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**Assessing Science-Based Solutions to Forest Management: A Case Study of the Upper Brantas River in Indonesia**

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**Abstract.** Brantas river spring area (KMASB) is located in Batu, East Java, Indonesia. The forest areas nowadays are damaged because its function is changing from forest to agriculture. Efforts to solve these problems require the involvement of various parties. Including scientific solutions to provide input in policy formulation. The transfer of scientific knowledge in policy can work depending on whether decision-makers can turn scientific advice into policies that are acceptable to all actors involved. To investigate the procedure for sharing scientific knowledge from cases of endangered Brantas River resources in Indonesia, we adopt the "research-integration-utilization" model of science-policy interaction. Scientific knowledge is created through scientific systems (research). Political actors implement a scientific-based solution to answer the problems (utilization), and there must be significant linkages between research and utilization (integration). We use empirical data to evaluate hypotheses about the research-integration-utilization model based on document analysis and expert interviews. According to our research, the local government's use of its limited authority and improper application of scientific findings are to blame for the failure of knowledge transfer. The Batu city government cannot turn the scientific solution into a regulation while being required to employ scientifically sound solutions as a prerequisite for creating regional regulations. The Batu city government put its own solutions into practice because they think they are comprehend more thoroughly than the researchers. Researchers are unable to participate in the integration process since the Batu city government is a powerful actor to determine the scientific suggestions that are made.

**Keywords.** Forest, RU, Science, Policy




**1. Introduction**

The efficient exchange of scientific knowledge between practitioners and scientists depends on science-based policy recommendations. The linear and coproduction models are two of the many models available for the transmission of scientific understanding (Maas et al., 2022). The linear model applies techniques from technology and scientific research (Sokolovska et al., 2019) and public policy and science (Pielke Jr, 2005; Sarewitz, 2000). According to this model of competence, scientists must first "get it right" before policy is involved (Rappert et al., 2018). The concept of the linear skill model is that knowledge is a necessary (but insufficient) foundation for decision-making (Wan et al., 2020). If the scientific

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**Abstract.** Brantas river spring area (KMASB) is located in Batu, East Java, Indonesia. The forest areas nowadays are damaged because its function is changing from forest to agriculture. Efforts to solve these problems require the involvement of various parties. Including scientific solutions to provide input in policy formulation. The transfer of scientific knowledge in policy can work depending on whether decision-makers can turn scientific advice into policies that are acceptable to all actors involved. To investigate the procedure for sharing scientific knowledge from cases of endangered Brantas River resources in Indonesia, we adopt the "research-integration-utilization" model of science-policy interaction. Scientific knowledge is created through scientific systems (research). Political actors implement a scientific-based solution to answer the problems (utilization), and there must be significant linkages between research and utilization (integration). We use empirical data to evaluate hypotheses about the research-integration-utilization model based on document analysis and expert interviews. According to our research, the local government's use of its limited authority and improper application of scientific findings are to blame for the failure of knowledge transfer. The Batu city government cannot turn the scientific solution into a regulation while being required to employ scientifically sound solutions as a prerequisite for creating regional regulations. The Batu city government put its own solutions into practice because they think they are comprehend more thoroughly than the researchers. Researchers are unable to participate in the integration process since the Batu city government is a powerful actor to determine the scientific suggestions that are made.

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## 1. Introduction

The efficient exchange of scientific knowledge between practitioners and scientists depends on science-based policy recommendations. The linear and coproduction models are two of the many models available for the transmission of scientific understanding (Maas et al., 2022). The linear model applies techniques from technology and scientific research (Sokolovska et al., 2019) and public policy and science (Pielke Jr, 2005; Sarewitz, 2000). According to this model of competence, scientists must first "get it right" before policy is involved (Rapport et al., 2018). The concept of the linear skill model is that knowledge is a necessary (but insufficient) foundation for decision-making (Wan et al., 2020). If the scientific

evidence is reliable, science is thought to have a powerful and deterministic influence on politics. After then, they directly and immediately affect policy (Kreps & Kriner, 2020). It is believed that politics and science have a unidirectional relationship, linear, and one-way: Science aims to guide policy ("speaking the truth to power") (Jasanoff & Wynne, 1998). The co-production model is the second paradigm, which is characterized by collaborative governance and participatory research and is typically founded regards to the theory of change (Schuttenberg & Guth, 2015). The study model's ultimate objective is to hasten the adoption of judgments and actions that are informed by the greatest knowledge currently available in order to address challenging sustainability concerns (Parker & Crona, 2012), and concentrate on the development of knowledge (Polk, 2015). Co-production will be successful if there is the right representation, ability, trust, and commitment to learning (Schuttenberg & Guth, 2015). As a link between politics and research, advice on scientific policy (science-policy interface) (Soomai, 2017). Therefore, an important research question is how to motivate politicians to employ science through the transmission of knowledge (Turnhout et al., 2016). Many academics adhere to a linear theory of the dissemination of scientific information in which politics solely takes into account the results of science (Hulme, 2009), and regret that there is not enough scientific evidence to sustain current policy practices. The two opposing perspectives on the intersection between science and policy serve as the basis for the goals of this study, which are to increase understanding and develop more accurate models of the relationship. Political scientists contend that there is a fundamental mismatch between the political and scientific ideologies, making it difficult to apply a clear grasp of science and its immediate influence on politics (Böcher & Krott, 2016a; Hunger & Paxton, 2022).

Brantas River passes through 17 regencies and cities in East Java and the headwaters of the Brantas River are in Batu. Brantas River Spring Area (KMASB) is an area of protected forest and production forests that were once in very good condition. KMASB has narrowed its area due to changes in forest function to vegetable farming. The impact of changing the function of the catchment area makes the springs dry up and sedimentation occurs in the upstream area caused by erosion. Sedimentation in the upstream area is caused by the process of silting in the dams Brantas watershed. The conversion of forest land to dry fields, namely rainfed land planted with vegetables, has the potential to be damaged by erosion.

The Government of Batu and related agencies often arrange rehabilitation programs to carry out reforestation in protected forest areas damaged by land conversion. However, the local community, who are mostly vegetable farmers, emphasized that the land planted on the rehabilitation land would reduce the productivity of vegetable farming because their vegetable crops would be shaded by trees. They argued that they had obtained permits and land management rights from State Forestry Public Company (Perum Perhutani in Indonesian) to grow vegetables under the stands. If they don't grow vegetables, they can't eat because vegetable farming is their livelihood. On the other hand, arguing for the demands on food security and increasing agricultural productivity, the community gets guidance from the agriculture office to be able to increase their agricultural productivity.

The Forest and Land Rehabilitation Program (RHL) is a national initiative to improve the carrying capacity, productivity, and role of forests and lands in maintaining life support systems by restoring, maintaining, and enhancing their functions. As an upstream area of the Brantas River, the RHL is carried out to restore the hydrological function of the Watershed, especially in the KMASB area, a good rehabilitation program.

However, the local people were not consulted publicly over the ongoing land rehabilitation effort by the government or other relevant parties. They believe that the

rehabilitation program in the KMASB area should continue to be carried out based on the results of the research that has been done. As a result, forest rehabilitation in the KMASB area, which is claimed by the local community as their property was not successfully implemented – giving rise to conflict. The overview of the issues in this region and the contention between the locals and the Batu government served as the basis for our case study. This paper's goal is to investigate the mechanism of knowledge transmission from the creation of knowledge-based suggestions to the Government of Batu and other relevant parties acting as regulators. Although the district government actively sought out scientific opinion for the restoration of KMASB, the transfer of scientific knowledge failed because local groups who also asserted ownership of the land were disregarded.

The findings of the study on the rehabilitation of KMASB are to advise the Batu government on policy based on science. However, the local government only utilized a portion of the suggestions, including some of them in the problem-solving policy. It is not easy to adopt science into policy because of the GAP mindset between researchers and political actors. The findings are therefore biased; this is not due to the caliber of the research, but rather to the variations in how the local government has used its authority to exploit the research conclusions. By citing science-based data, the government of Batu can justify its activities as being legal.

How can scientific knowledge founded on scientific norms influence and transform power-focused politics is the main issue. We have created the following study questions based on the issue of misused interactions between science and discoveries in the forest and land rehabilitation program at KMASB.

1. Are scientific findings used to inform policy recommendations for KMASB management?
2. What is the contribution of science to designing this solution?
3. How are the suggested policy changes put into practice to address issues?

To better understand the use of research-based information in policy, we suggest a scientific knowledge transfer model that does not overestimate the possibility of the direct application of science or undervalue the use of scientific information. The model can describe the two-way interaction between scientists and decision-makers and assess increasingly complicated and non-linear policy processes using scientific knowledge (Böcher & Krott, 2014a, 2016a). Along with the important role played by powerful allies in the dissemination of scientific knowledge who can advance scientific solutions despite opposition from other individuals (Dharmawan et al., 2017a, 2017b).

Research-integration-utilization (RIU) model's value can be empirically proven, and the various connections between research activities, integration, and utilization can be precisely defined, this study used a case study of the project hydrological rapid assessment of the Trees in Multi-Use Landscapes in Southeast Asia (TUL-SEA). Inappropriate utilization of scientific findings results in failures in knowledge transfer. According to Presidential Regulations No. 188/1998, the city authority must cite scientific findings in regional legislation. However, the city government only used scientific advice as a precondition when drafting the regulation. On the other hand, District governments favor using their own solutions because they feel they have a better understanding of appropriate remedies to real-world issues than researcher

## **2. Research-integration-utilization model and hypothesis**

For the successful transmission of scientific information between practitioners and scientists, science-based policy guidance is a crucial requirement (Sarewitz & Pielke Jr, 2007). There are a number of approaches for the dissemination of scientific information; the linear



model and coproduction are two of them (Bandola-Gill, 2022). The models of linear incorporate methods from scientific and technological research (Jasanoff et al., 1998). and public policy and science (Pielke Jr, 2005; Sarewitz, 2000). According to this model of competence, science must first "get it right" before policy can be effective (Thoni & Livingston, 2021). According to the linear skill model, knowledge is a necessary (but insufficient) foundation for making decisions (Boswell & Smith, 2017). If the scientific facts are "sound," science is seen to have a powerful and deterministic effect on politics. After then, they directly and immediately affect policy (Beck, 2011). Politics and science are thought to interact in a one-sided, linear, and unidimensional manner ("saying truth to power") (Jasanoff & Wynne, 1998). The next model is a collaborative governance strategy based on the idea of change called co-production, that's referred to as participatory research (Schuttenberg & Guth, 2015). This research model's ultimate objective is to hasten the adoption of judgments and actions that are informed by the greatest information currently available in order to address challenging sustainability concerns (Cash et al., 2003; Crona & Parker, 2012; Mauser et al., 2013), and emphasizes the process of creating a new knowledge (Walter et al., 2007). If there is the proper representation, trust, dedication to learning, and capacity, co-production will succeed (Schuttenberg & Guth, 2015).

To better understand the use of research-based information in policy, we suggest a scientific knowledge transfer model that does not overestimate the likelihood of the direct application of science or undervalue the use of scientific information. The model can describe the two-way interaction between decision makers, researchers, and assess increasingly complicated and non-linear policy processes using scientific knowledge (Böcher & Krott, 2014a, 2016a). As well as the crucial part played by powerful friends in the dissemination of scientific information who may push through science-based solutions despite opposition from other individuals (Dharmawan et al., 2016).

We employ the Research-Integration-Utilization (RIU) approach, which was created by Bocher and Krott (2016a), to offer recommendations for policies based on science. Scientific policy advice is defined by the analytical RIU model as the relationship between the different logics of research (R), integration (I), and utilization (U) (Böcher & Krott, 2016a). To produce scientific policy advice products, a two-way, switching between research and integration activities in a non-linear manner is expressed by the RIU mode. This approach is designed to examine the particular activity shared by the advancement of scientific understanding and scientific application of politician.

The creation of specialized knowledge via the application of scientific standards and techniques is known as research. The approach illustrates the need for high-quality research as a crucial condition for the dissemination of scientific information (Lentsch & Weingart, 2011) due to the fact that the quality of scientific information affects its validity and how practitioners use it (Pregernig & Böcher, 2012). When scientific conclusions are based on "state of the art" or "excellent-science" science, they are more legitimately used in environmental policy. There are standards for evaluating excellent scientific practice, such as those of the German Research Foundation, the UK's Director General of Research Councils (DGRC), and Chief Executives of the Research Councils (Forschungsgemeinschaft, 2013).

The following are crucial inquiries to ask when evaluating the quality of a scientific study by good scientific practice (Forschungsgemeinschaft, 2013): "Does scientific study follow ethical guidelines? Are the methods and findings of the research well-documented? Will the latest discoveries be released in a scientific journal? Has the assistance of outside scholars been enlisted when confronted with challenging questions? Many experts think that a key requirement for the standard of the provided scientific competence determines the quality of

science-based policy recommendations (Lentsch & Weingart, 2011). Reliance on current science (evaluating current scientific knowledge), adherence to sound scientific principles, cooperation with other scientific organizations, and projects are among the factors used to judge the quality of research (see table 2) (Böcher & Krott, 2016a).

Integration is referred to as a two-way phase in the relationship between research and practical usage. Research findings that are pertinent to political actors are chosen during integration utilizing standards based on actual needs. Meanwhile, according to Böcher and Krott (2020), Scientific research topics are understood as the practical need for scientific answers. Integration links scientific data to practical actors' aspirations and political interests without changing or distorting the findings of scientific study. It takes considerable understanding of the available scientific skills and practical experience to interact between research and integration (Dharmawan et al., 2016, 2017a). By choosing specific "knowledge bricks," integration connects research to real-world needs. Because they exhibit "advanced" science and are applicable in real life, these bricks are reliable (Dharmawan et al., 2016, 2017a). Useful truths assist rational decision-making and withstand the scrutiny of science (Jasanoff, 1998). Orientation to public aims, relevance to the political process, relevance to allies, and using a particular medium for target group-focused intermediation are all necessary evaluation criteria for integration efforts (Böcher, 2016). Utilization refers to the deliberate application by political actors of scientific advice. A variety of consultation materials are available, including brochures, written reports, new norms ideas and regulations, and implementation manuals (Böcher, 2020). Scientific articles or contributions to scientific gatherings are other ways to share discoveries that are necessary for policy guidance with the scientific community. This is another potential outcome of the transfer of scientific knowledge that can be used scientifically rather than politically. This distribution assures that the whole RIU process is conducted with high standards of research and that the scientific data used to educate policymakers is current. The distribution of goods to the scientific community as well as the actively utilizing scientific advice by political actors, people, the media, and administrators are among the criteria used to evaluate usage activities (see Table 2; Böcher and Krott (2016)). In our case study, agriculture management scientific research serves as an example of the scientific method for KMASB management research. Governments use the "integration" process to choose scientific discoveries that align with their objectives. The administration of KMASB also entails farmer engagement and their reaction to the scientifically informed policy. Discovering scientific guidance that is actively employed by the government for policy-making in agricultural management is what is meant by "utilization." It also takes into account the many scientific guidance materials utilized by governments and the farming industry. As a result, we formulate the following three hypotheses:

**Hypothesis 1. A strong scientific foundation is provided by high-quality research for developing recommendations for KMASB management policies.**

Research must consider the interests of KMASB smallholders as well as design a win-win solution.

**Hypothesis 2. For policy advice to be useful, scientific research has to be professionally integrated.**

With professional integration typified by the ability to put scientific findings into reality, a win-win solution for KMASB smallholders and the government may be effectively achieved.

**Hypothesis 3. As long as influential players encourage alternative answers, scientific solutions are not used.**

KMASB land growers would be reluctant to adhere to municipal government restrictions as a result of poor administration and a lack of support for win-win alternatives. On the premise that sound scientific evidence is necessary for scientific recommendations, Hypothesis 1 is proposed. Insufficiently high-quality research makes it impossible to provide sound scientific guidance (Böcher & Krott, 2014b; Pregernig & Böcher, 2012). In the RIU model, high standards for research are utilized to ensure that the most recent scientific ideas, techniques, and data are used, all of which have been preselected by the integration activity as being pertinent to the solving of real-world issues (Böcher & Krott, 2016b). As a result, the first component of this study will be an evaluation of the caliber of the research conducted for the KMASB hydrological quick assessment.

Since actors can employ scientific guidance, Hypothesis 2 takes into account the applicability of scientific research (Cash et al., 2003). Linking research to practical demands may be accomplished by choosing specific "knowledge bricks" that are based on modern science and practical in application. These requirements are included in the RIU model (Jasanoff, 1998).

The third hypothesis presents a scenario in which scientific theories and practical scientific solutions are insufficient. (Politicians are aware of the suggestions based on research, yet they choose to disregard the fixes)

### 3. Methodology

On expert interviews and document analysis, this report is built. In 2022, we conducted in-depth expert interviews with employees of several government agencies, researchers, and community leaders engaged in scientific transfer (see Table 1). This interview's goal is to create a causal theory to explain our findings. We examine and ponder our theories via interviews (Mosley, 2013). The list of interviews is shown in Table 1.

On policy analysis, we also do a content analysis of government papers. Our expert interviews form the basis of the content analysis. We base our policy decisions on the most recent and pertinent legal and administrative decrees, executive orders, ministerial rules, and local government judgments.

Table 1 Interviews List

Interviews	Position
Interview 1, 2022	Interview with the sub-district head of Bumiaji, Kota Batu 15 February 2022
Interview 2, 2022	Interview with the head of Bulukerto village, Bumiaji sub-district, Batu City, 22 February 2022
Interview 3, 2022	Interview with the village head of Sumbergondo, Bumiaji District, Batu City, 16 March 2022
Interview 4, 2022	Interview with Sumber Brantas village farmer, Bumiaji District, Batu City, 23 March 2022
Interview 5, 2022	Interview with the head of the NGO Pijar Lentera, 23 March 2022
Interview 6, 2022	Interview with the head of the Brantas watershed communication forum, 12 April 2022
Interview 7, 2022	Interview with staff of Batu city agriculture office, 14 April 2022



Interview 2022	8,	Interview with staff of Perum Perhutani RPH Punten BKPH Pujon KPH Malang, 23 April 2022
Interview 2022	9,	Interview with staff II of Perum Perhutani KPH Malang, 28 April 2022
Interview 2022	10,	Interview with staff of Brantas-Sampean River Brantas-Sampean Management Center, Ministry of Forestry and Environment, 4 May 2022
Interview 2022	11,	Interview with staff II of the Brantas-Sampean River Brantas-Sampean Management Center, Ministry of Forestry and Environment, 4 May 2022
Interview 2022	12,	Interview with the staff of the East Java Provincial Forestry Service, 23 May 2022
Interview 2022	13,	Interview with Researcher I Rapid Hydrology Appraisal CIFOR-ICRAF, 23 June 2022
Interview 2022	14,	Interview with Researcher II Rapid Hydrology Appraisal CIFOR-ICRAF, 25 June 2022

#### 4. Main conflict: Agriculture in the KHSB

We employ the models of RIU to pinpoint three crucial transmission of scientific knowledge activities and their connections to the cooperative management of KHSB. How research affects the integration and usage stages is shown by examining the features of every activity (research-integration-utilization).

Around 1963, the community began to plant vegetables and some began to plant in the forest area with the permission of the Forestry Bureau (now Perhutani). The total area of vegetable crops was increasing, and in 1970 in the forest area, vegetable plants were found which were also getting wider. In 1998, deforestation began everywhere, including in the area of Batu, so that by 2001 the timber plants in the forest had been cut down. The conversion of forest land into dry fields causes severe environmental damage. The condition of river water has changed over the past few decades. The actual changes that occur are the decrease in discharge in the dry season, which is often very small, and in the rainy season there are often larger floods than in the past. Several springs that used to exist in production forest areas are now no longer releasing water or are dead. This is related to the condition of the surrounding land cover, where there are no large trees that can hold water, replaced by seasonal crops. Most of the land has been worked by farmers to grow corn or vegetables. People understand that if there is heavy rain at any time, then some of the exposed soil layer will be washed away as swallow (erosion) which causes the river to become cloudy.

The reforestation process was hampered by the activities of the community around the forest who planted the bare lands with seasonal crops, especially vegetables. Vegetable crops turned out to provide extraordinary and fast economic results for farmers, so they were reluctant to stop their activities. The programs developed by the government to rehabilitate the land were not able to stop their farming activities. Reforestation or planting forestry trees on Perhutani land is no longer possible due to community involvement in forest areas. The community can't be removed or evicted from the area, so the only way is to involve them in forest management (the concept of PHBM by Perhutani). On the other hand, there is a conflict of interest where the Batu City Agriculture Office is required to improve performance with the measurement parameter being that the increase in agricultural productivity is not measured from where the productivity of these agricultural products is grown and produced but is based on the final results of agricultural production by farmers.



### 5. Results and discussion

Tabel 2. Results of analysis using the RIU model

Activities of the RIU model	Criteria	Occurrence <sup>a</sup>	Description
Research	<ul style="list-style-type: none"> <li>evaluating the most recent scientific information</li> </ul>	+	This research evaluates scientific sources from across the world and at home.
	<ul style="list-style-type: none"> <li>adherence to good scientific practice guidelines</li> </ul>	±	Research methods and findings are recorded. However, no other academics examined the study's findings.
	<ul style="list-style-type: none"> <li>collaboration with outside scientific institutes and initiatives</li> </ul>	-	There is no partnership between this research and any other research.
	<ul style="list-style-type: none"> <li>Independent significance of scientific results</li> </ul>	+	The outcomes of the study on KMASB management are independent of other research endeavors.
Integration	<ul style="list-style-type: none"> <li>Orientation toward public goals</li> </ul>	+	Research suggests agroforestry models with upstream and downstream environmental services reward
	<ul style="list-style-type: none"> <li>Relevance for solutions to problems</li> </ul>	±	Because the difficulties relating to farmers who manage the KMASB region were not integrated, this study had limited success in fixing problems.
	<ul style="list-style-type: none"> <li>Relevance in regard to allies</li> </ul>	±	Due to the lack of integration of issues about farmers who manage the KMASB region, this research had little success in resolving issues.
	<ul style="list-style-type: none"> <li>Intermediation focused on the target group for the appropriate medium</li> </ul>	+	To communicate research findings to the general population, workshops are organized.
Utilization	<ul style="list-style-type: none"> <li>support for democracy</li> </ul>	-	Farmers do not fully support the land rehabilitation program by the city government, perhutani and the ministry of forestry
	<ul style="list-style-type: none"> <li>Support for the rule of law</li> </ul>	-	Regulations regarding: I management of the land around the Brantas River springs have not been released by the city administration

• Support for "good government"	–	City government policies lack citizen involvement.
• Problems should be solved appropriately	–	The research solution does not affect land use, as evidenced by the increasing area of vegetable farming by reducing the forest area
• involvement in the scientific conversation	–	No established scientific theory

**5.1. Research design: Designing Policy Advice on KMASB Management**

A win-win outcome requires the contributions of science. To create win-win solutions, Hypothesis 1 calls for recognizing the elements that motivate research. The RIU model states that in order to conduct high-quality scientific research, it is important to ensure that current scientific knowledge is used, that good scientific practices are followed, that external scientific projects are collaborated on, and that research plays a significant role in scientific discourse (Böcher & Krott, 2016b).

The project of Trees in Multi-Use Landscapes in Southeast Asia (TUL-SEA), funded by the Federal Ministry for Economic Cooperation and Development (BMZ) of Germany and Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) through CIFOR-ICRAF, undertook a research study on the hydrology of the upper Brantas river between 2007 and 2010. This study's objectives were to analyze the RHA method's implementation in the Sumber Brantas watershed and to balance the opinions and perceptions of all Sumber Brantas watershed stakeholders regarding the conditions and management of the upstream portion of the Brantas watershed. BMZ, GTZ, and CIFOR-ICRAF, as funding institutions and researchers for the management of the Brantas upstream area, really hope for a win-win solution between the actors in the KHSB; interested in ensuring the success of the Project Trees in Multi-Use Landscapes in Southeast Asia (TUL-SEA) rapid assessment of the hydrology of the region to save the spring environment from agricultural activities that have reduced the springs of the Brantas river.

The research approach assumes that granting official land management permits approved by Perum Perhutani will increase farmers' confidence in resource ownership, especially land (Suprayogo & Lestariningsih, 2010). Farmers will enforce their own rules as most of them do now. However, the involvement of Perhutani is needed to give additional authority to the formation of "pressure" groups. Perhutani will formally enable farmer organizations to enact rules and designate the proper law enforcement officers to enforce these rules as needed. The upper Brantas river region is being destroyed for a number of reasons, one of which being land conversion. However, vegetable cultivation in the Brantas River's upstream region has a very high potential economic value.

The study offers the government suggestions along with a number of options (Suprayogo & Lestariningsih, 2010): (i) There is a common understanding of the parties (Community and Government) regarding the hydrological function and management of the Sumber Brantas watershed, especially general matters, such as the relationship between forests, tree felling and river discharge (floods and droughts). Differences in details do exist and not all can be combined; (ii) Based on the simulation scenario modeling the impact of land management on the hydrological function of the Sumber Brantas watershed, the best result is if the entire "forest" area which is mostly used as agricultural land for seasonal crops is returned

to forest (reforestation) and plantation forest (agro-forestry), while the cultivated area is with slopes  $> 60^\circ$  are also planted with perennial crops (agroforestry).; (iii) There are several factors that are strong enough to be used as a basis in developing a reward-for-service mechanism between upstream and downstream in the Sumber Brantas watershed. In addition, in Batu City there has also been a preliminary process that can be used as a reference if you are going to implement a reward mechanism for environmental services.

The Sumber Brantas watershed's agro-forestry system with a reward-for-environmental service mechanism between upstream and downstream is the most desired and practical option among all the choices since it will be a win-win situation for all parties involved. In this way, farmers can still manage the land and on the other hand, land rehabilitation efforts can be carried out by the community getting compensation as a form of compensation. This research employs a community-based management approach to create a win-win solution and depends on local expertise to ensure the solution's applicability. The strategy is to create an informal law-based management structure already in place in the communities. Research is carried out to ethical scientific standards, and the findings are recorded. But before being included in a scientific publication, the research findings were not subjected to a review procedure. As a research funder, BMZ is exempt from requiring a review procedure. The scientific study then serves as the foundation for the creation of KMASB management policies by the federal and local governments (Suprayogo & Lestariningsih, 2010).

The majority of these elements are readily available, as shown in Table 1, therefore a scientific basis for effective policy recommendations has been given. Thus, Hypothesis 1 has been proven true: information is created by researchers through high-quality research, and this knowledge helps to provide recommendations that are supported by science and may be used to inform successful policy advice.

## 5.2 Integration of Policy Advice Effectively

Integration ties political action to scientific understanding (Böcher & Krott, 2014a). For scientific findings to be more applicable to current political challenges, public goals must be linked to them. The results of the study suggest improvement in the management and rehabilitation of KMASB. This growth will help to further the crucial Indonesian policy of environmentally sustainable forestry and land use. The study's findings suggest replanting of degraded forest areas due to the conversion of forest land into agriculture so that the hydrological function is disrupted (Suprayogo & Lestariningsih, 2010).

We explore Hypothesis 2, which states that professional integration with the possibility of putting scientific findings into practice can lead to a win-win solution for smallholders in KMASB and the government. On the basis of the criteria provided in the RIU model, this hypothesis may be evaluated against integration activities (Table 2). The definition of the criterion clarifies integration's significance (i.e., does science generate something), allowing the researcher to analyze its impact on sustainability, usefulness to allies, relevance to the issue, and intermediation of the target group (Böcher & Krott, 2016a).

The study's findings are pertinent to the issue with the damaged spring area and provide a good scientific option to improve the condition of the area (Suprayogo & Lestariningsih, 2010). However, its relevance is limited to the destruction of forests and the reduction in the number of springs in the Brantas river. Social problems arising from the application of research policies at KMASB are not a research question, but in other studies the social aspects of changing the function of forest areas to vegetable farming are widely discussed. City governments aim to utilize scientific results for direction and to justify their actions as needed,



making them the only unique ally that promotes research and incorporates the findings into local planning legislation (see Table 1; interviews 1, 2, and 11 and 12). Presidential decree No. 188/1998 is cited. Workshops are held by the local administration to present the public with information that is both politically and scientifically skewed. This is in line with how the government intends to give KMASB's rehabilitation legal standing (see Table 1; interviews 2, 3, 4, and 7). As a result, Hypothesis 2 is supported since its integration component captures how scientific knowledge is incorporated into policy thinking.

### **5.3. Failure to use research results in policy**

Through CIFOR-ICRAF, the Federal Ministry for Economic Cooperation and Development (BMZ) of Germany and Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) launched and completely sponsored the first study. This study was conducted to examine the application of the RHA method in the Sumber Brantas watershed and to equalize the perspectives and perceptions of all stakeholders in the Sumber Brantas watershed about the conditions and management of the upstream area of the Brantas watershed.

One of the recommendations for managing KMASB is if the entire “forest” area which is mostly used as agricultural land for seasonal crops is returned to forest (reforestation) and plantation forest (agro-forestry), while cultivated areas with slopes  $> 60^\circ$  are also planted with annual crops (agroforestry). The Batu city government held a socialization of the research results to the community but there was no adoption of the research results as outlined in the policy. The failure of this utilization is the limited authority of the Batu City government over forest areas in KMASB because it is under the authority of Perum Perhutani. Due to the formal weakness of the Batu city government towards the area, the recommendation to restore the function of forest areas as part of efforts to improve KMASB was unsuccessful.

Scientific problem solving is focused on improving forests as well as all areas that have undergone forest conversion, and does not analyze the specific problems of the social problems that occur within them. Science is limited to its subject. Scientific recommendations are not wrong, but cannot predict the problem of conflict over forest area use in KMASB. Science-based policy advice has failed due to the city government's limited control over the region under Perum Perhutani's control and the lack of scientific analysis of particular social issues. The third hypothesis, which describes a scenario where science and the scientific solutions employed are poor, is supported by the local government's activities. On the other hand, the many interests of the contesting actors and differences in perceptions of management in KMASB make the overlapping policies applied over the Brantas River spring area (KMASB) make it difficult for research results to be used in practice.

### **Conclusion**

The situation looks like to be an instance of the RIU Model failing, which asserts that successful integration and strong science are prerequisites for the transmission of scientific information, but RIU also stresses the significance of quality for each of the three components' criteria. RIU (research-integration-utilization) also emphasizes the connection between the three components. Only in the presence of a solid partnership does RIU anticipate a successful transmission of scientific information (Böcher & Krott, 2016a). In our situation, the research's findings led to the local administration receiving sound policy recommendations. Effective policy advice, however, does not seem to be a good solution in this situation since the municipal administration has a different understanding of the study findings and is not powerful enough to put it into reality. The city government offers solutions to local communities in terms of



managing KMASB and they emphasize to local communities that KMASB is a very important area for the sustainability of the Brantas river springs. Administratively, the upstream area of the Brantas river is in the Batu city area, but legally the forest area is under the management of Perum Perhutani. Numerous recommendations from the research findings were disregarded or only partially included into the area management regulations. The KMASB rehabilitation action plan instance shows a failure in scientific policy advice while providing excellent broad research. The KMASB rehabilitation action plan is founded on sound scientific research and includes useful recommendations, however it does not address the issue of unsustainable forest management. Forest conversion cannot be stopped. The municipal administration is the key ally in the issue of the KMASB forest. These allies did not adhere to the advice of scientific study and its constrained logic, but devised solutions to the problem of forest land use conflicts and failed in practice. There are no regulations designed for the management of upstream areas around the Brantas river springs. RIU underlines that integration and utilization both have the flexibility to select scientific information, even when that knowledge is motivated by political agendas, but that this selection must be based on the findings of previous research. RIU advises being clear about the boundaries. Knowing the boundaries provides two options: first, the integration and usage decision processes must rely on information supplied by science. Second, political actors are not limited to acting just based on scientific information. They can make judgments based on other factors as well.

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