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Water and Society: Contextualization of Science in Politics and Public Policy

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Abstract

A study of science today is inseparable from a diversity of contexts. This is also reflected in society's discourse on the positioning of science itself. To that end, principles of science cannot be actualized as such, rather must be underpinned by society needs that are reflected in research and pre requisites of science manifested in reengineered forms. Findings that relate to the environment, especially water, are crucial today in many areas. By using a comparative and in-depth interview methodologies in a qualitative manner, this article which is based on a research that was conducted during 2008-2016 period in Code- Yogyakarta city (Indonesia), Air Panas Diwak- Semarang (Indonesia), Umbul Cokro-Klaten (Indonesia), Rawa Pening-Salatiga district (Indonesia), Curug Kalisidi- Semarang city (Indonesia) and Tasik Chini- Negeri Pahang (Malaysia), makes it interesting for a variety of reasons. First, based on a lot of previous literature, this article makes an argument that water with all its manifestations and forms, must have the quality of fulfilling needs of society. Water as an integral part of science, is accorded the position of a subject as well as an object in relation to society.

Keywords: *local policy, science, society, water*

INTRODUCTION

This article discusses the construction of natural science of water and management of water resources. First, tbe need to find common ground between two competing interests of water as a natural resource and the environmental challenges and social issues associated with using water to meet needs of society (Meissner, et.al, 2013).

The two interests involve water on one hand, and the need to meet the needs of society on the other. Secondly, the need for the two competing though not necessarily mutually exclusive interests to find a win-win solution that will contribute significantly toward environmental sustainability and improving quality of human life. Thirdly, to that end, taking the vantage point of the issue as an environment concern, the meaning of nature should be enhanced through the use of applied science and technology, while at the same time taking into consideration political and social aspects, in the futherance of a better life.

The discourse of on the importance of water as a natural resource and the importance it plays in livelihoods of society has been rife among the general public, academia, and the government. The singular implication of that including the meaning of function, benefits, and the making use of nature. Water is a natural element that has been put to many uses and has become a basic need for living organisms (Young, 2005).

Interestingly, the meaning attached to nature takes varied forms when society actively celebrates their own interpretation of nature through cultural events. Even beyond that, putting nature to a diversity of uses is also apparent in society's efforts in incorporating nature as part of the struggle ideology, political goals, and policy visions whenever the opportunity to formulate public policy arises. To that end, the emergence of political ecology thinking as a new study, which emphasizes the importance of nature a not only as an object, but also as a subject which has the potential to influence and compel society to take action.

Thus, the struggle to attach meaning and interpretation of nature as a policy becomes an interesting discourse in politics research and policy studies; especially in the context of society where local traditions are the principal source of values. This is because determination of priorities in contestation with world views and outlook, meaning, and interpretation of nature in traditional society are not always based on modern scientific principles. This is the main reason why this article is important. The article discusses the diverse interpretations of nature. The diversity in interpretation is not only limited to academic versus the government, but is also very evident, amidst members of society. There lies the urgent challenge of finding a win-win solution through finding common ground among a diversity of interests of different actors who profess and practice equally different interpretation of nature and management of water resources.

RESEARCH METHODS

The study is a comparative investigation that the author conducted during 2008-2016 period in several locations that included Yogyakarta city, Semarang city, Semarang district, Salatiga district, and Klaten district (Indonesia) and Pahang state (Malaysia). A cast study approach was used with the expectation of generating unique research results and outcome from each location (Neumann, 2003). To that end, the expectation is that uniqueness of the research findings will help to explain the scientific construction of water as a natural resource, and that way help in finding some amicable and sustainable consensus for the diverse interests of various actors in relation to recognizing nature, water resource and water resource management.

Data that were used were obtained in two stages. First, identifying and selecting opinion leaders who became key informants and resource persons. Rithcie and Lewis (2003) underscores the importance of opinion leaders in qualitative research and case study approach. This is because of the representation that each resource person commands. Thus, the study conducted a mapping of potential key informants based on their competence and capacity to provide relevant information, and afterwards cate-

gorized them prior to obtaining field data. The mapping was aimed at determining the competence of informants as well as identify the kind of informant that each informant could competently give. The outcome of the mapping and categorization of informants was a list of informants and interview guides.

Secondly, interview guidelines were used to obtain primary data from selected informant using in-depth interviews. The mapping was aimed at determining the competence of informants as well as identify the kind of informant that each informant could competently give. The outcome of the mapping and categorization of informants was a lis of informants and interview guides. Secondly, using interview guidelines to conduct in-depth interview with selected informants. The data collection technique was chosen because of the strengths and advantages in obtaining detailed unique, specific, and interesting data on a phenomenon. To that end, the author was involved in collecting data using interview, documented outcomes of interviews from opinion leaders in society, government institutions, and NGOs that were deemed having the capacity to provide key data and information required for the author to support the argument development process during the course of the research.

Data analysis involved comparing research findings and data from all the case studies using the same approach, findings from each case study were later compared with those obtained from other findings from other case studies (Table 1). The expectation was that comparison of case study findings would generate patterns that linked findings across caste studies. Nonetheless, the author deems it necessary to complement the previous research findings with results of research that is currently underway. Such research includes Diwak Hot water bathing in Semarang district.

Findings in each location focused on water use and management. To minimize information bias, the research mapped water in accordance with natural science approach (biology, chemistry, geology, and so on) as well as social science and policy (Mclnerny et.al., 2014). Water was categorized on the basis of the diversity of existing values, both from the perspective of science and social parameter (Costanza et.al., 2014). The research employs a local political and policy approach to present a scientific construction of natural science that underpins the process of water becoming a source of benefits to society, within a context where the two are essentially intricately interrelated and interdependent (Young et.al., 2014), (Wesselink et.al., 2013).

RESULTS AND DISCUSSION

Water from The Perspective of Science Vis-a-vis Contestation

Based on findings in previous research, there are various interpretations of meaning that society attaches to water (Peranginangin, L. S. U., 2014). In the context of a rational and modern society, meaining that is be attached to water should be based on modern and rational principles.

Academia and government also must have an understanding of water, which serves as basis for analysis that is used in formulating policies, including on water resources management. On the contrary, the meaning and interpretation of water in local and traditional society which is underpinned by traditional, cultural and communal viewpoints in its social and political structure is very different.

It is not surprising therefore that policies issued by the government, are often contradict cultural values in society (Budiman, A., 2001). In fact under some conditions, informal authority or power can bear strong influence on the implementation of policies which are not based on prior sound scientific analysis. This happens because water is a basic need for all sections of elements, including local and traditional communities, the availability and access to which, the government should facilitate (Seftyono, Cahyo, 2013).

Some studies indicate the existence of "negotiations" between the perspective of the science of water as a natural resource and needs of society for water, which is evident in Code river banks society in Yogyakarta. Based on the rules that the Government of Yogyakarta issued on river band and community, specifically the provincial disaster reduction agency (BPBD), there is a boundary between the residential areas and

river fringes. However, the existence of need to fulfil the right to homes/shelter for citizens, governments, educational institutions and independent research institute devised necessary measures to craft the best approach to meet that basic need under the circumstances .

Consequently, the 3 M concept emerged in relation to the development of settlements along Code Kali -Yogyakarta: "Mundur, Munggah, Madep Kali" (shift backwards, elevate, and face the river). Scientific reengineering besides generating benefits in terms of cost savings, it also has social and cultural advantages. For instance, it enhances the society appreciation of one another as well as the value and importance of maintaining a river to society. Such an achievement is attributable to the fact that members of society live together and interaction intensively while making collective use of the river together with the river.

The involvement of member of academia in reengineering the relationship between science and public policy is unavoidable. This is due to the fact that the neutrality attached to academia, which is an important value in conducting realistic planning and evaluation (Ingold et.al., 2014). The importance of academia is also reflected in a research in Tasik Chini-Pahang Malaysia, where Universiti Kebangsaan Malaysia was one of the most important actors in the research on environment and spatial planning in the region.

Academia in other places, serves as facilitator in resolving problems that arise from the conflict between science and needs of society. Milkoreit et.al. (2015) gives an even more concrete analysis. Academia in addition to mediating academic analyses is also an agent of advocacy for crucial issues on the environment and society. In this case, this is through the involvement of academia in providing support for development ideas that are environment friendly as well as in encouraging policies that create solutions without endangering public rights, directly and otherwise.

Some of the roles academia plays in translating science into public policy are futuristic in nature. Society does not only face today's reality, but must also have to contend with the future state of things which require forecasting or prediction. Some of the important things which Science has succeeded in identifying through prediction and have become public policies include at the global level include greenhouse gas effect and maritime pollution.

With regards to the greenhouse gas effect, today we face a gaping hole in the ozone layer which has crossed the safe threshold, with dire implications for global warming for all parts of the earth (Paustian et.al., 2004). Nonetheless, academia has devised a solution through cutting the emission of CFC (Chloro Fluoral Carbon) and curbing the use of fossil fuels.

Another example on the role of academia is in finding solution to marine pollution s other marine problems as elucidated in (Mathis et.al., 2015). According to the source, PH of sea water has deteriorated since the beginning of the industrial revolution. The impact has been manifested in the deterioration of marine life. Such a problem is evident in the quality of water in Tasik Chini, which crosses land that is used for oil palm plantations. A lot of chemical residues find their way into the river stream, polluting the water in the process, with dire consequences for the biodiversity in the river.

To that end, academia try to transform the issue into one for which all parties are responsible. Consequently, the demand for palm oil business activities, nature tourism (which also generates pollution of its in terms of effluents from homes), and meeting the basic needs of local communities society. Today, Tasik Chini has become one of environment-themed tourist destinations in Malaysia.

Connecting Science to Local Politics and Policy

The relationship between water, from the vantage point of science, and local public policy is strongly linked to the existence of three important actors in the formulation of public policy. The three actors include society, academia and the government. The three actors, not only interact intensively among each other, but also have strong influence on the interpretation of and response to policy. Their interpretation of and response to, policy on water can both be active and passive. Figure 1 shows the relationships among the

three actors and their interpretation of policy.

Who has the authority to interpret science on water?

As the elucidation in the previous section showed, there are differences in the meaning that society, academia, and government attach to water. The difference in meaning attached to water is attributable to the differences in understanding of the knowledge and authority that is vested in each actor. In relation to society for example, their understanding of issues from vantage point of science is limited to their learnt in classrooms and some additional knowledge that was acquired through special training. This is contrary to academia, who specialize in water as a science which is integral to their livelihoods. To that end, the understanding that academia has about science is more detailed and deep compared with the knowledge the general public have.

The condition that academia faces with respect to science is similar to that of government officials. In government institutions there are elements that serve provide scientific functions. Government officials therefore are not only limited to being implementers of policies they formulated, on the ground, but also act as thinkers on all existing and emerging issues. To that end, access, understanding, and worldview or outlook government officials have in relation to the interpretation of water, is often not dissimilar to that espouses by academia.

Nonetheless, stark differences in attitude and interest of the three actors emerge when a deeper look at the context in which they exert influence on existing policies. The various interpretations of water by the three actors is reflected in policies that are implemented, which in turn depends on the influence that is vested in each actor. Meanwhile, the general public, is in general, largely involved in the implementation of policies, and plays limited role in agenda setting and policy formulation.

In fact it is not far removed from reality to say that the general public is by and large, the party that faces the impact of policies the government implements. In this regard, being intensively involved in policy implementation while playing a passive role in agenda setting and policy formulation, makes public participation passive. In a number cases, the general public is also involved in the formulation and evaluation of policy. However, it is the government that plays the pivotal role in determining the outcome of policy formation and evaluation.

Besides, academia and society have different interpretation of water. Academia, is relatively more actively involved in interpreting and influencing government policy, through research and academic institutions where it can contribute to new research.

The involvement of academia also occurs in formal channels through carrying government our work through research funds. In this position, academia are required to play an active role during the policy formulation and evaluation phases. Academia gives policy suggestions and ideas to the government in accordance with their competence and expertise in the form of policy briefs. In addition, academia also undertakes evaluation of policy that has been implemented by the government. Thus, academia differs from the general public. Another important feature of academia is that once the policy is approved, it 'withdraws' from the policy process prior to its implementation. Academia is longer intensively and actively involved in the policy implementation process. The same applies to the government. Equipped with quality and all round human resources, the government has diverse stances and interpretation of science. The government has the ability to consider an issue from various perspectives, by making use of SWOT analysis (strengths, weaknesses, opportunities and threats) and through the use of priority scale approach. To that end, the government is able to give a comprehensive picture on understanding issues that relate to water that arise from various perspectives of science, politics and policy. Nonetheless, research results from Code river banks-Yogyakarta and Diwak hot water bathing site, Semarang district, disclosed something interest that is crucial to grasp an understanding of the meaning that is attached to water which in turn translates into government policy on natural resource management. It is the fact that government understanding is in contravention with com-

Table 1. Mapping in Value of Water Resources

Location/ Topics	Natural Science Approach	Socio-Political and Policy Approach	Natural Science and Socio-Political/Policy Approach Integration
Tasik Chini-Pahang	Water pollution (M.Y. Arafat, I.M. Sujaul, Zularisam A. Wahid, 2016) and heavy metal concentration (Jasim, Idris, Abdullah, & Kadhum, 2014) in influencing quality of water in Tasik Chini	Potential place of Tasik Chini as natural resources in promoting Eco-Tourism Program (Habibah, Mushrifah, Hamzah, Er, et al., 2013)	Potentical of Tasik Chini (Habibah, Mushrifah, Hamzah, Buang, et al., 2013) and society support in managing Eco toursim (Seftyono, 2011).
Kali Code - Yogya	Water Quality and the impacts on natural and socio-economics potential of Code River (Purnama, 2013)	Value of Code River in Society Perspective (Seftyono, 2010).	Code River as Disaster Prone area and the prospects of eco-tourism and livable place (Rachmawati & Budiarti, 2016) (Seftyono & Noviyanti, 2017)
Rawa Pening-Salatiga/Ambarawa	Environmental Condition and eutrophication in the quality of Rawa Pening as Natural Lake (Sulastri, Henny, & Handoko, 2016) based on Pesticide Use (Isworo, Purwanto, & Sabdono, 2015)	No recent data	Eco-Tourism in society perspective (Political Perspective) (Seftyono, 2014).
Umbul Cokro & Jolotundo-Klaten	Vegetation and water supply in Umbul Cokro and Jolotundo (Saputra, 2014) (Sancayaningsih, Saputra, & Zahra, 2014)	No recent data	No recent data
Curug Kalisidi-Kota Semarang	No recent data	No recent data	Natural resources and society preparation for Eco-Tourism program (Seftyono, Arumsari, Arditama, & Lutfi, 2016)
Air Panas Diwak-Kabupaten Semarang	No recent data	No recent data	Natural resources and society preparation for Eco-Tourism program (Seftyono et al., 2016)

Source : Data Analysis

munalism spirit that is embodied in the meaning that the general public attaches to water. Despite being an urban society that is associated with utilitarian and materialistic behavior, members of the public show strong willingness to use water collectively. To ad-

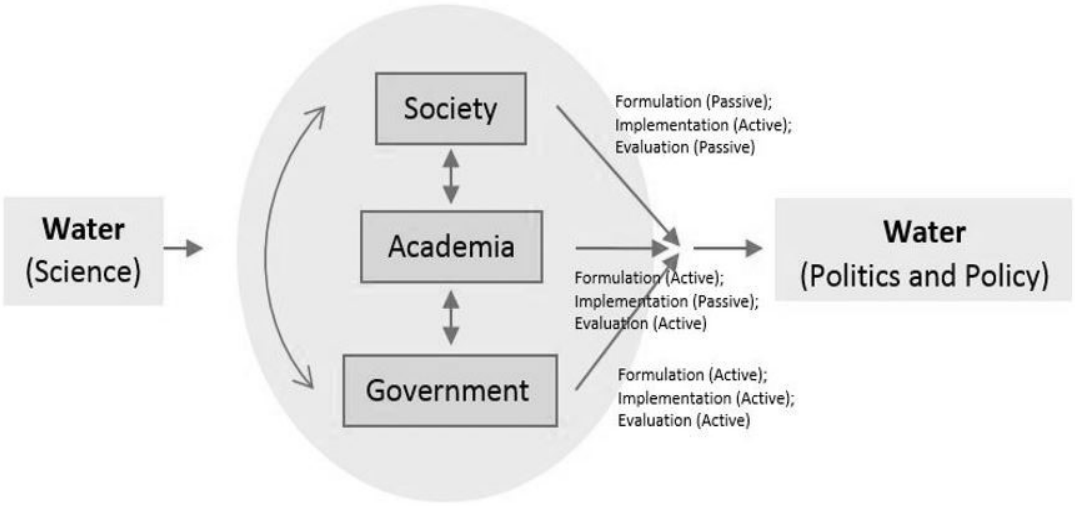

Figure 1. Society, Academia and Government Nexus
Source : Data analysis

dress problems that often arise in making use of government budget, the general public responds by contributing to the development of their areas through self-help efforts.

Research finding in Code river-Yogyakarta and Diwak hot water bathing site in Semarang district attested to the absence of rivalry and competition for budget resources among community members, but concerted effort to ensure that other members played their respective roles. In other words, community members were motivated by the spirit of "if we can share, why should we engage in rivalry and competition", in using budget resources. With the hope that achieving better collective wellbeing from water resources (Code river banks and Diwak hot water bathing site) will run smoothly, sustainably and without any conflicts.

Authority in influencing policy

The manner and forms in which actors that are vested with authority over the two components, interpreter and actualize and translate their respective interpretation of water as a science into policy on mater management is another important issue on the relationships among science, politics, and policy. This is important because knowledge about water without the factor of authority and influence does not have much importance.

Today, the concept of capital based knowledge has taken on increasing importance. Nonetheless, the reality is that political power and influence and access to policy also play key roles. The combination of power, politics, and access to policy, makes issues that relate to science and policy susceptible to become sources of conflicts, resolution, and compromise. It is at such point that actors contest among each other in pursuit of their respective interests. Nonetheless, with time, there is still room for reflection and even taking common stand that creates the synergy necessary to face problems. Such finding was evident in Code river banks community (Rachmawati & Budiarti, 2016) and Diwak area which is famous for its hot water bathing site (Seftyono et.al., 2016).

The power and access to policy approach puts the general public, academia, and the government in a difficult position (Smajgl et.al., 2013). Each actor has independence, freedom, and interest in interpreting water and form a policy that is appropriate to for water management. The interpretation of water and formulation of an appropriate policy on water management should in principal be underpinned by the objective of fulfilling public need for water.

In countries such as Indonesia and Malaysia, where democracy has taken root, the

general public plays a great role in interpreting the meaning and in management of water. To that end, approaches on interpreting and understanding the meaning of water is not the monopoly of academia and the government. On the contrary, the general public also has its own viewpoint, values, and management of, water.

From the vantage point of the general public, water does not only have a primary function, but also secondary and tertiary functions. Water is sold, it has invigorating, and attracting features as an object of ecotourism, and even in some tradition, and water is associated with sacred features hence used as a cultural media in ceremonies. In the non-formal context, the public plays an active role in the implementation of public policy. Such active participation is manifested in activities that are conducted after reaching general consensus, at both the household, second tier household neighborhood, to hamlet or village level and national and internal level.

Meanwhile, with respect to the role of academia, authority influence, and access to policy, it takes two forms: independent or financed by the government. Academic institutions that have their own funding tend to exhibit relative neutrality in their activities. This is attributable to the fact I doing their work, such institutions do not have to fulfill government expectations and interests. On the contrary, academia whose activities are based on funding from the government is obliged to follow procedures and dictates of the government.

Despite differences in standards and viewpoints on the meaning attached to science of the two models of financing research, the contribution of academia in interpreting science and formulating policy lies in policy formulation and evaluation. In principal, however, academia has a more active contribution to the two policy phases. Academia provides non-governmental consultancy to support or give inputs in what the government does.

Such a role enables academia to contribute to scientific reengineering services as well as in conveying research findings to the government. This is in line with the existence of the Center for Tasik- Chini research, in Universiti Kebangsaan Malaysia which dabbles as a research center and disseminator of information, discoveries, and field research findings to the public (Seftyono, 2011). This function is similar to what academia does through forest and climate change news reports in Sweden (Kleinschmit et.al., 2014).

However, it is the position of the government that is even more interesting. This is due to the fact that the government is not monolithic or a single entity, rather comprises several sections that conduct various distinct functions: planning institutions, finance, and so on. To that end, the meaning that is attached to science that emanates from the government does not constitute a singularity , but various 'voices' that include the planning body at both the national and local government level.

In the meantime, with respect to policy implementation, there are agencies or government offices that are responsible for executing policy. Policy implementation, which occurs after the policy has received the approval of the legislature and government supervisory agencies such as the Supreme Financial auditing agency and the corruption eradication agency and so on.

Government system and institutions in Indonesia bear resemblance to those in Canada and Australia. In the two countries, the functions of civil servants or government apparatus are complex but also characterized by clear delineation or work (Hickey et.al., 2013). Civil servants serve in role that are in accordance with their respective core tasks and functions. Nonetheless, with regards to the context of attaching meaning to water and water resource management, of the three actors above, the government through its various elements is the most active player in the policy formulation and implementation process.

To that end, ideally, the government must have the ability to mediate the meaning attached to water from the perspective of science professed by the general public, academia, which subsequently embodied in the formulation of policies that are more productive and provide solutions to existing water related problems (Van Enst et.al, 2014). At this point in time, the science of water in this context, is no longer based on a singular perspective as an object, but encapsulates a

multiplicity of values. The prevailing meaning, is thus elucidated in positive political contestation, leading to environment friendly and pro people policies.

CONCLUSION

Science cannot stand on its own. Science follows context in which it is applied. To that end, at the level of ideas, science does not only have principal features, which are akin to the flow of water from high to low pressure, following the form that the object or terrain takes, and so on. Nevertheless, at the level of implementation, the basic features which characterize the implementation of science oftentimes adopt to the reengineering process that is done in accordance with the needs of the community in the vicinity.

There has been an expansion and extension of the meaning and value of water, in the context of fulfilling societal needs has expanded. The meaning and perspectives of water, are no longer limited to science but is today involves cultural, economic, social, and political values. Water has become a basic need of humanity, which is why, it has spawned competition over its access and use. Besides becoming a basis and primary need, there is a section of society that consider water as a source of social integration.

In that case, an in-depth discussion on the meaning attached to water and the policy on water management is very crucial. This is because water is no longer viewed as just a science, but also a medium for fostering and creating harmony in society. To that end, this articles makes three principal arguments. First, the meaning attached to water and good policy on water management can be the monopoly of a single entity or party. In a number of findings in previous research, good policy on water management to meet public need for water in fact becomes the confluence of various interests, inter alia, the government, academia and the general public.

Secondly, in the context of social relations in society, which is built and developed on the basis of the existence of a collective use of water, this research provides interesting findings. The research finding, shows the extent to which under certain conditions, individuals with varying interest provide mutual support and assistance in accessing and using water resource.

The approach used in making use water shifts from considering water as a resource that can be contested over to one that can be shared, and managed collectively to the benefit of all. That perception about water shifted to a resource that must be protected by all members of society, an approach that fosters the creation of a harmonious, caring and sharing society.

Thirdly, this article espouses the view and standpoint that sustainable management of water resource must take into account local uniqueness and traditions that in turn inform the need of society for the resource. The expectation is such an approach will protect society from losing out from the contestation over the interpretation and influence over the formulation and implementation of water management policy. It is at the point when society who use water, on one hand, and science, politics, and policy, on the other, that the meaning of water experiences changes.

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