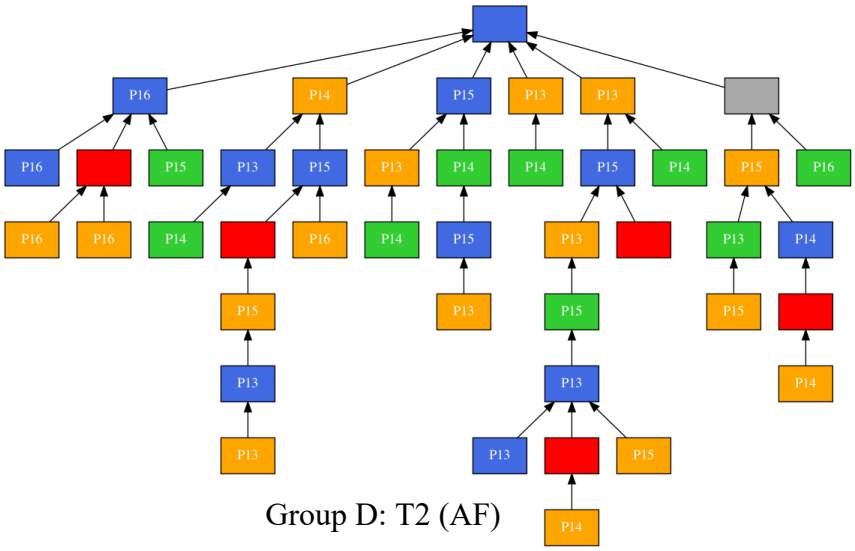
Group C: T4 (JP)

Note: T stands for Topic; female labelled as P9 and P10; and male as P11 and P12. In the discussion tree, blue is Issue, yellow is idea, green is pro, purple is con, AI facilitator comment is red, other (Startup Message) is grey. The blue square at the top is the theme topic.

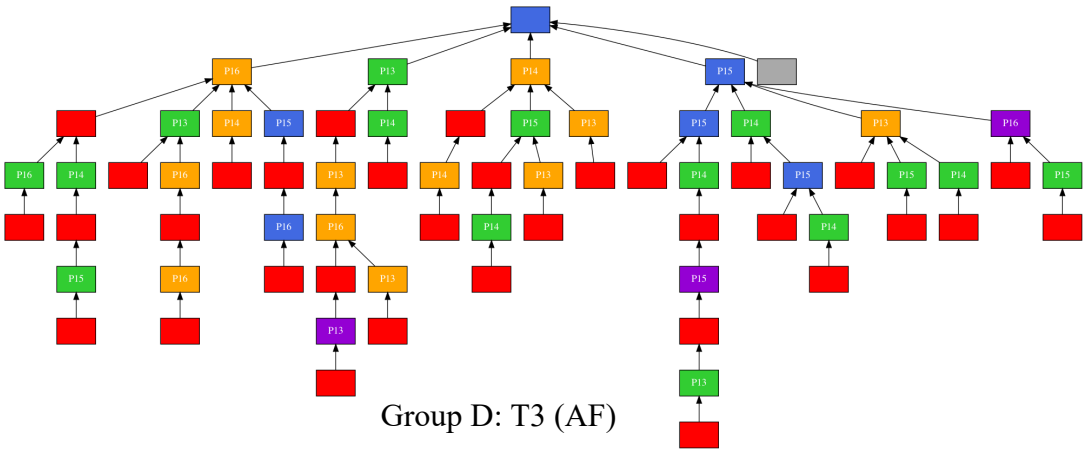
Figure 8. 11: Obtained discussion trees from group C (JPN).



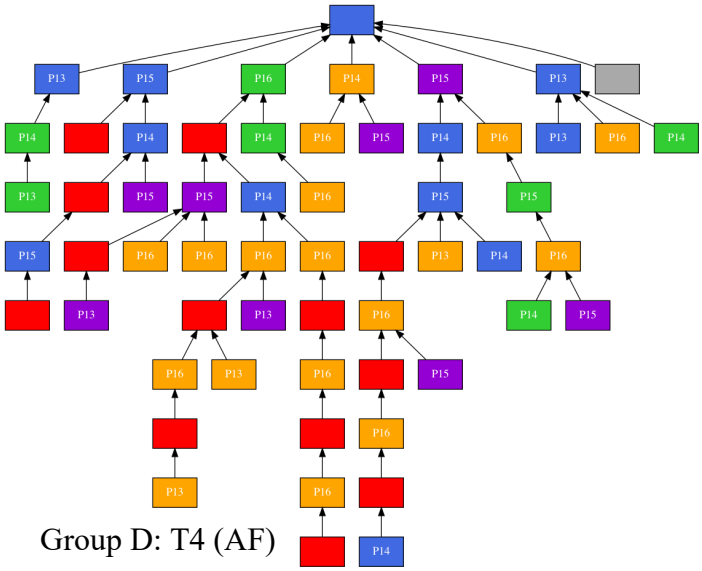
Group D: T1 (AF)



Group D: T2 (AF)



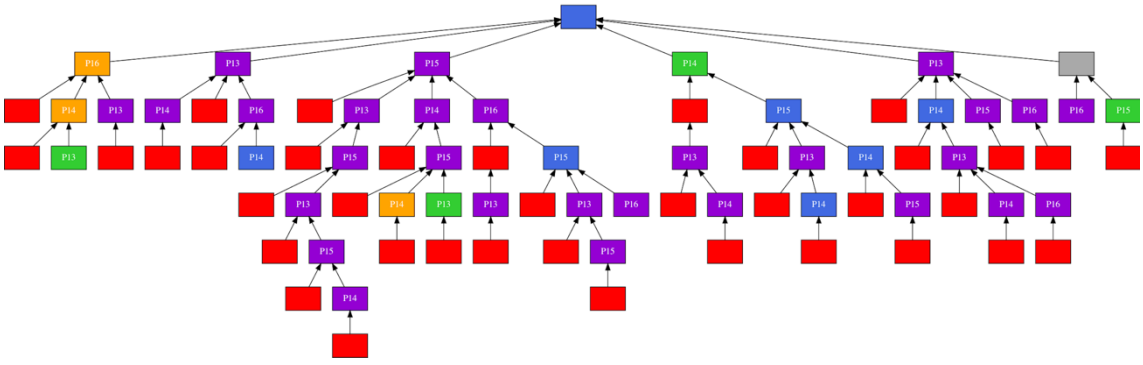
Group D: T3 (AF)



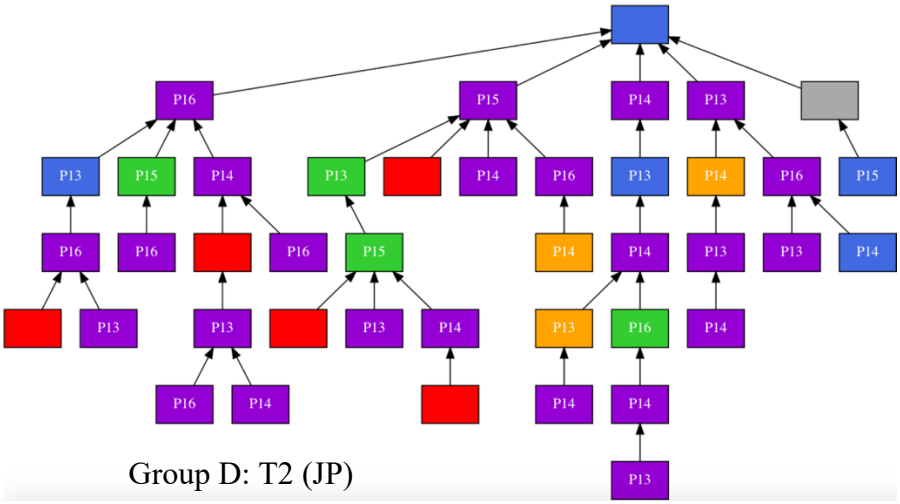
Group D: T4 (AF)

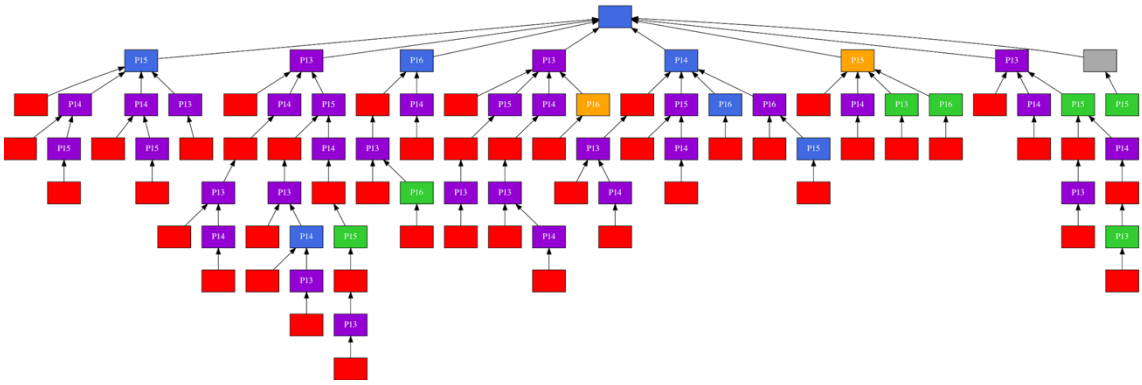
Note: T stands for Topic; female labelled as P13 and P14; and male as P15 and P16. In the discussion tree, blue is Issue, yellow is idea, green is pro, purple is con, AI facilitator comment is red, other (Startup Message) is grey. The blue square at the top is the theme topic.

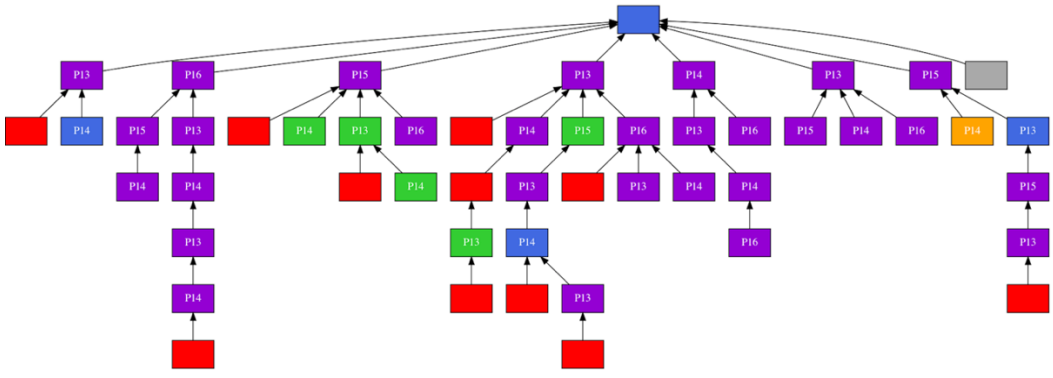
Figure 8. 12: Obtained discussion trees from group D (AFG).



Group D: T1 (JP)







Note: T stands for Topic; female labelled as P13 and P14; and male as P15 and P16. In the discussion tree, blue is Issue, yellow is idea, green is pro, purple is con, AI facilitator comment is red, other (Startup Message) is grey. The blue square at the top is the theme topic.

Figure 8. 13: Obtained discussion trees from group D (JPN).

CHAPTER 9

CONCLUSION

CHAPTER 9: CONCLUSION

This chapter summarizes the dissertation, discusses its findings and contributions in the light of contemporary scholarship and practical utility of our proposed method in Afghanistan, and outlines the prospective points for the future work. First, a short summary of each chapter is given along with its major findings and then, some gaps in current knowledge are articulated to guide future research in this field.

9.1. Summary and Conclusion

This dissertation proposed an experimental digital participatory platform as a framework to guide urban planning developments in the city of Kabul. The framework was based on the widely accepted and applied urban participatory theory, *communicative and deliberative participatory planning* and AI-enabled digital participatory platform. The framework is an attempt to help local municipal governments to provide meaningful participation to enhance social relations by devising solutions that address sustainability problems in Kabul city. This was done by establishing an official and novel developed and developing joint research partnership. To adapt our proposed method to Kabul City, we (1) evaluated our methodology ease of use and usefulness with city management high profile officials; (2) establish an official joint research program, in which Kabul city agreed to officially adopt our proposed method as solution for participatory process in Kabul city; (3) we evaluated the impact of conversational agent on discussion development across class of areas; people, and countries. We also explored the relation between quality opinion submission and discussion development in the idea contest. Accordingly, we conducted a digital participatory planning and explored their applicability for efficient and democratic policy making. The report of the dissertation was organized into nine chapters including the Conclusion Chapter.

Chapter One introduced the background, articulated the purpose of the study, presented the structure of the dissertation and gave a general overview of the trend of urbanization and some of its attendant challenges in Kabul City and role of digital participatory platform to stimulate crowds to come together and work with city to devise

solutions. Additionally, this chapter lays the major remarks, justifications, and objective that was set to achieve in this study.

Chapter Two presented a digital participatory framework based on facilitation in the Context of Kabul, Afghanistan. The author began by examining proposed methodology ease of use and usefulness, paying particular attention to the discussion of our proposed methodology usefulness in the context of Kabul city, where due to security and culture issues collective participation processes are untenable using traditional approaches. In view of the above, we proposed a framework to guide large-scale participatory planning in Kabul City.

Chapter Three identified and discussed impact of conversational agent as facilitator to lead digital participatory process. Hence, an online social experiment was conducted across 22 districts of Kabul City. The online discussion was conducted with and without conversational agent as facilitator using a combined quantitative approach to analyses the efficiency. The results were analyzed using a quantitative method that combines web-based discussion generated annotated data, and statistical analyses.

It was found that the discussion leading towards consensus were positively affected by conversational agents' existence. Accordingly, the study revealed that the discussion with agent-based facilitation works better to motivate participants to engage and devise solutions and are likely to enhance the responsiveness.

Chapter Four investigated the impact of conversational agents on cross-class of area measurement in two types of city areas; (1) formal settlement areas and (2) informal settlement areas. Consequently, two online social experiments were conducted with settlers of both settlement types. The experimental sites were distributed across settlement types included: (a) considered four districts of Kabul as formal settlement areas; (b) another 9 districts as informal settlement areas. A difference between participation across settlement types has been discovered. Despite the constrains and problems in informal areas, still people in those areas were keener to participate in planning process as same as to people in formal areas. Using this finding, it is possible to suggest that conversational AI platform is more successful for communities in crisis than stable communities. This study led us to a new direction to conduct a comparative study in developed and least developed countries, to validate this finding in terms of conversational AI efficiency across countries with socio culture background (Chapter 8).

Chapter Five presented and investigated the impact of conversational agents on cross-class people measurement in two types of people's knowledge stance on discussion topic; (1) participants with prior or extensive knowledge on discussion topic and (2) participation without having prior and extensive knowledge on discussion topic. We

selected COVID-19 related topics and selected health workers as experts and private citizens as public paradigms. Consequently, two online social experiment were conducted.

In Chapter 6 an experimental idea contest studies have been conducted to obtain the information needed for a deep understanding of the relation between "quality opinion submission" and "discussion development in the real-world online idea contest project. A "relationship" between active competitor and discussion development and its impact as extrinsic motive on discussion development has been discovered in this study. This method can be applied to develop ideas for online idea contests.

Chapter 7 presents a detailed case study regarding the policy-decision making and role of our proposed method. The application of the proposed method is extended to identify the issues occurring in the planning process in Kabul city, and its solutions to help policy makers. A comparison is made between private citizens collected insights and people-representative insights analysis. This chapter finds its usefulness in selecting the real-insights based on the citizens' inclusion in societal activities and processes, and found that it is a critical component in the successful implementation of any plan in Kabul city. The study achieved contradiction among citizens and their representatives by comparing their collected insights regarding working and not working functions inside Kabul city. One of the main failures of implementation of plan in Kabul city were not including the citizens in societal activities and processes, and their voices were manipulated by their non-elected representee. One of the major real-world contributions of this study was to gather social insights in collective intelligence to convince Kabul city local government to directly include its citizenry in societal activities and processes, and also change the non-elected representee to direct elected-representees.

Chapter 8 presents the comparison results of conversational AI for online discussion among Japan and Afghanistan. The developed and least developed countries have been selected for this case study. A comparison has been made between the threshold of *n* people facilitation between groups of individuals of both countries. The findings suggested that, people in least developed countries were keener to participate and discuss in online discussion compared to people in least developed countries. Using this finding, it is possible to suggest that conversational AI platforms are more successful to moderate discussion in least developed countries than developed countries. Thus, it is recommended as an efficient moderation tool to lead participatory democracy in least development countries.

In sum, this research focus on Conversational AI for participatory democracy with real-world partnership context. Developed novel framework based on digital participatory conversation systems and novel developed and developing world partnership and

evaluated it in least developed countries such as Afghanistan. The main objective was to promote participatory democracy through research of conversational AI among cross people, areas and countries. Novel contributions include integration of conversational AI facilitation and online crowd interaction context to participatory planning process in Kabul city in partnership with local municipal government, which enables more appropriate facilitation to crowdsourcing and planning with people in Kabul city. The work was published in the Springer JSSSE and Sustainability journals, and also, in ACM CI20, IEEE/WIC/ACM WI-IAT20, JSAI20, AI4SG20 and ACM CI21. It was supported in part by the JST CREST Project, Grant Number JPMJCR20D1, JST AIP Challenge Program 2020 and 2021, and also, in part by the Japanese Government MEXT Scholarship.

9.2. Lessons Learned from Implementation

Kabul city, for the first time in history has been actively engaged to promote citizen-inclusive urban planning and harness the wisdom of the crowds for policy making. Kabul city agreed that the collected insights will be expressed in plans, projects, and activities in the areas of sustainability.

This study conducted the first experimental participatory planning as a case study for participatory democracy in the urban planning process on behalf of the Kabul municipal government using an AI-enabled society platform. We found that Kabul's municipal government's open-call idea that stimulated planning with people may influence the crowd (online communities) into collaborating with the city to find innovative solutions for their common urban problems.
The following are some specific findings:

1. An online direct participation at Kabul city municipal level offers curious insights and can be a complement tool to effectively collect people's insights and concerns about urban policy and decision-making.

2. The methodology as a novel element of develop (Japan) and developing world (Afghanistan) partnership is among the earliest adopted participatory e-planning crowdsourcing tools for urban and public policy in Afghanistan.

3. Our system, artificial intelligence-based facilitation, is the earliest adopted automated facilitation tool in municipal government urban development e-planning practices in Afghanistan.

4. Our gamification of participatory democracy is among the earliest adopted extrinsic motivations in participatory e-planning in Afghanistan.

5. Unlike traditional participatory gatherings from which women are banned, female participants joined our e-planning experiment. We also had many participants from ethnic/religious minorities and achieved meaningful and equal public consultation.

6. Unlike conventional in-person town meeting from human facilitation, bias and interest of groups having key positions cannot be avoided; automated facilitation of participatory e-planning and meeting is comprehensive, acceptable, and more easily implementable.

7. We faced no security or health issues. Gathering people for urban dialogues and large-scale social experiments is risky in an unsafe city like Kabul.

Despite the existing ICTs infrastructure is relatively in good condition in Kabul and successful of D-Agree as a digital participatory society. However, there are a number of channelings such speed and cost of internet access is still an issue. For ease of use, we have to provide easy social login and also provide consistent internet access such as introducing D-Agree's internet package or to allow connections to D-Agree through Facebook's internet service plan or implement free Wi-Fi zones and hotspots [311] in 911 Gozars of Kabul city, all of which make communication easier and affect quality of life. Trying to manage such services within Kabul city successfully would result in a digital society growth of the D-Agree Afghanistan community [309].

The promotion of ease of use and usefulness of D-Agree Afghanistan is required. The more favorable the efficiency and ease of D-Agree Afghanistan, the more successful the digital society would be for policy-making of smart cities. There are some suggestions that might be used to promote ease of use and usefulness of established digital society platforms.

The empirical research conducted throughout this study enabled the author to gain a long track record in conversational AI platforms for collective decision-making

[36, 37, 218, 90], the use of AI for social good [158] [89] [88] (as shown in publication list).

9.3. Suggestions for Further Research

While this dissertation has presented a framework to evaluate and promote digital participatory as a society platform for Kabul City, as a city in crisis, the author acknowledges that there is a possibility of extending the scope of this research. I strongly suggest two types of suggestion, a) suggestions for the D-Agree's engineering team, and b) suggestion for sociotechnical experimentation team.

A few of some of the venues and areas that could merit future research for the D-Agree engineering team are presented below.

1. **There is a need to train node and link extraction other than current version (usefulness):** The suggestion to engineering team (backend) to consider to train the node and link extractions by collecting dataset of discussions conducted in Afghanistan two official languages (Farsi Dari and Pashto) while adding them to the system in the future.
2. **There is a need to promote ease of use of reliable social login (ease of use):** To make opinion collection more reliable engineering team (frontend) needs to increase the ease of use of the social login by adopting the existing login partibilities techniques within social platforms.
3. **There is a need to work on other extraction method (usefulness):** The suggestion to the engineering team (backend) to further work on a GAT method to improve the accuracy of the node and link extractions. Also, should improve the fact-checking and content similarity within D-Agree community.
4. **There is a need to work on other lighter version (ease of use):** The suggestion to the engineering team (backend) to work on system light version to improve the ease-of-use inn LDCs.

A few of some of the areas that could merit future research for the D-Agree engineering team are presented below.

1. **There is a need to evaluate other features of digital participatory platforms, especially for promoting participatory democracy in other cities:** We established a partnership with Kabul and conducted a series of social experiments to evaluate our

used methodology. The author believes these can be examined for other cities like Herat, Mazar Sharif and Kandahar by studying digital platforms, other characteristics and their social efficiency. We need to include more Afghan cities like Kandahar and Herat and upgrade the collaboration level from local to central governments to stimulate participatory e-planning in the country. Our final direction will reframe the system as a participatory-planning social platform, which can maintain a social network, where discussions should be about urban-related planning to offer innovative solutions for improving the city in line with the United Nations' sustainable development goals (SDG-11~13).

2. **There is a need to develop a typical conversational agent for different parts of the city with different population densities and different types of settlements**: The conversational AI platform utilized in this research was mainly based on consensus polity and aimed at the consensus building. Further facilitation plans and policies can be developed targeting different parts of the city with different types of settlements.
3. **There is a need to examine the D-Agree ease of use and usefulness for the application and other countries:** In order to evaluate the efficiency of D-Agree, with different digital participatory tools and across different countries. Thus, further works could examine the strategies for the application of the D-Agree needed to be conducted.

At the end it's very important for us to bring a new conversation to the table about our world, and giving the voice to unvoiced because in LDCs country there are not opportunity to speak out. So, we have to change the current online discussion with the power of autonomous facilitation support where everyone discusses in harmonize way. Conversational AI as representative application of AI technologies can be important when it support traditional human interactions. So, AI technologies are one of the methods for promoting participatory democracy and making citizens and city work together.

"Towards the intelligence social network, making a way for next generation society"

"I believe the change would come"

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[**13**] **Jawad Haqbeen**, Takayuki Ito, Mohammad Arifuzzaman, Takanobu Otsuka, "Joint Routing, MAC and Physical Layer Protocol for Wireless Sensor Networks", *2017 IEEE Region 10 Conference (TENCON),* p.935-940, Penang, Malaysia, November 5–8, 2017.
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[**16**] **Jawad Haqbeen**, Takayuki Ito, Takanobu Otsuka, Mohammad Arifuzzaman, "Traffic adaptive hybrid MAC with QoS driven energy efficiency for WSNs through joint dynamic scheduling mode, *19th IEEE/ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (SNDP),* Busan, South Kora, June 27-29, 2018.
DOI: 10.1109/SNPD.2018.8441079

(Other than Thesis Publication)

International Workshop Papers:

[**1**] **Jawad Haqbeen**, Takayuki Ito and Sofia Sahab, "AI-based mediation improves opinion solicitation in a large-scale online discussion: Experimental evidence from Kabul Municipality", *International Workshop on AI for Social Good (AI4SG) in conjunction with 30th International Joint Conference on Artificial Intelligence (IJCAI),* online, 2021.

[**2**] **Jawad Haqbeen**, Takayuki Ito, Sofia Sahab, Rafik Hadfi, Shun Okuhara, Nasim Saba, Murtaza Hofaini and Umar Baregzai "A Contribution to COVID-19 Prevention through Crowd Collaboration using Conversational AI & Social Platforms", *International Workshop on AI for Social Good (AI4SG) in conjunction with 29th International Joint Conference on Artificial Intelligence (IJCAI),* online, 2020.

[**3**] **Jawad Haqbeen**, Takayuki Ito, Rafik Hadfi, Sofia Sahab, Amiryar and Nishida "Usage & application of AI-based discussion facilitation system for city issues and town meeting: Kabul experimental view", *2nd International Workshop on Agent-based Crowd Decision-making (AgentCrowd2020) in conjunction with 2020 International Conference on Autonomous Agents and Multiagent Systems (AAMAS20)*, May 9, Auckland, New Zealand, 2020.

International Tutorial:

[**1**] Takayuki Ito, Rafik Hadfi, Ryuta Arisaka, **Jawad Haqbeen** and Sofia Sahab, "Towards Hyperdemocracy, AI-enabled Crowd Consensus Making and Its Real-World Societal Experiments" *18th Pacific Rim International Conference on Artificial Intelligence (PRICAI21),* Hanoi, Vietnam, 2021.
https://www.pricai.org/2021/program/tutorials#tutorial_ti
https://sites.google.com/view/pricai2021tutorial/

Invited Talk and Discussion:

[**1**] **Jawad Haqbeen**, "Agents that facilitate online discussions and Its Real-World Societal Experiments", at the Intersection of Human Science and Information Technologies: Cultivating Relationships between Humans & Machines MediaX Theme Day, Jointly organized by Japan Science and Technology and Sandford University, Online, January 20, 2021.

[**2**] **Jawad Haqbeen**, "Agents that facilitate participatory planning in Afghanistan", at the Global Young Scientist Summit (GYSS20), Singapore, January 12-15, 2020.

[**3**] **Jawad Haqbeen**, "Agent that facilitate discussion among people: A large scale discussion in Afghanistan", at Japan Science and Technology SCIENCE AGORA, Tokyo, Japan, January 21, 2020.
https://www.jst.go.jp/sis/scienceagora/2020/planning/planning_2109.html

Awards and Honors

1. Monbukagakusho (MEXT) Scholarship, October 2016–March 2019
2. IEE TENCON17: IEEE Best International Presentation Award
3. PAAMS20: International Conference IBM Excellence Research Award
4. KICSS20: International Conference Best Paper Award
5. KICSS20: International Conference Best Discussant Award
6. JST AIP Program 21: 1,000,000 YEN
7. GYSS20: Recipient of Global Young Scientist Summit
8. KICSS21: International Conference Best Presentation Award