Application of Corpus Retrieval System to Support Public Deliberation in Mangrove Management

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ABSTRACT

This study aims to propose a Corpus Retrieval System for supporting public deliberations and decision making processes in mangrove management by providing a description on how the Corpus Retrieval System works and what advantages can be generated. Mangrove forest is important as common resource. In the sustainable mangrove management, public deliberation helps to find out the resolution of mangrove forest problems by getting mutual understanding among relevant public. Based on the research questions, why public deliberation is needed in mangrove management and how the Corpus Retrieval System support public deliberation, first of all review in concepts of deliberation, governance, and legitimacy is addressed. Consequently, functions of the Corpus Retrieval System are discussed. An analysis for building Corpus Retrieval System is applied to a case, Ramsar convention resolution in Mangrove ecosystems. Finally, the applicability of the proposed Corpus Retrieval System to support practical deliberations is discussed.

Keywords: Common resource, Governance, Legitimacy, Public Deliberation, Corpus Retrieval System.

1. INTRODUCTION

Mangrove forests as common resource have diverse value and function at a wide level, environmental social and economic aspects. Indeed, a wide range of stakeholders having diverse interests involve in mangrove forests. In sustainable mangrove management, it is important to get mutual understanding among relevant public and make available their desirable roles based on their consensus. People are able to understand each others more through communication. The public deliberation means to get mutual understanding as a public communication process. However, not all relevant people can be involved in the deliberation. Even if they do attend the deliberation, it is not easy to get mutual understanding due to limited time and knowledge. Hence, this study proposes a Corpus Retrieval System for supporting public deliberations and decision making processes in mangrove management as providing a description on how the Corpus Retrieval System works and what advantages can be generated. The study has two main questions; (i) why public deliberation is needed in mangrove management, and (ii). how the Corpus Retrieval System supports public deliberation. In order to understand the questions, first of all, literatures on the concepts of deliberation, governance, and legitimacy are reviewed and addressed in section 2. Consequently, functions of the Corpus Retrieval System are discussed in section 3. An analysis for building Corpus

Retrieval System is then applied to a case, Ramsar convention resolution in Mangrove ecosystems and finally the applicability of the proposed Corpus Retrieval System to support practical deliberations is discussed in section 4.

2. BASIC IDEA

2.1 The risk in Mangrove forests as common resource

As mentioned in previous section, mangrove forests as common resource have diverse value and function at a wide level. Indeed, a wide range of stakeholders having diverse interests involved in the usage of mangrove forests. For instance, some people are interested in environmental aspects of making sound mangrove ecosystem such as biomass, a sink of carbon, a living space for animals and etc. And others are interested in social and economic aspects as a generative power of the coastal areas development or as disaster prevention. Those are reasonable enough for the stakeholders to be interested. There is however, a possibility that cognitive dissonance exists around mangrove forests in use. In addition, mangrove forests are limited resources and therefore not all stakeholders are able to use it according to their interests. Along with the over cutting of mangrove threes for using its economic value such as construction materials and shrimp pond, mangrove forests are destroyed. If this situation continues, mangrove forests will no longer serve its purpose and this will decrease its value. This study considers cognitive dissonance in mangrove forest in use and the shortage of mangrove forest as common resources. These two problems are the primary risks in mangrove forests sustainable management. In order to manage the risk of mangrove forests, it is important to make good corporate governance of mangrove areas. It can be derived from public deliberation and help people find legitimacy solutions for problems of mangrove areas by mutual understanding among stakeholders and build a consensus around the sustainable mangrove management.

2.2 Review on Governance, Legitimacy and Deliberation

The term 'Governance' is derived from the Greek word 'Kybernan' and 'Kybernetes'. It means 'to steer and to pilot or be at the helm of things.' [1] People who take the helm can decide for what and to where steers and must have the response of the decision. In general process of governance, in which authority of decision making is hold by an elite coterie such as politicians, bureaucrats and technocrats, public are powerless to influence the decisions that may have far-reaching consequence for their lives and livelihoods. It is known as 'Top-down Governance or Governance by Government.' The main problem of top-down governance is 'Informational Asymmetry.' Decisions based on narrow perceptions of what people want can result in wastage of scarce resources i.e., in the loss of allocative efficiency.[4] Various scholars have proposed alternative governance mechanisms, Bottom-up Governance (or Government without Government), Market Governance, Network Governance, Cooperate Governance, Participatory Governance, and Democratic Governance, which various stakeholders can be represented in participatory processes dealing with socially sustainable development issues. [3],[4]-[7] The common object of alternative governances is to build good and better governance for the relevant public.

What is good and better governance which is both a goal and a process. 'Good governance steers a decision making to legitimacy.'[1] Not only political and administrative decision making but also public choice is piloted to enhancing legitimacy by good governance. The definition of legitimacy has not been settled by consensus. Max Weber (1947) defined it as "the belief in legality, the conformity to the rules which are formally correct and have been imposed by accepted

procedure."[9] Seymour martin lipset (1959) defined it as the 'capacity of the system to engender and maintain the belief' [10] Spencer (1970) say that the essence of legitimacy, whether it be of norms or authority, is the sense of duty, obligation, or 'oughtness' towards rules, principles or commands [9]. Jürgen Habermas (1996, 2000) argued that laws and regulations are legitimate only if all those "who are possibly affected could assent (to their enactment) as participants in rational discourses" and defined it as "a measure of a political order's worthiness to be recognized." From the definitions, it can be said that legitimacy depends on public belief, what public understand and trust. If public believe any rules, laws and regulations are legitimacy, they will obligate and ought towards them. That is to say, 'A governance that public believe it good governance can derive legitimacy.' In addition, improvement in legitimacy is possible through public belief revision. Generally, participations, strategic vision, rule of law, transparency, consensus orientation, equity building, effectiveness/efficiency, accountability, responsiveness, capacity of state, dialogue, social capital and so on are regarded as components of good governance. [2][8][11] Larry (2004) said that these factors in turn breed legitimacy and stability. When governance has at least the characters, perhaps may more components able to improve governance there is, a decision making can get legitimacy. Indeed, public deliberation, a formal process of open dialog, is examined as a system and method of ensuring legitimacy by means of looking to good governance for the relevant public.

How public deliberation can promote governance and legitimacy. Joshua Cohen (1989) argued "for them (members), free deliberation among equals is the basis of legitimacy…because the members of a democratic association regard deliberative procedures as the source of legitimacy, it is important to them that the terms of their association not merely be the results of their deliberation, but also be manifest to them as such" (For philosophical discussions of the importance of manifestness or publicity; Kant(1983), pp.135-9; Rawls(1971), p.133 and section 29; Williams(1985), pp.101-2, 200) [14] He explored the ideal of a deliberative democracy and proposed the ideal procedure as "a free and reasoned agreement among equal" and addressed "ideal deliberation aims to arrive at a rationally motivated consensus – to find reasons that are persuasive to all who are committed to acting on the results of a free and reasoned assessment of alternatives by equals." It is based on the values of fairness or equality of respect. [14]-[15]

Besides, Joseph M. Bessette (1994) defined deliberation as "a reasoning process in which the participants seriously consider substantive information and arguments and seek to decide individually and to persuade each other as to what constitutes good public policy" and argued "every deliberative process involves three essential elements: information, arguments, and persuasion." [16] Amy Gutmann & Dennis Thompson (1996) addressed the core idea of deliberation as 'when citizens or their representatives disagree morally, they should continue to reason together to reach mutually acceptable decisions." , "Deliberation conception is based on three principles-reciprocity, publicity, and accountability." [17] Jon Elster (1998) defined it as follows "Deliberative Democracy includes collective decision making with the participation of all who will be affected by the decision of their representatives: this is the democratic part. Also, all agree that it includes decision making by means of arguments offered by and to participants who are committed to the values of rationality and impartiality." [18] Upon reviewing the concepts of governance, legitimacy and deliberation, it is concluded that their relationship can be regarded as a pair of wheels. The three aspects move together towards one direction. In the meantime, information helps smoothing the move. Figure 1 describes the relations between governance, legitimacy, and deliberation in this study.
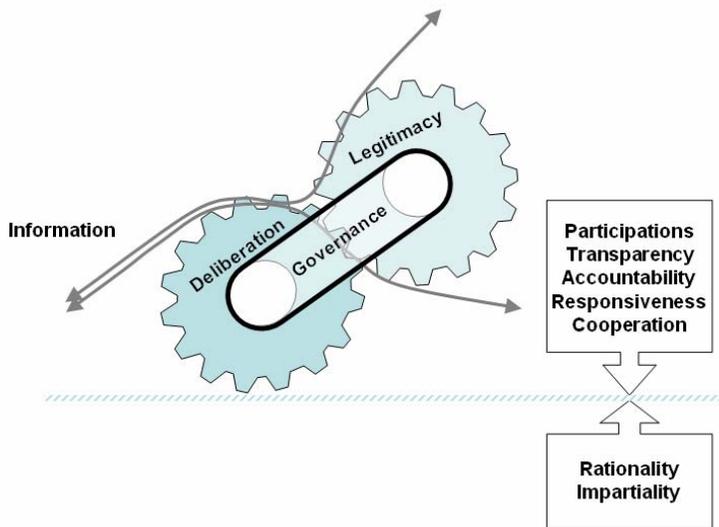
Fig 1 The Relation of Governance, Legitimacy, and Deliberation

The information is derived from both the internal communication process of bargaining, arguing, reasoning, and persuading among deliberation participants and the external side such as mass media, public policy, and public law. Participants in deliberation will judge which information is good and better for them and plan to what information they will offer. The judgments of participants are based on their beliefs produced by their cognitive system. If all participants reach an agreement on what information is good for related public, governance can fosters/makes good decisions based on the information and the legitimacy of the decision can be ensured. Finally, the ideal deliberation can serve participations, transparency, accountability, responsiveness and cooperation for decision making process and rationality and impartiality for decision making result. It can contribute to improve both governance and legitimacy. These three aspects are commonly very important in public management, also in sustainable mangrove management.

2.3 Public Deliberation Problems: Benefits and Risk/Troubles

Public involvement is important in the decision making process of public policy.. One such public involvement, i.e; public deliberation has been examined. Public deliberation is expected to be more and more important as a provision of decision making process of public policy for improving governance and legitimacy. The participation planning process is anticipated to make diverse participants understand each other and to have common concerns, thus enable them to design a sound substitution plan through prior communication in the early stage of making decision of public policy. Effective public deliberations are thought to create civic learning opportunities for participants and observers that presumably add to the health of a democratic polity. [20] There are, however, specific problems in public deliberation: 'Cognitive Dissonance', 'Dilemma between Rigidity and Appropriateness', 'Informational Asymmetry', 'Cascades of False Information', 'Group Polarization', and 'Structured Deliberations'. [19]-[21] These problems are primary obstacles to building a consensus in a decision making process.

Cognitive Dissonance is the phenomenon that "A social problem is considered as different problems/subjects."[22] It is mainly caused by the difference of the interest subject under consideration. As mentioned above, people have diverse interests of

mangrove forest in use. They will have different views about the mangrove area problems. Dilemma between Rigidity and Appropriateness is caused by linguistic habits in language use. On the controversy of the technical and scientific terms (elite terms) of experts, citizenry understands and addresses opinions with daily terms (non-elite terms). The dilemma between 'rigidity and appropriateness' is also one of the reason why cognitive dissonance among participants happens. Informational asymmetry problem in top-down approach planning process can be reduced through the public deliberation, but there is a possibility that another informational asymmetry exists. Though diverse opinions of participants are addressed in the deliberation, it can not say that the information addressed by deliberation participants is right and can represent what major public consider, and it is known as common concerns. This is because the deliberation participants, though experts and professionals, are limited knowledge and the ability to reason. As related deliberation problems, scholars have addressed in 'Cascades of False Information' problem. Sunstein's argumentation (2005) about 'Group Polarization' and 'Structured Deliberations' can be thought as the cause of 'Cascades of False Information' problems. According to his argument, polarization cascades occur when individuals holding the minority opinion in a group adopt the majority opinion for normatively undesirable reasons after deliberating. In some cases, the minority adopts the majority position simply because of the numerical disadvantage of their ideas within the group, as opposed to changing their minds based on the merits of the majority's ideas. In other cases, members of the original minority position move toward the majority position because of cosmetically persuasive arguments, social comparisons, confidence that breed extremism and emotional contagion.[21] Discussion is a way of combining information and enlarging the range of arguments.[23] It is only valid to the deliberation which is under the good governance. If a deliberation has some problems among 'Cognitive Dissonance', 'Dilemma between Rigidity and Appropriateness', 'Informational Asymmetry', 'Cascades of False Information', 'Group Polarization', and 'Structured Deliberations', there will be another risk in a decision making process. It is to commit a fault such as collecting false information, false understanding, making false decisions and persuading fault decisions. Extreme cooperative attitude of participants and the competitive conditions may be more like obstacles of decision making of public policy.

Under the critical view of public deliberation problems, this study focuses on a corpus based discourse analysis as a way to observe whether the deliberation problems occurs in present public involvement process or not and how the problems work and affect a decision making process. Using a data processing technology, corpus of language body can be assessed and formed as a computational information resource. As a result, the corpus based discourse analysis can deal with a huge language data, a qualitative data of descriptive information. The computational processing of discourse analysis is meaningful to be used as a statistical tool. A result derived from the corpus based discourse analysis can be adopted as an objective scheme in order to estimate public deliberation. Moreover, it may contribute to prevent arbitrary assessment of investigator in discourse analysis. This study regards a corpus discourse analysis as a useful methodology to investigate public deliberation.

3.   CORPUS BASED DISCOURSE ANALYSIS

Corpus is the language body which is produced through social interactions among people. A discourse can be realized as exchanging languages between two or more individuals. Analyzing the corpus is useful in understanding a discourse as social interactions among people. As certifying the structure of discourse as well as both their linguistic content and their sociolinguistic context, it realizes to understand the

relative circumstances and its contexts. [22] It is also same in analyzing public deliberation discourse to investigate their interactions. Corpus can be set in accordance to the research purpose. Indeed, researchers of education study use corpus of communication between teacher and students, media researchers focus on the language used in newspapers and broadcasts, medical sciences use dialogs between patients and doctors as available corpus. It realizes to understand people's specific language used under each circumstance and its context. That is, corpus is used as contextual information.

In recent years, the computational processing of many corpuses in discourse analysis have been examined. Corpus is more evidential to explain the social interactions among diverse people as reducing the arbitrary selecting of corpus. In analyzing the corpus, computational processing is necessary. Computational processing of the corpus is possible with Global Document Annotation (GDA) based on Extensible Markup Language (XML). The GDA initiative allows machines to automatically recognize the underlying semantic and pragmatic structures of documents [22]. As popular methods of data processing for discourse analysis, there is term frequency for understanding main keywords of subject discourse, collocation extraction for understanding specific context. [25] The methods deal with corpus as evidences of explaining a discourse circumstances. In addition, Part-Of-Speech (POS) tagging by researcher has examined to aid relevant information to corpus. For instance, there is Chasen, a Japanese morphological analysis system, which automatically invest the morpheme of each term. In another example, researcher can tag information of speaker to utterances such as speakers' names, sex, age, ethnic background. [22] Tagging thesaurus, interpretation of listener, and others for discourse analysis is also possible. Therefore, researcher can investigate not only language itself but also relative information of the language, identified as 'beyond the sentence'. [24]

Using a corpus based discourse analysis is useful to investigate public deliberation problems as mentioned in the preceding section. As extracting frequent and typical terms of each participant in deliberation, 'Dilemma between Rigidity and Appropriateness' can be observed. Comparing between subjective deliberation and ordinary opinions from mass media and others help to identify 'Informational Asymmetry' , 'Cascades of False Information' , and 'Structured Deliberations'. As tagging information of speaker to utterances, it could infer cognition and intention of participant and compare cognitions between participants, and help understand 'Cognitive Dissonance', and 'Group Polarization.' Evaluating public deliberation whether it is good or not by using a corpus based discourse analysis is possible, which may be available to support a consensus building and a decision making based on the consensus for public policy. As a method for examining and supporting to discourse analysis of PI deliberation, the study proposes Corpus Retrieval system. In the next section, outline of Corpus Retrieval system is addressed. In order to facilitate understanding, a corpus based discourse analysis is examined on 'Ramsar Convention Resolution VIII.32-Conservation, integrated management, and sustainable use of Mangrove ecosystems and their resources' written in Japanese. [25]

4.   CORPUS RETRIEVAL SYSTEM

4.1 Outline of Corpus Retrieval System

To build a corpus retrieval system, the first consideration is to collect and design corpus. In order to build a Corpus Retrieval System, minutes of public deliberation can be used as PI corpus. It is spoken and written corpus. If many PI deliberation minute corpus is accumulated, it will be sufficient to analyze a public deliberation discourse. It is also possible to get much useful data from a small corpus,

particularly when investigating high frequency items. Yet, generally bigger corpus considered to be better. [26] The most important thing in collecting corpus data is to be balance included diverse concerns of both participants and non-participants in deliberation. All participants' speech can be recorded in minutes, but none of non-participants. For the non-participants' concerns, alternative language data such as internet article, interview, and survey data can be used. If a lot of minutes of diverse deliberations are collected, it will keep the balance sufficient for a Corpus Retrieval system. Next, this study proposes a Corpus Retrieval system to be designed including the contents as belows:

- Statistical Data of Term Frequency and Collocation
- Semantic and pragmatic structure
- Deliberation information: time, participants numbers, and relevant deliberation
- Participants position such as citizen, experts, and administrator
- Facet of utterance
- Rhetorical Relation

Formalization of qualitative and quantitative information by means of statistic access is able to take account social context as a comprehensive information system.[27] For instance, statistical data of language is useful to tracking not only a social common notion, belief and true information but also individuals' concerns, belief and knowledge information. By analyzing the statistical data of language, investigator can understand what deliberation issues and individual concerns of participants. At the same time, by means of grasping discourse structure as semantic and pragmatic structure, it is possible to understand discourse context. POS tagging participants' information, facet and rhetorical relation to corpus is useful to analyze the interaction of participants in the deliberation. Here, facet means utterance information related with general interpretation to the utterance. For example, if a utterance is positive or negative assertion in interpretation of general listeners, judged by investigators, its facet is defined as positive and assertive. The participants' attitude in deliberation can be inferred with facet information, also the cognition change based on belief revision. It is anticipated that the application of a Corpus Retrieval System is an infinite of possibilities, which discussed in more details in section 4.2. Figure 2 shows the outline of Corpus Retrieval System proposed in this study.
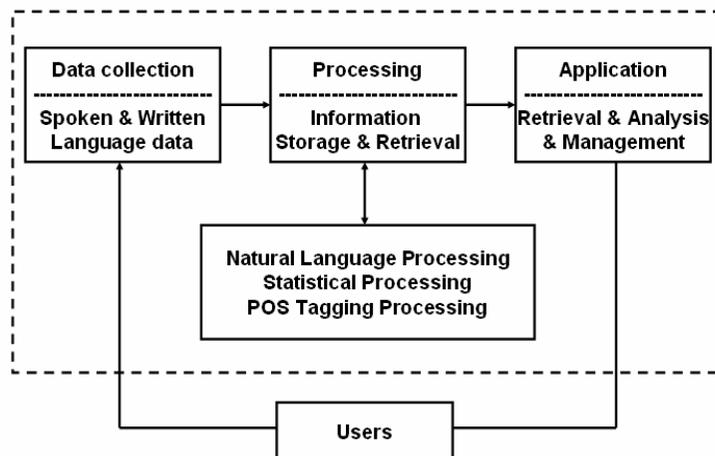

Fig 2 Outline of Corpus Retrieval System

In First step, PI minutes as database for PI corpus are collected. Second step is for formalization of qualitative and quantitative corpus data with Natural Language Proceeding, Statistical Data Processing, POS Tagging Processing. In this step, topic and co-occurrence of minute are extracted by the TFIDF weighting and the collocation schemes. Using the topic and co-occurrence data as applying VSM model and MDS model, deliberation structure can be represented [22]. In addition, POS tagging is examined with facet classification and rhetorical relation. Finally, the Corpus Retrieval System can be developed by using an MySQL database server, Senna embeddable fulltext search engine and Mecab Japanese morphological analysis system. The technical process for building a retrieval system is not addressed in detail. As using the Corpus Retrieval system proposed in this study, it is predictable that users will be able to access to retrieval and analysis information on PI deliberation and the retrieval system enables them to manage deliberations.

4.2 Functions of Corpus Retrieval System

Public Involvement aims to improve mutual understanding among relevant public and help them find out a good solution for their present problems towards a win-win situation. It is based upon a consensus building which will be derived from an agreement to resolution subject and its way on how to resolve it. As mentioned in the previous section, people have diverse interests and therefore the problems they consider are various. In addition, they don't know others' consideration clearly. Public deliberation can help participants improve mutual understanding, but not for non-participants. There is uncertainty. About the uncertainty of social interaction among public, Claude Shannon (1948) who have served as the backbone to a now classical paradigm of digital communication said 'Quantities of the form (the entropy of the set of probabilities state 1,2,3,…, n) play a central role in information theory as measures of information, choice and uncertainty' [28] Vast data of deliberations can be stored and formalized with data processing technology. Therefore, Corpus Retrieval system can function to reduce uncertainty among relevant public as supporting information sharing. Raw vast data of deliberations, however, is all things complexity of deliberation. Corpus Retrieval System functions to facilitate understanding outcome of deliberations by means of showing accurate information based on statistical data so that the complexity can be represented in a simple way. It helps to improve mutual understanding among relevant public. As collecting scatter data and processing them, uncertainty and complexity can be reduced. This study calls the functions of Corpus Retrieval System 'Aggregate Function.'
Corpus Retrieval System is a content-based retrieval system. Using the retrieval system, users can trace the deliberation contents and its context. Reasoning process of participants can be cleared up by means of observing detail contents and its rhetorical relations of deliberation. Users of non-participants can infer the participant's beliefs and knowledge and compare it with their own. In the meanwhile, users of participants can look back upon their deliberations and find out their insufficiency with the reflection in the retrieval system. It helps people discover and rediscover new knowledge. In addition, as checking the information progress, a decision maker can predict, with certainty, which deliberation state should be generated. The judgements of the decision maker will be derived from the probabilistic evidences provided in the retrieval system. Retrieval system can show the specific relationship between information and deliberation condition. That is, Corpus Retrieval System functions to prepare and review deliberations. This study calls the functions as 'Search and Certify Function.'
Formalized historical data of deliberation in the retrieval system will be opened to all public. Everybody can check if a participant in deliberation addresses right or wrong information. It means that user can mornitor the deliberation situation, which progress towards wrong or not. If there is any wrong information, it can be revised

towards right way by many surveillants. In addition, Corpus Retrieval System included diverse deliberation context information which can show the effectiveness and well-directed and applicable deliberation samples based on statistical and non-statistical evaluation. The transparency will improve responsibility of opinions of both participants and decision makers. Both of them will struggle to find out an optimize way to resolve present problems based on their beliefs and knowledge. The final choice from their effort is based on reasonable evidences should be good. Mattessich's Accounting Theory (1996) emphasizes accounting function of formal information system. In this theory, accounting defined as follows "the
process of identifying measures, communicating information to permit informed judgements and decisions by users of the information" [28] He looked at what management science, systems concepts, the computer, and information technology are doing to the information system and then to the accounting function. People involved in a decision process will hold accountability of the final choice. Keeping the responsibility and accountability is connected with public trust. In addition, openness makes the final decision fair, which as known 'Impartiality.' The decision which people believe is valid and its process is impartiality ensures legitimacy. Corpus Retrieval System will support open progresses and those effects. This study calls these functions of Corpus Retrieval System as 'Open and Coordinate function.'
Important thing is that maintaining records on deliberations performances and accessing the data with timeliness, currency, and frequency can support usefulness of Corpus Retrieval System.

4.3 A Content Analysis Sample and the Application in Corpus Retrieval System

In this section, 'Ramsar Convention Resolution VIII.32-Conservation, integrated management, and sustainable use of Mangrove ecosystems and their resources (in Japanese)', a written deliberation performance data, is analyzed. The application on how the result of content analysis is used for Corpus Retrieval System is addressed. As a sample of content analysis TFIDF weighting scheme is examined after the Natural Language Proceeding. Table 1 shows the result of analysis.

Table 1 TFIDF weighting in 'Ramsar convention resolution
in Mangrove ecosystems'

Term	TFIDF	Term	TFIDF
生態系(ecosystems)	137.50	採択(adopted)	16.04
締約(contracting)	83.50	重要(importance)	15.98
決議(resolution)	67.93	生物多様性(biodiversity)	15.11
湿地リスト(list of wetlands)	54.85	国際的(global)	14.10
条約(convention)	49.57	戦略(strategic)	13.77
マングローブ(mangrove)	36.00	劣化(degradation)	13.64
ラムサール(ramsar)	33.63	潮間帯（intertidal）	12.66
持続可能な(sustainable)	32.63	渡り性鳥類(migratory birds)	12.22
沿岸(coastal)	29.53	水鳥(waterbird)	11.21
生態学(ecologic)	22.42	地域(community)	11.21
海面上昇(see-level rise)	22.42	消失(loss)	11.21
管理(management)	20.25	統合的管理(integrated management)	11.21
気候変動(climate change)	18.03	技術的知識(technical knowledge)	9.22
認識(concerning)	17.82	破壊(dstruction)	9.01
手引き(guidance)	16.88	管理計画の策定 (appropriate planning management)	8.99
河川流域(river basins)	16.88	価値(values)	8.82
先住民(indigenous peoples)	16.82	情報交換(exchange information)	8.20
利用(use)	16.74	種(species)	7.98
保全(conservation)	16.43	指定(designation of mangrove ecosystems)	7.87
要請(request)	16.17	持続不可能(unsustainable)	7.83

TFIDF is based on the term frequency of word appearance and is used to decide the significance of a term in a document. The definition of TFIDF is given below. [22]

$$W_{i,j} = tf_{i,j} \times idf_{(i)}$$
$$idf_{(i)} = \log(\frac{N}{df_i}) + 1 \quad (1)$$

$tf_{i,j}$ = number of occurrences of i in j
$df_{(i)}$ = number of documents containing i
N = total number of documents

By using the result of analyzing the convention resolution in Mangrove ecosystems, it is possible to get an accurate understanding on what should be considered in the deliberation of Mangrove forests use. For example, we can understand the convention's main keyword, "Ecosystems" according to the high-ranked term by TFIDF value. The following two terms are related to convention itself. The two terms are used to use in the convention documents. We can infer situation and social context generating the convention. It may be motivated from cognition of risk in mangrove ecosystems. The high-ranked terms are 'contracting' and 'resolution.' The terms are used to be recorded in documents related with 'convention'. The following terms 'list of wetlands', 'mangrove', and 'ramsar' show the specific subject of the convention. The terms 'climate change' 'see-level rise' as the mangrove risk are mainly focused in the documents. Meanwhile the terms 'sustainable', 'coastal', 'ecologic', and 'river basins' give us a clue. That is, the mangrove is related to coastal areas. By using the TFIDF method, the document is analyzed as statistical processing for a Corpus Retrieval System. It can derive new knowledge or beliefs to users by reviewing the documents in a different perspective. In addition, through

ranking the keywords based on the statistical processing, we can clearly understand the concentrated interests of participants involved in the document.

In this way, analyzing other documents in mangrove ecosystems or in different aspects can be examined. If vast data in mangrove is accumulated and formalized by data processing based on Natural Language Proceeding, Statistical Data Processing, and POS Tagging Processing, a Mangrove Corpus Retrieval System could be build. It is also anticipated that uncertainty and complexity among relevant public would be reduced by gathering information, relevant public's interests of which mangrove forests in use. Moreover, searching the reason and confirming based on evidences, open and coordinate function in the Corpus Retrieval System as mentioned in previous section can also be realized. The retrieval system can support to improve mutual understanding in mangrove forest use and to find out good resolutions of present problems for relevant public. Consequently, relevant public monitor all public deliberation process by using the retrieval system as open information resources so that they can learn what is legitimacy and rational behavior and can reach to agreements on their beliefs what decisions are legitimated.

5. CONCLUSION

This study proposes a Corpus Retrieval System for supporting public deliberations and decision making processes in mangrove management by providing a description on how the Corpus Retrieval System works and what advantages can be generated. From the review of literatures, the concepts of governance, deliberation, and legitimacy, and their relationships were debated. The first research question, 'why public deliberation is needed in mangrove management', was discussed in detail. Deliberation is "a free and reasoned agreement among equal" and promote governance and legitimacy. In addition, good governance steers deliberation to legitimacy. In the sustainable mangrove management, public deliberation helps to find out the legitimacy resolution of mangrove forest problems by getting mutual understanding among relevant public.

The Corpus Retrieval System proposed in this study is a content retrieval system based on discourse analysis. In the Corpus Retrieval System, diverse and vast utterance are recorded and formalized by data processing technology. The three functions of Corpus Retrieval System defined in this study can help public deliberation to reduce uncertainty and complexity in its process and accurately understand interests based on statistical evidence. The search and confirm function, open and coordinate function help people to find out good resolution to their present problems. The process of reasoning and deciding on resolution can be represented in the retrieval system and be transparent. It promotes responsibility and accountability. Finally, the sample of content analysis in section 4.3 shows that the Corpus Retrieval System is useful to support public deliberation and to coordinate the public deliberation towards good way. The corpus retrieval system may be valid with information balance. In order to build the Corpus Retrieval System proposed in this study, collecting the data on diverse and vast deliberations is necessary. The Corpus Retrieval System is on the process and has limitations without presentation of real corpus and limitation of data processing technology for automatic system. Now it can only be realized by semi-automatic method. Desirable corpus retrieval system is to use on internet environment for accessing timeliness, currency, and frequency. Consequently, desirable Corpus Retrieval System will be valid and fully support public deliberations.

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