



## Understanding the role of scientific knowledge transfer in the women's participation and farmer activities in Central Java

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**Abstract.** *The forest turns to agricultural land in the Serayu watershed in Central Java, Indonesia. The Strengthening Community-Based Forest and Watershed Management (SCBFWM) project aims to improve and expand the Indonesian government's community-based forest and watershed management programs. The study's objectives are: 1) investigate the factors that contribute to the successful implementation of scientific findings in everyday life; 2) analyze the potential impacts of alternative strategies for the development of farming systems in the watershed on rural livelihoods; and 3) analyze the rules and governance structure that organizes the action of actors and how decisions are made. We use the RIU (Research-Integration-Utilization) Model to examine how scientific research can yield effective policy advice and decision-maker's role in transforming advice into effective problem-solving. The findings that emerged from the research demonstrated that the district government cares about the environment but does not prohibit upstream potato cultivation strictly. When the SCBFWM project was established, cultivation restrictions were implemented. The research on the importance of women's participation in watershed management was communicated to the district administration and included in the SCBFWM project's proposal, but the actual action was different. The RIU model demonstrated that high-quality science is insufficient without efficient integration and acknowledges the inherent divergent interests within science and policy.*

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## INTRODUCTION

The Serayu watershed in Central Java, Indonesia, has five districts: Wonosobo, Banjarnegara, Purbalingga, Banyumas, and Cilacap (UNDP and MoF 2012). The watershed region is made up of forests, farmland, and villages (Poniman et al. 2021). Due to the proximity of the watershed to the community activity, it becomes a means of sustaining these activities. Agriculture, fisheries, industry, tourism, and energy generation are all viable options (Lee et al. 2021). Water from the watershed has been used to irrigate agricultural fields in the agricultural industry. Watersheds are utilized in freshwater fisheries to deliver water to fish ponds. Individuals or businesses conduct this business. The watershed is used by the industrial sector to power their manufacturing processes. There are both small and major businesses in this area that use the

watershed as part of their manufacturing process. The watershed is being used as a hydroelectric facility by the energy sector.

There are both state-owned and privately owned large-scale power facilities (Harliando et al. 2023). In the Serayu watershed in Central Java, Indonesia, the forest turns into cultivated land. In this region, rice is grown downstream while vegetables are grown upstream. Due to their biophysical compatibility with Indonesian soil, vegetables have a high selling value as an export good and high productivity (Wiryo and Nurliana 2022). In the upstream region, close to the forest, there is agricultural land used for growing vegetables. Because the forest area is not properly secured, vegetable farmers can easily access it. Through this action, the proportion of land used for agriculture increased, while the amount of forest land dropped (Poniman et al. 2021). Conflicts over forest land expansion for vegetable land, which causes erosion and disrupts access to the river, have a negative influence on the lives of farming families (Yanto et al. 2019). The decreased income of rice farmers as a result of declining rice yield and the lack of energy are indicators of this impact. Conflict of interest arises as a result of the different interests of vegetable producers, electric consumers, and rice farmers in accessing the river.

The applied techno-institutional environment shapes the dynamics of this conflict of interest. The unique location is distinguished by the divergence of natural, technical, and social systems, which results in erosion, water and energy scarcity, and some inferior livelihoods in this area (Wiryo and Nurliana 2022). It serves as a reminder that services, values, and benefits are social constructions that emerge from interactions between people, institutions, and the environment (Setyawan et al. 2019). The value of ecosystems is always changing as a result of human interactions with their surroundings (Harliando et al. 2023). The study's ultimate goal is to better understand the interplay between environmental, social, and technology systems along water, energy, and food nexuses from a policy standpoint. Using the case of the Strengthening Community-Based Forest and Watershed Management (SCBFWM) Project in Serayu Watershed, Central Java, Indonesia, this article seeks to assess how scientific research can produce effective policy advice, as well as the role of decision-makers in transforming the advice into good problem-solving.

The goal of the SCBFWM Project is to improve and expand the government of Indonesia's programs on community-based forest and watershed management by addressing the unequal distribution of benefits derived from forest resources and the lack of coordination between various actors and stakeholders as significant fundamental causes of land and ecosystem deterioration. The Project is funded in total by the Global Environment Facility/GEF (US\$ 7 million), the Government of Indonesia (US\$ 41 million), the United Nations Development Program/UNDP (US\$ 500,000), and other partners (US\$ 950,000). The Project began operations in the fourth quarter of 2009, and full management was in place by the beginning of 2010 (UNDP and MoF 2012). It is essential to provide direction that is based on scientific evidence for the development of public policy in order to improve the flow of scientific information from professionals to scientists (Sarewitz and Pielke 2007). The transmission of scientific knowledge can be accomplished through a variety of means, such as the linear model and co-production (Hove 2007). Methods from scientific and technological research (Jasanoff and Wynne 1998; Miller 2009), as well as public policy and science (Pielke 2005), are incorporated into linear models.

For policy to be effective, scientists must first "get it right," according to this competence paradigm (Beck 2011). According to the linear skill model, having knowledge is a necessary (but not sufficient) foundation for sound decision-making (Luukkonen and Nedeva 2010). It is generally accepted that science exerts a powerful and decisive impact on politics, provided that the facts underlying the science are "sound". After then, they are able to immediately and directly impact the direction of policy (Beck 2011). The interaction between political power and scientific knowledge is thought to be one-sidedly, linearly, and one-dimensional ("saying truth to power") (Jasanoff and Wynne 1998). Co-production, which is also known as participatory research, is a concept of change that serves as the basis for the collaborative governance model (Schuttenberg and Guth 2015).

The ultimate goal of this research paradigm is to hasten the adoption of judgements and actions that are informed by the best available evidence in order to address challenging sustainability challenges (Cash et al. 2003; Mauser et al. 2013), and it places an emphasis on the process through which new information is generated (Walter et al. 2007). Co-production will be successful if adequate representation, believe, commitment to learning, and capability exist (Schuttenberg and Guth 2015). A model for the dissemination of scientific knowledge that neither overstates nor underrates the significance of scientific information is what we refer to as the RIU model, and it is what we propose and apply in order to gain a better understanding of how research-based information is used in policymaking. The model is able to show the bidirectional interaction between decision-makers and researchers by making use of scientific knowledge. Additionally, the model can evaluate increasingly complicated and non-linear policy processes (Böcher and Krott 2014, 2016).

Furthermore, the strong actor plays a significant part in the spread of scientific information because of their ability to push through science-based solutions despite opposition from other parties (Dharmawan et al. 2016). To restore watershed functions and ecosystem services, the project supports efforts to mitigate forest and land deterioration. The Project has three Outcomes: 1) using Community-Based Forest and Watershed Management (CBFWM), vital watersheds with complex ecological and social conditions demonstrate enhanced management; 2) authorities contribute to the creation of CBFWM initiatives; and 3) The consistent policies and programs that support CBFWM are the result of collaboration between and among various tiers of government. The Project is implemented in six locations across Indonesia in collaboration with central agencies and multi-stakeholder partnerships as well as community-based organizations. The Serayu Watershed serves as the sole research topic and case study for this project. The Project is taking place within the background of solid economic growth throughout Indonesia, a strengthening democracy and decentralization process, a vulnerable natural resource base, high rural population densities, and chronic poverty and gender challenges (UNDP 2014).

The SCBFWM program's emphasis on the importance of forest and land preservation makes a major contribution to the region. Among these are group endeavors that resulted in the formulation of an all-encompassing plan for Dieng's recuperation, which was accomplished through collaboration. This region is made up of six districts, and it was the Banjarnegara and Wonosobo Districts that were instrumental in establishing the Dieng Area Recovery Work Team (TKPD). Furthermore, it is crucial to comprehend how socioeconomic and technological institutions account for the inherent complexities that lead to uncertainties in the dynamics of these coupled human-nature systems. The study's specific objectives are as follows: 1) Investigate the factors that contribute to the successful implementation of scientific findings in everyday life; 2) Analyze the potential impacts of alternative strategies for the development of farming systems in the watershed on rural livelihoods; 3) Analyze the rules and governance structure that organizes the action of actors and how decisions are made. This paper investigates the knowledge transmission process in the Serayu Watershed, describing the relationship between research on watershed management, the process of local government regulation on watershed, and the impact of non-friendly river and forest use.

The RIU-Model is an innovative approach to providing policy advice that is founded on scientific evidence. It was developed for the purpose of analyzing scientific research and advisory efforts in the Serayu watershed in Central Java, Indonesia. Research (R), Integration (I), and Utilization (U) are the three pillars of the analytical model known as the RIU-model. Scientific policy guidance is described as the relationship between these three pillars (Böcher and Krott 2014). Accordingly, we formulated the following three hypotheses:

- Hypothesis 1 : The formulation of policy recommendations for watershed management requires a sound scientific foundation, which can be provided through high-quality research.
- Hypothesis 2 : Effective integration is necessary for scientific research to become useful recommendations for policymakers.
- Hypothesis 3 : Utilization that is based on scientific guidance is associated with hazards that are not necessarily present in scientific justifications.

## METHOD

### Research Location and Time

The watershed of the Serayu river in Central Java, Indonesia served as the location for the investigation (Figure 1). The information was gathered in two phases, from December 2022 to February 2023, then from March 2023 to April 2023. The first phase of data collection focuses on identifying village samples, selecting respondents, generating primary data for farm management, and cross-checking secondary data from vegetable and rice farmers, cooperatives, electric users, the organization that builds the hydropower, and village administration. Conducting semi-structured interviews with respondents about the conflict issues of land-use change and watershed as common-pool resources affecting their livelihoods. The second phase of data collecting focuses on the potential implications of alternative farming system development techniques and rules and governance structures arrange players' actions on rural livelihoods.

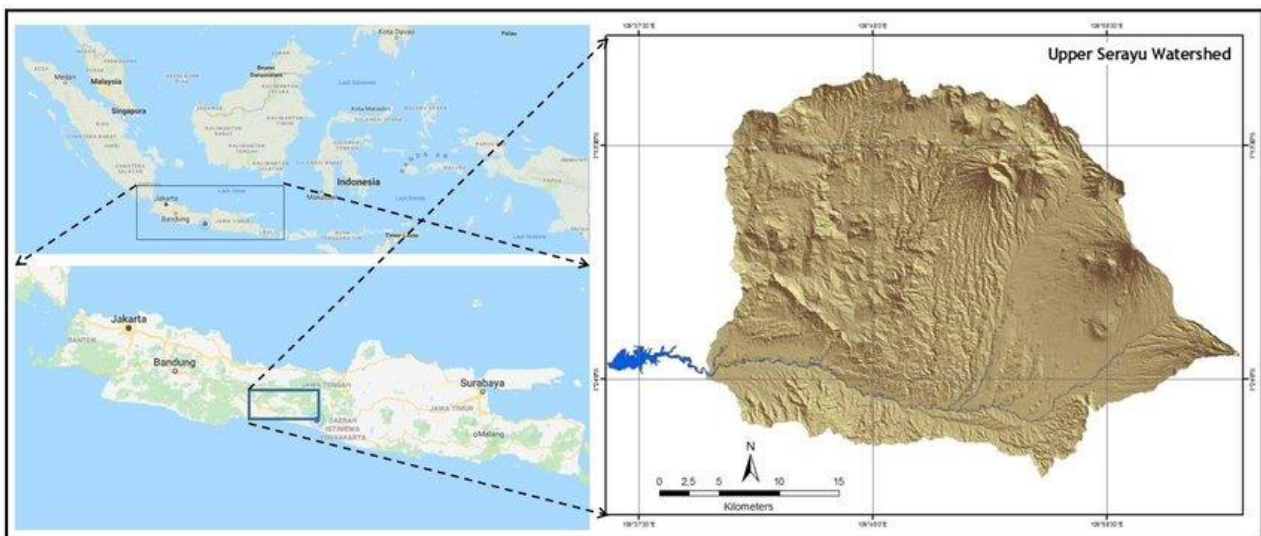


Figure 1 The research site is located in the Serayu Watershed in Central Java, Indonesia (Source: Christanto et al. 2018)

### Method of Data Collection

The study incorporated qualitative data. To acquire detailed and credible data, the researchers used a variety of methodologies, consisting of both semi-structured and in-depth interviews, as well as discussions in focus groups, all in accordance with the triangulation method. Document examination and discussions with recognized authorities in the field form the basis of this study. In 2022 and 2023, we carried out in-depth expert interviews with workers from various governmental institutions, scientists, and local leaders involved in the knowledge transfer. The goal of this interview is creating a causal explanation for the result that we obtained.

Interviews serve as our primary method of investigation, after which we analyze our hypotheses (Mosley 2013). In addition to policy analysis, we also analyze the substance of official documents. The content analysis is based primarily on the interviews with our subject matter experts. The most recent and pertinent legal decrees and administrative directives, presidential directives, ministerial rules, and local government judgments are used as the basis for decision-making regarding public policy.

### Analytical Framework of Research-Integration-Utilization (RIU) Model

We use the Research-Integration-Utilization (RIU) model developed by Böcher and Krott (2014) to make scientific policy suggestions (Figure 2). With regard to the analytical RIU Model, the interplay between the distinct principles of research (R), integration (I), and utilization (U) constitutes the definition of scientific

policy advice (Böcher and Krott 2016). The RIU Model expresses a two-way, in order to develop scientific policy advice products, non-linear transitioning between research and integration efforts is required. This method is intended to investigate the particular activity carried out by both the development of scientific comprehension and the application of scientific knowledge by politicians. Research is the generation of specialized knowledge via the application of scientific standards and methodologies. Because the standard of scientific knowledge determines both the veracity of that information and the way that practitioners apply it (Pregernig and Böcher 2012), the method emphasizes the requirement for outstanding research is an essential prerequisite for the communication of scientific information (Lentsch and Weingart 2011).

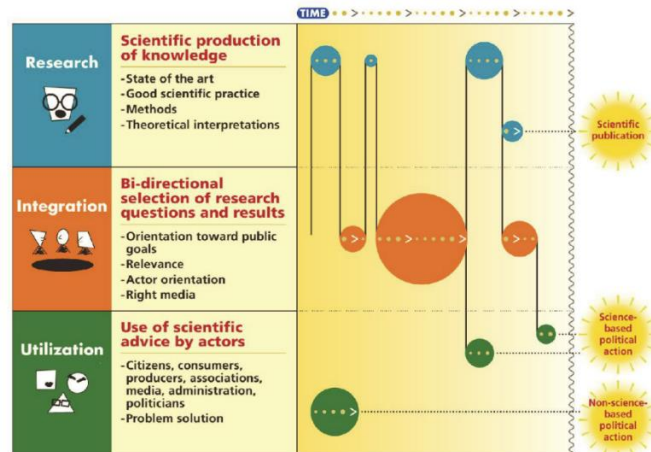


Figure 2 The RIU Model of scientific knowledge transfer (Böcher and Krott 2016)

There are criteria that can be used to judge the quality of scientific work. Some examples of these criteria are those established by the German Research Foundation, the Director General of Research Councils (DGRC) in the United Kingdom, and Research Council Chief Executive (DFG 2013). When determining the value of a scientific investigation based on accepted standards of conduct in the scientific community (DFG 2013), the following questions must be asked: "Does scientific research adhere to ethical guidelines?"; Are there sufficient citations for both the methodology and the findings of the research?; Will the most recent findings eventually be presented in a peer-reviewed scientific journal?; When confronted with challenging questions, has the advice of researchers from other institutions been sought out?. Numerous authorities are of the opinion that the quality of the scientific information that is provided has an effect on the quality of the scientifically-based policy recommendations (Lentsch and Weingart 2011). Reliance on the most recent scientific findings (the evaluation of the most recent scientific information), adherence to fundamental scientific principles, scientific collaboration with other institutions, and research initiatives are some of the criteria that are utilized to evaluate the quality of research (Böcher and Krott 2016).

The relationship between theoretical study and actual practice involves a process of integration that goes in both directions. During integration, relevant research findings for political actors are selected using standards based on actual requirements. As stated by Böcher and Krott (2014), the perceived demand for practical applications of scientific knowledge is what drives research subjects in the scientific community. Integration makes a connection between the findings of scientific research and the goals and political interests of practical actors. This is accomplished without changing or misrepresenting the conclusions of the research. In order to bridge the gap between research and integration, one needs to have a solid knowledge of the scientific skills and practical experience that are currently available (Dharmawan et al. 2016, 2017a).

Through the process of selecting various "knowledge bricks," integration connects research to the needs of the actual world. These bricks are reliable because to the "advanced" science that they display as well as their applicability in the "real world" (Dharmawan et al. 2016, 2017b). Making logical decisions is made easier by truths that are useful, and these truths can withstand the scrutiny of science (Jasanoff 1998). Integration activities are evaluated based on needed evaluation criteria such as orientation toward public goals, importance

to the political process, significance to allies, and the use of a specific medium for target group-focused intermediation (Böcher 2016). The purposeful implementation of scientific recommendations made by various political actors is referred to as utilization. As consultation materials, we can choose from things like brochures and written reports.

We can also choose from new norm conceptions and regulations, as well as implementation instructions (Böcher and Krott 2014). Scientific articles and contributions to scientific conferences are additional methods for disseminating policy-relevant discoveries to the scientific community. It represents another potential outcome that can be employed for scientific reasons rather than political ones, and the dissemination of scientific knowledge brings it about. This distribution ensures that the entire RIU process adheres to rigorous research standards and that the scientific information used to educate policymakers is up-to-date. Distribution of commodities to the scientific community and the active use of scientific advice by political actors, people, and administrators are two of the factors that are utilized in the process of evaluating utilization activities (Böcher and Krott 2016). In the context of the case we are investigating, scientific investigation into agricultural management serves as an example of the scientific approach relevant to research into the management of the Serayu Watershed.

The "integration" process is used by governments to select scientific discoveries that correspond with their objectives. The administration of Serayu Watershed also requires the participation of farmers and their response to the scientifically-based policy. The finding of empirical guidance that is actively utilized by the government in the policymaking process about agricultural management is what is meant by the term "utilization". It also considers the numerous scientific guidance resources utilized by governments and the agricultural industry.

## **RESULTS AND DISCUSSIONS**

### **Condition in Serayu Watershed**

There are four sub-watersheds within the Serayu watershed. The Dieng plateau includes this watershed. Upstream, the majority of the Serayu watershed is dry land with precipitous slopes, and annual precipitation can reach 4,000 milliliters. Since 1979, this steep, arid land in Dieng Village, Campursari Village, Kejajar District, Wonosobo Regency and Beji Village, Pekasiran Village, Kepakisan Village in Banjarnegara Regency has been planted with annual commodities such as potatoes (Poniman et al. 2021). Chili, carrot, and corn plants are the only source of income for cultivators in Kalidesel Village, Mutisari Village, Semanganggung Village, and Babatan Village in the Banjarnegara District. The sowing pattern of potatoes and other annuals in the Serayu Watershed region disregards conservation principles, as the plant ridges are perpendicular to the land's steep slope.

Because it is assumed that if potatoes and other annual crops are planted according to the contours, they will produce less than their optimum yield and be susceptible to fungus during the rainy season, causing farmers to incur losses. Farmers in this watershed area have an average of 0.3 ha of land, so they intensify land processing for production so that they and their families can meet their daily requirements without giving the land a chance to rest (Astuti and Suryatmojo 2021). The intensification of land use can increase the rate of erosion in the Serayu Watershed, affecting the subterranean ecosystem and leading to sedimentation and silting of the river in the downstream region. In addition, potato plants are cultivated without any perennials in a monoculture. This situation is becoming increasingly worrisome for the inhabitants of the southern Dieng plateau, particularly those in the Tulis Sub-watersheds, because the Serayu Watershed is the infrastructure of economic life, including hydroelectric energy, small industry, agriculture, and fisheries in Wonosobo District, Banjarnegara, Purbalingga, Banyumas, and Cilacap. If the Serayu Watershed is harmed, poverty will increase, the environment will be harmed, and the social life of the community will also change, as the area of life in the district will create an imbalance in the ecosystem, preventing the attainment of a sustainable way of life (Wiryo and Nurliana 2022).

## **Research to Support Policy on Serayu Watershed Management**

The objective of the SCBFWM initiative is to encourage government efforts to mitigate forest and land deterioration, restore/rehabilitate watershed functions, and elevate environmental services for the public's benefit. The ultimate goal of the SCBFWM project is to construct designs of forest and watershed administration by enhancing the skill sets of the stakeholders, i.e., citizens and the government (UNDP 2014). Therefore, numerous activities exist to support the objectives. Nonetheless, the SCBFWM initiative has two primary goals, namely, woman participation and environmentally friendly potato cultivation.

### ***Research in Woman Participation***

In the global Human Development Report for 2021 (UNDP 2022), Indonesia ranks 100th from 146 countries on the global Gender Inequality Index. It is located between Cambodia and Nicaragua, and is significantly lower than regional counterparts Malaysia (43) and the Philippines (75). According to a 2007 study conducted by the Joint Donor and Government Mission (UNDP and MoF 2012), despite a national policy framework for promoting gender equality and development in some of the social indicators, such as the reduction of education gaps, significant gaps and barriers to gender equality still exist: Slow progress has been made in reducing maternal mortality, and women's economic potential is only slowly being realized. Nationally, women's political participation is low, but it is lowest at the district level, which has become the focal point of decision-making since decentralization. Indonesia now trails behind many East Asian nations that have made more rapid progress in promoting gender equality.

Qualitative research was carried out in the Banjarnegara and Wonosobo Districts to investigate gender dynamics of power in development planning for forest and watershed management in the Serayu Watershed. The research adopts a feminist post-structuralist approach (Willy and Holm-Müller 2013). The dynamic interactions of three important stakeholders—government institutions, community-based organizations (CBOs), and individual community members—will serve as a lens through which the link between gender and power in the development planning of forests and watersheds will be analyzed. These stakeholders include individuals. This approach sought to develop a conceptual framework for comprehending gender power relations in the interaction between structure (government institutions and their regulations) and actors' (women's CBOs and individuals') interests and behavior in the development planning of forest and watershed resources.

Specifically, this approach was interested in understanding how these gender power relations play out in the development planning of forest and watershed resources. This method was shaped by Theda Skocpol's 'drawing the state return in' (Skocpol 2008), determining the relationship between framework and actors (Akram 2013) comparing the investigation of policy to the research of natural resource management (Willy and Holm-Müller 2013). When compared to the power dynamics that existed between government institutions and the general populace during the former authoritarian regime in Indonesia, those that exist under the democratic governance that is in place during the reformation period of Indonesia's democratic governance (Darmastuti and Wijaya 2018). In Indonesia, forest and watershed development planning has only recently adopted this methodology. Caramani (2017) mentioned gender power relations examined at three levels: macro (state structural actors), meso (CBO), and micro (community members). During the research process, national and international scientific sources were assessed for their current scientific information. In Serayu Watershed area, families continue to place less emphasis on women's education and literacy than on men.

Women who have not had an official education are significantly hindered in their efforts to better their standard of living and to take part in the political process. Therefore, natural resource management development planning hardly integrates women's interests. Despite significant progress, gender equality and mainstreaming continue to face obstacles, particularly in rural areas. The linkages between the advancement of gender relations and the preservation of land are critically important given the considerable part that women play in the administration and harvesting of land, forests, and other natural resources. This material has been

complied with the standards of acceptable scientific practice in its collection and presentation. The alleged relationship between the participation of women in the process of development planning has not been demonstrated. The findings of the research showed that the District Government of Banjarnegara's policy had not been fully implemented; the issue of gender equality is not always a priority for the Development

Board of Planning, Department of Family Planning and Women's Empowerment, and Department of Forestry when it comes to the management of forests and watersheds. To say nothing of elevating gender equality to the status of a top priority, these three offices do not provide evidence of the institutional needs and support needed to implement gender mainstreaming inside their respective institutions. Neither institution-wide regulations nor a designated unit is in place to implement gender mainstreaming within these offices. None of these entities have devised specific policies and programs to integrate gender into the development processes of the forest and watershed sectors. There was a lack of complete implementation of collaboration with outside scientific initiatives and institutes. However, independent meaningfulness of scientific findings could be found in these research activities. In addition, they lack an explicit objective for bringing women's CBOs within the development planning process and a Standard Operating Procedure (SOP) to guarantee the inclusion of women's interests into the planning phase of development.

### ***Research in Potato Cultivation***

Prior to the advent of potato farms, the native people who lived in the Serayu Watershed maintained their fields as mixed gardens. These gardens consisted of a variety of plants, including fruit trees, timber trees, and a wide range of other tree species. Today, a considerable portion of the mixed gardens have been converted to potato plantations (UNDP 2022). The depletion of the soil that is caused by potato growing is the primary obstacle that the society of this area must overcome. Before potato farms were established in the Serayu Watershed, the local residents there had a variety of gardens on their own properties. All of the mixed gardens have been converted into deforested farmland prone to landslides. Even small-acreage farmers sell their land to large potato growers. Research on potato farming activities in the Serayu Watershed revealed a disregard for environmental conservation, as demonstrated by the excessive use of chemical fertilizers and pesticides, illicit harvesting of protected forests, and improper potato cultivation (Poniman et al. 2021).

Environmental carrying capacity has been diminished by land degradation. Population growth and limited agricultural land result in a high PPL (Population Pressure on Land) of 1.24. Carica as a Dieng potential, can be used as a conservation strategy to rejuvenate and restore Dieng's vitality. As an effort to restore Dieng's condition, the Carica plantation must be innovative, particularly in its farming technique and product variety, so as to increase farmers' desire to plant Carica (Harliando et al. 2023). The investigation accumulated recommendations for the government, including utilizing an agroforestry scheme as one of the top innovations. Agroforestry refers to land-use systems in which woods or vegetation are cultivated alongside crops (agricultural crops or pastures), in an organized manner or rotation and in which ecological and economic interactions exist between the forests and other system components (Wiryo and Nurliana 2022). In this plan, the potato plantation will be interspersed with Carica trees on the same land.

Agroforestry will enhance not only environmental conditions but also economic and social conditions. Using Carica trees decreases the rate of erosion from 463.86 tons per hectare per year to 115.96 tons per hectare per year (estimated data using the USLE formula). In an effort to reduce the environmental crisis caused by potato cultivation, it is anticipated that a sustainable development-based agriculture program will alter the mentality of the locals so that they can utilize the full potential of the region. The research procedures adhered to sound scientific principles and the findings were meticulously recorded. In addition, the independent meaningfulness of scientific findings implies that scientific findings provide a rationale for their descriptions and recommendations (Böcher and Krott 2014). This suggests that the results of one investigation are important to a number of other research projects despite the fact that each study has a different connection to the others.



The study on the management of the Serayu Watershed is a standalone investigation because it was not linked to additional investigations (such as the forest management plan research).

Table 1 shows that the majority of these factors were accessible, providing a scientific basis for sensible policy advice. Consequently, Hypothesis 1 has been confirmed: researchers produced science based on high-quality research, contributing to the development of a scientific proposal that might be used as the foundation for good policy guidance.

Table 1 Analysis outcomes using the RIU model in the SCBFWM project

<b>Activities of the RIU Model</b>	<b>Criteria</b>	<b>Occurrence*</b>	<b>Description</b>
Research	● Assessing current scientific information	+	The study evaluated both domestic and international scientific resources.
	● Compliance with the procedures of good scientific practice	+	Research methods and outcomes are documented.
	● Cooperation with external scientific projects and institutions	±	The research had not specifically cooperated with another research.
	● Independent meaningfulness of scientific findings	+	The outcome of watershed management research was independent of other research initiatives (i.e., research on ecologically sound potato cultivation)
Integration	● Orientation toward public goals	±	The research recommended prohibiting potato cultivation in order to increase ecological sustainability but ignored the fact that potatoes are a community's only source of income.
	● Relevance for solutions to problems	±	The research yielded limited problem-solving because it did not give a bigger role to women's participation in watershed management.
	● Relevance in regard to allies	+	The only ally was the district government, which incorporated the study's findings into its regulations.
	● Target group-oriented intermediation for the right media	+	The research findings were disseminated to the community through workshops.
Utilization	● Contribution to democracy	–	Citizens insisted on potato cultivation.
	● Contribution to rule of law	+	The district government issued regulations on the establishment: i) community-based organizations (CBOs); and ii) programs for forest and river basin management activities.
	● Contribution to “good governance”	–	There was an absence of community involvement in the district government regulations.
	● Appropriate solutions to problems	–	The cultivation of potatoes demonstrates that the regulations had no effect on the utilization of the watershed.
	● Participation in the scientific discourse	–	No scholarly discussion was established.

Note: \*(- not given; ± partly given; + given); Source: modified per Böcher and Krott (2014, 2016)

### **Integration of Efficient Policy Advice**

Integration is the process of bringing together scientific understanding and political practice (Böcher and Krott 2014). It is vital, in order to enhance policy compliance, to integrate the results of research with community aims (Dharmawan et al. 2017b). Local administrations from six districts in the province of Central Java have collaborated to develop a Grand Plan to rehabilitate the degraded Serayu Watershed by constructing institutional capacity. To construct this general plan, a working team, the Dieng Recovery Team (TPKD), comprised of multi-stakeholder representatives, has been established. The team has collaborated with NGOs, universities, and other stakeholders in the course of its work. Multiple donors, including DFID and JAVLEC (local NGOs), support the development of the general plan.

District Forestry Offices, notably in the district of Banjarnegara, have supported local people through the development of experiments for integrated conservation by planting puspa (*Schima wallichii*) with chili and papaya (*Carica papaya*) since 2003. Local administrations in the districts of Banjarnegara and Wonosobo have secured some funding (primarily from APBN) and grants (from abroad) to assist local communities with terrace/terasering improvement. Banjarnegara District became the first district in Indonesia to have a watershed when it promulgated a Regional Regulation on Watersheds (UNDP 2022). This demonstrates the local administrations' long-term commitment to conserving watersheds.

### **Integration in Woman Participation**

The Indonesian government has announced a new Gender and Development strategy after realizing that the Women in Development (WID) approach could not achieve genuine gender parity in the context of development. The WID strategy promoted more women to participate in development projects (e.g., in Indonesia, via the Enhancement of Women's Role/P2W) by establishing activities and projects specifically for women and by enhancing women's domestic responsibilities skills (UNDP and MoF 2012). The local government of Banjarnegara embedded this concept to the local government. In the Indonesian context, however, this transition away from a top-down approach has had a greater impact on academic debates than on the everyday lives of people, particularly women. Because of this, the concept of women's rights is not widely recognized by government officials, who are the most powerful persons responsible for changing the approach taken to day-to-day operations by the government (Johnson et al. 2015). It is now absolutely necessary to include women's interests in the planning and management of forests and watersheds in order to achieve gender equality in terms of involvement, access, control, and advantages derived from forest and watershed resources. This is necessary in order to achieve gender equity in these areas (Johnson et al. 2015). In many regions, forests and watersheds are the two vital resources for human survival.

### **Integration in Potato Cultivation**

The research findings were pertinent to the issue of a degraded watershed, and they provided a viable scientific option for restoring the stands. However, their applicability is limited to the forest, and the potential for ecological destruction is not addressed. As a result of environmental devastation in the Serayu watershed, the Wonosobo Regency Government established the Dieng Recovery Work Team (TKPD) in 2007, as confirmed by the Wonosobo District Decree No. 180/25/2007 (Turasih 2019). Even the Wonosobo District issued a stringent prohibition against planting on land with intolerable slopes. In spite of their attention to social, economic, and environmental factors, the various programs that continue to be promoted are mechanistic in nature and emphasize the environment as the primary objective. In reality, the problem in the Serayu Watershed is not only the destruction of the environment caused by overly productive potato cultivation but also the emergence of social stratification as a result of the concentration of land tenure.

Only the district government expressly bolstered the study, and it was the only entity to incorporate the findings of the research into a planning policy. The district government organized seminars to disseminate research findings to the public by distributing both scientific and politically biased information. The integration

was regularly examined but there were catastrophic flaws: the orientation toward sustainability is biased toward ecological sustainability; the relevance towards problem solutions is low because important problems are not included in the research; and the power player disregards the limitations of the scientific information, and as a result, they generate a point of view that is only partially based on science. We can therefore corroborate hypothesis 2, as its integration factors describe the incorporation of scientific research into policy concepts.

### **Utilization of Ineffective Policy Advice**

From 2010 to 2014, SCBFWM established and revitalized a number of community-based organizations (CBOs) in the Serayu Watershed, specifically in Banjarnegara and Wonosobo Districts. These groups receive assistance from field facilitators and a variety of trainings, including administrative and thematic trainings. In addition, SCBFWM devised a small grant program for forest and river basin management activities for which the group is solely responsible for planning (UNDP 2014).

### ***Utilization in Woman Participation***

In order to ensure the long-term viability of a natural resource, it is vital to plan for the development of forest and watershed management. However, policymakers do not always take women's interests, abilities, and participation into account during implementation. The inconsistencies in the Banjarnegara and Wonosobo Districts' government policies regarding the participation of women. In the Office of Family Planning and Women's Empowerment, the Planning Board, and the Office of Forestry, gender equality is acknowledged as part of a larger vision. However, their officials lack the policies necessary to make this an actuality. Women's civil society organizations are dissatisfied due to the absence of specific government policies regarding the incorporation of gender perspectives into forest and watershed management. The gendering of forest and watershed management as well as the introduction of social forestry programs over the past couple of decades have had a significant impact on environmental sustainability. From a democratic standpoint, this is a significant deficit. There was also no citizen participation, which would have constituted effective governance.

### ***Utilization in Potato Cultivation***

As a result of intensive potato cultivation, a number of local farmers have very little or no available land. Potatoes' enormous economic profit has awakened large farmers, large corporations (including one of Indonesia's major agricultural industries), and elites from different regions to invest in potato farming by purchasing land and employing local farmers as wage laborers in potato fields. Some of the land they acquire is privately owned and densely forested. After selling the land to prominent farmers, "large" farmers, or large landowners, local farmers desiring to continue potato farming are eager to purchase new land for potato fields. The majority of them converted state forest land (production forests and protected forests) into potato fields. In doing so, they typically pay dues to low-level government employees.

The two groups (government employees who engage in illegal activities by requesting commissions in the form of illicit money and local farmers who convert forest land into potato fields) have not yet been punished. This action has nearly covered the entire Dieng Plateau in the Serayu catchment region. In connection to the problems that have been discussed up to this point, the circumstance of potato growers presents an opportunity for the economy, but if it is not addressed, it has the potential to be a disaster for the environment. The local administration is striving to find a solution that would benefit all parties, one in which farmers will not be required to give up their means of subsistence in order for there to be sustainable development. In this sense, actors need to work toward developing an appropriate model or communication strategy. In this particular scenario, many interconnected features, including the sociocultural aspects of local agricultural communities, the economic aspects linked with potato commodities, and the political components associated with the government as policy players, are extremely important from an economic standpoint. It is

impossible to disregard the farmers' negotiating position with the government, but at the same time, the government cannot unilaterally prevent farmers from planting potatoes.

However, if farmers reach land that is not allocated to agriculture because it serves as a protected forest, the government cannot do nothing. Communication in this program is dialogic, and there are elements of empowerment, not through coercion, but by raising awareness of the long-term effects of the Dieng community's continued exploitation of the land for the benefit of the present only. Participatory communication is highly relevant to the goals of this community development program, and it is one of the most important components of the program. Government efforts to rehabilitate forests and land through tree sowing and land preservation have failed. The community did not support the government's planting efforts, either by removing and disposing of the seeds that had been planted or by reselling the seeds to those who required them.

In a number of locations, tree-planted land has been transformed into villas. Astuti and Suryatmojo (2021) explained that the poor performance of government institutions in administering the Serayu watershed was the root cause of the failure: (1) the existence of government agencies involved in the management of the Serayu watershed was only based on the duties and functions they carried out without knowing the position and role of each in implementing watershed management activities; (2) low capacity of government agencies in watershed management; (3) poor coordination of programs and implementation of watershed management; and (4) institutions capable of managing the Serayu watershed in an integrated manner. The scientific approach to the issue prioritized the improvement of the watershed, the woods, and the whole area as a whole, but it did not investigate the particular problem of potato production. The scope of science is limited. The scientific recommendation was not incorrect, but it was unable to anticipate the conflicting land use of potato cultivation.

In addition to this, the local government in this area had an incorrect perception of its capacity to handle this problem via the implementation of rules and stricter enforcement. A failure in the science-policy interface was caused by the district government's erroneous perceptions and the absence of a scientific analysis of the specific issue regarding potato cultivation. The action taken by the administration of the district lends credence to the third hypothesis, which holds that the use of scientific advice may significantly minimize the risks connected with political action, but it cannot remove those risks entirely. The district government neither questioned its ability to regulate watersheds nor sought scientific advice regarding the most effective means of doing so. In order to legitimize the entire program, including neglecting potato cultivation, the district administration also relied on scientific advice on how to conduct watershed management. This misuse of scientific advice to justify favored policy ultimately led to the failure of this policy.

## **CONCLUSION**

The process of transferring scientific knowledge may encounter several pitfalls that are independent of one another. These include research, integration, and utilization, which may not efficiently result in an improvement in knowledge transfer despite significant research efforts. It has been demonstrated that an increase in scientific knowledge alone does not necessarily lead to an enhancement in knowledge transfer, as the variables of research, integration, and utilization operate separately. Therefore, any limitations or expansion of the transfer of scientific knowledge can be attributed to one or more variables within the RIU Model (Do et al. 2020). The objective of the research was to aid the district government in the formulation of sound policies. In this instance, however, effective policy advice did not translate into good problem-solving because the district government lacked the expertise to transform the research results into sound scientific advice. The RIU Model demonstrated that excellent science is insufficient without effective integration. The RIU emphasizes the connections between all three elements, namely research, integration, and application. RIU only anticipates effective knowledge transfer if the connections are robust (Böcher and Krott 2016; Dharmawan et al. 2017a).

The effectiveness of conservation strategies can only be enhanced through research that adheres to rigorous scientific standards and is well-integrated. Suboptimal outcomes of policy support can be attributed to research that is of inferior quality and inadequate integration. Thus, to ensure successful conservation efforts,

it is imperative to make progress in research and the integration of systems for disseminating scientific knowledge (Do et al. 2018). The district government cares about the environment, but they do not strictly prohibit upstream potato cultivation. When the SCBFWM project was established, only then was the cultivation restricted. The research on the significance of women's participation in watershed management was reported to the district administration and stated in the SCBFWM project's proposal, but the reality was different. RIU emphasizes that both integration and utilization have the freedom to select scientific knowledge, even if it is driven by political interests, but this selection must be based on extant research results (Dharmawan et al. 2017b). If actors choose to act contrary to scientific findings, there is no transfer of "scientific knowledge," and science cannot be held responsible for political failures. Nevertheless, we suggest studying women and potato farmers' motivation for future research to better understand the success or failure of the SCBFWM project in this area.

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