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Research Article

EXPLORING THE USE OF SCIENTIFIC AND TECHNICAL INFORMATION IN COLLABORATIVE FOREST MANAGEMENT: THE CASE OF SAMAR ISLAND NATURAL PARK, PHILIPPINES

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Abstract

This paper addresses the lack of current investigations on the role of scientific and technical information in a collaborative forest management organization. Using Samar Island Natural Park Management as a case study, eighteen (18) Protected Area Management Board members, are interviewed to generate information on the type of scientific and technical (S&T) information they have accessed and the ways of which they are being used to inform their decision making. Likewise, several documents are sought and obtained to support and triangulate the primary evidence. Qualitative content and thematic analysis revealed that the common type of S&T information obtained by PAMB members are *processed* type of scientific information which in form is generic and intended for layman's use as opposed to hard science which is obtained from primary literature. Despite having a dearth of S&T information that goes inside the SINP management, decisions made at SINP are still built of certain science. In terms of the role of S&T information, it is revealed that science is perceived to be valuable; however, it is not the overriding tool to make a decision as other factors are also given equal importance. Science usually comes into play only when PAMB members are confronted with complex issues and serves as the last recourse. It is recommended that SINP management should intensify its effort to provide sufficient and relevant scientific and technical information to the PAMB members being at the forefront of managing the forests.

Keywords: Scientific Information, Decision – Making, Forest management, Samarisland natural park, Biodiversity.

INTRODUCTION

More than ever, there is a growing concern and urgency for the government and the general public across the globe to address these environment-related issues due to the level of magnitude and its adverse effects to mankind. One of the environmental concerns is the growing loss of forests cover due to continued deforestation. In the Philippines alone, FAO reported that the forest area of the Philippines is estimated to have declined from 12 million hectares in 1960 to a current level of about 5.7 million hectares (which includes less than 1 million hectares of virgin forest largely confined to very steep and inaccessible areas). This massive loss has created an agreement among government agencies and environmental-cause groups across the globe to come up with a sustainable approach to manage our forests. One of this approach, which is now adopted at the Samar Island Natural Park management, is to consider and value the participation of various stakeholders in forest management due to that to the vast area that each single protected area has -- which is impossible to be managed by the government agency alone. With the involvement of stakeholders in forest management, the lingering question now is how the decisions are being made considering that issues addressed in forest management are sometimes complex. In forest management, knowledge and information is considered to be of prime importance. Central to decision – making in collaborative forest management is the use of scientific information. Policy makers are required to use evidence-based information as part of the legal mandates that regulate forest management. As Lalor & Hickey (2013 as cited by Soomai, 2015) puts it, "modern governance espouses evidence-based policy-making wherein decisions are expected to be made based on the best available information."

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As a result during this current times, there is a multitude of scientific evidences and information that are being produced worldwide as a way to address the demand for scientific information used for policy making. Consequently, more scholars have turned their attention into enriching the value of scientific and technical information in order to broaden the sources and domains of knowledge from which solutions to environmental problems can be generated. Sarewitz and Pielke (2000) observed that environmental analysis and policy have called on the efforts of science (information) for knowledge about human impacts on the environment and the implications of alternative policies. Evidence shows that scientific information may matter for policy-making (Pascual, 2010). The need for scientific advice for decision – making is evident, given the complexity of interactions among the environment, resource users, economies and social well-being of communities (Soomai, 2015). This is the reason why governments are putting an effort to modernize the government machine through greater commitment to evidence-based policy, the assumption being that "policies informed by knowledge and research evidence are better policies" (Pelline *et al.,* 2012). In the Philippines, the use of scientific knowledge or data is imperative in environmental agencies and in managing various environment resources. The mandate to use science in natural resource management more broadly was formalized in the NIPAS Act of 1992 which require the use of 'best available science' and in some environment-related policies (e.g the RA 9147 or otherwise known as the Wildlife Resources Conservation and Protection Act; the RA 10121 or the Philippine Disaster Risk Reduction and Management Act; RA 7611 – Strategic Environmental Plan for Palawan Act and the PD 1586 or the Environmental Impact Statement System Law). All of these policies are promoting the use of scientific information in the implementation of its mandates and/or in the application of its services. Moreover, the Philippine

government had shown initiatives of promoting S&T by way of institutionalizing agencies dealing with the scientific production in the country (e.g PCAARRD, National Academy of Science and Technology (NAST) and the National Research Council of the Philippines (NRCP) – which are all under the umbrella of the Department of Science and Technology. While scientific and technical information is encouraged to be a viable source of knowledge to inform decision-making, a systematic review on the barriers to and facilitators of the use of evidence in policy decisions found it was difficult to ascertain the role of scientific evidence and other factors (e.g., resource constraints, costs, socio-political environment) influencing policy processes, partly because most researchers neither define what they mean by evidence nor explore how and why different factors come into play during the policymaking process (Oliver *et al.,* 2014). Furthermore, Doremus (2006) even contends that there is no guarantee that science will be used effectively in decision-making since it must be interpreted and applied and this is not always done effectively due to a range of institutional and cultural factors. Additionally, there are varying interpretations of the 'best available science' or usable science (Sullivan *et al.,* 2006). Lastly, it would be more complicated when science is used or adopted in the decisions involving individuals with different backgrounds and orientation.

There are, however, many challenges applying science in management and developing usable scientific information for decision – making (Colavito, 2015). The role of scientific information in policy-making (or more broadly, "decision-making"), i.e., the role of information at the science-policy interface, is increasingly being questioned and examined (Gluckman, 2013 as cited by Soomai, 2015). Policy-making is a complex process with multiple internal and external influences on governments' use of research information which is often grounded in a range of factors related to institutional and organizational aspects, the characteristics of the actors involved in policy processes, or embedded in the characteristics of the information itself, among other factors (Soomai, 2015). Furthermore, Sareqitz and Pielki (2007 as cited by Colavito, 2015) further added that institutional barriers, poor communication, political considerations and many other factors contribute to what has been characterized as a a gap between science and decision-making. In order to reduce this gap, there have been numerous efforts within both research and practice sphere to determine how to conduct collaborative research and better connect science with decision – making in environmental management (Cash et.al, 2006 as cited by Colavito 2015). Many of these efforts by researchers and practitioners to better connect science and decision – making have focused specifically on climate research and related decision processes (Dilling and Lemos 2011 as cited by Colavito 2015). However, despite several studies that tackles the use of information in environmental management decision making process, there is a dearth of investigation that focuses on its use in collaborative forest management. To that end, the author highlighted the need for an empirical study to permit the exploration how is scientific and technical information is applied in decision-making at Samar Island Natural Park Management, and in what ways can the use of science for decision-making in this context be improved? This study also is a way to address of a call the need for qualitative research to understand how and why different types of evidence are used during decision-making processes (Turne *et al.,* 2017).

METHODOLOGY

This research was a case study of the Protected Area Management Board (PAMB) in Samar Island Natural Park Management (SINP). The main arguments for choosing case study for this research, however, were the "descriptive and exploratory nature of the research (not requiring control of behavioral events but rather describing and documenting them) and the dominance of 'how' (and exploratory 'what') questions" (De Weerd-Nederhof, 2001). A complete enumeration of the Executive Members of PAMB was considered as participants of this study. The Executive Committee was composed of representatives from all the stakeholders of SINP. A total of 18 key informants were interviewed for this study instead of the 21 original numbers that comprised the Executive Committee (Execom) of PAMB. The 18 informants were chosen following the inclusion and exclusion criteria set by the researcher to obtain the necessary data. Several methods were employed to obtain necessary information: key informant interviews, actual observation of the stakeholder's meeting, and secondary sources particularly documents. These documents (e.g., minutes of the meetings, incoming/outgoing communications, memoranda, general management plan, technical reports, journals and other relevant documents) were acquired to gain historical and contextual perspectives of how decisions were made, to examine how scientific evidence was presented to and applied by stakeholders, and to corroborate and augment evidence from the interviews. All documents were identified and accessed through key informants, Internet searches, and specific requests to individuals and organizations directly involved in the cases.

In-depth semi-structured interviews were conducted with key informants to gain perspectives on and experiences with the decisions made by the stakeholders, in this case, the Protected Area Management Board Executive Committee Members comprised of twenty-two individuals representing from the various sectors, namely: the Natural Resource Management Sector, Local Government Sector and the Non-Government/Civic Organization. The author purposively identified potential key informants based on their involvement in the decision-making process. By imposing the inclusion and exclusion criteria set by the author, there were 18 PAMB members in total who proceeded for an interview. An interview guide with open-ended interview questions and related probes, was drafted based on the study objectives. The researcher solely conducted a face-to-face interview and made follow up telephone call if it was deemed necessary. All interviews were audiotaped to ensure the data were captured and retrievable in true form, and transcribed verbatim. This study primarily used qualitative content analysis (Bryman, 2004)in sifting and evaluating documents obtained from SINP management and the participants itself and thematic analysis by Braun & Clarke (2006) in the analysis of the extracts derived from interviews. To analyze the data, the author conducted several stages in order to obtain the necessary data: first, the author went through the transcript of every interview and highlight everything that jumped out as relevant or potentially interesting; second, filtering out irrelevant information; third, preliminary coding using descriptive coding which was looking at the word that would describe the contents of the data; fourth, collating together all the data into groups identified by codes; fifth, reviewing all the codes and making necessary recoding; sixth, using focused coding

approach finalizing set of codes and re-code, if necessary, but this time preparing for the final code and lastly, themeing which was formulating the theme and became the basis for constructing the narrative. All of these were done through manual coding process. The primarily reason for coding manually was the fact that transcripts of interviews were in local dialect and NVivo analysis could deviate the original meaning or context of the data provided. Meanwhile, the patterns and themes that emerged from the interviews were presented to some of the key informants to ensure the consistency of the transcription and interpretation made by the researcher on the informants' statements, as well as to verify the accuracy of the results. Member-checking procedure and a critical friend technique involving experts were also employed.

This study also considered and applied some of the suggestions of Yin (2014) in analyzing and presenting the results and these include: "putting information into arrays; making matrix of categories and placing the evidence within such categories; creating data displays – flowcharts and other graphics; tabulating the frequency of different events and putting information in chronological order or using some other temporal scheme."

Quotes from interviews and observation were used judiciously to authenticate and improve the satisfactoriness of qualitative findings. Although some of the responses of informants were given local dialect, exemplars were translated and presented in English. For reference and validity purposes, original excerpts are given in Appendix D. Also, to secure the confidentiality of data and anonymity of the participants, the use of pseudonyms was applied in the excerpts

RESULTS AND DISCUSSION

A. Types of Scientific & Technical Information Obtained by PAMB Members

The Protected Area Management Board is the sole decision-making body of SINP management. The decisions made are crucial to the present and future conditions of the forests, hence, various information is provided to ensure that they are well-informed in their decisions. While there are several types of information that guide PAMB members in their decisions, the focus of this study is mainly on the scientific and technical information, which in this study, refers to an information derived from various sources such as scientific literature (e.g. peer reviewed journals, proceedings, theses, books), or set of empirical data (e.g. technical reports) which can be accessed through formalized (conferences, seminars, workshops, online lectures) or informalized setting (informal meeting and mass media).

Forest Biodiversity Information: The forest biodiversity information was the most common type of information accessed by the majority of the PAMB members which apparently has been ubiquitous and accessible to all because it has been regularly mentioned in various lectures and other open-source learning platforms such mass media and social media. Some of the examples of this information include but not limited to the following: animal and tree species composition and distribution; endangered/threatened species status inside SINP Protected Forest areas in the Philippines; effectiveness of protected area and/or area managed for biodiversity; natural forest habitat types and forest related species. Based on the interview with some of the PAMB members, this information mentioned above was regularly mentioned during meetings, lectures and found in the materials provided to them by the SINP management such as in the annual report.

Forest Technology and Innovation Information: PAMB members were recipients of information aimed to increase their knowledge about innovations and technologies in forest governance. Some of this information was formally discussed during seminars/workshops or it could be something that was provided to them by their colleagues in varied forms and occasions. A key informant from the People's Organization sector affirmed this finding:

> *Adrian: "If my memory serves me right, there was one time where we got an information about how to increase the volume of trees planted. That was during a seminar. Also, we attended training on germplasm collection, seed production - sort of that information."*

Analysis of interviews revealed that PAMB members from the NRM sector and PO/NGOs were the most active sectors in terms of accessing this type of S&T information and relatively used it as reference in their decision making. This finding did not come as surprise since getting such kind of information was part of their mandate being at the frontline agency of protecting our environment. Similarly, PAMB members from the PO/NGO sector were also aware of this information being at the receiving ends for the various programs and projects of DENR, in the case of POs, and for the NGOs as advocates for environmental protection.

Technical Information Produced by Environmental Agencies

For PAMB members, if there was one clear type of scientific and technical information which made it accessible to them were varied technical reports prepared by the natural resource management offices such as the Provincial Environment and Natural Resource Office (PENRO) and the Regional Environment and Natural Resource Office (RENRO as reflected in Table 2. These reports were products of compiled information generated from its sub-level agency units (CENRO/PENRO) and transformed it into a comprehensive technical report for submission to higher level unit agencies (DENR National Office). For instance, the DENR Regional office regularly submits consolidated reports to the Central DENR office and furnished the same to the Provincial – level field offices (PENROs) including the SINP Management office. Technically, most of this information produced by the NRM agencies can be considered as 'secondary scientific data' since its purpose was not exactly to generate new knowledge as opposed to a research study where scientific procedures must have been followed completely and orderly. These reports contained raw data, prepared and organized using a template format and usually presented in a brief discussion or mere simple analysis. Nevertheless, this information is vital reference for important decisions made by the PAMB members.

**in collaboration with or commissioned by external agencies*

Table 2 also shows the minimal occurrence among PAMB members to access scientific information taken from highly-formalized documents such as journals and theses.

Table 1. Types of Scientific and Technical Information Accessed by the PAMB Members

Types of Scientific & Technical Information	Description	Examples
Forest Biodiversity Information	General information on biodiversity acquired from various sources	*Animal and tree species composition and distribution; endangered/threatened species status inside SINP Protected Forest areas in the Philippines; effectiveness of protected area and/or area managed for biodiversity; natural forest habitat types and forest related species; Woodland habitat condition; Forest types coverage including maps*
Forest Technology and Innovation Information	Information on technology that aids stakeholders to improve their forest management	*Adoption of modern agroforestry technology; facilities used for forest resource inventory; raptor identification, survey observation protocol and retrieval on forest endemic species; forest products harvesting method; technology used for production of calamity resilient fruit products; and techniques in germplasm collection and seed production.*
Technical Information Produced by Environmental Agencies	Data and information regularly prepared by state agencies on environmental and natural resources	*Forest tree holdings; logging incidences/confiscation report; (see table 3)*

Table 2. Scientific & Technical Information Obtained by PAMB Members from

PENRO & RENRO	
PENRO	DENR REGION
• Report on issuances of forestry tenurial instruments • Forest Protection and Biodiversity Monitoring System Report • Environment & Natural Resource Profile • Annual Report • Validation Report on Plantation Establishment for eNGP • SEAMS (Socio-Economic Assessment & Monitoring System) Report • Confiscation/disposition Report • Reforestation Report • Forest Production Report • Geospatial Data (flood-prone areas; landslide-prone areas)	• Research Study Reports (e.gSamar Biodiversity study, Perception Study, Site Characterization Study, Resource Valuation Study) * • Site assessment report with map for national and foreign assisted projects (e.g Millennium Development Road Rehabilitation project by the US govt • Forest Protection Report • Statistical Reports such as ENR statistical profile, quarterly/annual statistical profile and regional profile • Annual concession Report

*in collaboration with or commissioned by external agencies

Interviews revealed that the only opportunity for some of the PAMB members to access highly scientific information was when they were provided copies of the research projects of which they were originally part of. Apparently, the bulk of consumers of this research-based information as described above were mostly coming from the NRM sector and rarely accessed or used by the rest of PAMB sectors. One key informant shared his encounter upon reading a scientific information that was derived from a research study:

> *Renato: "Also, recent scientific studies about species, for instance, on mining. Based on previous research on Biological Assessment, it was found out that the Protected Area has this metal-eaters plant. It can be used in mining areas to lessen its impact and so that it won't be able to reach to stream flow. That's why we need to read all the time." (#8)*

The fact that majority of the consumers of this scientific information came from NRM sector didn't pull a surprise, because once and for all, uptake in scientific and technical information has been strong in forest government agencies as part of their legal/office mandate. Furthermore, these environmental agencies usually have their own research units, as in this case, the Environmental Research and Development Bureau, who provided researches and developed science-based technologies to address the needs of the different DENR bureaus and stakeholders. This finding that informants from the NRM sector were exposed to scientific and technical information than that of the rest of PAMB members is similar to that of Pascual (2010) who asserted that the high proportion of science use among NRM personnel came from State Government departments and this could be explained by their traditional base and responsibility for resource management functions that emphasized production research, scientific reporting, and environmental responsibilities.

B. Usage of Scientific & Technical Information

Table 3 presents the summary of themes to describe how scientific and technical information were used in decision making at SINP management. A brief description, as well as its corresponding examples, is also provided in the table before proceeding to the more detailed discussion of each theme.

Foundational

The scientific and technical information in this aspect was treated as the primary consideration that informed the PAMB members to analyze the problem. Its practical value was a necessary component to varying projects and certain conditions because, without a reference to science, decisions made by the PAMB members could be questionable. Here, the use of scientific information underwent a formal process where decision makers actively sought scientific advice from different sources, particularly from the Regional or Central DENR offices, presented this acquired information to the agency board and translated into a management response.

Science as baseline information in policy-making: Decision makers placed a high value on science as an important reference in arriving at a decision. For PAMB members, scientific information/advice provided a strong evidence base for making decisions and helped them assess of various management interventions inside the SINP. PAMB members sought for baseline information about the current state of biological resources in the natural park necessary for planning and decision making for current and future management programs of SINP. This foundational function of S&T information can be supported through the statements provided by an informant:

Table 3. Summary of themes to describe the use of Scientific and Technical Information at SINP Management

Use of scientific & technical information	Description	Example
Foundational	Science is the main reference and primary consideration in arriving at a decision. Without science, everything is questionable.	Environmental Impact Assessment/Biodiversity assessment/Other technical reports as the main requirement for granting permit; Research study as baseline information for the construction of a hydro-thermal plant at SINP
Supplemental	Science is essential but not the overriding consideration; Science as a complementary tool and support to other evidences.	The need for scientific and technical data but at the same time assessing the economic and social impact/benefit of an alternative; seeking expert's advice when PAMB is confronted with complex issues.
Educational	Science' role is simply to inform and educate the reader; it perceived to have less value and presents very minimal influence in decision – making.	When the speaker is just mere describing or explaining science terminologies, facts or figures (e.g climate change, flora, and fauna found in SINP) in a presentation.

Jose: "Several cases already that we stick with facts as a foundation of our decisions. For instance, there is one time we conducted a tree planting activities in a municipality somewhere in Eastern Samar. I said, although the intention is good, they cannot just plant trees anywhere since there is a specific tree that suits the type of soil for its growth and development. I told them to remove it because when the tree is already big if might pose a bigger problem." (#38)

A strong reliance with scientific facts as critical source of information for making decisions was concurred through the study of Cvitanovic *et al.,* (2014), who showed that participants have a positive attitude towards the role of science "as a strong evidence base for making decisions, which in turn increases the likely success of that decision."

Relative to this, PAMB members believed that the use of scientific and technical information does not just permit a strong foundation of evidence but also to prove that decisions made in the SINP management were not based on a hearsay or personal opinion; instead, problems were carefully analyzed and that PAMB members considered well - thought solutions through the aid of science. This finding was attested by informants:

Warren: "Yes of course! Isn't it right that a policy is strong if we know if it is backed up by science? In other words, it's proof that our decisions are not just made-up, or based on hearsays or because we just wanted it only." (#40)

Furthermore, the primary reason why PAMB members put some value and had to incorporate science in their decisions was that they would like to ensure that the public as well as those at the top management level of the agency will find no reason/s to question the recommendations or advice that the SINP-PAMB would be decided on. A point in case was when a PAMB member recalled a situation wherein he tried to defend a PAMB decision during a Senate hearing. He cited scientific facts to assert their decisions:

Jose: "I remember when I was scanning on my personal paper this was 2013. We went to the Senate because at that time we wanted the legislation of SINP Bill. We faced the hearing with so many opponents. I presented this one through a Powerpoint. One mining businessman stood up because the highlight of my presentation told them that, SINP has 25 river systems and 8 major watersheds. That alone generate at about 28b cubic meter, according to Symbio Report in 2000, and so we have to make some valuing analysis of water discharge. I told them there were 24 billion cubic meters for the next 25years specifically for the water alone. That was my presentation. And then this businessman stood up and asked me: "What is your methodology?" He was trying to challenge my presentation and so I said that it was based on a scientific study. I attended so many hearings in both Congress in the committee level. Just in the lower house, I already attended three (3) and in Senate two (2). In 2003, we were accompanied by the Bishops of three Samar Provinces going to Malacanang and of course, some members of SIBF for the signing of Presidential Decree."

Scientific and technical information as statutory requirements: PAMB members referred to scientific data or advice as a requirement to assess proposed plans and projects as well as existing projects/programs that have been in operation inside the natural park. These were essential that without this necessary information, granting permits to operate a project may not be approved by the board. The presence of scientific or technical data as a primary requirement in granting permits was pointed out in the statements of key informants:

Czarina: "Just like how to count birds (sinc) 'cause we have what we called the Biodiversity Monitoring System. It's just like an assessment conducted at SINP wherein you count the number of species of both the flora and fauna. It also has components such as transect walk, FGD, field diary, and photo documentation. It is conducted by our SINP personnel" (#43)

This foundational role of science in decision making was also highlighted in several studies. For instance, Soomai (2015) emphasized the significant use of scientific advice for operational decision making in the context of marine management. It was noted that the recommendation from scientific advice is used 100% to "ensure that decision maker has no reason to question the management recommendations or advice because it was done with due diligence and consultation and research."

Meanwhile, this foundational role of science was perceived to be the least of value or use inside the SINP primarily because, as evidence showed, the different issues or matters taken up at SINP management were generally simple and administrative in nature. Therefore, the types of information that would be sought by the PAMB members were something relevant to address for a specific issue. Their less perceptive view about the foundational role of science could also be associated due to the low of awareness of some PAMB members to distinguish science from other forms of knowledge (Cuanico, 2019). These informants might not be aware that they were already using S&T information, but in reality, they were already applying it though in some manner or level. Informants' lack of orientation about science concepts could have been influenced

on their view that science was not at all useful or has little value in their decision-making.

Supplemental

Relying on the scientific and technical information was treated to be an important aspect of the decision-making process, however, its role was complementary in nature. Its value rests on merging other factors (i.e political, social and cultural factors) in the policy-making space to result in a more concrete solution to a particular problem. Consequently, science information was used to supplement the knowledge of the decision makers, however, they were bounded by specific guidelines to use it. Of the three themes that emerged from the interview analysis, this was the dominant function or usage of science among the PAMB members who made decisions to different issues at SINP management.

Science is valuable but not the be-all-end-all solution: Analysis of the interview transcripts revealed that most of the participants believed and valued the importance of science. However, its use was only one part of the equation in the NRM policy and should not carry more weight in making decisions as several factors were also taken into consideration. In effect, there was flexibility on the part of the decision makers to choose whether or not scientific advice will overrule among other factors in coming up with a final decision. As one key informant explained:

> *Jose: "It may not be the sole basis for a decision; it is one of course -- but not the overriding consideration. It is because sometimes you are in a situation where in what really important is the sentiments of the whole - of PAMB members. You have to respect their decisions especially if the majority would not agree with you. In PAMB, we do not discount scientific studies or evidence but we still adhere to what is best for the organization, to the community and to the environment." (#44)*

Scientific and technical information as complementary tool to agency's plan: Scientific and technical information were seen not a distinct or separate reference guide in making a decision but rather it should complement or harmonize with other strategies, factors or consideration either to support or enhance the decision. A key informant recalled how her knowledge in science was utilized in the PAMB decision:

> *Maricar: "I was a Planner before. I was part of a group who formed the Physical Framework Plan so basically, I know how a plan works; that's why I applied it at SINP when they formulated the General Management Plan. Basically, I know how to appreciate a plan document because of my (planning) background. I also know how LGU works based on LGU code - the dynamics of LGU. Of course, every LGU should have a land GIS (geographic information system) or data map processing on how it jived with the SINP Plan and how it is harmonized with that of SINP plan." (#49)*

Scientific and technical information as a neutralizer in dealing with complex issues: The role of science could have been felt or most needed especially when PAMB members were confronted with a complex issue. In this case, scientific advice was solicited from technical experts during a compromising situation where PAMB members turned to them either to neutralize or balance the dilemma faced by the PAMB members or it could be the last remedy to aid the decision, which at some point, was needed to break or end a decision. This was validated by the statement made by one of the informants:

> *Jose*: *"We are there to neutralize everything especially when there are heated issues or when to confront controversial issues. I believe that science, although, it may not the ultimate deciding factor, is necessary so that our members will also consider the implication if we don't honor scientific facts."*

From this statement made by the informants, it was clear that science value rests only upon certain conditions primarily as neutralizer or tie-breaker of complex issues. Again, as emphasized earlier, most of the problems addressed by members were, in general, highly regulatory and/or administrative in nature and so it followed that the information they have to acquire would cater to address on such capacity or level only. That means PAMB would have to resort seeking a type of information that was useful for their decision making and science would only be relevant under certain circumstances. This would have been the reason why the supplemental function of science in decision making was the dominant theme to emerge from this investigation.

The supplemental role of science in decision making was also confirmed in several studies. For instance, Shaw et.al (2000 as quoted in Szaro *et al.* 2004) emphasized that "managers and policy-makers should not only use scientific information but must also balance legal mandates, social desires, political objectives, policy considerations, and other factors into their final decisions and that includes trade-offs and compromises for one or more resources." Colavito (2015) also observed that science is one of the many values and perspectives that are brought to bear in the CFLRP and should balance science with other decision-making considerations. In the context of decision-making for traffic planning and land use, Kansanen (2004) valued the effect of ecological information on the decision-making process. In his findings, it was revealed that ecological facts through the environmental impact assessment (EIA) is used in making legislation but hand in hand with economic and technical perspectives.

The same observation was noted to happen inside the SINP management where PAMB members invoked the role S&T information as important but practically speaking, other factors were laid under the table and even given greater emphasis in their decisions such as the social, economic, legal and moral aspects of the situations. The presence of these factors to its decision – making only showed that all of the PAMB members operate on values to an extent, even if they use S&T to support their arguments. This study, therefore, coincides with the findings of Colavito (2015) who concluded that science integration is "affected by a range of procedural, personal and social issues and that it should 'decide how to balance science with other decision – making considerations."

Educational

The scientific and technical information in this aspect was treated by the decision makers solely to be informed about scientific facts but was never considered to be used or referred to in their decisions. Science, therefore, was perceived to have

a lesser role or value considering that it created a minimum impact to the decisions made by PAMB members.

Science is mere description of facts and for contextualization: Interview analysis revealed that the use of scientific and technical information was merely for presentation purposes and to provide a context of the issues raised during PAMB meeting. There were instances that PAMB members mentioned about science facts or data during a talk, meetings or specialized forums or seminars but they do not have much bearing to justify their points or to the overall decision-making process. One key informant recalled how science was treated during one of their PAMB meetings:

> *Warren: "Mostly the issues that were being discussed at PAMB were about the request to grant permits of those who will conduct activities inside SINP. Rarely that we use science as basis for our decision. If there were instances that we mentioned about it was just simply to describe a product, plants, a variety of trees, endangered animals, sort of that. But it is not a major component to make a decision because most of the issues raised do not warranty for it." (#51)*

Scientific and technical information as an enlightening concept: Similarly, PAMB members acquired S&T information to broaden their understanding in a certain issue and in order to guide them properly in arriving a good decision. However, S&T information in this manner was not the sole factor that dictates the member's final decision. One key informant expressed this particular sentiment:

> *Maricar: "Yes, at times there is science. It was being mentioned because obviously, we encountered information from the academe, literature, listening to seminars or from reading journals, which are vital references for our decision making. But inside PAMB, its purpose is just to guide us or to enlighten us, but it is not the sole reason that dictates our decision. Ultimately in NRM, it's not only what the science says that matters, but rather consider also the implications of our decisions towards the community. We also studied the cost and benefits of what we invest which in effect is a value-laden decision – making processes." (#52)*

Congruent to the finding of the current study, Colavito (2015) examined the role of science in collaborative forest management and how it informs decision making. Significant findings of the study showed that science "is largely used for educational purposes, in addition to project planning, though there was some sense that this was largely to support decisions that had already been made."

Conclusion

1. Technically speaking, there are several S&T information that goes inside the SINP management but the nature of S&T information commonly accessed by the PAMB members are considerably generic and not highly formalized types of scientific information; however, it is safe to say that decisions made at SINP is still built of certain kinds of science regardless of its contents or level of "*science-ness.*
2. The accessibility and use of scientific and technical information as reference inputs for decision-making of PAMB members is dependent on the nature and scale of problems that are trying to be resolved. In other words, it is important for PAMB members to be able to identify the S&T information that is most relevant and useful in each case. Naturally, since most of the issues tackled are simple and ministerial in nature, the S&T information therefore is no longer necessary. It becomes only relevant when decision-makers are confronted with complex or controversial issues where science had to play a significant role in justifying and in pushing for a policy intervention. Hence, this study concluded that PAMB members are flexible in the use of S&T information in decision-making.
3. There is a disparity on the accessibility of scientific and technical information between and among stakeholders. Naturally, those sectors whose jobs are mandated to make use of S&T information or advice are more privileged to have better access of this information than those sectors outside the government agencies. This disparity led to have a low-regard in science among stakeholders outside the natural resource management agencies which may affect in coming up with a sound decision making.
4. By and large, the use of S&T information as perceived by the PAMB members was categorized as indirect (i.e., *supplemental* in general) and not as a primary instrument (i.e., *foundational*) in their decision-making. Their less perceptive view regarding the foundational role of science could have stemmed from the fact that issues tackled at SINP were more regulatory/administrative in nature. Hence, they would naturally seek information that was useful in their deliberations.
5. It is apparent that PAMB members have less regard to science as an imperative tool for decision – making considering that they put premium on other factors (i.e., legal and moral basis) – which formed the larger considerations in making a decision. This could have attributed to the lack of provisions for S&T information and even if S&T information is available, PAMB members could not fully distinguish S&T information from other knowledge forms, when in fact, they could have already been using S&T information without consciously being aware of it.
6. Although science information was used in varying ways and widely accepted as being one of the many values that was considered in making a decision, the low regard to science may inhibit its useful application in the decision-making process. This is because PAMB members have been used to and are comfortable with the *status quo* approach of making a decision—basing their decisions subjectively (i.e., ethical or moral) of an issue rather than being rational—which is based on evidence-based facts. Undermining science to be at the center of policy making could have a negative implication to the present forest conditions.

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