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Recasting knowledge governance:
The struggle of accommodating divergent knowledge systems
in East Java, Indonesia

A thesis
submitted in partial fulfilment
of the requirements for the Degree of
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Hesthi Utami Nugroho

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The role of knowledge in environmental policy development and implementation is gaining more attention nowadays. Scholars have argued for some time that the implementation of environmental policy should appreciate the local situation more, as people’s understanding about the environment is diverse, and scientific knowledge cannot be the only knowledge to view, explain and solve environmental issues.

It is believed that including the knowledge of local people can improve the implementation of environmental policies. Nevertheless, what happens when local knowledge is explicitly included in the decision-making process? Drawing on a knowledge governance conceptual framework and an analysis of documents, field observations and 35 semistructured interviews, this qualitative research investigates knowledge governance in practice through a conservation agriculture programme introduced to two rural villages in East Java, Indonesia. The programme endeavoured to integrate the scientific knowledge of public agency scientists and the local knowledge of farmers with the expectation that this integrative approach would foster social, economic and environmental sustainability and improve the water quality of the Brantas River at the same time.

Inspired by Arnstein’s (1969) ladder of participation, this thesis develops a knowledge governance ladder as a way to understand and assess the processes of knowledge production in environmental decision-making in terms of power sharing, divergent ways of knowing, and the ontologies held by different groups of stakeholders. This research concludes that the knowledge governance ladder needs to incorporate a pathway of “coexistence” to move beyond current conceptions of coproduction. It is argued that coexistence highlights mutual understanding, recognition and respect for different ways of knowing and ontologies of different stakeholders. The thesis concludes that recent definitions of knowledge governance in the context of environmental management lack sufficient applicability in developing
countries as they do not adequately address the existence of traditional/ or local traditions and rituals. The definition of knowledge governance should, therefore, include respect for local knowledge and the elements within it, which are traditions, rituals, and religious values. The expected goals to be achieved from knowledge governance must be based on the consent of all stakeholders without overlooking others’ beliefs and values. This thesis also provides recommendations for both practice and further research.

**Keywords:** Knowledge governance, coexistence, scientific knowledge, local knowledge, ontology, ways of knowing, power sharing, knowledge scales, knowledge coproduction, knowledge integration, local farmers, East Java Indonesia, conservation agriculture
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<td>ANU</td>
<td>Australian National University</td>
</tr>
<tr>
<td>CGIAR</td>
<td>Consultative Group on International Agricultural Research</td>
</tr>
<tr>
<td>CRC</td>
<td>Canterbury Regional Council</td>
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<tr>
<td>CWMS</td>
<td>Canterbury Water Management Strategy</td>
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<tr>
<td>ENSO</td>
<td>El Niño/Southern Oscillation</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organisation</td>
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<tr>
<td>HW</td>
<td>Hurunui-Waiau</td>
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<tr>
<td>IK</td>
<td>Indigenous knowledges</td>
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<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
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<tr>
<td>ISFM</td>
<td>Integrated soil fertility management</td>
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<tr>
<td>PEBEJ</td>
<td>Provincial Environmental Bureau of East Java</td>
</tr>
<tr>
<td>STS</td>
<td>Science and technology studies</td>
</tr>
<tr>
<td>SW</td>
<td>Selwyn-Waihora</td>
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<tr>
<td>VOC</td>
<td>Vereenigde Oost Indische Compagnie</td>
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<tr>
<td>WFD</td>
<td>Water Framework Directive</td>
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<td>ZIP</td>
<td>Zone Implementation Programme</td>
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Chapter 1
Introduction

1.1 Background

In recent years, the role of knowledge in environmental governance and policy implementation has received increasing, critical scholarly attention. While it is recognised that knowledge is only one piece of a large and complex puzzle linking knowledge, policy and action, scholars argue that knowledge should be better governed in order to produce decisions that support sustainable development, and to develop workable and implementable policy to address environmental problems (Van Kerkhoff, 2013; Cash, Adger, Berkes, Lebel, Olsson, Pritchard, & Young, 2006b; Van der Molen, Van der Windt, & Swart, 2015). This thesis addresses the critical question of: how can we govern knowledge when each kind of knowledge carries with it and is derived from different ontological and epistemological values? This question is particularly important given the widespread adoption of participatory and collaborative approaches to decision making (Arnstein, 1969; Innes & Booher, 2010), in both developed and, increasingly, developing countries. These processes aspire to bring together different actors and their knowledge and experiences on the basis that this broader societal involvement in decision-making processes will produce policy outcomes that are more sustainable.

Nevertheless, in such processes, power and knowledge become issues. Arnstein (1969) argues that within participatory processes, power can be unequally distributed due to the gradation of stakeholders’ involvement. In addition, the collaborative approach has been questioned: whose knowledge is counted in the final decisions, whose is excluded and do these stakeholder encounters provide a platform for one group of stakeholders to manipulate others? (Bremer & Glavovic, 2013). The governance approach for knowledge emerges as a way of addressing these problems, particularly the problem of exclusion. The growing focus on knowledge governance in environmental governance and policy implementation has occurred alongside calls for increased participation in environmental decision-making, together with the rise of collaborative approaches to address environmental issues and shift away from the expert-led technocratic models of environmental decision-making that have been dominant for many decades (Bocking, 2004; Fischer, 2005). Knowledge governance recognises the diversity of people and processes that can be involved in creating, sharing, accessing and using knowledge, and seeks to configure the formal and informal governance practices that
can shape decisions and actions to foster the desired goals (Van Kerkhoff, 2013). Hence, knowledge governance is concerned not only with the production of knowledge and the opening up of governing spaces for different kinds of knowledge, but also with innovation in the practices of its deployment and validation and reflexive learning (Gerritsen, Stuiver, & Termeer, 2013).

According to Wiersum (2000), knowledge is about how people understand the world, which they then interpret, and apply this understanding through their experience and practices. This understanding of the world, he argues, is through “the process of selecting, rejecting, creating, and transforming information” (Wiersum, 2000, p. 20). Governance is “a system of formal and informal rules, rule-making systems, and actor-networks at all levels of human society (from local to global) that are set up to steer societies” (Van Kerkhoff, 2013, p. 84). In other words, governance is both a formal and informal process of rule-making, planning and managing networks at all levels of human societies (Ansell & Gash, 2007; Van Kerkhoff, 2013). In summary, knowledge governance can be defined as a process of managing different knowledge systems, either formal or informal, in order to overcome the gap between knowledge and action; thus, ambitions, perceptions, and interests of stakeholders can be aligned (Van Buuren & Eshuis, 2010; Van Kerkhoff, 2013).

Within organisational theory, knowledge governance has different definition. For example, from organisational economic theory, Michailova and Foss (2009) define knowledge governance as “an emerging attempt to think systematically about the intersection of knowledge and organisations” through the process of “choosing governance structures and coordination mechanisms” (p. 8) which can be formal or informal. Another example is the definition from Burlamaqui, Castro, and Kattel (2012), who define knowledge governance as a framework that deploys a governance mechanism to the diffusion, production and appropriation of knowledge; a deployment that influences how knowledge would be shared, retained, and created.

Given its early theoretical development, there is an ongoing debate about the principles and practices of knowledge governance, and how they should be put in place (Gerritsen et al., 2013; Van Kerkhoff, 2013; Van Buuren, 2009). Van Buuren and Eshuis (2010, p. 284) define knowledge governance as a way to find innovative solutions to complex societal problems by encouraging stakeholders to leave their “traditional insights and practices, and get away from inert interaction patterns, stalemate negotiations and interest conflict” (see also Gerritsen et al., 2013, p. 605). This would mean that; people called in to be involved in participatory or
collaborative processes would be expected to leave their knowledge behind and adopt more enlightened scientific knowledge. Scholars such as Simpson, De Loe, and Andrey (2015); Raymond, Fazey, Reed, Stringer, Robinson, and Evely (2010); Edelenbos, Van Buuren, and Van Schie (2011); Callon (1999); Lemos and Moorehouse (2005) propose the idea of the integration and coproduction of knowledge. However, Nadasdy (1999) criticises approaches to the inclusion of local knowledge that sees policy makers trying to integrate scientific knowledge with local knowledge for policy purposes that are often predetermined. Turnhout (2010) criticises as utopian current approaches to the coproduction of knowledge, which assumed that knowledge can be produced in a way that society would transform to what was expected by policy makers. Ahlborg and Nightingale (2012) identify mismatches in knowledge scales as a barrier to integrating and coproducing knowledge. These criticisms therefore indicate that the role of local people is still a concern in participatory and collaborative processes, and that knowledge governance is an important focus for research. These issues in the literature of knowledge governance have inspired this research, which opens questions about power as well as the epistemological and ontological underpinning of knowledge interaction.

1.2 Research problem

This research focuses on the implementation of a conservation agriculture programme in East Java, Indonesia, which was established by the Provincial Environmental Bureau, in order to evaluate the process of knowledge interaction between the public agency representatives and local farmers. Local farmers’ involvement was a highlight of this programme after previous conservation programmes conducted by the local Department of Agriculture were assumed to be failures because of the absence of farmers in the decision-making process.

The involvement of farmers in agricultural policy-making decisions denotes a significant shift in practice over the last half century. In 1969, Indonesia started to implement the Green Revolution programme, where farmers were required to adopt particular farming practices and techniques (Winarto, 2004). Even though the adoption of these techniques have made Indonesia a self-sufficient producer on agricultural commodity, by the 1980s the productive success was in decline, and high residues of pesticides were being found in agricultural land and products from Java Island (Adimihardja, n.d). Significant change came in 2001 when there was a shift from a centralised to a decentralised government system and the Indonesian government changed its agricultural policy. A new agricultural policy paradigm was introduced, representing a significant shift in government and governance in Indonesia, one
which signalled a preference for increased farmer participation in the key decision-making processes associated with agriculture (FAO, 2002). Furthermore, the development and implementation of new agricultural policy in Indonesia is now more explicitly linked to the desire to improve production and wealth, while also addressing environmental issues, such as water quality.

As a result, Indonesia farmers have been expected to ‘produce’ environmental ‘goods’ as well as agricultural products, in a similar way to farmers affected by the agri-environmental policy in Europe. In a developing country such as Indonesia with its high population, low levels of income, a deeply engrained cultural and religious history and practices, the method of how change is to be achieved is an important focus of this research. The Indonesian context for this study provides a unique backdrop for the study of knowledge governance. The political backdrop, which has changed significantly over the last five decades, has only very recently come to include a preference for local involvement in decision making processes; there is, therefore, much learning currently happening in policy-making circles, and among local people, scientists, extension experts, and the stakeholders who are stepping forward to participate in collaborative-type decision-making processes, not least because it is where divergent forms of knowledge collide.

As noted above, the focus of this research is a conservation agriculture programme established by the East Java Provincial Environmental Bureau, Indonesia, in order to evaluate the process of knowledge interaction between the public agency representatives and local farmers. The programme provides an excellent setting for exploring and critically questioning different dimensions of knowledge governance, including what happens when “expert” agricultural knowledge (derived from the hard sciences) is delivered to and confronts the ideas, values, and century-old cultural traits of local farmers. It is for this reason that a knowledge governance theoretical framework was developed for this research.
1.3 Research questions

This thesis examines knowledge governance in practice in the implementation of a conservation agriculture programme instituted by Indonesia’s East Java government. The research focus is on the process of knowledge interaction in the implementation of this programme in two rural villages in East Java. The research questions that guided the research are:

1. How is the conservation agriculture programme delivered in East Java, Indonesia?
2. What are farmers’ perceptions towards the programme of conservation agriculture?
3. How do farmers navigate divergent knowledge systems?

1.4 Research structure

This thesis is divided into eight additional chapters:

Chapter 2 provides background information about East Java province as part of the Republic of Indonesia. This chapter gives a brief overview of its geography, climate, demography and the government system. An overview of agricultural policies in East Java and links with environmental issues are also discussed. Chapter 3 sets out the knowledge governance theoretical framework. Chapter 4 outlines the methodological framework of this study and methods used to collect and analyse data. Chapters 5, 6, and 7 present the research results. Specifically, Chapter 5 sets out an analysis of the interviews with the public agency representatives, who were the scientists and the head of the Conservation Department from the Provincial Environmental Bureau of East Java as the representative of the East Java government. These representatives were responsible for the implementation of the conservation agriculture programme in rural villages. Chapter 6 presents an analysis of the interview with the field person who acted as the mediator between the public agency representatives and the farmers. This chapter also explains how the management boundaries works and how science was delivered to the farmers. Chapter 7 presents an analysis of the interviews with the farmers involved in the conservation agriculture programme. The discussion in Chapter 8 links the results of the research with the theoretical framework that is set out in Chapter 3. The conclusion set out in Chapter 9 demonstrates the theoretical contribution of this study and the implications of this study for policy and practice.
Chapter 2
Background

2.1 Introduction

This chapter provides the background information of East Java province as part of the Republic of Indonesia and the location of where this research took place. East Java’s geography, demography and, history and government system are outlined. This chapter will also give an overview of the agricultural policies that have been implemented in East Java so far, and provide the historical context of the conservation agriculture programme that is the subject of this study.

2.2 East Java province

East Java province is located on the east side of Java Island with Surabaya as its capital city. The location of East Java is adjacent to the Java Sea in the north, Bali Strait in the east, the Indian Ocean in the south, and the Central Java province in the west (Indonesian Ministry of Finance, 2012). The area of East Java province is approximately 47,963 km², which is divided into two main areas, East Java mainland and Madura Island.

![Map of East Java Province](image)

*Figure 2.1 Map of East Java Province (Source: Google map, 2015)*
2.2.1 Geography and climate

Other than its two main areas, East Java also has several other islands: Bawean, Kangean, Masalembu, Nusa Barung and Sempu. Geographically, East Java is divided into three zones; the south-west, which is a mountain range with its mining area; the middle zone, which is the volcanic area, and quite lush, ranging from Ngawi, Blitar, Malang to Bondowoso; and the north zone and Madura, an area that is less fertile. In the middle area of East Java, there is a chain of volcanic mountains: Lawu, Wilis, Liman, Arjuno, Welirang, Anjasmor, Wayang, Kawi, Kelud, Bromo, Semeru, Argopuro and Raung. Semeru (3,676m) is the highest mountain in Java Island. (Provincial Environmental Bureau of East Java, 2015).

East Java has a tropical wet climate. It has low precipitation compared to the west side of Java Island, with an average of rainfall around 1,900 mm per year. The range of temperature is between 18°C and 35°C. Like many other parts of Indonesia, East Java has two seasons in a year; the dry season (June to October) and the rainy season (November to May) (Indonesian Ministry of Forestry, 2015).

2.2.2 Demography

For Indonesia, East Java province is the province with the largest population compared with the other provinces. There are more than 38 million people who live in East Java. The majority of East Java people work as farmers, others would work in businesses, services and industrial areas (Jatimprov, 2013). The ethnicity in East Java is quite diverse. The largest ethnicity is Javanese, and others are Madura, Bali, Tengger, Oising and Samin. The majority of people in East Java adhere to Islam as their religion; others are Protestant Christian, Catholic, Hindu and Buddhist. East Javanese people are famous for their frank way of speaking, loud voice and outspoken manner, which make them distinct from other Javanese people who live in other provinces in Java Island (Jatimprov, 2013).

2.2.3 Local language

Bahasa Indonesia is the national language of the Republic of Indonesia, however, the Javanese language is the local language used by the majority of people in Indonesia. The Javanese language used in East Java has several dialects (Mengenal Budaya Jawa, 2012). In the west part of East Java, cities located on the border of East Java and Central Java Province use the Javanese language with a dialect similar to Central Java’s. Moreover, the Javanese language that is spoken by the people who live in central and eastern parts of East Java is considered a non-standard Javanese language (Mengenal Budaya Jawa, 2012). The
characteristics of the East Javanese language are being outspoken and ignorant to the formality level in its spoken language. It should be noted that the standard of Javanese language has level of formality within it. Javanese people, generally, have to speak using different level of formality towards different people to show the level of respect that they have to those people. For example, they will use the highest level of formality of Javanese when they talk to their parents, and a low level of Javanese when they talk to their siblings. The low level of formality that they use is an indication that they consider them as friends. In general, these levels of formality are used among the Javanese people to show the social status of a person, which is still considered an important aspect when developing communication with somebody. However, in East Java, generally, this standard does not apply. This is because there is an intention to show that East Java people are more familiar and friendly to others. Some parts of East Java also have a unique use of Javanese language. For example, in Malang city the people used to alphabetically reverse some words in Javanese when they talked to each other. Another example is the people who live in the mountainous area of Tengger still use the ancient Javanese language (Mengenal Budaya Jawa, 2012). Being familiar with East Java’s culture, the researcher expects that farmers would speak in Javanese without considering the levels within, which is in contrast to her perspective and culture, where she should talk to them using the highest formality level of Javanese to show her respect.

2.2.4 History and government system

The first government system was constructed by the King of Kanjuruhun who resided in the Malang area in the year 760. The system was hierarchical, that is, it was from the central government (Keraton) to local government (Watek). This type of government remained until the 13th century, when the King of Singhasari reigned. The hierarchy of the government then changed to a provincial system based on, central (Keraton), country (Provincial), district (Watek), and then village (Wanua). During the Mataram era (1582-1755), the government system then changed again to country (Keraton), inside province (Negaragung), outside province (Mancanegara), district and village. This division of district and village was used until today’s government system, even though the other divisions had changed. The hierarchical system was kept even though the Dutch arrived and colonised Indonesia, where the system of centralisation was introduced in 1830. VOC (Vereenigde Oost Indische Compagnie) was a trade venture from the Netherlands that controlled the spice trade in the Eastern part of the world. Parts of the VOC’s rights were in developing their own government system and an army, making their own currency, and making an agreement with the kings of the Eastern part of the world. For Indonesia, the VOC established their own hierarchical
government system which became the central government. The centre was Batavia (now Jakarta), and there was a governor in each province (Jatimprov, 2013). Indonesia gained its independence in 1945, when East Java also started arranging its own government system. The system was centralised, similar to the Dutch system and, at this time, the first Indonesian governor for East Java was chosen. In short, it can be seen that for more than a decade the Indonesian government used the system of centralisation, which emphasised the hierarchical or top-down structure from central to local government.

Centralisation was also carried out by President Soeharto, who ruled from 1965 to 1998. At that time, the Indonesian army was heavily involved in the system of centralisation that was carried out by Soeharto. This was because President Soeharto aimed for a strong and steady growth of the economic sector of Indonesia, for which he believed a strong political sector was needed. Therefore, the involvement of the army was, he thought, paramount (Joshua, 2015). Jenkins (as cited in Joshua, 2015) mentioned that President Soeharto not only dominated the Indonesian army but also controlled the Ministry of Defence and Security. He had the power to decide which candidates went into the Indonesian parliament in order to make sure that they would chose him as the only presidential candidate in the next election. President Soeharto also controlled every department and national company, and also the social dynamics in villages (Joshua, 2015). He worked hard to make himself the father figure of development in Indonesia.

However, the dictatorship of Soeharto ended in 1998 when Indonesia was hit by the Asian economic crisis. At this time, the currency of the Indonesian rupiah was quite low compared to the US Dollar. President Soeharto then decided to obtain funding from the IMF (the International Monetary Fund), which revealed that for more than three decades Soeharto and his people within the Indonesian government had spent 30% of the national development funds for their own interests (Ahira, 2013). This impacted on national stability; for example, the occurrence of a huge wave of protests, especially in Java Island, inactive public services for weeks, increased food prices, and many closures of shops to avoid lootings. These conditions forced President Soeharto to stand down, in 1998, bringing an end to more than three decades of dictatorship (Winarto, 2004). Within weeks, the Indonesian government was forced to make a massive change in their government system.

The people of Indonesia urged their government to reform its government system in order to leave behind the centralisation system that had caused misery for the country. In this era of reformation, a decentralisation system was then chosen by the new Indonesian government as
this system carried the democratic concept as its main principle (Darmawan, 2012). The Indonesian government believes that through decentralisation, local and central governments would obtain equal justice, benefits and responsibilities. At this time, the Indonesian government tried to process the delivery of equal autonomy to local governments, manage the division of local resources, and arrange an equitable sharing of finance between the local and central governments (Darmawan, 2012). To provide the decentralisation system, the Indonesian government issued Law 22 in 1999, then revised it into Law 32 in 2004. It concerns autonomy, where the Indonesian government gives authorisation to the provinces to explore, manage and develop the potential of their area, in order to improve the wealth of their people (Jatimprov, 2013).

Nevertheless, Jati (2012) questioned the work of decentralisation as still being ambiguous. He argues that decentralisation means that the government system would have no divisions within its regional government system (Jati, 2012). However, division within the Indonesian government system still exists, based on the 1945 constitution, even though they declared the system of decentralisation, according to Jati (2012), centralisation is still being practised under the guise of decentralisation. This then raised the question of how the Indonesian government would conduct the implementation of their policies, especially relevant in the case of this research. New agricultural policies are implemented under so called decentralisation system, yet to some extent previous constitution which relied on centralisation system may still be applied.

2.3 Overview of the agricultural policies in East Java

This section presents a brief overview of agricultural policy and management in East Java, and how the East Java government implemented the new paradigm of agriculture innovation within its agriculture policy.

2.3.1 Agriculture policy in the centralisation era

Together with other provinces in Indonesia, East Java received the implementation of Green Revolution technologies and practices when President Soeharto resigned. In 1965, the Indonesia agricultural sector started the adoption of the so-called “Green Revolution” (Winarto, 2004). It was a mass guidance programme that was pursued by the Government of Indonesia to achieve self-sufficiency of the staple food commodity, rice. At this time, the Indonesian government provided infrastructure rehabilitation, agricultural extension, fertilisers, various varieties of high yielding seeds, and pesticides. Foreign firms from Europe
and Japan were contracted by the Indonesian government to provide fertilisers and pesticides to farmers through the village heads (Winarto, 2004).

This adoption of Green Revolution practices and technologies made Indonesia become self-sufficient in agricultural commodities, especially rice, by the 1980s. Nevertheless, it limited farmers’ ability to manage their own fields profitably, and created a dependency for farmers on overseas production inputs and the abandonment of their local knowledge (Siahaan 2006; Winarto, 2004). Winarto (2004) states that during this adoption the army was mobilised to help farmers carry out pesticide spraying. Under these circumstances knowledge was transferred under duress. In fact, there was a trend of “mysterious shooters” who would gun down those who “disturbed” public order. Ahira (2013) maintains that this level of violence discouraged farmers from expressing their ideas. Moreover, the condition of the land and water in Indonesia degraded over time, as the knowledge of the Green Revolution technique was not only transferred and applied to the rice commodity but also to other agriculture commodities in Indonesia. The adoption of the Green Revolution programme, especially in East Java, had brought its agricultural land into a critical state, meaning that the land suffers from, or is in the process of physical, chemical, and biological destruction, all of which threaten agricultural productivity, rural homesteads and livelihoods (Nugroho, 2011). In other words, land was becoming degraded because of the way it was cultivated. These practices were also found to be contributing to water pollution and affecting the water quality of rivers (Sunaryo, 2001).

2.3.2 Conservation agriculture – a new policy approach

Indonesia set a course for a new agriculture policy approach when the General Director of Agriculture Infrastructure attended a meeting to discuss what has become known as the Bangkok Declaration. This meeting was held by the Food and Agriculture Organisation (FAO) in 2001. In this deliberation there were several points of agreement that related to land and water investment that had to be achieved by countries in Asia and the Pacific. One of the areas of concern was land intensification. Remedies included land and water investment, such as the maintenance of soil fertility, soil conservation, and river-basin management (FAO, 2002). FAO (2012) has maintained that soil conservation through conservation agriculture practices seeks to improve not only soil productivity and sustainability but also farmers’ incomes. Hence, the FAO (2012) has promoted conservation agriculture as having the potential to increase farm profitability and improve the livelihoods of farmers while achieving agriculture sustainability at the same time.
Moreover, during the deliberation of the Bangkok Declaration, the General Director of Agriculture Infrastructure stated that Indonesia, especially in Java, has suffered a massive loss of land fertility due to the adoption of the Green Revolution technique. This mass guidance programme that used widespread amounts of pesticides and fertilisers had resulted in high levels of insecticide residues that were found not only in agricultural land but also in agricultural products from Java Island (Adimihardja, n.d.). This was a significant problem because developing new land for agriculture outside Java Island is not easy, not only because of the increasing Indonesian population, but also because the type of soil may not be suitable for cultivation as it is too acidic, especially for the main Indonesian crops (FAO, 2002). Through the deliberations of the Bangkok Declaration, the General Director supported the application of conservation agriculture by stating that conservation agriculture not only offers knowledge and tools for farmers in order to increase farm income through improvements in crop yields, but it also reduces crop vulnerability to extreme climatic events, as well as protecting the environment (FAO, 2002). This, then, was the starting point of having conservation techniques as part of the agriculture policy in Indonesia; it was expected that by adopting conservation techniques, not only would farmers increase their income and crop production, but they would also support the government’s aim to preserve the environment.

In addition, the Indonesian General Director of Agriculture Infrastructure declared that Indonesia needed to adopt conservation agriculture following the new principles of the agriculture paradigm:

1. Democracy, transparency, accountability, good governance, and decentralisation should reflect on the development of agriculture.

2. The agricultural development should prioritise a community-based participation. In this case the role of government was restricted to that of regulator, facilitator, catalyst and a dynamic force.

3. The District/Regional Autonomous Law No. 22, 1999, and Government Regulation No. 25, 2000, should be carried out in the development of agriculture (FAO, 2002).

With the new agriculture paradigm, and supported by decentralisation laws (No. 22/1999 and No. 25/2000), it is expected that local government or community could empower themselves to regulate and manage their affairs and the use of their own agricultural resources. With the restricted role that the government has, there was the potential that local farmers would be
actively involved in the decision-making process. As the government is now more open to the participation of local farmers, the act of power sharing and integration between scientific and local knowledge could be expected.

**A new participatory approach: giving a voice and power to farmers**

Following the agreement that was reached in the Bangkok Declaration 2001, and in order to support the implementation of conservation agriculture as part of land and water investment, the FAO has widely promoted participatory development in agricultural and rural development since 2003 (Van Heck, 2003). It is expected that by participating in agricultural and rural development, farmers will “contribute to the planning of a project or a programme, participate actively in its implementation and evaluation and share fully in its benefits” (Van Heck, 2003, p.7). Van Heck, an FAO consultant, (2003) defines participation as: “(1) sensitising people to make them more responsive to the development programmes and to encourage local initiatives and self-help; (2) involving people as much as possible actively in the decision-making process; (3) organising group action to give to hitherto excluded disadvantaged people control over resources, access to services and/or bargaining power; (4) promoting the involvement of people in the planning and implementation of development efforts as well as in the sharing of their benefits”; and (5) involving a number of people within a programme that would improve their well-being, such as “their income, security, or self-esteem” (p. 6).

In order to put participation into practice, Van Heck (2003) has set three types of participation:

1. Induced involvement: the strategy, design, and work plan of a project are predetermined and the intended beneficiaries are encouraged to participate in its activities and obtain certain benefits. In various projects, people are invited to make contributions of labour and/or other resources, which are also seen as a form of cost-sharing.

2. Transitory mobilisation for community development: the people participate in certain specific temporary tasks mainly for the development of their community, but there is no institutional base or structure (groups or organisations) for more sustained participation.
3. Group formation: the project has a specific objective to help create new, or strengthen existing, self-formed and self-run groups and organisations through which the rural poor gain access to resources, inputs and services, and participate actively in the project, also by means of self-proposed actions. It is expected that from the implementation of this type of participation, farmers will be empowered; they would obtain not only access to resources but also decision-making and bargaining power as well as a base for sustained self-development efforts.

Nevertheless, Van Heck (2003) argues that in putting participation into practice, some obstacles may emerge. One of them would be the diversity in the farmers’ communities, as “there are various categories with class, caste, tribal and religious difference, and also with different interests, needs, access to resources as well as potential” (Van Heck, 2003, p. 12). In addition, Van Heck (2003) maintains that farmers’ “low level of education”, “ignorance of their rights to self-organise groups”, and “lack of know-how to move in this direction in order to promote their interests” (p. 12) are also challenging. In other words, it is difficult to put participation into practice as most of farmers do not have a formal education, and they do not have the self-esteem to work together in a group in order to pursue their rights and their interests. Therefore, Van Heck (2003) argues that it is important to have a dialogue between “politicians, top decision-makers, and planners” (p. 14) before they approach the farmers with the idea of participation. Having a dialogue in advance with the “key officials, planners, and decision-makers of national and international development agencies” would strengthen the promotion of participatory development to farmers. In this case, argues Van Heck (2003), farmers “have to become convinced that it is in their own short- and long-term interest to support the project” (p. 16) or programme. In all, as argued by Van Heck (2003), no matter which type of participation a country might use in order to develop their agricultural sector, it is best for policy makers, scientists, and the relevant bureaucrats of that country, to have a dialogue before the notion of participation is promoted to rural farmers. This is because for farmers, in general, not having a formal education means that they do not to know how to self-organise their groups, and this may affect their self-esteem to work together with the government group.

Nevertheless, what has been proposed by Van Heck (2003) as the consultant of FAO, yet again, showed that farmers were being marginalised and framed due to their lack of formal education. Farmers might be lacking formal education yet their knowledge about cultivation through daily practices cannot be overlooked. The types of participation that were proposed
by Van Heck also did not recognise the role of local knowledge as an important aspect in the work of participation. In regard to this statement, and given the recent scholarly attention to the involvement of local knowledge in the decision making process, part of this study explores the dynamic lives of rural farmers that relate to their agricultural activities, their farmers’ groups, and how they receive new information and knowledge.

2.3.3 Conservation agriculture in Indonesia

Following on from the Bangkok Declaration, the Indonesian Ministry of Agriculture then started to set a conservation agriculture policy, and guidelines for its implementation were also developed. According to these guidelines, conservation agriculture is a system that emphasises the optimal use of arable land in order to increase agricultural production, such as crops, horticulture, plantation, and livestock, by applying conservation techniques, in order to conserve the land and water at the same time (Ministry of Agriculture of Indonesia, 2010). These conservation inputs and techniques include:

1. Providing production inputs for the farmers, such as fertilisers, seeds and fodder grass. The selection of seeds provided needs to be adjusted to the condition of the targeted area and its potential markets. Therefore, farmers can sell their products right after the harvest rather than having to search for markets for their products.

2. Providing livestock to farmers. The Ministry of Agriculture expected its local departments to provide sheep or goats to the farmers in their areas. In this case, local departments should give three goats or sheep for every 10 ha of the targeted villages. The reason for giving this type of livestock was because of their rapid reproduction and a source of feed was easy to find.

3. Building meeting huts as places for farmers to meet and have discussions with extension officers and community organisers. Community organisers are persons who were hired by the local department to guide farmers in applying the concept of conservation agriculture. The meeting huts needed to be equipped with a map of the village, a list of farmers involved in the programme, a diagram of the structure of the organisation of the programme and a list of the programme’s activities.

4. Building a seed bank. In this case, the Ministry of Agriculture expected that the seeds or parent trees were chosen according to the farmers’ preferences which, when produced, could be sold easily at the nearest potential markets.
5. Rehabilitation of arable land. In this case, the Ministry of Agriculture expected its local departments to guide farmers to apply a terracing system on their land. In addition, farmers would have to make diversion ditches to control the water flow and plant fodder grass to strengthen the terrace patio.

6. Building compost huts. The function of a compost hut is to become the centre of organic compost making and the place where organic fertiliser processors are kept. The intention of having the compost huts is that the Ministry of Agriculture expected that farmers would apply the compost products from these huts on to their fields, which would later increase their land productivity, and farmers could sell the compost for additional income.

7. Holding regular farmers meetings every month to discuss problems that occurred, to find solutions and do evaluations. These meetings must also be attended by the community organiser as an instructor and facilitator.

8. Holding field gatherings. In this case, the Ministry of Agriculture expected that all stakeholders would meet and develop similar perceptions of the concept and management of conservation agriculture in the upstream area. The stakeholders are bureaucrats from the local Department of Agriculture, community organisers, extension officers, official village heads and farmers. The government established these gatherings so that farmers can also exchange information and experience among themselves about the application of the programme (Ministry of Agriculture of Indonesia, 2010).

The Ministry of Agriculture also put in place some indicators to measure and benchmark the success of their conservation agriculture programmes. They were:

“(1) the development of horticulture commodities which have high economic value; (2) an increasing area of vegetation which cover the land with a critical state condition; (3) a decrease in erosion and increase in land productivity; (4) decreasing area of land with critical state condition; (5) an increasing income and wealth of farmers” (Ministry of Agriculture of Indonesia, 2010, p. 40).

For East Java province, the Provincial Department of Agriculture delegated the implementation of this conservation system to its local departments. For example, the local Department of Agriculture in Batu and Malang followed and implemented the guidelines
from the Ministry of Agriculture in 2008. On this occasion, the villages that took part in this research study were also involved.

2.3.4 Agriculture and the Brantas River watershed

The Brantas River is the main river in East Java. It has a catchment area of 14.103 km² or around 26.5 per cent of the area of East Java region and passes through 15 districts and cities (Department of Public Works, 2008). The location of the Brantas watershed is quite strategic in providing water for several uses, such as for drinking water, electric power, industrial needs, and irrigation (Management Bureau of Brantas Watershed, 2011).

![Figure 2.2 A sighting of the Brantas River from a satellite. The flow of the Brantas River (purple colour) starts from the mountainous area of Kawi, Arjuno, Welirang, and Anjasmor to Surabaya and Sidoarjo. (From: Power Point materials from Management Bureau of Brantas Watershed, 2011)](image)

The river’s upstream area has become the main producer of several horticultural products, such as potatoes, cabbages, onions, carrots, kidney beans and apples (Soemarno, 2011). However, according to Soemarno (2011), the way the local farmers have cultivated the land is believed to be the trigger for soil erosion in the Brantas upstream area, which affects the water quality of the Brantas River. Due to this concern, the East Java government, through its Provincial Environmental Bureau, established the conservation agriculture programme as a way to improve the water quality of the Brantas River. Reflecting on the deliberations of the Bangkok Declaration, it was hoped that this programme would put in place the new agricultural policy paradigm, which involved farmers in the decision-making process. This study evaluates the way farmers fulfil this expectation (actively participate, improve crop
production and preserve the environment) and how farmers “see” this expectation from their perspectives.

2.4 Local traditions within the agricultural sector in East Java

East Java has a very rich culture, from its dances and ceremonies to beliefs and religious practices. Most of these are related to agricultural activities. The Javanese ancestors always had their own proverbs when it comes to farming and these strongly influence farmers’ activities in the field. One Javanese proverb that relates to farming is “Ibu bumi, Bapak aksa”, which means “Mother is earth, Father is sky” (Putri, 2012). Through this proverb, the Javanese ancestors have symbolised the Earth as a mother who gives lushness to any farming activities, with the sky as a father who gives blessings through his rain. This taught people to love and respect the Earth as if it is their mother (Putri, 2012). Another Javanese proverb that relates to farming activities is the concept of Manunggal, which means “become one” (Putri, 2012). This concept taught people to become one, not only with their gods but also with nature. It is taught that if humans become one with nature, they would never dare to destroy nature, as it means that they would destroy themselves (Putri, 2012).

These concepts of Manunggal and respecting the earth have been known by farmers in East Java for decades through a number of traditional ceremonies; for example, the Kasada ceremony, in Tengger, where farmers will gather and bring their stock and crops to the Bromo mountain and throw them into its crater. This ceremony occurs every 14th to 16th of Kasada month or at the full moon, once a year. This ceremony occurs to show the farmers’ gratitude to their god and also to request a blessing for their farming activities (Winma, 2015). Another example is the buffalo ceremony in Banyuwangi, where the rituals would go from praying, led by the elderly, to sharing foods that have been blessed by the elderly, to a parade of some men who walk around the village with their buffaloes (Winma, 2015). This ceremony occurs not only to show the farmers’ gratitude to their god but also to avoid diseases and pests that may attack their crops in the future. Moreover, most of the farmers in every village in East Java also conduct a ceremony named “Bersih Desa” or “cleaning the village.” This ceremony is meant to show their gratitude to their god, and ask a blessing not only for the next stage of their farming activities but also for protecting their villages. At this ceremony farmers would sacrifice their stock and crops and parade around the village (Winma, 2015).
2.5 Historical context of conservation agriculture programmes in East Java

The East Java provincial government started the implementation of its conservation agriculture programmes in 2008. In the villages of Tulungrejo and Sumberbrantas, the study sites, the programme was at first conducted by the local Department of Agriculture. This particular conservation programme followed the guidelines that by the Department of Agriculture from the Government of Indonesia. It involved:

1. Holding a coordination meeting with the leader of the extension officers and other related institutions, such as the local government and local environmental organisations. Therefore, these institutions become aware of the existence of the programme, provided guidance for the implementation of the programme, and arranged the conservation activities that needed to be applied in Sumberbrantas and Tulungrejo village.

2. Providing production inputs, such as horticultural seeds or trees, fertilisers and pesticides to the farmers, and building meeting huts. In this case, Sumberbrantas village received tamarillo trees (Solanum betaceum), and Tulungrejo village received apple trees (Malus sylvestris), coffee (Coffea arabica L.), avocado (Persea americana) and guava trees (Psidium guajava).

3. Holding a meeting with farmers to facilitate socialising in the programme. In this case, the local Department of Agriculture informed the farmers about the conservation agriculture programme from the government, its benefits, what the government would provide for the farmers, the proposed activities of conservation agriculture, and what the government expected from the farmers during the programme.

4. Holding formal training sessions for the farmers, which were conducted in a classroom. The aim is to develop local knowledge about a conservation agriculture system (Department of Agriculture of Batu, 2008).

During this implementation, the farmers had to adopt the programme on their tilted/sloping land. This meant that farmers had to change the form of their land to terraced land by following the directions from the extension officers on how to set up a terrace system and plant the trees at the beginning of the rainy seasons (Department of Agriculture of Batu, 2008). The local Department of Agriculture also expected that farmers committed to the programme and maintained the land as well as the plants. In order to run the programme smoothly, the local Department of Agriculture expected the farmers to demonstrate a clear status in regard to land ownership to avoid conflicts. However, the local Department of
Agriculture also warned the farmers that they could not claim from the government for any damage that might happen during the programme.

When the programme ended at the end of 2008, monitoring from the central Government of Indonesia was conducted. It was conducted during the third and sixth month after the project ended. The first monitoring was a field visit to check the condition of the production inputs given to them; in terms of whether the production inputs were given to the farmers that truly needed them, whether the trees are well maintained, and whether the farmers have adopted a proper conservation agriculture system. The second monitoring visit was conducted to check the use of the budget for establishing this programme. Furthermore, by the time the local Department of Agriculture delivered the final reports on the implementation of their conservation agriculture programme several problems were noted.

First, the local Department of Agriculture argued that there were delays in receiving the document that controls and maintains the budget of this project from the Ministry of Agriculture of Indonesia. Therefore, they could not proceed with the programme until the document arrived, which delayed the adoption of conservation agriculture system. Second, extension officers, who knew the situation of villages in the Batu city area well, were excluded when the local Department of Agriculture decided which villages would receive the programme. Therefore, the extension officers felt there was lack of coordination between them and the relevant bureaucrats in the Department of Agriculture. Third, the local Department of Agriculture argued that there was lack of coordination and communication from the farmers about how far the implementation of conservation agriculture project had gone (Department of Agriculture of Batu, 2008).

In 2010, a similar programme was implemented by the local Department of Agriculture. However, the programme was only conducted in one of the case-study villages, Sumberbrantas village. In this village, the local Department of Agriculture built another meeting hut, compost huts and gave production inputs to the farmers of Sumberbrantas, such as organic and non-organic pesticides, and persimmon trees (*Diospyros kaki*). In this programme, the local Department of Agriculture promoted the programme as a means to empower farmers in taking their role as field implementers, to improve their knowledge and skills in undertaking a conservation agriculture system, to improve their awareness about preserving natural resources and to improve the willingness to share knowledge among the farmers (Department of Agriculture and Forestry of Batu, 2010).
When the programme ended, the local Department of Agriculture made its final report, in which it highlighted the issue of vertical and horizontal coordination. In this case, it mentioned that there needed to be an improvement in the vertical coordination between bureaucrats of the Department of Agriculture and extension officers, and in the horizontal coordination between extension officers, the community organiser and farmers. Importantly, the report stated that the Department of Agriculture needed to pay attention to the practical needs of the community organiser who regularly guided the farmers in implementing the programme (Department of Agriculture and Forestry of Batu, 2010), for example, their transportation, a place to stay and accessibility to food.

It can be seen that the conservation agriculture programmes implemented by the Department of Agriculture did not promote participation by local farmers nor did it seek to include or use their local knowledge. The Department of Agriculture had applied a one-way communication, from its representatives to the farmers, in the implementation of its programmes. Putting the programme in place according to the guidelines did not involve giving a voice to farmers.

To remedy these deficiencies, the Provincial Environmental Bureau of East Java (PEBEJ) stepped in. It proposed a new paradigm of implementing conservation agriculture programmes to attain sustainability for the people, land and water. In line with the Bangkok Declaration and FAO principles, PEBEJ (2010) maintains that farmers should be involved from the planning to the evaluation stages, so that the programmes can be sustained and conservation agriculture adopted to ensure the environment is preserved for future generations.

The PEBEJ (2010) points out that the Department of Agriculture had failed in implementing conservation agriculture programmes in 2008 and 2010. This was shown by the behaviour of farmers not improving as the farmers continued to cultivate the sloping land and ignored the conservation techniques by not terracing their land; neither did they build diversion ditches to control the water flow, nor did they plant fodder grass on the terrace patio (PEBEJ, 2010). PEBEJ (2010) also argues that previous conservation agriculture programmes had put aside the role of farmers within the programmes. Therefore, in 2010, the PEBEJ applied another conservation agriculture programme for farmers in Tulungrejo village and Sumberbrantas villages. Farmers’ participation then became an important aspect of this most recent iteration of conservation agriculture.
For the Environmental Bureau, this conservation agriculture programme in the Sumberbrantas and the Tulungrejo villages was to be their pilot project. They define conservation agriculture as using natural resources or, in this case, arable land, to fulfil the needs of human well-being and to improve their quality of life by managing the use of land and water. Therefore, sustainability of the ecosystem can be developed to meet the needs of farmers and their families, and the needs of their future generations (PEBEJ, 2010). This philosophy contrasted with that of the Department of Agriculture, in which conservation agriculture was about maximising the use of arable land to increase agricultural production through the application of conservation techniques. From the implementation of the conservation agriculture programme by the PEBEJ, it was hoped that the results could be applied in other villages also located in the upstream area of the Brantas River. This is because Sumberbrantas village and Tulungrejo village were in the region of the origin of the flow of Brantas River. They are also located near the sources of many springs, which are being depleted over time (PEBEJ, 2010).

To put this conservation programme in place, the PEBEJ requested help from scientists at one of the educational institutions in East Java. The scientists then hired a field person who was expected to help them in the field when the knowledge of conservation agriculture system was delivered to farmers and also to monitor the implementation of the programme by farmers. The programme was applied in Sumberbrantas village, in 2010, and in Tulungrejo village from 2010 to 2012.

Implementation proceeded by:

1. Setting up meetings between scientists and the head of the Conservation Department of Provincial Environmental Bureau. In this case, they discussed the budget for the programme, how the programme would run and who would run the programme. It was decided that the Provincial Environmental Bureau would give their authority to the scientists to run the programme, while the Environmental Bureau only handled budgeting and monitoring matters.

2. Hiring a field person who would help the implementation of the programme in the field. The scientists had set up some criteria to choose a field person. For example, he or she needed to know the area well and the farmers of Sumberbrantas and Tulungrejo village; he or she had to have a degree in agriculture as their educational background, and have a strong commitment to do the tasks. Once the scientists found the right field person meeting their criteria, the scientists transferred the results of previous meetings to this field person. Together with one of the scientists, the information that the field person received was delivered to the farmers in Sumberbrantas and Tulungrejo as part of his tasks.
3. Holding a focus group discussion with farmers and an official local head in both villages, to deliver what had been previously discussed by scientists and the Environmental Bureau, and to find out what farmers wanted from the programme. Nevertheless, at this stage it was unclear to whom the development of this group discussion was dedicated, although participation was a key aim.

4. Holding training sessions, by scientists about the conservation agriculture system for the farmers, which were undertaken at the beginning of the programme. In Sumberbrantas village, the training was through an extension class, which was held at the village hall and in the field. In contrast, the training in Tulungrejo village was conducted at informal farmers’ meetings and in the field. The Provincial Environmental Bureau expected that mentoring would be given regularly by the scientists to the farmers. Therefore, it was expected that the farmers’ knowledge, attitudes and behaviour towards natural resources would change significantly (PEBEJ, 2010).

According to PEBEJ (2010), from the focus group discussion, it was concluded that farmers wanted the following:

1. Building a terracing system on their arable land

2. Planting apple trees (Malus sylvestris L.) that were offered by scientists and Environmental Bureau. In this case, farmers could choose the type of apple trees.

3. Continuing to plant vegetable crops on terraced land while waiting for the apple trees to grow.

4. Accepting the offer from the scientists to plant vetiver grass (Andropogon zizanoides) for strengthening the terrace patio rather than fodder grass. This is because, according to the scientists, fodder grass tends to damage the top soil. Planting vetiver grass would not only save the nutrition of the top soil but it also can also become part of an investment for the farmers, as vetiver grass is a raw material for the perfumery industry in Indonesia. It will be remembered that during the 2008 and 2010 conservation agriculture programmes, the Department of Agriculture recommended fodder grass.

5. Letting the public agencies introduce them to the conservation system by having a demonstration at the field. In this case, the public agencies had to rent a plot of land and build a cultivation system using conservation agriculture techniques, which was done only in Tulungrejo village. Nevertheless, the introduction of a conservation system in Sumberbrantas
village was only undertaken after giving workshops and holding discussions. Field visits took place in Sumberbrantas village only for showing the farmers what they should and should not do when they did understand the cultivation system on tilted land.

6. The demonstration plots were managed by a field person until the expected result was achieved.

The apple trees were an important part of the conservation agriculture programme. According to the scientists, this is because this tree has been proven to have long and strong roots that can anchor the soil and prevent erosion. Another reason was because apples are the main fruit produced in Batu city (PEBEJ, 2010). In this programme, monitoring was undertaken frequently during the first three months of implementation, when one of the scientists and a field person would come to the villages two to three times in a month. Thereafter, the monitoring was only conducted as needed by the scientists. In this case, the field person went to the village once a month and reported the condition of the implementation of the programmes to the scientists. The scientists would come when the field person found problems in cultivating the apple trees such as the occurrence of pests that that the farmers did not know how to treat.

Overall, in the case of the Indonesian agricultural sector, the conservation agriculture programme instituted by the PEBEJ as the representative of the Indonesian government, is seen as a new breakthrough. Under this enlightened regime the Indonesian government realised the importance of local participation within their policy implementation. It was expected that the farmers’ participation as the new element in this government programme would give better results than the previous conservation agriculture programmes instituted by the Department of Agriculture. How the government puts this element into place, however, and how it works together with local farmers, acknowledging their local knowledge, is an important question. The new paradigm of embracing local knowledge and inviting local farmers to participate and contribute to the government programme is the focus of this research.
Chapter 3
Conceptual Framework

3.1 Introduction

This chapter presents the conceptual framework that underpins this study. The literature of how knowledge governance has been theorised is reviewed in order to later investigate how it plays out in practice; in this case, in the implementation of a pilot programme for pioneering a new policy of the conservation agriculture system in Indonesia.

First, this chapter explains that evaluations of environmental policy development and implementation have identified the challenges in linking scientific knowledge and action. Second, the chapter outlines efforts to involve those who are expected to take action (e.g. farmers, indigenous communities) by calling on them to participate in programmes, or be included in collaborative processes, in a bid to improve the prospects for on-ground implementation (Innes & Booher, 2010; Folke, Hahn, Olsson, & Norberg, 2005; Newman, Barnes, Sullivan, & Knops, 2004). Given the scholarly attention that is now being placed on the role of knowledge in facilitating participation and collaboration to implement environmental policy, this chapter turns to the developing field of knowledge governance. The chapter examines the four key principles of knowledge governance: differences in ontology and ways of knowing, the existence of power sharing, and the scales encountered (Duncan 2016; Van Buuren, 2009; Giebels, Van Buuren, & Edelenbos, 2015; Edelenbos, Van Buuren, & Van Schie, 2011; Cash, Adger, Berkes, Garden, Lebel, Olsson, Pritchard, & Young, 2006a). This chapter also outlines and reviews how scholars have recently attempted to find the most appropriate pathway to accommodate all divergent knowledge systems in which the gradation of the role of local knowledge in the decision-making process has similar results to the participation ladder established by Arnstein (1969).

This conceptual framework draws theoretical insights from the fields of environmental geography and the field of science and technology studies (STS). Castree (2005) states that environmental geography sees “the world as a mesh of multi-scalar and sometimes unstable knottings of people (with their varied outlooks, economic practices, etc), plants, animals, soils, water, forests, and much more” (p. 235). Environmental geography, therefore, allows us to “trace the varied ecological impacts of different human actions upon the non-human domain, and vice versa,” rather than “to judge human actions against some eternal benchmark of stability imposed by the non-human world” (Castree, 2005, p. 235). Moreover,
environmental geography conceives nature and society as “hybrid”, where their relationships are constituted into a single unity based on their different domains (Castree, 2005). The field of STS, through the work of Jasanoff (2004), for example, critically examine how the process of knowledge production and state-making occur together. Jasanoff describes this as a mutually constitutive process of coproduction whereby “nature and society” are produced together. In other words, these fields study the evaluation of the relationship of people with their environment based on their geographical location, and culture that has constructed their judgments towards environmental issues. In addition, these fields of study also allowed the researcher to evaluate how people with local knowledge are taking part in the decision-making process together with policy makers.

3.2 Implementing environmental policy: the focus on knowledge

The role of knowledge in environmental policy development and implementation is now earning more attention. In the context of Indonesia, the implementation of environmental policy that was once based on centralisation has changed to a decentralised process, in order to give an opportunity for local institutions to explore, manage, and develop the potential resources of their area for the improvement of wealth of their people (Jatimprov, 2013). The autonomy that is given to local has been discussed by scholar, such as Sillitoe (2007, p. 1) who says that the implementation of environmental policy should appreciate the local situation more as people’s understanding of the environment is “varying with culture, history, [and] place”. Sillitoe also argues that scientific knowledge is no longer the only knowledge to view, to explain and to solve world’s problems, as “pay[ing] attention to other views” (p. 1) is also needed. Moreover Sillitoe explains how local people and scientists have different interpretations of similar environmental cases. He gives Australia as an example, in which a geological scientist sees a rock formation as “a record of sedimentary processes millennia ago and contemporary weathering activity”, while an Aboriginal leader sees it as “the petrified record of some event in the Story-time involving some creator being such as the rainbow serpent” (p.8). This example shows the distinct way of thinking between the geologist, who relies on their perspective on scientific judgment/examination, with the Aboriginal leader, who relies on their perspective of what has been told and believed over decades from generation to generation. Kolawole (2013) also gives the case of soil management in the sub-Saharan Africa region. He argues that improving the soil fertility in south-western Nigeria becomes complicated because divergent views and knowledge systems exist. In this case, farmers in south-western Nigeria argued that they had “employed traditional anthropogenic approaches” such as “shifting cultivation and fallow” in order to “replenish and conserve the
soil and vegetation”, while soil scientists maintained that farmers lacked soil management knowledge and claimed that their ISFM (integrated soil fertility management) was “always the best option” (Kolawole, 2013, p. 480).

As nature has different meanings to different groups of society (Wynne 1992), Booher (2004) argues that various societies that have divergent perspectives, ways of thinking and worldviews, should be included in the decision-making process. This recognition of ontological and epistemological divergence has led to calls by Sillitoe (2007), for more inclusion and participatory approaches, and more expectation that local knowledge needs to work in conjunction with science to have a “synergetic interaction” (p. 1) to solve environmental problems together. Gururani and Vandergeest (2014) explain that a narrative of blaming local people for the cause of environmental problems will develop if the role of local knowledge is neglected in the decision making process, when, in fact, the core problem is different perspectives of thinking and knowing about these environmental problems.

Folke et al. (2005) also argue that exclusion of local people in the decision-making process will only lead to environmental destruction. This is because policy managers and local people, together, enforcing their way of doing things with nature without compromising their actions, can only lead to an exploitation of nature (Folke et al., 2005). An example is the problem of the depletion of the base river flow in Yaqui Valley, Mexico, in which the water was exclusively managed for agricultural purposes only, and knowledge was dominated by agricultural water-user groups. However, knowledge from non-agricultural water users had been neglected due to “knowledge imbalances among the players” (Jacobs et al., 2009, p. 3).

The management of water in Yaqui Valley was only of benefit for agricultural water-user groups, as it was controlled by the irrigators and their main concern was delivering water to farmers and irrigation for infrastructure such as canals and drains (Jacobs et al., 2009, p. 2). The non-users, however, were set aside as it was assumed that their knowledge did not have any relation to the management and allocation of river water. This shows how certain groups had imposed their power and knowledge in the management of water in Yaqui Valley, and other groups had been marginalised and their knowledge and perspective were neglected.

The imbalances of knowledge used, which was highlighted by Jacobs et al. (2009), can be related to the ladder of participation developed by Arnstein (1969). Arnstein argues that when the participation of a group of people is not considered over others in the process of decision making, it can be concluded that power has not been equally distributed. Arnstein illustrates this distribution of power through the ladder of participation (see Figure 3.1), which shows how governments who involve stakeholders and devolve power in different ways have a
significant gradation of involvement/participation when it comes to the decision-making process.

![Ladder of participation](image)


The bottom levels of participation are manipulation and therapy. In these levels, the objective of the powerholders “is not to enable people to participate in planning or conducting programmes, but to enable powerholders to ‘educate’ or ‘cure’ the participants” (Arnstein, 1969, p. 217). The next level is tokenism, whereby participants are allowed to express opinions. In informing and consultation, even though the participants may “hear and be heard,” their power of making sure that their views are considered by the powerful is still lacking. In the level of placation, the participants are allowed to give advice “but retain for the powerholders the continued right to decide” (p. 217). The next level is partnership, in which participants can “negotiate and engage in trade-offs with traditional powerholders” (p. 217) and, in the level of delegated power and citizen control, the participants obtain full power in the management of decision-making process. It is expected that local people’s views are being considered and valued, and these views later become the basis of the decision-making process.

In light of Arnstein’s now well-known critique of power and participation and ongoing work with this focus, efforts have been made by, for example, governments and project proponents to shift public processes to involve and take into account the needs of local people. A similar step has also been taken by the Government of Indonesia by declaring new principles of the agriculture paradigm, in the Bangkok Declaration 2001. Through these new principles, the
Government of Indonesia limited their role in the process of decision making, encouraged the implementation of decentralisation and expected local farmers would be actively involved in the decision making process. Later, this involvement of local people is expected to improve policy implementation and not only deliver improvements in people’s social condition but also improve environmental management (Wiersum, 2000). This participation logic embodies several assumptions about the role of local knowledge and opens questions about the extent to which the process of participation would accommodate all values within the knowledge systems, linking to knowledge governance and what follows. Nevertheless, Wesselink et al. (2011) believe that even though improvements have been made in “the design and structuring” process of participation, this improvement only had “a little effect on the quality of the output and the relative satisfaction of the participants” (p. 2689).

From the research that these authors investigated, the findings show that the most common type of participation being practised in the real world is instrumental participation, with the aims to “restore public credibility, diffuse conflicts, justify decisions, and limit future challenges to implementation” (Wesselink et al., 2011, p. 2690). This type of participation does not allow for open discussion, and tends to reinforce the power that bureaucrats have in the process of decision making. It cannot be denied that instrumental participation is still widely practised, as towards the end of the decision-making process local views quite often collide with the top-down legal rules that still exist. Therefore, it is, “the hierarchical regulatory and institutionalised planning context that wins” (Tewdwr-Jones & Allmendinger, 1998, cited in Wesselink et al., 2011, p. 2696).

Hence, reflexivity and realism are needed and should be given more attention in the research on participation. Having reflexivity is essential to understand “the perplexities and dilemmas that crop up time and again in the set-up, running and uptake of results of deliberative and participatory policy analyses” (Wesselink et al., 2011, p. 2699). In addition, having realism included will allow researchers to notice that frictions and tensions between divergent knowledge systems that have different values, cultural contexts and beliefs are unavoidable, and need attention (Wesselink et al., 2011)

Moreover, it is now also widely recognised that levels of participation are strongly linked to how engagement occurs and communication is built between stakeholders. Agrawal (2005) argues that power can be deployed through the way engagement occurs; for example, whether through one-way or two-way communication. According to German, Verma, and Ramisch (2010), in one-way communication, power is mostly exercised by high level bureaucrats or policy makers, in order to regulate the way local people treat natural resources. However,
local people may have their own traditional ways to treat natural resources, which are contrary to the governments’ ways. German et al. (2010) argue that the different ways of treating the environment would make local people reluctant to apply the programme in accordance with the government’s desires. Agrawal (2005) gives an example of one-way communication in the case of a sheep and pasture development programme in India. In this programme, the government of Rajasthan, with funds from the World Bank wanted to control the mobility of raika shepherds in India. These shepherds are the largest group of agro-pastoralists, whose “mobility allows them to enhance levels of agro-pastoral production by taking advantage of variations in production across territorial landscape units, and depends on their ability to enact a series of exchange relationship with farmers, wool shearers, merchants, and petty commodity producers” (Agrawal, 2005, p. 74). However, the movement of the shepherds from one place to another had been viewed by the government “as an irrational response to environmental constraints, modernisation, and market forces” (Agrawal, 2005, p. 74).

Through the sheep and pasture development programme, the government of India had fenced 49 plots of land, each of 100 hectares for almost 2,500 raika households, which they divided into cooperative societies – one for each plot. From these plots, the government expected that the shepherds would develop their pastures and improve the quality of wool and mutton. However, after ten years of implementation, the shepherds had not yet settled down. Agrawal (2005, p.74) argues that the raika shepherds showed their power “by refusing to cooperate with the processes the programme sought to institutionalise, the shepherds defended their lifestyles and showed their power to undermine externally imposed solutions to their problems.” In summary, it can be said that the process of knowledge interaction between the government of India and the shepherds was tokenistic, as they could not engage their different ways of knowing; the government and the shepherds failed to create a common ground of knowledge in order for the programme to work. The shepherds thought the programme did not make sense for them. The government told the shepherds how to treat the environment; however, the shepherds had their own ways of behaving which were not taken into account by the government, resulting in uncooperative action by the shepherds.

Moreover, it is now widely recognised that two-way communication between local people and environmental practitioners can be appropriate and productive, can avoid the kind of conflict identified by Agrawal (2005), and can also make members of society aware of the power that they have, as argued by German et al. (2010). It is expected that two-way communication would give equal power to all stakeholders and make their main views heard, as this type of communication would help to break down barriers between the different knowledge, cultures,
and disciplines of, for example, bureaucrats, scientists, and local communities (Edelenbos et al., 2011). In the context of Indonesia, a similar step was also undertaken by the PEBEJ (see sub-chapter 2.5). The PEBEJ claimed their conservation agriculture programme differed from the previous conservation programmes that were held by the Department of Agriculture, because this most recent iteration of conservation programme put forward farmers’ participation, and the role of farmers within the programme is paramount (PEBEJ, 2010).

It is hoped that when farmers participate more in the conservation agriculture programme, they can bring their different perspectives, and work on problems that the bureaucrats (the PEBEJ), scientists, and farmers themselves, have faced together. Therefore, shared knowledge and shared understanding can be created, in accordance with the objectives of two-way communication (Innes & Booher, 2010; Edelenbos, et al., 2011). To demonstrate how distinct are two-way communication and its process to one-way communication, Edelenbos et al. (2011) have characterised these two types of communication, as shown in Table 3.1:

Table 3.1 The distinction between one-way communication and two-way communication (Source : Edelenbos et al., 2011, p. 678)

<table>
<thead>
<tr>
<th>One-way communication</th>
<th>Two-way communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The process of knowledge interaction appears to be just a symbol. There is no actual desire to form new knowledge by all actors.</td>
<td>1. Experts, bureaucrats and communities meet and are eager to create a common base of knowledge.</td>
</tr>
<tr>
<td>2. Experts, bureaucrats and communities meet, but they do not actively share their information and knowledge with each other.</td>
<td>2. All stakeholders seek to create open communication; thus, they can share knowledge and experiences, as well as receive inputs from others</td>
</tr>
<tr>
<td>3. They cannot open themselves to different knowledge, and fail to create common ground of knowledge.</td>
<td>3. They meet regularly, and they are all involved from the beginning until the implementation of their decisions.</td>
</tr>
<tr>
<td>4. The interaction that emerged is for convincing other groups about particular assumptions and epistemic values.</td>
<td>4. Experts, bureaucrats, and communities are trying to communicate and negotiate the differences in their knowledge, until mutual agreement is reached.</td>
</tr>
<tr>
<td>5. The interaction that emerged is more of a consultation; thus whoever is involved can ask questions. Reflexive dialogue is removed.</td>
<td>5. They apply certain methods and procedures in order to have open dialogue, and give equal position to all stakeholders to express their opinions and knowledge in a forum.</td>
</tr>
</tbody>
</table>
Two-way communication is also highlighted in the notion of collaboration that is proposed by Innes and Booher (2010): in the process of collaboration, it is expected that stakeholders would all be present and have “face to face dialogue” (p. 6) in order to discuss different views and problems that they have. In this case, not only power, but information should also be equally shared among stakeholders; thus, stakeholders would be able to express their own views and be listened to. Nevertheless, recognition of the need for more inclusion in decision making through increasing involvement, and the need for more interactive and equal communication raises important questions about the extent and range of views and knowledge to be counted in the final decisions. Another question now being asked is “by what pathways is it possible to bring divergent knowledge types together to link knowledge into action?”

3.3 Knowledge governance

As set out earlier, according to Wiersum (2000), knowledge is the way people understand the world, and interpret and apply understanding to their experience and practices, while governance, as argued by Ansell and Gash (2007) and Van Kerkhoff (2013), is a formal and informal process of rule-making, planning, and managing networks at all levels of human society.

Van Buuren (2009) argues that a focus on governing in knowledge is important as different ways of knowing embody different world views, values and perceptions, which “encompass different sets of organising capacity – the human, social, and institutional capital used to organize activities that make sense within specific ways of knowing” (p. 209). It is the different ways of knowing that shape the different bodies of knowledge that have led authors to argue that divergent knowledge systems lead to “miscommunication, controversy, and conflict” (Van Buuren, 2009, p. 209). Therefore, Van Buuren and Eshuis (2010) insist that knowledge governance is needed to organise knowledge development in regard to solving problems within society. However, a set of governance rules should be applied in order to align “ambitions, perceptions, and interests,” through “a set of principles, methods, and strategies,” which will make the involved actors “realise their individual and collective ambitions” (Van Buuren & Eshuis, 2010, p.285). In all, scholars (e.g. Van Buuren, 2009; Van Kerkhoff, 2013; Van Buuren & Eshuis, 2010) have identified knowledge governance as an emerging focus for study that is needed to theorise how divergent knowledge systems should be governed in order to not only bridge the gap between knowledge and action, but also to gain a deeper understanding about different ways of knowing to develop better responses to complex environmental problems.
Scholars (e.g. Michailova and Foss, 2009; Burlamaqui et al., 2012) have defined knowledge governance differently. For example, from organisational economic theory, Michailova and Foss define knowledge governance as “an emerging attempt to think systematically about the intersection of knowledge and organisation,” through the process of “choosing governance structures and coordination mechanisms” (p. 8) which can be formal or informal. In this context, knowledge governance is seen as a means to enhance organisational innovation. This is similar to the ideas of Burlamaqui et al. (2012), who address knowledge governance as a framework that deploys a governance mechanism to the diffusion, production and appropriation of knowledge. This deployment influences how knowledge would be shared, retained, and created (Burlamaqui et al., 2012). However, relevant for this study is the work of Van Kerkhoff (2013), who examined knowledge governance in the context of environmental issues and sustainable development. Van Kerkhoff (2013) maintains that knowledge governance is knowing how knowledge is processed, which are “situated in the domain of sustainability science” (p. 85), and could be done through creating, sharing, accessing, or using knowledge. Formal and informal rules should be applied, not only to redirect the decisions to the desired goals, but also “to overcome the perceived ‘gap’ between knowledge and action” (Van Kerkhoff, 2013, p. 85). In regard to this study, the researcher summarises knowledge governance as a process of managing different knowledge systems, either formal or informal, in order to overcome the gap between knowledge and action; ambitions, perceptions, and the interests of stakeholders can thus be aligned (Van Buuren & Eshuis, 2010; Van Kerkhoff, 2013).

Gerritsen et al. (2013) emphasise that knowledge governance is a “promising concept” (p. 605), in a way that this concept would help scholars in understanding more about the knowledge role in governing complex social issues. Having knowledge governance would help stakeholders to learn to challenge, not only, their previous assumptions, but also to challenge the existed reality, ideas and routine activities. It is expected that stakeholders would be more innovative, creative, and would learn about problems that have occurred and how to solve them. Moreover, reflexivity is important within knowledge governance and it seems to be the answer to the point of view of Wesselink et al. (2011), which states that reflexivity and realism to divergent values in society should be given more attention in academic research. In all, through knowledge governance, as argued by Gerritsen et al. (2013), communities can be more self-organised while “knowledge is produced socially and transdisciplinary” (p. 607). “Transdisciplinary” means that communities and policy makers are engaging and cooperating in order to produce new collaborative knowledge while, at the same time, the stakeholders or communities involved can self-organise in terms of being open...
to different views, new patterns and, cultures, and be ready to engage in any experiment (Gerritsen et al., 2013). However, no matter how innovative are the ways for stakeholders to try to engage in knowledge production, for Gerritsen et al. (2012), the aim of knowledge governance would be about “regulating the development and use of new scientific and technical knowledge” (p. 605).

To illustrate this, through the case of water management in Waalblok, Netherlands, Van Buuren and Eshuis (2010) contributed to theorising knowledge governance within an environmental management context. According to these authors, the problem that Water Framework Haaglanden tried to solve was “persistent problems in the spatial planning of the whole area, and especially concerning the difficult balance of water management and other spatial functions” (p. 290). This programme aimed to develop “technical and institutional innovations” (p. 290). Various governmental bodies and the representatives from the Defland area, the Westland area, and the LTO (an agricultural interest organisation) gathered in order to develop “new and systematic knowledge” (p. 291) in order to improve water management in Waalblok. A local consulting firm, which specialised in horticulture and floriculture, had the idea of reusing “pouring water in greenhouses” (p. 291). “This idea was enhanced with an idea to realise cellars under the greenhouse to store rain water in times of extreme rainfall in combination with the storage of pouring water” (p. 291). After having 20 scenarios as part of an intensive research process, and compromising the desires of the growers who were members of LTO and the wishes of the Water Board, a consensus between “the representatives of the growers, and the municipal and Water Board authorities” was reached, which was to test and compare the concept called 4B with “other alternatives for the spatial organisation of the polder and the water management” (p. 292). This consensus, to test and compare, was also a result of knowledge intervention, which occurred over two years, where stakeholders were presented with several alternative proposals and a financial analysis, to investigate “the costs of the preferred alternative” (p. 292) and which things contributed to these costs.

Van Buuren and Eshuis (2010) conclude that the intervention of knowledge that occurred in the water management of Waalblok “inspires actors to leave existing perceptions and insights, and stimulates them to develop new problem definition; bridging existing conflict of interests by proposing combinary solutions” (p. 293). Drawing from this case, therefore, Van Buuren and Eshuis argue that knowledge governance is about creating new insights and finding innovative solutions that would tempt actors to leave their “traditional insights and practices, and get away from inert interaction patterns, stalemate negotiations, and interest conflicts” (p.
Knowledge governance, as argued by Van Buuren and Eshuis, “rationalises the dialogue between stakeholders with different world views and problem perceptions” (p. 297), even though it does not guarantee that joint action will occur. In this case, Van Buuren and Eshuis identify a number of factors that contribute to the success of knowledge intervention, namely:

“(1) translating policy problems into questions for research and knowledge development; (2) mobilising knowledge institutes and consortia to develop innovative ideas and proposals to fit into a definition of the problem in the region; (3) accompanying the process of fact-finding and facilitating the link between research and policy-making to enable the fit between the coordination problem and the knowledge product; (4) stimulating the spread of knowledge between various pilot projects and throughout the whole programme to enhance the effectiveness of the knowledge produced and its translation into collective action” (p. 293).

Nevertheless, the definition of knowledge governance in the environmental management context proposed by Van Buuren and Eshuis (2010) tends to give precedence or, in other words, epistemic weight to scientific knowledge over other knowledge. It seems, for Van Buuren and Eshuis, that science is the most credible way to solve problems between stakeholders. However, the scientific way of knowing the world is a particular way of knowing the world. Berkes (2012) argues that the non-scientific way of knowing the world is through looking at the meanings that relate to the particular problem, such as patterns of traditions, familial relationships, and the intimate relationships between human, nature, animals, and plants, which is reflected through day-to-day practices and stories. Hence, it can be said that Van Buuren and Eshuis’ (2010) definition of knowledge governance and the strategies to link the knowledge produced into collective action within environmental management does not sufficiently capture the importance and implications for policy development. Nor does the implementation of the different epistemologies and ontologies and how they interact, nor how individuals and communities encounter nature, engage with environmental issues or respond to policy interventions by the government.

Ways of knowing is an important epistemological concept that underpins knowledge governance (Van Buuren, 2009). It raises the prospect that there can be multiple ways of encountering, engaging and understanding the world. Ways of knowing highlight the various knowledge practices of how we know the world. According to Castree (2005), how people know the world influences their mind sets about what seems to be valid, legitimate and true; overall, the epistemology that people invoke can shape their understanding, behaviours, and practices towards nature.
Another important concept for theorising knowledge governance is ontology. Ontology is about what exists in the world; for example, different views or conceptualisations of nature. While it is usually the epistemological aspects of knowledge governance that receive attention, ontology is also important to consider. For example, it is argued by Castree (2005) that it is important to understand how people frame nature, because without knowing this, we will not know which nature these people refer to. Furthermore, it is important to conceptualise epistemology and ontology working together. Duncan [2016, citing Jasanoff, 2004; see also Ahlborg and Nightingale (2012) and Watson (2013)] argues that epistemology and ontology are mutually constitutive – in other words, one constructs the other. This is an important insight when considering the existence and validity of multiple types of knowledge and how different social and cultural experiences, geographic locations, personal and social values can influence, and are influenced by, different scales of encounter, interaction and understanding of nature (Ahlborg & Nightingale, 2012). It also brings into view how power can be deployed in decision making processes to invalidate, dismiss or exclude local knowledge, as argued by Agrawal (2005). The need for equal power sharing is also an important dimension of knowledge governance in order to open access to information and attention to knowledge scale differences (Giebels et al., 2015). Ontology, ways of knowing, power sharing and scale, are key points of knowledge governance, which for this study are important for consideration; these key points can help the researcher reveal the process of implementation of the conservation agriculture programme in East Java, how the public agency representatives and farmers overcome their diverse knowledge systems, and how the power sharing works. The sub-sections below will explain more fully the different of types of knowledge, their epistemology and ontology, as well as the different scales encountered.

3.3.1 Scientific knowledge

Scientific knowledge is the process whereby a study must go through set of strict rules, in order to be used and accepted universally. This means that this type of knowledge is generalised and explicit, and is seen as “pure technical knowledge” (Negev & Teschner, 2013, p.51), as it is done by technical professionals (Raymond et al., 2010). Historically, scientific knowledge has solved many problems and provided many technological breakthroughs (Bocking, 2004), for example, during the era after World War II, when scientific knowledge delivered “radar, penicillin, DDT and the atomic bomb” (Bocking, 2004, p. 17). During this era, it was assumed that scientific knowledge, provided with sufficient funds, could grow stronger in technological inventions, which later made scientists think that they could apply
the strategies they used in war to “defeat” problems in the environment or nature (Bocking, 2004).

Scientists’ logical explanations, together with technologies that they created, have convinced the world that science provides “true and useful accounts of reality” (Bocking, 2004, p. 17). Bocking argues that the validation of scientific knowledge is important and, in order to obtain it, scientific knowledge needs to be “presented as universal: true everywhere, independent of local interests and circumstances” (p. 17). In other words, the validation of scientific knowledge is perceived when it becomes universal, which is applicable to all circumstances and can work independently without any involvement from society. Other than being universal, continuous improvement and observation about scientific models and strategies are needed for scientific knowledge to gain validation (Bocking, 2004; Edelenbos et al., 2011). When validation is achieved, scientists need to convince others, in order to gain authority. This authority becomes critical when science associates with policy, as policy has a link to legal frameworks, which can ensure, as argued by Bocking (2004), that scientific methods, results, and interpretations are perfectly maintained and become undeniable when science becomes part of the framework. Commonly, scientific knowledge with its universal characteristics tries to solve problems of nature (Callon, 1999). The way of science knowing nature is perceived from the presumption of an ideal situation, in which formal hypothesis is set and tested through random trials, under the standard of laboratory conditions (Fischer, 2005; Sillitoe, 2007). The results are then delivered in formal written texts. Overall, it can be said that, specifically from Bocking’s (2004) point of view, science so far has given both good and catastrophic things to society, for example, penicillin and DDT.

Another example of catastrophe is the nuclear accident of Chernobyl, in which its radioactive cloud dispersed as far away as the UK (Wynne, 1992). “Heavy thunderstorms [which] rained out radiocaesium deposits over upland area” made the government issued a prohibition against “hill sheep sales and slaughter” in “Cumbria and North Wales [area] in particular” (Wynne, 1992, p. 114). The prohibition that was expected to only last for three weeks was still valid six years later. This condition shows how science had produced a good thing for society (nuclear energy) that became a catastrophic in an accident. This accident resulted in difficult relationships between science and society because the unexpected length of the prohibition timeline put farmers into an uncertain situations. Conditions of uncertainty due to wrong predictions by science can affect society’s trust in science.

The scientific way of knowing views nature and society as independent and separated (Hinchliffe, 2007; Castree, 2005; Machnaghten & Urry, 1998). The scientific knowledge view
is that anything that happens with nature is independent from “human imagination, dreams and schemes” (Hinchliffe, 2007, p. 8). These “imagination, dreams, and scheme” relate to society’s stories and beliefs towards nature, which do not make sense in the way science knows the world. Therefore, any involvement in human activities needs to be removed, even though these activities, in which they have a role in creating nature, have been carried out for so long. Other than the scientific way of knowing, the process of science standardisation also contributes to the separation of nature from society. Scott (1998) gives an example through the case of the utility change in German forestry. He argues that science, with support from the government, had changed the diversity of old-growth forest into “more uniform forest that closely resembled the administrative grid of its technique” (Scott, 1998, p. 15). This example also shows the relationship of science to legal institutions, which results in the deployment of science methods that are undeniable through the deployment of science methods; for example, the relationship between flora and people in the nature of the forest disappeared and changed into a group of “economic resource[s that needed] to be managed efficiently and profitably” (Scott, 1998, p. 13). The government of Germany sees forests as a product that can be managed economically, while the common people see forests as nature that maintains its relationship with flora and people. Thus, it can be seen that science not only has a distinct ontology but also has different scales to those of local people; this will be discussed later.

3.3.2 Local knowledge

Local knowledge is knowledge of local contexts, in which field practices, stories, values and beliefs, and social relations, are seen as a holistic element. Local knowledge cannot be generalised, as it is bound to “a given culture or society” (Bremer & Glavovic, 2013, p. 114), thus its “characteristics, circumstances, events, and relationships” (Berkes, 2012, p. 9) are specific, and creates different understanding of meanings to different culture or society. Hence, local knowledge can be considered to be as valid as scientific knowledge, even though it is not formally observed and experienced through science in a laboratory (Duncan, 2016; Watson, 2013).

Berkes (2012) makes a distinction between indigenous, traditional and local knowledge. He argues that indigenous knowledge is part of local knowledge; and traditional knowledge is a subset of indigenous knowledge and limited to “land-related knowledge” (p. 9). As traditional knowledge is also part of local knowledge and the discussion is also around land-related knowledge, the theories of traditional knowledge from Berkes (2012) will be used in order to explain more about local knowledge, as their terms can be used interchangeably. The unity of local knowledge is what Berkes (2012) called a “knowledge-practice-belief complex” (p. 17).
Drawing from several sources Berkes explains this knowledge-practice-belief complex as the process where societies understanding of their relationship with nature comes together within the way they manage their practices in the field, which are based on this knowledge, along with a “code of ethics [in] governing appropriate human-environmental relationships” (p. 17), he then suggests there are layers or levels within this complex relationship that he pictures as in Figure 3.2.

![Figure 3.2 Level of local knowledge and management systems. Adapted from Berkes, F. (2012). Sacred Ecology (Third Edition ed.), p. 17. Copyright 2012 by the author. Reproduced with permission](image-url)

According to Berkes (2012), the first level includes knowledge of the landscape, animals, soils and plants. In this dimension, the information about landscape and animals, including taxonomy which is empiric and “readily accepted cross-culturally”, and commonly included in government reports, was, too often, taken “out of cultural context” (p. 18). In other words, societies and policy makers have similar basic knowledge of the landscape and animals, which are simply retrieved by policy makers when deciding the best environmental policy options, without further investigating the relationship between societies and nature from the societies’ cultural points of view. The second level is about the management system, which includes a set of tools, practices and techniques that needs “understanding of ecological process, such as the functional relationships among key species” (p. 18). The third level is about how local people manage their local knowledge, where they have their own ethical code, in order to maintain the practice of their knowledge through social institutions such as
norms and rules. Lastly, the fourth level is about the worldview of the local people which shapes their complex practices, beliefs and knowledge relationships. Berkes argues that all these levels within local knowledge have a dynamic relationship, in which they are not rigidly distinct from each other as some of the levels are sometimes coupled. For example, the management and social dimensions of local knowledge may link to each other and work as a single unit, in which the work of land management may be regulated by local rules, and the local rules are set based on years of experience in managing land, which also shows that the ontology and epistemology of the local people are intertwined and mutually constitutive, as also emphasised by Duncan (2013) and Watson (2013). They construct each other in the sense that the ontology of local knowledge describes the meaning of the world and this derives from the ways local people know the world, and how they know the world influences what they see as existing in the world (Demeritt, 2002).

In relation to the way Berkes (2012) explains the levels within local knowledge, it clearly shows how local knowledge is very much distinct from scientific knowledge. In this case, scientific knowledge tends to rely more on empirical observation and repeatable experimentation, which is quite important in the pursuit of intellectual understanding. Meanwhile, local knowledge has based its management system of land or nature not only on careful observation, but also on common sense. This common sense has been built from years of fields experience and is somehow part of cultural traditions that are learned and communicated among relatives, from generation to generation (Fischer, 2005; Sillitoe, 2007).

In regards to norms and rules within societies, Fischer (2005) argues that different groups of society have different social norms and rules. This statement is undebatable as each society has “its own conception of knowledge, philosophies, understandings, and principles” which shape their norms and rules, and are somehow “tied to mystical or religious beliefs or ideas about spirits or ancestral ghosts” that are embedded strongly in nature (Fischer, 2005, p. 201). For example, research in north-west Yunnan, China by Allendorf et al. (2014) found that the Tibetan villagers had sacred forests, where they performed Bon and Buddhist traditions. It is argued by Allendorf et al. (2014) that these local people lay their beliefs in nature because it is where their deities live. Nature is the place where they can make spiritual connections with the deities through prayers. These authors explain that “Bon traditions, centre on the worship of natural features, including trees, springs, forests, and mountains based on the belief that these were homes of the deities. As Buddhism spread into Tibet, religious leaders incorporated pre-existing beliefs and traditions into Buddhist belief systems” such as Buddhist “worship, including rites, such as pilgrimage and circumambulation” (Allendorf et al., 2014,
p. 303). For decades, Tibetan villagers use these sacred forests as “a place to light incense and pray for good luck” (p. 307), such as praying for the rain. Therefore, when understanding local knowledge, it should include the religious value in it. Allendorf et al. argue that policy managers should find “deeper and more complex ways” (p. 308) of understanding local people’s ways of thinking, as this became one of the reasons why these Tibetan villagers requested that the policy managers not interfere with the existence of their religious values, and they preferred that “their beliefs and practices concerning the sacred forests [were] to be left alone” (p. 309) when these policy managers had the notion that these sacred forests were “to be integrated into conservation strategies” (p. 303).

From the way of local people knowing the world, as stated above, it shows that the ontology of local knowledge is conceptualised as “hybrid”, whereby nature and society interact and are woven together (Hinchliffe, 2007; Irwin, 2001). In other words, nature and society are constructed by each other until where one begins and the other ends cannot be distinguished (Machnaghten & Urry, 1998). There is always a continuous process of producing, reproducing or transforming the meaning of nature and its value within society. This process then not only influences the process of shaping society’s culture but also their manner towards the environment, as members of society conceptualise the environment or nature in their day-to-day lives. Therefore, when talking about nature, local communities always consider their social relations with a particular nature, and the meaning of its values to their group, in which they would later relate these relationships and value-meaning to the way they conduct their practices in the field (Machnaghten & Urry, 1998; Nadasdy, 1999; Irwin, 2001).

It is the context-embeddedness and scale of local knowledge that diverges so starkly with decontextualised scientific knowledge that has led to calls from scholars, such as Sillitoe (2007), Innes and Booher (2010), Van Buuren (2009), and Wynne (1992), that local knowledge is needed in the process of decision making in order to solve or improve environmental issues. This consideration challenges the historic dominance and authority of scientific knowledge in the domain of environmental policy. Nevertheless, the inclusion of local knowledge is paramount to eliminate uncertainty, and maintain the trust of society (Wynne, 1992). The inclusion of farmers, in the context of the implementation of the conservation agriculture programme in Indonesia, is considered important to solve the problem of the water quality of the Brantas River.

In recent times, the association between science and policy has fostered criticism towards the authority and purity of science. This is because, as Innes and Booher (2010) argued, in order to be useful for policy purposes, scientific knowledge needs insights from others, which blurs
the boundaries between science, policies and politics. According to some scholars (Bocking, 2004; Fischer, 2005), scientists then have to follow the interests of politics. This affects the authority of scientific knowledge, as the decision about the world’s problems not only arises from the concern of the researchers but also from those overseeing the funding, the process of implementation, and the publication of their researches (Van Kerkhoff & Lebel, 2006). Negev and Teschner (2013) criticise this process because the authority of scientific knowledge is somehow driven by political interests, which makes the implementation of this knowledge quite often become an arena to impose power over other actors with less power. Overall, it can be concluded that while scientific knowledge is undoubtedly a useful tool, we cannot depend on scientific knowledge alone to resolve our environmental problems. In particular, its ethos, methods, and practices that seek to produce universal decontextualised knowledge are not only somehow driven by political factors, but also it cannot deal with the diverse culture and values of local knowledge (Wynne, 1992). It is also argued by Berkes (2012) that different societies have different ways of knowing and work under different local norms and rules, to which the scientific concept of universal cannot be applied. It does not mean that involving local knowledge would then elevate the authority and legitimacy of local knowledge above that of science, but would highlight that all knowledge is conditional upon embedded, but often implicit and normative social models and assumptions about the world and how people should or could operate within it (Wynne, 1992).

Therefore, scholars, such as Agrawal (2005), Folke et al. (2005), Cash et al. (2006a), Ahlborg and Nightingale (2012) and Wynne (1992), suggest that in order to have a “debate” and work together with local knowledge to address environmental issues, stakeholders must realise the scale differences between knowledge and the need for power sharing.

### 3.3.3 Power and scale

One principle of knowledge governance is that power is equally shared among stakeholders when decision making is processed. Edelenbos et al. (2011) maintain that power sharing would give recognition towards the role of local people in the decision making process, in which a fruitful contribution “to the identification of [environmental] problems and their solutions” (p. 677) can happen. Having power sharing in the decision making process means that stakeholders will have their opinions heard and they will also receive similar information, equal freedom and the capacity to express their ideas. Everyone who is involved in the dialogue has the right to deliver their points of view, and engage and interact with others, where there will be no domination over a particular group of stakeholders, making the dialogue or discussion become more robust. Importantly, when local people participate in the
process of decision making, it is hoped that the existence of power sharing would empower their position within the dialogue. In this situation, mutual trust between stakeholders is expected to improve and develop (Folke et al., 2005; Innes & Booher, 2010). However, Sikana (2010) argues that the empowerment that emerges from local knowledge is not only about articulating local people’s demands, but also realising those demands, which can cut across sustainability ideals.

Moreover, scale is at the heart of the issues identified by Berkes (2012), Wynne (1992), Nadasdy (1999), and Duncan (2016). Ahlborg and Nightingale (2012) too emphasise the need to consider the different epistemic and ontological scales of divergent knowledge. For example, from the case of forest management in Nepal, Ahlborg and Nightingale (2012) outline that the local villagers and the government and international donors have different interests, problem understanding, and scale of knowledge about the forests. In this case, the villagers are concerned about the availability of water resources because if they are drying up, it would change the whole situation of the grazing species. However, the government and international donors are more concerned with changing the geographic distribution of the forest ecotypes. The government sees forests as trees that will produce timber, while local villagers see forests as a place that not only gives them food sources but also has a historical reference as their relationship with the forests “spans multiple time frames, based on people’s lifelong relation to it, the daily and seasonal harvesting of various forest resources, and the oral knowledge and symbolic meaning traded from older generations” (Ahlborg & Nightingale, 2012, “Scales of Observations and Multiscale Assessments”, para. 7).

Moreover, from her research with farmers in two locations - Hurunui-Waiau (HW) and Selwyn-Waihora (SW), in the Canterbury region, South Island, New Zealand - Duncan (2016) indicates different scales between policy and farmers in terms of their views about water quality problem. For the last two decades, dairy farming has been expanding in the Canterbury region, affecting its water management and allocation. It is the government, through the Canterbury Water Management Strategy (CWMS), that “establishes a collaborative water governance framework [and targeting]: ecosystem health/biodiversity, natural character of braided rivers, kaitiakitanga (i.e., Māori stewardship), drinking water, recreational and amenity opportunities, water-use efficiency, irrigated land area, energy security and efficiency, regional and national economies, and environmental limits” (Duncan, 2016, p. 153). To put the collaborative paradigm in place, the CWMS created ten zones, each with a committee that included the CRC (Canterbury Regional Council) representatives, local Māori, several communities, and relevant territorial authorities (Duncan, 2016).
The Zone Implementation Programme (ZIP), created by each zone committee, where HW and SW are located, agreed “to address water quality by setting nutrient limits while also seeking to deliver on the key socio-economic goal of substantially expanding irrigated agriculture through large scale irrigation” (Duncan, 2016, p. 153). In order to improve irrigation, water quality needs to be maintained or improved, which means farmers need to reduce their nutrient outputs by 30 to 50 percent (Duncan, 2016). Relying on scientific knowledge and prediction, the CRC maintains that the losses of nitrogen from agriculture would go directly “to a nearby waterway through the sub-surface or overland via its various microbial transformations or direct from cow urine patches” (Duncan, 2016, p.153). Nevertheless, farmers have different perspectives. Farmers see that their nearby streams are clean and, for some, they look even better than in previous years. In addition, farmers could not see how their farms could contribute to the increasing nutrient pollution in the river as their farms were located quite far away from the closest river, and they argued that the soil would filter the nutrients (Duncan, 2016). In summary, in the implementation of the water policy, there are different scales of knowledge about how dairy farm activities contribute to the increasing levels of nutrients in the river.

In recognition of these scale issues, Cash et al. (2006a) argue that knowledge should be portrayed on a scale, as there always challenges in “matching the scale of what is known about the world and the scale which decisions are made and action taken” (“Mismatch”, para. 2). For example, local people will see scientific knowledge lacks salience and credibility as environmental issues that have been brought up by scientists are not relevant to their daily lives (Cash et al., 2006a). Cash et al. define scale as “the spatial, temporal, quantitative, or analytical dimensions, used to measure and study any phenomenon”, while level is “the units of analysis that are located at different positions on a scale” (“Scales”, para. 1). These relationships are shown in Figure 3.3. Through this scale and level, a gap between different knowledge systems can be clearly seen, for instance, a gap between scientific knowledge with its “generalisable understanding” and local knowledge with its “practice-based understanding” (Cash et al., 2006a, “Scales”, para. 7)
Figure 3.3 The illustration of the dynamic human-environment interactions which shows knowledge of scientific and local are way apart. Adapted from “Scale and cross-scale dynamics: Governance and information in multi-level world” by Cash, D.W., Adger, W.N., Berkes, F., Garden, P., Lebel, L., Olson, P., Pritchard, L., Young, O. (2006a). Scale and cross-scale dynamics: Governance and information in multi-level world. *Ecology and Society*, 11(2), 8. Copyright 2006 by the authors. Reproduced with permission.
Realising the distinct way of knowing nature, how power infuses knowledge-policy interactions and often obstructs participatory approaches, and the implications for policy development and the implementation of different knowledge scales, scholars (Simpson et al., 2015; Edelenbos et al., 2011; Innes & Booher, 2010; Callon, 1999) propose different approaches to accommodate these important aspects in governing knowledge, in order to link knowledge and policy in the hope that it will inspire action on the ground.

3.4 Knowledge integration

The notion of integration has been put forward by a number of scholars as a way to address the issues above with the expectation of merging divergent knowledge, which is between “expert science and local knowledge with community beliefs and values” (Simpson et al., 2015, p.1). The integration of knowledge must provide a mutual understanding between actors, continual communication and negotiation, reflexivity, and the flexibility of changing perceptions to new information. The identification of which knowledge is involved in the process of integration should be undertaken beforehand, to ensure the relevance of the knowledge to the environmental problem addressed, and to ensure that the experts engaged have sufficient relevant experience (Raymond et al., 2010). In this notion of integration, it is also expected that local knowledge “fills the gap” of scientific knowledge and “provides information about context, and offers pragmatic, experience-based insights” (Innes & Booher, 2010, p. 170). Local people may therefore ask for storytelling and expressing their feelings because stories are an important part of local knowledge: through stories, local knowledge is communicated, cultural values can be identified, and feelings and emotions about good and bad decisions can be expressed (Innes & Booher, 2010).

Nevertheless, the idea of integrating knowledge has invited some criticism. For example, Nadasdy (1999) challenges the notion of knowledge integration through the case of the management of a population of Dall sheep in the Southwest Yukon Territory, Canada, where scientists had tried to compartmentalise aboriginal people and nature, and distil the complex relationship between the hunters and the sheep. In this case, Nadasdy maintains that even though the aboriginal people are welcome to participate in the process of managing the sheep population, their inputs were still selectively evaluated “according to the standard of forestry, ecology, geology, or geo-physics” (p. 7). Nadasdy argues that the integration of local knowledge within knowledge production is actually extracting information from local people by scientists, in a way that this information can be utilised “within the institutional framework” and can be interpreted “in a manner consistent with the assumptions of scientific wildlife management” (p. 9).
Through this case, Nadasdy (1999) challenges the premise that local knowledge is only about field practices, while other elements within local knowledge were treated as additional data that can be ignored. Nadasdy rejects the use of local knowledge as a gap filler of scientific knowledge, as envisaged by Innes and Booher (2010). According to Nadasdy, integration only becomes an arena for expressing local knowledge “in the forms that are compatible with the already existing institutions and processes of scientific resource management” (p. 5). From his research and experience in working with resource managers and indigenous people, Nadasdy argues that scientists and policy managers compartmentalise and distil out parts of local knowledge for policy purposes that are often predetermined and unarticulated to local people. The case of distilling out does not only apply to local people’s knowledge about their values, but also to their environment, such as delivering knowledge in a formal situation, which local people did not do previously. Moreover, the locals’ way of knowing, which was presented not only through practices but also through narratives, stories and cultural heritage, as mentioned by Sillitoe (2007), and Innes and Booher (2010), is very different from science’s way of knowing, which is mainly from formal observation, standardisation and experimentation. Thus Nadasdy argues that scientific and local knowledge is “incommensurable” (p. 2), which raises a question regarding to what degree this knowledge can be “reconcile[d]” in the integration process (Bremer & Glavovic, 2013) or they may actually become “irreconcilable” (Duncan, 2016, p. 156). Supporting Nadasdy’s argument, Fischer (2005) also emphasises that both knowledge types have distinct methods, which are incompatible with each other. Therefore, having this knowledge integrated, may cause the suppression of power over the other knowledge or distil out elements of values, beliefs and social relations within local knowledge, as these elements are “incomprehensible from the perspective of Western science” (Fischer, 2005, p. 201).

3.5 Knowledge coproduction

In order to overcome the problems of knowledge integration, scholars such as Edelenbos et al. (2011), Callon (1999), and Lemos and Moorehouse (2005) propose knowledge coproduction. According to Edelenbos et al. (2011), knowledge coproduction is “knowledge which is harmonised and combined between different sources, and forms a new, overarching and integrative body of knowledge which is collectively perceived authoritative to underpin decisions” (p. 63). Knowledge coproduction differs from integration in that, in coproducing knowledge, all elements within knowledge systems are included, harmonised and combined. It is believed that through knowledge coproduction, local people are empowered, as they are offered a role as partner, not clients, of public agencies and policy makers. Local knowledge
is in an equal position with scientific knowledge, and is involved more in the decision-making process and joint knowledge-production process (Callon, 1999; Sirianni, 2009, Turnhout, 2010). Scholars (Lemos & Moorehouse, 2005; Aeberhand & Rist, 2009; Corburn, 2007) argue that a two-way exchange and an open dialogue between stakeholders are encouraged within knowledge coproduction, in which new ideas and paradigms may emerge, and it is expected that coproduced knowledge can be created and can be accounted for by both sides of the knowledge holders.

Approaches to govern the coproduction of new knowledge have drawn theoretical insights from the field of STS, in particular from research that has critiqued conceptions of a linear one-way relationship between science and policy (Jasanoff, 2004; see also Duncan, 2013). STS research has shown that the relationship between science and policy is mutually constitutive (Jasanoff, 2004); however the representations of boundaries between these domains is blurred and open to negotiation. Ideas of how to govern knowledge draw heavily on the concept of “boundary work” as articulated by Gieryn (1995). The function of boundary work is to distinguish, defend and secure the cognitive authority of the institution of science from non-science, in order to make “science [become] next to being the source of cognitive authority [which] anyone who would be widely believed and trusted as an interpreter of nature needs a licence from the scientific community” (Barne & Edge in Gieryn, 1995, p. 405). Therefore, the challenge from the community can be suppressed, and the influence of political interests obscured from view. For the institution of science itself, Gieryn argues that boundary work can give strength over “the credibility, prestige, power, and material resources that attend…a privileged position … of the cognitive authority of science” (p. 405). In addition, boundary work keeps the scientific concepts within scientific knowledge so that the scientific concepts that have been applied in the laboratory will be the same when they are applied in the field, which Gieryn (1995) has emphasised in four of his type of boundary work:

1. Monopoly - whereby each knowledge tries to show its authority by trying to control a situation that has been shared among them. For example, by trying to give meanings or symbols over land status, which might trigger a dispute about the legitimisation of cultural authority between scientists and local users.

2. Expansion - this type applies when practitioners try to expand the authority of scientific knowledge into a space which has been claimed by other knowledge.
   Following the D’Alembert boundaries, Gieryn argues that the expansion type makes a
boundary between the unknowable, which includes imagination, narratives, beliefs and history, with the known, which is science. Therefore, scientists can easily select which knowledge can be included within the authority of scientific knowledge. Knowledge that is accumulated is deemed authentic and there is no space for imagination to work.

3. **Expulsion** - this type is used to legitimise the reason for scientists being removed from their membership. The reason for removal is because this member is not deemed to be scientific enough and does not have the required homogeneity of thoughts and beliefs of the other members of the institution of science.

4. **Protection** - this type is used to protect scientific knowledge from external powers, such as political institutions, as the tricky situation becomes difficult when scientists develop their relationship with them. Scientists may lose control over scientific knowledge when they get too close to political institutions, even when they have a mutual relationship.

In respect of the four types of boundary work above, Guston (2001) argues that the relationships that scientists and political institutions have will somehow create a “fuzzy” boundary between science and politics, where the boundaries on each side become unclear and may create confusion, especially when it comes to policy making. In other words, Clark et al. (2011) maintain that it will cause instability and a risk would be the “politicization of science” (p. 3), where policy makers place their authority and use research carried out by scientific experts in order to legitimise their decisions to direct society to reach their desired goals. Another possibility is the occurrence of the “scientization of politics”, where policy makers grapple with taking responsibility for their decisions, “repackaging them as merely technical issues to be resolved by experts they controlled” (p. 3). In other words, policy makers conceived that problems in nature are unresolvable, so then they obtained help from scientists who would work under their regulations. Therefore, it can be concluded that the function of boundary work is to keep scientists in a neutral position and away from those kinds of situations.

Boundary objects could actually stabilise boundary work, as stated by Star (2010) According to Star and discussed further later in this study, boundary objects provide a means by which different groups or actors work together. Boundary objects emerge because science needs cooperation within them, so that the results can be accounted for to society. However, the work of boundary objects would not be stable if certain actors disagree over the cooperation
agreements they have made and consent is not obtained from the actors that involved. Therefore, scholars such as Cash et al. (2006b) emphasise that boundary organisations stand as an institutional mechanism for managing these different boundary objects, by taking advantage of the benefits and reducing the inefficiencies of different arenas, and solving the problem of instability of boundaries within science policy relationships.

### 3.5.1 Boundary organisations

Boundary organisations have received considerable attention in recent years in environmental governance and policy literature. Boundary organisations are an institutional means of conducting co-production, where they can have a role as a mediator between the local people and environmental practitioners, in order for knowledge coproduction to work (Guston, 2001; Cash, 2001; Carr & Wilkinson, 2005; Cash et al., 2006b; Sarkki et al., 2013, Leith et al., 2015). This is because boundary organisations serve to manage the divergent boundaries of knowledges and stabilise these boundaries. Guston (2001) states (cited by Sarkki et al., 2013) that boundary organisations are accountable to both sides of the boundary because they are not only involved in participation, but also give help in defining problems’ scales and become the mediator of information that flows between boundaries and across levels.

Through the research in Victoria, Australia, Carr and Wilkinson (2005) argue that boundary organisations can become “a powerful force” in order to bring together the divergent perspectives and knowledge claims of farmers and scientists in a collective forum in order to improve “the management of natural resources on farms” (p. 256). In this case, the role of boundary organisations would be to have definite accountability and responsibility by becoming a mediator between science and policy, and also use boundary objects that are “flexible enough to be used by different parties for their own purposes and can be interrogated in their own language”, such as “maps, diagrams, and computer models” (p. 261). In other words, the role of boundary organisations also includes translating information from multiple voices along with mediating different cultures among stakeholders, in order to understand others’ ways of knowing. Therefore, it can be seen that the work of boundary organisations is dynamic, as it follows the changing interests of the groups involved, as boundary organisations support two-way communication and hold continuous negotiation between different groups (Cash, 2001; Cash et al., 2006b).

Another study about boundary organisations was done by Cash et al. (2006b), in which these scholars studied the case of a comparative analysis “between El Niño/Southern Oscillation (ENSO) forecasting systems in the Pacific and southern Africa with a focus on how scientific information is connected to the decision making process” (p. 465). In this research, Cash et al.
demonstrate the useful role of boundary organisations in efforts to more effectively link knowledge and action by making scientific knowledge more meaningful and accessible to the knowledge users. These authors describe the use of boundary organisations as a process of co-production, which is contrasted with the “loading-dock approach” (p. 484), whereby the way scientists forecast climate is heavily based on scientific tools without any effort to explain or translate what it means to society. Cash et al. identify the latter as an outdated and unhelpful mode of engagement between knowledge producers (i.e. scientists) and knowledge users (i.e. policy makers, public authorities and non-scientists), and claim that boundary organisations hold much promise for producing information or technology through collaboration, by unifying the values and characteristics of both communities. This work of Cash et al. makes an important contribution to improving knowledge interactions by identifying knowledge attributes of “salience, credibility, and legitimacy” (p. 468) and institutional functions that are needed to cultivate and balance these attributes within the system of science and technology, while bringing the values and characteristics together. Therefore, Cash et al. propose four institutional functions; namely, convening, translation, collaboration, and mediation that boundary organisations need to have to balance the knowledge attributes of salience, credibility, and legitimacy across the boundaries’ objects:

1. Convening - brings different groups together to form mutual trust and respect.
2. Translating - involves translating between scientific and other knowledge that cannot be understood by certain parties merely because of language or scientific nomenclature.
3. Collaboration - brings actors together to coproduce knowledge through the identification and development of appropriate boundary objects (to be discussed later)
4. Mediation - seeks to mediate and arbitrate different interests, and values to ensure mutual gains can be achieved.

As the work of boundary organisations is a counterpart of different knowledge systems, including translation and mediation of different knowledge and cultural beliefs, it is therefore expected that the actors involved would act and work cooperatively and collaboratively. Communication is one of the main factors required for boundary organisations to work, along with commitment to a time allocation by public agencies, as well as having sufficient funds, personnel and infrastructure. This means that stakeholders should not simplify the views of each side of the stakeholder groups in order to avoid ineffectiveness in boundary
organisations. In other words, narrow framing to other groups of stakeholders will influence the effectiveness of communication among them (Carr & Wilkinson, 2005; Lemos & Moorehouse, 2005).

For example, as mentioned by Carr and Wilkinson (2005), casting the view of science as “theoretical, detached and white coats” and local practices as “practical, profit and production oriented” (p. 262). Instead, what should be done by the stakeholders is to develop mutual problem framing among themselves, in which Leith et al. (2015) then argue that science should become the central concern in the role of boundary organisations. In other words, despite having a mutual agreement, two-way communication and encouraging more participation of local knowledge, science still holds an important role in the work of boundary organisations. It is then open to questions and criticisms about the existence of knowledge coproduction and boundary organisations, which is discussed below. Corburn (2007) proposes “boundary spanners” (p. 158) to support the work of boundary organisations. Boundary spanners are believed to be agents that translate information from local to science, in order to clarify different terms that both sides used. Boundary spanners can be professional institutions or local people who have close relationships with well-known institutions (Corburn, 2007).

### 3.6 Knowledge coproduction: a critique

The concept of ambiguity is used to characterise a gap that can arise through the participatory process when stakeholders with their divergent knowledge systems are collaboratively engaged. Brugnach and Ingram (2012) identify ambiguity as “a distinct type of uncertainty that emerges from the simultaneous presence of multiple possible interpretations, different sensible and valid ways of knowing reality, and distinction in [framing a problem]” (p. 61). This is problematic as it means problems and solutions become unclear; the ambiguity that occurs is then “in terms of the type of knowledge used, how and by whom [new] knowledge is created, what values are incorporated and how values are weighted” (Brugnach & Ingram, 2012, p. 61). In other words, even though knowledge coproduction seems to legitimise and use local knowledge, the final decision of knowledge coproduction might not reflect the preferences of local people, as final decisions usually only benefit certain groups of stakeholders who have more power than others, while the diversity that local people have - such as religious and cultural values - that can influence the decision-making process - become invisible. Therefore, Brugnach and Ingram propose a better way of fostering knowledge co-production through three strategies: (1) recognising interdependencies, in which solutions “capitalise on the many different and unique contributions that each party could make”, thus, “solutions become situational”; (2) building good relationships through
securing “trust and credibility among participants”; (3) “creating the decision space that supports collaboration” through “face to face engagement” (p. 67) that can support stakeholders to share their experience and gain an understanding of each other’s way of knowing, in order to develop trust among them.

Criticism about knowledge coproduction also comes from Turnhout (2010). Turnhout explains that in order for knowledge coproduction to be able to work, all stakeholders must be involved in the production of knowledge, and to “to bridge the gap between science and policy” (p. 28) and between science and non-science, the existence of boundary organisations is needed. Nevertheless, Turnhout argues that the process of knowledge coproduction has fallen into utopian characteristics. In this case, Turnhout maintains that knowledge coproduction: (1) considers that coproduced knowledge is easily makeable; (2) wants whole societies to transform as expected; and (3) cannot afford any mistakes or deviations that may jeopardise the process of knowledge production. Therefore, knowledge coproduction can be conceived as a means of subjugating one group of actors to another. In this case, policy makers use knowledge coproduction to improve the rationality of a policy to society, which means knowledge coproduction’s only use is to speed up the implementation of policy, and can be seen as an arena to strengthen the power and position of policy makers among other groups of stakeholders (Turnhout, 2010). Turnhout gives an example of water governance in the Netherlands. She points out that those participants who were involved in knowledge production were asked for their opinions about the Water Framework Directive (WFD). However, the involvement of societies in what is called knowledge production, was only used to obtain public opinion and speed up the implementation of the WFD. These findings show knowledge production can be used as a tool to impose rather than to liberate power (Turnhout, 2010).

The work of Ahlborg and Nightingale (2012) identify a mismatch of scale as contributing to divergent problem framings and power imbalances (see also Duncan, 2016; Cash et al., 2006). Overlooking different scales of knowledge, as argued by Ahlborg and Nightingale (2012), means also “overlooking the differences within communities” (“Conclusions”, para. 2). It should also be noted that local knowledge is not only about local knowledge scale, but also about involving geographical scale and time frame, which are embedded in this knowledge system. For example, as previously mentioned, through research in forest management in Nepal, Ahlborg and Nightingale (2012) found that the government and international donors have different interests, understanding of problems and scale of knowledge about the forests. Moreover, from the research in the Canterbury region, South Island, New Zealand, Duncan
(2016) also found that dairy farmers have different scales of knowledge from the CRC for linking nutrient outputs from farming to the condition of the river. In addition, Nadasdy (1999) found that different scales of knowledge also occur when the aboriginal people and policy managers talked about the management of populations of Dall sheep in the south-west Yukon Territory, Canada.

Overall, realising that ambiguity, utopian characteristics and having mismatch on scales may occur when different stakeholders with different ways of knowing work together (Brugnach and Ingram, 2012; Turnhout, 2010; Ahlborg & Nightingale, 2012; Duncan, 2016; Nadasdy, 1999), the question of how knowledge that includes an overarching element of knowledge systems can be produced and “have real implications for on-the-ground management” emerges (Ahlborg & Nightingale, 2012, “Conclusion”, para. 6).

### 3.6.1 Boundary objects

As previously discussed, boundary organisations are meant to stabilise boundary objects that emerge between stakeholders (Leith et al., 2015). Guston’s (2001) conceptualisation of boundary organisations derives from the work of Star and Greisemer (1989) on what are known as boundary objects. According to Star and Griesemer, in Wyborn (2015), boundary objects are artefacts, objects, or concepts that embody different meanings in scientific or non-scientific domains. Boundary objects emerge because science needs cooperation within them, so the results can be accounted for society; for example, patents for research results, that are used by scientists to commercialise or to gain priority for their work. In this matter, politicians have also used patents in order to measure research productivity. However, without consent from actors that are involved, the work of boundary objects can be unstable. Therefore, as previously stated, Cash et al. (2006b) emphasise that in order to stabilise these boundaries, boundary organisations stand as an institutional mechanism, and work through taking advantage of the benefits, reducing the inefficiencies, and solving the problem of instability within science policy relationships. In other words, there is an ongoing selection that occurs within boundary organisations, in which things that are assumed to give benefits to the process of, knowledge coproduction will be chosen, while things that are assumed to cause inefficiencies in the work of boundary organisations will be dismissed. This situation opens the opportunity for the distillation of things that are valuable for local people, as mentioned by Nadasdy (1999).

Nevertheless, scholars (Cash et al., 2006b) believe boundary objects would help the work of boundary organisations as they are a key component in collaboration and institutional function, as well as facilitating translation across knowledge boundaries. The key aspect of
boundary objects, and why they have been found useful in governing knowledge production and interaction, is that if they are chosen wisely, they can be sufficiently flexible to “adapt local needs and the constraints of the several parties employing, yet robust enough to maintain a common identity across site” (Star and Griesemer, 1989, p. 393). Star and Griesemer argue that there should be a common structure within boundary objects so that different stakeholders can easily recognise them, which will also ease the work of translation. For example, they outline coincident boundaries, where the objects within coincident boundaries are common; however, they have different internal contents, such as the creation of the state of California. In this case, the maps of California created by amateur collectors and conservationists resembled traditional roadmaps, emphasised campsites, trails and places to collect. However, the maps created by the professional biologists were filled in with a highly abstract, ecologically-based series of shaded areas representing “life zones”, an ecological concept.

Another example is delivered by Wyborn (2015) through the case of coproduction “connectivity conservation” in Australia, in which “connectivity” as a boundary object has been interpreted differently by scientists and practitioners, in terms of “what it means to implement connectivity in practice” (p. 300). Wyborn (2015) discovered that scientists focus more on “the application of connectivity as it pertains to the ability of species or ecological process to disperse across landscape”, while practitioners are more “focused on a more diverse suite of motivations,” especially on “collaboration, an intuitive appreciation of the concept of connectivity” (p. 300). Drawing on the different interpretations about the maps of California and the term “connectivity” in the coproduction of connectivity conservation in Australia emerges, it can be seen that there is a need to understand what constitutes these interpretations, which can be established through “a dialogue across the boundary” (p. 294). Nevertheless, when these differences are too complex and could not be resolved through a dialogue, due to fundamental differences of epistemology and ontology the “interpretive flexibility” (Duncan, 2016, p. 155) of boundary objects may not occur. It is then become a question about how boundary organisations would work if boundary objects fail to meet their common structures between the different knowledge systems.

### 3.7 Coproductive capacities

Van Kerkhoff and Lebel (2015), and Wyborn (2015b) propose the concept of coproductive capacities, as the alternative pathway in environmental governance, in order to resolve the issues (above) in managing divergent knowledge systems. Within this concept, the issue of knowledge scale is explicitly addressed. Van Kerkhoff and Lebel (2015) define coproductive capacities as “the combination of scientific resources and governance capability that shapes
the extent to which society, at various levels, can operationalise relationships between scientific and public, private and civil society institutions and actors to effect scientifically informed social change” (“Coproductive capacity”, para. 1). Within coproductive capacities, the process of making knowledge, as well as the decision-making process, will be examined according to relevant scales; thus problems can be resolved. In this case, the capacity is related to coproduction, in which science is expected to make a positive contribution to the environmental governance by having a harmonious combination with local practices and knowledge that already exist, in order to change the global environment. Therefore, both knowledge types, local and scientific, will be identified in order to seek their weaknesses and strengths, so that environmental problems can be handled according to the relevant scales (Van Kerkhoff and Lebel, 2015). In summary, coproductive capacity is a conceptual base that provides a way to understand diverse perspectives and seeks to, accepts these differences. Thus, not only can science contribute more to environmental governance, but also frictions between scientific and local knowledge, and “how legitimacy and authority [that] may be gained or lost in environmental decision making” can be better addressed (Van Kerkhoff & Lebel, 2015, “Coproductive capacity”, para. 2).

However, practicing coproductive capacities will also face some challenges. For example, the implementation of Western scientific knowledge may override the authority and values of existing local knowledge. In other words, coproductive capacities would become another arena for suppressing the power of a weak group and ignoring local knowledge values. Moreover, another challenge would occur from the scientific side. This is because, the implementation of coproductive capacities means that not only would the strength and weaknesses of science and governance resources be explored, but also the importance of power sharing with other stakeholders would be highlighted, both of which are not commonly undertaken in science, so definitely challenging “scientific elitism” (Van Kerkhoff & Lebel, 2015, “Conclusion”, para. 4)

Van Kerkhoff and Lebel (2015), and Wyborn (2015b) have different approaches to explain how to enhance or develop coproductive capacities, even though these authors reach similar critical points. According to Van Kerkhoff and Lebel (2015, stakeholders’ willingness to engage in the process of coproductive capacities merely depends on the previous “history, experience and preconceptions [of science and government]” (“History, experience, and preconceptions”, para. 2). In addition, factors that play an important role in enhancing the capacities of coproduction include: the effort of developing quality relationships, in terms of being more positive and trusting, between stakeholders; identifying different knowledge
scales, and their important constraints and opportunities; and incorporating power, interests, and legitimacy (Van Kerkhoff & Lebel, 2015)

Meanwhile, Wyborn (2015b) argues that co-productive capacities need four attributes in order to develop; these are: (1) material, which expects strong commitment and infrastructure; (2) cognitive, which focuses on “enhancing the credibility, salience, and legitimacy of scientific knowledge” by having knowledge relevant to the needs of decision makers, and making sure that the information is equally shared, and that the process of co-productive capacities respects different values and beliefs of stakeholders; (3) social, which focuses on how “to produce effective and equitable governance” through “communication, mediation, and translation”; and, (4) normative, which focuses on exchanging information, adopting various strategies, and focusing on the case of particular place, either local or national, in order to meet the overarching goal and “motivate action and negotiation of different management objectives” (“Coproductive capacities”, para. 4). In summary, Van Kerkhoff and Lebel (2015), and Wyborn (2015) emphasise history, experience, preconceptions of science and government, positive and trusting relationships, power sharing, boundary organisations, coproduction, divergent scales and commitment and sufficient infrastructure as critical points to develop co-productive capacities. Nevertheless, the question now is how coproductive capacities accommodate the divergent values and beliefs of their stakeholders, specifically local values and beliefs, as only respecting them, as stated by Wyborn (2015b), may not be enough.

### 3.8 Ladder of knowledge governance

From the literature that is presented above, it can be seen that there are varying degrees of interaction, power sharing and approaches involved in knowledge governance, which are similar to the pattern of Arnstein’s (1969) ladder of participation. Drawing on that ladder of participation, the ladder of knowledge governance shown in Figure 3.4 is proposed:
**Figure 3.4** Ladder of knowledge governance (adapted from Arnstein’s (1969) participation ladder)

<table>
<thead>
<tr>
<th>Coproducive capacities</th>
<th>Knowledge coproduction</th>
<th>Knowledge integration</th>
<th>Collaboration</th>
<th>Education</th>
</tr>
</thead>
</table>

The bottom level of the ladder is classified as education, whereby knowledge is governed individually. Stakeholders were neither open to engaging with different knowledge nor having a desire to integrate knowledge or produce new knowledge. The more powerful players seek to educate those with less power and try to convince groups with less power about the epistemic authority of its way of knowing. One-way communication occurs, as the powerful group does not have any reason to learn from less powerful groups (Edelenbos et al., 2011).

The next level of knowledge governance is collaboration. At this level, the voice of local people is sought and sometimes heard. Two-way communication occurs, in terms of stakeholders being eager to have open communication, share knowledge and create a common basis of knowledge (Edelenbos et al., 2011). However, with collaborative knowledge governance, the issues of power are not addressed as it is assumed that the epistemic practices of scientific knowledge are to guide decision making. In other words, power sharing is not discussed appropriately and science is assumed to be the benchmark of the decision-making process. Hence, important questions arise about power, in particular, whose knowledge and whose epistemic practices will prevail in problem framing and reaching final decisions?

Knowledge integration occurs when parties seek to move beyond collaboration and try to accommodate divergent ways of knowing. At this level, it is expected that divergent knowledge can be integrated into one integrative body of knowledge that will be accountable to all knowledge holders (Simpson et al., 2015). Nevertheless, Bremer and Glavovic (2013) argue that having more inclusion and interactive communication will not guarantee that all stakeholders are empowered, as the interaction can become an arena for one group of stakeholders to manipulate others. Nadasdy (1999, p. 5) contests that knowledge integration only becomes the arena for policy managers to re-form local knowledge in order to fit into the
existing “institutions and processes of scientific resource management” through the act of compartmentalisation and distillation.

The next level is knowledge coproduction. Knowledge coproduction differs from integration, because in coproducing knowledge, all elements within a knowledge system are included, harmonised and combined together to form new knowledge (Edelenbos et al., 2011). Callon (1999) and Sirianni (2009) believe that through knowledge coproduction, local people are empowered, as they are offered a role as partners, not clients, of public agencies and policy makers. Realising that different knowledge systems have different boundaries, scholars (Star, 2010; Guston, 2001; Cash, 2001; Carr & Wilkinson, 2005; Sarkki et al., 2013; Star & Griesemer, 1989) believe that in order for knowledge coproduction to work, there should be boundary objects that share common structures between stakeholders and, later, these objects would need boundary organisations to be stabilised. This includes the role of boundary spanners (Corburn, 2007). Nevertheless, the criticism directed to knowledge coproduction surrounds its ambiguity and its character, which falls into the utopian characteristics (Turnhout, 2010; Brugnach & Ingram, 2012). In addition, the existence of boundary organisations also creates the problem of oversimplifying the boundary objects of local knowledge due to differences in interpretation as the differences in epistemology and ontology are too fundamental.

The newest pathway that should be considered is coproductive capacities, in which the idea of having coproductive capacities is resolving what knowledge coproduction has in order to manage divergent knowledge systems by taking on board the issue (so called ‘themes’) of history, experience, preconception to science and government, positive and trusting relationship, knowledge scales, power, interests, legitimacy, commitment and sufficient infrastructure (Van Kerkhoff & Lebel, 2015; Wyborn, 2015b). Yet, as the aim of developing coproductive capacities is to improve the contribution of science to the process of governing, how values and beliefs within local knowledge can be accommodated is still being questioned. Instead of being on the top of the ladder, coproductive capacities is positioned on the side of the ladder, as its movement is flexible in accordance with the themes that have emerged. For example, throughout time, the preconceptions of the public towards science and government are changing; it is hoped that by the time the movement of the capacities reaches the step of knowledge coproduction, the public would have positive views towards science and have greater willingness to work together with scientists and government in order to achieve the desired goals (and vice versa).
It can be concluded that knowledge governance contributes to theorising how divergent knowledge systems could and should be governed in order to gain a deeper understanding about different ways of knowing, and to develop better responses to complex environmental problems. Putting the pathways of knowledge governance into the form of a ladder gives clarity into how scholars have so far sought alternatives in managing divergent knowledge systems. This will help the researcher to examine the process of knowledge interaction between farmers and the public agency representatives in the implementation of the conservation agriculture programme in East Java.
Table 3.2 summarises the review of the knowledge governance ladder.

**Table 3.2. Summary of the knowledge governance ladder**

<table>
<thead>
<tr>
<th>Levels of knowledge governance ladder</th>
<th>Characteristics</th>
<th>Attributes</th>
<th>Challenges</th>
</tr>
</thead>
</table>
| **Education**                        | 1. Knowledge interaction between stakeholders is tokenistic (Edelenbos et al., 2011)  
2. The interaction is only for convincing less powerful groups about particular assumptions and epistemic values (Edelenbos et al., 2011). | 1. One-way communication (Edelenbos et al., 2011)  
2. The practice of the powerholders to suppress the power of the less powerful (Arnstein, 1969; Agrawal, 2005)  
3. Limited participation for less powerful groups (Arnstein, 1969)  
4. Interaction between stakeholders is more towards consultation (Edelenbos et al., 2011) | 1. People uncooperative to apply the programme in accordance with the government’s desire (German et al., 2010)  
2. Failure to create common ground knowledge (Agrawal, 2005) |
| **Collaboration**                    | 1. The process of collaboration can break down barriers between different knowledge systems (Edelenbos et al., 2011)  
2. All stakeholders are eager to make a common basis for knowledge (Edelenbos et al., 2011)  
3. Encourage negotiation for reaching mutual agreement (Edelenbos et al., 2011) | 1. Encourage two-way and open communication (Edelenbos et al., 2011)  
2. Sharing knowledge and understanding between different stakeholders (Edelenbos et al., 2011)  
3. Must reach consensus from all stakeholders (Innes & Booher, 2010)  
4. Equal power among stakeholders is encouraged (German et al., 2010)  
5. Applying certain methods and procedures to obtain open dialogue | 1. Unclear explanation of which views are accounted for in final decisions to become a common basis of knowledge (Brugnach & Ingram, 2012).  
2. The issue of power is not appropriately addressed (Brugnach & Ingram, 2012) |
<table>
<thead>
<tr>
<th>Knowledge integration</th>
<th>Knowledge coproduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Must provide a mutual understanding between actors, continual communication and negotiation, reflexivity, and the flexibility of changing perceptions towards new information (Raymond et al., 2010)</td>
<td>1. All participants are at the same level and framing other groups of stakeholders is avoided (Carr &amp; Wilkinson, 2005; Sirianni, 2009; Callon, 1999).</td>
</tr>
<tr>
<td>2. Local knowledge is treated as a gap filler for scientific knowledge (Innes &amp; Booher, 2010).</td>
<td>2. Communication, commitment, and sufficient infrastructure are parts of the keys for coproduction to work (Lemos &amp; Moorehouse, 2005)</td>
</tr>
<tr>
<td>1. Integrating divergent knowledge systems (Simpson et al., 2015)</td>
<td>3. Boundary organisations with the support of boundary spanner is important to reach new knowledge that is salient, legitimate and credible (Cash et al, 2006b; Corburn, 2007)</td>
</tr>
<tr>
<td>2. Allowing local people to express their ideas through storytelling (Innes &amp; Booher, 2010)</td>
<td>4. Having coproduced knowledge in which all elements within knowledge systems are included, harmonised and combined together (Edelenbos et al., 2011)</td>
</tr>
<tr>
<td>1. Compartmentalisation and distillation of local knowledge (Nadasdy, 1999)</td>
<td>1. Ambiguity of final results of decision making quite possibly occurred (Brugnach &amp; Ingram, 2012)</td>
</tr>
<tr>
<td>2. The integration does not guarantee the empowerment of local knowledge (Bremer &amp; Glavovic, 2013)</td>
<td>2. May fall into the utopian characteristics (Turnhout, 2010)</td>
</tr>
<tr>
<td>3. Encouraging more involvement of local knowledge in the decision-making process (Turnhout, 2010)</td>
<td>3. Oversimplify the “interpretative flexibility” of boundary objects (Duncan, 2016)</td>
</tr>
<tr>
<td>4. Having coproduced knowledge in which all elements within knowledge systems are included, harmonised and combined together (Edelenbos et al., 2011)</td>
<td>4. Lack of attention to mismatch scale (Ahlborg &amp; Nightingale, 2012)</td>
</tr>
</tbody>
</table>
5. Recognising the importance of power sharing through empowerment of local people in the decision making process (Brugnach & Ingram, 2012)

| Coproducive capacities | 1. Resolving issues within coproduction by highlighting more on the issue (themes) of different history, experience, and preconceptions to science and government, quality relationships, scales, power, interests, legitimacy, commitment and infrastructure (Van Kerkhoff & Lebel, 2015; Wyborn, 2015b)  
2. A way to understand and allow different perspectives so that science can make more contributions to the process of governing (Van Kerkhoff & Lebel, 2015). | 1. Different scales are strongly highlighted in this framework (Van Kerkhoff & Lebel, 2015; Wyborn, 2015b)  
2. The importance of boundary organisations (Wyborn, 2015b)  
3. The need to look at the historical background of the engagement between stakeholders, and experience and preconception toward science and government. Also the importance of power sharing between stakeholders (Van Kerkhoff & Lebel, 2015; Wyborn, 2015b) | 1. The concern over scientific knowledge overrides local knowledge, authority, and values (Van Kerkhoff & Lebel, 2015)  
2. Challenge “science elitism” (Van Kerkhoff and Lebel, 2015)  
3. Uncertainty in accommodating local values and beliefs of local knowledge |

3.9 Trust

In studying the literature of knowledge governance and how scholars attempt to develop pathways in order to link knowledge and action, the subject of trust stands out across this literature. For example, Wynne (1992) mentions farmers’ distrust towards scientists due to their wrong predictions towards Cumbrian sheep, which later put farmers into apposition of uncertainty. Folke et al. (2005) argue that mutual trust will improve when there is power sharing between stakeholders. Van Kerkhoff and Lebel (2015) emphasise that trust in relationships between stakeholders can escalate the capacity within coproduction of knowledge. Moreover, Raymond et al. (2010) argue that because of trust, mutual understanding between stakeholders can occur. However, as mentioned by Lucas et al. (2015), there is little focus on the meaning of trust across the academic literature.
According to Lucas et al. (2015, p. 81), “trust is both an individual psychological act and a collective cognitive reality”. Trust is merely about emotion and logical acts. It is either “a rational, conscious, and evaluative explicit cognitive process” or “an emotional, intuitive, and implicit one”. These so-called, dual systems in trust “do not function independently, but show a high degree of connectivity and mutuality” (Lucas et al., 2015, p. 82). This means that the cognitive process of trust may shape the condition of the implicit trust, and vice versa, relating to the emotional state of a person or groups. However, some scholars, as argued by Lucas et al. (2015), have defined trust merely based on rational decision making only, or as the long-term consequences of those decisions.

There are various definitions of trust, however: in general, trust can be defined as “being able to predict what other people will do and what situations will occur” (Changing Minds, 2017, “Predictability”, para. 2). The trust builds from assessing “the probabilities of gain and loss, calculating expected utility based on hard performance data, and concluded that the person in question will behave in a predictable manner” (Changing Minds, 2017). Yet, trust can also be defined as exposing one’s vulnerabilities to others and enabling others to take advantage of these vulnerabilities. This kind of trust relates more to emotional feelings that are associated with “companionship, friendship, love, agreement, relaxation, [and] comfort” (Changing Minds, 2017, Introduction, para. 2).

In regards to individuals' relationships within group(s), Lucas et al. (2015) argue that trust among them is shaped by sociocultural dynamics. In this case, instead of relying on physical strength in order to survive in life, people now tend to build cooperation and interdependence between them by trusting one another. Therefore, it is believed that social interaction is needed in order to achieve “interdependence and reciprocity among individuals and groups” as the important keys in stimulating trust and perceiving trustworthiness (Levin and Cross, 2004; Lucas et al., 2015, p. 83)

Furthermore, in relation to how trust influences knowledge exchange between stakeholders, Levin and Cross (2004) argue that trust can lead to “greater knowledge exchange” (p. 1478). This is because people would either have a willingness to give useful knowledge or listen and absorb knowledge from others when trust exists. Through their research, Levin and Cross (2004) suggest that the benevolence-based trust, which has an affective component, and competence-based trust, which has a cognitive component, matter to the process of knowledge exchange. In this case, Levin and Cross (2004) argue that the benevolence-based trust would shape “the extent to which knowledge seekers will be forthcoming about their lack of knowledge…[which] creates conditions for learning” (p. 1480). This condition would
emerge if the strong ties between stakeholders occur because of strong emotional bonds. Moreover, when people start to trust the knowledge source’s competence in making suggestions, they would be “likely to listen to, absorb, and take action on that knowledge”, which later would lead to the development of “common ways of thinking and communicating” (Levin and Cross, 2004, p. 1480).

3.10 Summary

This chapter has presented the conceptual framework that underpins this research. It has set out the challenges of linking knowledge and action, and ideas that have sought to involve local communities more equitably and effectively in participating in the environmental decision-making process (Innes & Booher, 2010; Folke et al., 2005; Newman et al., 2004). Much scholarly attention has recently been placed on the role of knowledge in environmental policy in a bid to improve the prospects for on-ground implementation. Drawing from the literature of knowledge governance, the researcher has come to the conclusion that knowledge governance is a process of managing different knowledge systems, either formal or informal, in order to overcome the gap between knowledge and action, thus, ambitions, perceptions, and interests of stakeholders can be aligned. Key aspects of knowledge governance are ontology, way of knowing, power sharing and knowledge scale.

However, it has been shown that the nascent knowledge governance literature suggests important questions about how divergent knowledge can be harmoniously reconciled. From the literature, it can be concluded that scholars are still seeking an alternative pathway that can accommodate the epistemically-diverse elements embodied within divergent knowledge systems without marginalising the epistemic practices and commitments of; for example, communities that hold context-specific local knowledge (Ahlborg & Nightingale, 2012). It can also be concluded from the literature that the pattern of finding a pathway that can govern and accommodate all elements within divergent knowledge systems is similar to the pattern of participation conceptualised by Arnstein (1969). Drawing on Arnstein, the knowledge governance ladder is proposed as a theoretical contribution, specifically and importantly, in understanding the varying degrees of stakeholders’ interactions in terms of power sharing, the recognition of different scales encountered, and the recognition of the way of knowing and ontology of each group of stakeholders. From the bottom to top this includes: education, collaboration, knowledge integration, knowledge coproduction and coproductive capacities.

In all, knowledge governance literature contributes to theorising that divergent knowledge systems could and should be governed in order to gain a deeper understanding about different
ways of knowing and to develop better responses to complex environmental problems (Van Buuren, 2009; Van Kerkhoff, 2013; Van Buuren & Eshuis, 2010). Specifically, this case is in an Indonesian context, as the shift of the government system from centralisation to decentralisation has made tremendous impacts to overall implementation of government’s programmes, including agricultural programmes. The Indonesian Government is trying to include more local perspectives and action into the implementation of their programmes. The conservation agriculture programme, held by the PEBEJ in East Java, is one such example. This programme sought to involve farmers and their knowledge in its development and implementation in order to reach environmental sustainability. It was hoped there would be not only an improvement in environmental conditions, but also in farmers’ incomes. As the aim of this research is to investigate knowledge governance in practice, this programme provides an opportunity to investigate how farmers encountered scientific knowledge, and how the scientists encountered farmers’ local knowledge, as both sides have distinct ways of knowing, and ontological value in agriculture. This situation also provides an opportunity to examine how power is shared and how different knowledge scales are identified in the context of knowledge cultivation. Moreover, as conservation agriculture is a new knowledge paradigm for farmers, it is important to investigate farmers’ perceptions and how they incorporate (or not) this knowledge within their existing knowledge systems. The process of knowledge interaction between farmers and the public agency representatives in the implementation of this programme will be examined by using the ladder of knowledge governance. This case would give new insights and enrich the literature of knowledge governance as it has been widely evaluated in Western countries but not in Asian countries, particularly South East Asian countries. The next chapter sets out the research setting and methods.
Chapter 4
Research Methods

4.1 Introduction

This chapter provides a description of the research methods used to investigate knowledge governance (in practice) in the context of a government-led conservation agriculture programme that was piloted in East Java, Indonesia. The chapter presents a detailed report of the research process – a replicable model of how the research was carried out. The chapter includes commentary on the qualitative methodological foundations of the research, the research setting, the two case study villages and the rationale for their selection, and the data collection and analysis processes. The chapter concludes with a brief discussion of the limitations of the research and reflections on the researcher’s role – as an Indonesian woman working for an Indonesian university – in the research process and its impact on the process. Given that the selection of research methods – “the plan of action” – is significantly influenced by the type of questions for which answers are sought (Crotty, 1998), at this point the three main exploratory research questions are reiterated:

1. How is the conservation agriculture programme delivered in East Java, Indonesia?
2. What are farmers’ perceptions towards the programme of conservation agriculture?
3. How do farmers navigate divergent knowledge systems?

4.2 Qualitative social research

To address these research questions, a mix of qualitative social research methods were deployed, including document and official report analysis, in-depth interviews, and participant observation. Qualitative methods are well suited to research projects aimed at addressing questions that are new and exploratory and, by extension, open-ended, such as those at the centre of this research. Qualitative research methods are also appropriate for projects conducted in real-world (social) settings where the researcher is seeking to “…make sense of, or interpret, [understudied] phenomena in terms of the meaning people bring to them” (Denzin & Lincoln, 1994, p. 2). This real-life orientation – sometimes called a naturalistic approach – places the researcher in the life-world of the participant, thereby enabling them to
develop a rich understanding of that world “and what they [their research participants] are trying to do in it” (Gillham, 2000, p. 12).

Given the above, it follows that case study research is also well-suited to the use of qualitative methods. Yin (2014, p. 16, also see Gillham, 2000) describes case studies as research that “investigates a contemporary phenomenon in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident.” This link to the real world demands the purposive selection of appropriately grounded cases – those which, through the application of qualitative methods, will yield rich-information about the phenomenon being studied and will, therefore, directly address the question(s) for which answers are sought.

This study of knowledge governance in the context of a government-led conservation agricultural programme in Indonesia involved six months of fieldwork in two rural villages in East Java: Sumberbrantas and Tulungrejo. The two villages (the “case studies”) were selected on the basis that they were in the recent past (three months before the beginning of the research) participants in the government’s pilot conservation agriculture programme. Thus, they provided excellent cases through which to explore how officials have attempted to deliver conservation agriculture programmes to farmers in Indonesia, and how local farmers' had responded to the (scientific) information and knowledge presented to them.

4.3 Research setting

As noted above, the fieldwork for this study was carried out in the East Java province (population 38,318,791) of Indonesia, in two rural villages located in an area known as Batu (Figure 4.1). Batu is a mountainous region, with a rolling topography ranging from 900 to 3000 metres above sea level. A key feature of this area is the Brantas River, the main river in East Java. The river, which passes through 15 districts and cities, is used for multiple purposes, including drinking water supply, electric power generation, industrial needs and irrigation for agri- and horticultural production (Department of Public Works, 2008; Management Bureau of Brantas Watershed, 2011).
The local cultivation practices of farmers operating in the upper reaches of the Brantas River watershed – particularly tilted-agriculture – have been linked to increasing soil erosion and, by extension, declining river water quality (Soemarno, 2011). Due to this concern, and in line with the deliberation of the Bangkok Declaration, the East Java government through its Provincial Environmental Bureau established the conservation agriculture programme as a way to improve the water quality of the Brantas River. Government scientists anticipated that such a shift would lead to improvement in the water quality of the Brantas River. Such a view also underpinned the development and implementation of the government’s pilot conservation agriculture programme, which aimed to shift local farming methods towards better practice. The two rural villages on the outskirts of Batu city region that were selected as case studies were: Tulungrejo and Sumberbrantas.

### 4.3.1 The villages (case studies)

Sumberbrantas (population 3,900) and Tulungrejo (population 8,400) are the two rural villages where the Provincial Environmental Bureau first piloted its conservation agriculture programme (Figures 4.2 and 4.3). Agriculture – farming on tilted-slopes – has, for a very long time, been the economic mainstay of both these neighbouring villages. Most of the citizens own arable land and work as farmers. The level of prosperity of these two villages is similar. In this case, people of these villages live in a fair condition, where they live day by day, selling either crops or vehicles, such as motorbike, as they have no spare money. The average area of land tenure for each farmer is around 2.5 ha to 10 ha (Provincial Environmental
Bureau of East Java, 2010). Nevertheless, many of them do not own the land and provide their needs in farming by renting land.

Both villages are situated at the origin of the flow of the Brantas River. Sumberbrantas is, in fact, the first village through which the Brantas River flows. Both villages are known for the production of vegetable crops – most notably potatoes, onions, cabbages and carrots. Tulungrejo farmers differ slightly in that they also produce apples: Batu city is famous for its apple products and the Tulungrejo village has been one of its main suppliers of the fruit. In contrast, Sumberbrantas village depends solely on the cultivation of vegetable crops, which has resulted in Sumberbrantas having a more significant (negative) impact on water quality and land degradation (Provincial Environmental Bureau of East Java, 2010). The soil type found in the arable areas of both the villages is sandy loam. After rain events, this soil type, in combination with the hilly topography, creates soil erosion issues and events and the associated introduction of sediment into the Brantas River (Provincial Environmental Bureau, 2009).

Both villages are, therefore, very interesting and appropriate cases for this research. Their farming systems are both well-established, with farming methods firmly founded on “tradition” and “ritual”. They have also both participated in the government’s pilot conservation agriculture programme, which sought to change farming methods towards best practice (in order to improve local water quality issues and erosion problems). Both villages, therefore, were considered to be real-world settings within which to explore the researcher’s interests and questions.

![Figure 4.2. The white boundary represents the area of Sumberbrantas village (source: Google map, 2015)](image-url)
4.4. Data collection procedures and participant selection

The main data collection technique employed in this research was semistructured interviews (see Appendix 1 for the interview schedule). Complementary data gathering techniques included document analysis and participant observations. All interview and observational data were collected between March and August 2013 (some transcribing occurred after data collection in Indonesia and was completed on the researcher’s return to New Zealand). This section of the chapter describes each of these data gathering procedures and how they were implemented in this study.

4.4.1 Semistructured interviews

Longhurst (2009) maintains that semistructured interviews are about “verbal interchanges” where an interviewer tries to obtain information and detailed stories and narratives by working through a series of predetermined questions. While semistructured interviews are, generally, structured around a set of key questions, they are designed to provide room for the following of new themes that may arise when conversing with research participants. The semistructured interview is, therefore, a very useful technique for answering central questions, while also enabling a level of exploration.

The semistructured interview technique was used with local farmers (n = 30) and key informants from public agencies (n = 5). Employing this social research method enabled in-depth information to be obtained on how the system of conservation agriculture was applied by public agencies, their perspectives towards farmers’ local knowledge, and how public agencies attempted to incorporate local knowledge within the implementation of the pilot programme. The researcher was also able to learn how local farmers applied their local knowledge to their daily farming activities, what local knowledge meant for them, and how
farmers negotiated the scientific information that they encountered during their involvement in the conservation agriculture programme.

A purposive sampling strategy was used to identify potential research participants for this study. According to Liamputtong and Ezzy (2005, p. 46), purposive sampling is “selecting information-rich cases for in-depth study to examine meanings, interpretations, process and theory.” The criteria for selection was that participants had either been involved in the development of the pilot conservation agriculture programme (i.e., representatives from public agencies), or had been participants in the programme (i.e., farmers) (see below for more detail about the selection processes).

Information sheets were provided to all research participants before the interview (see Appendix 2), in accordance with Lincoln University Human Ethics Committee requirements. (The Human Ethics Committee of Lincoln University approved the study before the field research began). All the information sheets were translated into Bahasa Indonesia, so that the respondents could understand what the research was about and how the data from the interviews would be handled. Further explanations about the research and the process of the interviews were delivered verbally so the respondents could have a clear vision of what was to occur. Before each interview began, the respondents were asked for their permission to digitally record the conversation. It was explained to them how the recording would proceed and what the recording would be used for. All 35 respondents agreed to be recorded. It was explained to the respondents that their names would not be revealed in any publications linked to the research. They were informed that this anonymity would be achieved by using broad descriptors in all reporting to identify the insights provided by interviewees. For example, the scientists would be interpreted as S1, S2, and S3, and farmers would be interpreted as either F1 Tulungrejo or F1 Sumberbrantas, and so on.

The researcher personally transcribed all the interviews. As they were conducted in Javanese for interviews with farmers and Bahasa Indonesia for the public agency representatives, this required them to be translated into English. Once transcribed into English, each interview was listened to again while reading the English transcript, to check the accuracy of the first attempt at the translation and to make corrections where necessary.
4.4.2 Farmer interviews

Purposive sampling was used to identify farmers from the Sumberbrantas and Tulungrejo villages who had participated in the pilot conservation agriculture programme. As noted above, 30 farmers in total were interviewed: 20 farmers from Tulungrejo village and 10 from Sumberbrantas village.

Cultural considerations and protocols were respected and followed in order to gain access to the farmers. It is a tradition in Indonesia, and East Java, in particular, to ask permission from the leader of a village or local group before entering a village and conducting any form of research.

Accordingly, the secretary of a farmers’ group in the Tulungrejo village was contacted to express interest in undertaking research with local farmers. He requested the researcher to come in person and discuss her intention in the Tulungrejo village. She met the secretary at his house a week after the initial call where they discussed the research project. He suggested that the researcher attend their next farmers’ meeting, in three days’ time to provide an overview of the project. At the meeting the researcher introduced herself and explained what she wanted to do, what the interviews were about and how they would be conducted. The leader of the farmers’ group encouraged the members to help this research – they responded favourably. At the meeting, the farmers suggested that the interviews should be conducted after one or three o’clock in the afternoon, as they were engaged in farm work in the morning. Contact numbers were collected from farmers so they could be telephoned to arrange a time and place for the interview.

The local leader of the Sumberbrantas village was also contacted. Similarly, this initial contact was followed by a meeting with the village leader at his house few days. The leader was supportive of the research and after giving his advice, he helped by making telephone calls to each farmer to let them know that the researcher would come to their house for an interview.

The in-depth interviews with farmers began with an initial set of demographic questions, such as age, the structure of the family, the area of arable land, the level of education, and their years of experience in farming. The focus of the interview then moved to the farmers’ local knowledge of cultivation, and their knowledge and perceptions of the conservation agriculture system (see Appendix 1 for a list of the questions which guided the interview).
In conducting these interviews, the local language, Javanese, was used; where possible local farming terms were used. For example, the term “sabuk gunung” (mountain belt), which refers to a terracing system, or “obat” (medicines), which locally refers to nonorganic pesticides were used. In conducting these interviews, the local language, which was Javanese, was used. The semistructured, the interviews were often conversational, as this allowed for open-ended responses.

It should be noted that a local resident in each village provided transport from one farmer’s house to another. This arrangement was greatly beneficial not only in that it provided transport, but it also helped the researcher gain the trust of the farmers who were to be interviewed. These local residents knew the farmers well and introduced the researcher in such a way that positioned her as a new friend.

### 4.4.3 Key informant interviews

As noted above, five key informant interviews were also carried out as part of this study. These interviewees were all officials in public agencies, each of whom had been involved in the design and/or delivery of the pilot conservation agriculture programme. Information provided in reports and also through the researcher’s own local networks, (i.e., those established during her previous employment in Malang, Indonesia), helped with the initial identification of appropriate representatives from the relevant public agencies, including scientists, the head of the Conservation Department of the Provincial Environmental Bureau, and field personnel. Five public agency representatives agreed to participate in the research and their interviews lasted 45 to 60 minutes each. The scientists, who participated in the research, and the head of the Conservation Department of the Provincial Environmental Bureau, were interviewed at their workplaces. The interview with the field person was conducted at the participant’s private house.

As noted above, three of the key informants were scientists (referred to hereafter as Scientists 1, 2 and 3). Scientist 1 led the science team involved in the Environmental Bureau’s pilot conservation agriculture programme, and was responsible for budgets and contracts. Scientist 2 defined himself as a “field coordinator” within the programme. He worked closely with the local “field person” who acted as a coordinator with the farmers. Scientist 3 worked closely with provincial government and Scientist 1 – conveying messages from them to those working in the field, that is, Scientist 2 and the field person. Interviews with these three scientists provided valuable insights into all dimensions of the programme – from the government level, through to science delivery to local farmers.
The head of the Conservation Department of the Provincial Environmental Bureau of East Java was also a key informant. This interviewee was the initiator of the pilot conservation agriculture programme and a representative of the provincial government. This person could, therefore, provide critical contextual information with regard to the programme, such as its: history, development, central goals, challenges and future.

The fifth key informant interview was the ‘field person’ involved in the pilot conservation agriculture programme. The role of the field person was to work directly with (and between) local farmers and government scientists. The role involved a mix of responsibilities including: briefing farmers, occasionally acting as the spokesperson at workshops and assisting the scientists when they visited the villages. The role was critical to the full implementation of the programme at the local or village level.

Key informant interviews began with general questions, such as how long the participant had worked in conservation agriculture, the degree to which they worked mostly with farmers (if at all), and what things excited them most in their work (Appendix 1). As the interview progressed, more direct questions were also asked about: the pilot conservation agriculture programme, how the process of knowledge governance (or information exchange) worked, and how the programme’s team was structured and how they interacted with each other. In conducting these interviews, both Javanese and Bahasa Indonesia languages were used (some use of the Javanese language was important to show respect).

**4.4.4 Document analysis**

An extensive desk-study was conducted in 2012, before conducting this fieldwork. The process involved identifying, retrieving and analysing official documents and reports relating to the government’s pilot conservation agriculture programme. The aim of this process was to develop a rich contextual understanding of the programme before entering the field. The search for official secondary data extended to a pursuit for more general historical resources about the development of agriculture and farming communities in East Java province. This information was also used to develop detailed profiles of the case-study villages and the East Java region, in general. Over the course of the research project, the researcher continued to search for, and engage with, official documents; many were collected when she was in Indonesia on fieldwork. These resources were systematically scanned for information relating to: (a) previous conservation agriculture programmes in Indonesia; (b) the Brantas River
catchment and its communities; and (c) the conservation agriculture programmes implemented in the case study areas. More general information relating to agriculture in Indonesia (particularly relevant policy) was set aside for use in developing the contextual background chapter of this thesis. The information gathered from secondary sources informed the development of the first interview schedule and was also used to cross-check and verify information provided by the interviewees.

4.4.5 Participant observations

This study also involved participant observation. This entails entering the research setting to watch and observe (social) action, as it happens and in-situ. Observational data can be used to support findings, such as emerging interview themes, and this may give rise to new and important questions. The observations involved in this research included a farm visit and attendance at farmer meetings. The farm visit provided the opportunity to observe local farmers engaging in various agriculture activities and to photograph this activity. Verbal permission was gained from farmers before taking photographs of their properties and of them working in this setting. The photographs were helpful in prompting the researcher to remember details about the research setting once she had left, and also aspects of the farms that the research participants were referring to in their narratives about conservation agriculture. Observations helped in grounding the researcher's thinking in the real world of her research participants, while also offering further opportunities to raise questions. It also provided the opportunity to see the farmland (and erosion) that was at the centre of this research project. (Note: it was not possible to do more than one farm visit because of issues surrounding access and safety).

Attending farmer group meetings provided the opportunity to observe, first-hand the interaction between local farmers. Attendance at the meetings – generally held at farmers’ houses – also allowed the researcher to introduce herself and become a familiar and trusting face in the village. It also enabled her to see how the farmers discussed farming information and how they responded to visiting speakers, such as representatives from pesticide companies. The researcher was very interested in seeing if the information they had gained through their participation in the pilot conservation agriculture programme was influencing their discussions and decisions (such as to the purchase of pesticide).
4.5 Thematic analysis of the interview data

For this study, a process of inductive thematic analysis was used to systematically explore and interpret the interview data. The interviews were conducted in Bahasa Indonesia for scientists, the PEBEJ and the field person; and in Javanese for the farmers. The interviews with farmers were then translated into Bahasa Indonesia as the analysis is done in Bahasa Indonesia. The reason for this is because the researcher has tried to reduce the risk of losing the meaning of participants’ statements. The analysis is then conducted in English as part of the requirements of writing this doctoral thesis.

According to Braun and Clarke (2006), thematic analysis, which is sometimes called coding, is used to identify patterns or common “themes” within qualitative data sets or narratives. Identifying themes is important because they “represent some level of [shared] meaning within the data set” (p. 82). Boyatzis (1998, p. 4) argues also that for qualitative researchers, the value of thematic analysis is that it provides a way of “making sense out of [and systematically organising] seemingly unrelated material.”

Determining key themes across interview transcripts requires judgment from the researcher and is fully informed by the theories guiding the research, which had underpinned the initial development of research questions (see Chapter 3). It can be done manually with coloured pens, note taking and the creation of evolving “brainstorm” diagrams (see Appendix 3 for an example), as was the case in this research, or with the help of computer software. It is an emergent and iterative process, involving a careful and ongoing search by the researcher for connected narratives within and across interview transcripts, supported (or perhaps refuted) by other data sources, including the theory with which the researcher has engaged. This gradual analytical process includes identifying the “underlying ideas, assumptions, and conceptualisations – and ideologies – that are theorised as shaping or informing the semantic content of the data” (Braun and Clarke, 2006, p.84). Lofland and Lofland (1995, p.181) purport that while the thematic analysis of qualitative data has its conventions, it is “intended to be completely open-ended in character. In this way it is also very much a creative act.” While thematic analysis calls for “flexible thinking” (Agar, 1991), Braun and Clark (2006) suggest that the process of inductive analysis commonly proceeds through six phases (Table 4.4), beginning with the identification of general themes, and then through various cycles of interpretation, developing more finely grained concepts that relate to the research question. This process was followed.
Table 4.1 Phases of thematic analysis. Adapted from “Using thematic analysis in psychology” by V. Braun and V. Clarke, (2006). Qualitative Research in Psychology, 3(2), p.87. Reprinted by permission of Taylor & Francis, LLC, (http://www.tandfonline.com)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description of the process</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Familiarising with the data</td>
<td>Transcribing the data, reading and re-reading the data, noting down initial ideas</td>
</tr>
<tr>
<td>2. Generating initial codes</td>
<td>Coding interesting features of the data, collating data relevant to each code</td>
</tr>
<tr>
<td>3. Searching for themes</td>
<td>Collating codes into potential themes, gathering all data relevant to each potential theme</td>
</tr>
<tr>
<td>4. Reviewing themes</td>
<td>Checking if themes work in relation to the coded extracts, generating a thematic ‘map’ of the analysis</td>
</tr>
<tr>
<td>5. Defining and naming themes</td>
<td>Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme</td>
</tr>
<tr>
<td>6. Producing the report</td>
<td>The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating the analysis back to the research question and literature, producing a scholarly report of the analysis</td>
</tr>
</tbody>
</table>

4.6 Research limitations

In discussing the methods of any research project, it is important to reflect upon and comment on the limitations of the research. The main limitation of this study relates to the generalisability of the overall findings to different geographical areas and contexts. The current study focused on the implementation of the pilot conservation agricultural programme in East Java province, in two distinct rural villages – each with their own unique social and economic histories. As such, the results of the study cannot (absolutely) be generalised throughout the whole region of Indonesia or further afield, as local farmers in other provinces, regions and countries are likely to “do things differently” as defined by their own unique local values and beliefs, their experience with rural extension, different local governance arrangements and the geographical context (climate, soil type, topography) within which they farm. Therefore, caution is needed when seeking to apply the findings to other locations (see Yin, 1989). While it is important to make this comment, the “lessons learned” from the research will provide helpful starting points for other researchers studying knowledge governance in different geographical settings and cultural contexts.

The second limitation of the study relates to time and budget constraints, and the effect this had on various aspects of the research process. While the fieldwork for this was conducted in Indonesia, the researcher was based in New Zealand for most of the duration of this doctoral research. This distance from the actual research setting, and the cost of getting there, meant it
was not possible to return to the field to follow up on particular comments or to make additional observations. Essentially, all fieldwork (and follow up conversations) had to be completed during the six-month fieldwork posting in Indonesia. Thus, there are some loose-ends that the researcher remains curious about – which will be discussed later in the thesis as future research ideas.

4.7 Role of the researcher (reflexivity)

A qualitative approach to research, particularly studies involving interviewing and participatory observation, requires the researcher to step out of the office and into the field. It is, therefore, important for the researcher to be aware of their own presence in the study location/community and to reflect on how that presence (including one’s prior understanding of the topic and previous connections with the people and the places under investigation), may have influenced the research process (Lofland & Lofland, 1995). This is known as reflexive thinking. In this section, the researcher gives her background.

The researcher has had a long-term interest in the development of agriculture in Indonesia. Before commencing postgraduate work in New Zealand, she had obtained an undergraduate degree in agriculture, specialising in agribusiness, from Brawijaya University, Malang, Indonesia. During her undergraduate studies, she assisted with many agriculturally-focused projects that were led by staff of Brawijaya University. For example, she was involved in an agricultural research project in rural villages around East Java province, which sometimes required her to conduct interviews with farmers. Accordingly, before starting her doctoral studies, she had gained some field experience in engaging directly with local farmers.

It was during this work that the researcher realised that environmental issues were not being fully considered within the agricultural context in Indonesia. This inspired her to complete a master's degree in environmental management and development from the Australian National University (ANU), Canberra. Her study in ANU was the real turning point – it was then that she began to really appreciate the links between agriculture and environmental degradation and, by extension, became very curious about the impacts of Indonesian agricultural practices on local natural resources.

After receiving her master’s from ANU, the researcher started a career as a lecturer and researcher at Brawijaya University. Lecturers who hold the degree in environmental management were rare in the department where she worked so she became one of only three researchers in environmental subjects. She also became the main researcher of gender and
environment in the Women Studies Research Centre of Brawijaya University. She also happened to become an environmental consultant for one of local nature tourism centres in East Java. These positions and this personal journey provided her with experience in a great range of projects covering environmental and agricultural issues, including work on agricultural policy. Together, these experiences enriched the researcher’s knowledge and understanding of the environmental issues that can be linked to agricultural activity in East Java. Her research positions have often involved and allowed her to work with farmers and government agencies, and it is this unique experience which first stimulated her (enduring) interest in how Indonesian farmers experience, and are empowered through participation in, government led agriculture programmes and initiatives.

Even though living in Malang, the researcher was not originally an East Javanese, being born in Yogyakarta, a distinct region within Central Java, before moving to Malang, East Java. Therefore, she grew up within two different cultures. One culture has a hierarchical structure that obliged her to be very well-mannered and to use different levels of Javanese language to different people in the community. The norms of the other local culture did not require the use of different levels of Javanese for different people – it was a more equal culture. These previous experiences of (and adaptation to different) local cultures in East Java, along with previous work with Indonesian government agencies, have helped in this research. The following outline shows some of the ways this occurred.

Given the above, and being a “local”, and a “professional” – this dual role provided the researcher with some advantages. First, because the researcher had previously engaged with people from the Indonesian government and rural policy officials, she understood the manner in which these people should be respectfully approached and treated. Her combined cultural and work background was therefore very useful in gaining access to officials as she knew to use the highest level of Javanese language with them to not only show respect but also to obtain their attention and trust.

Second, her previous work concerning issues of gender and environment had raised an awareness of gender divisions of labour and different roles in rural villages, and in family farming households. Again, an understanding of local cultural rules (and associated protocols) within villages made it easier to negotiate access to farmers (men and women) and work with them, without causing offence.

Third, the researcher's previous professional relationship with some of the key informants, mainly the scientists, helped with gaining access to the rural villages and information
pertaining to the conservation agriculture programme. While this was a great advantage, it required her to ensure that the farmers did not think she was representing the scientists and the programme they had been involved in. This was important, especially when raising potentially sensitive questions about the implementation of the conservation agriculture programme. The support from the science team coupled with the researcher’s familiarity with the research setting (“localness”), also provided some logistical advantages: such as knowing who should be contacted first in each village and who to inform about the study of the conservation agriculture programme.

4.8 Summary

This chapter has provided an overview of the research approach and methods used in this study. Qualitative social research was chosen in order to investigate the practice of knowledge governance within the implementation of a government-led agriculture conservation programme. The topic has not been investigated before in Indonesia and, therefore, the research questions were open-ended and the overall study was avowedly exploratory. Two rural villages located on the outskirts of Batu city region (East Java) were selected as case studies: Tulungrejo and Sumberbrantas. In these villages, the pilot conservation agriculture programme had been implemented. To address the three main research questions, research data were collected from various sources using a variety of social research methods: semistructured interviews, document analysis and participatory observations. A purposive sampling strategy helped to identify appropriate research participants for the study. Thematic analysis was the technique used to identify key themes in the data. This search for themes and subsequent analysis was guided by the study’s theoretical framework: this was informed by an ongoing engagement with knowledge governance and allied social scientific literature. The following chapter presents the results of the data analysis.
Chapter 5

Public Agency Representatives:

Government and Scientists

5.1 Introduction

Chapter 5 to Chapter 7 will present an analysis of the interviews with the public agency representatives, the field person and farmers. This chapter will deliver an analysis of the interviews with public agency representatives, namely, three scientists, and the head of the Conservation Department from the Provincial Bureau of East Java (PEBEJ), as the government representative. This chapter will present how the conservation agriculture programme is delivered in East Java in this particular case, how the public agency representatives delivered knowledge of conservation agriculture in the Sumberbrantas and Tulungrejo villages, the challenges that emerged during the implementation, and the perspectives of the scientists towards farmers’ knowledge.

5.2 Programme implementation

The programme ran in order to investigate the catchment-wide issue of the availability and accessibility to clean water sources from the Brantas River. Farmers would be those blamed if the spring sources in the upper stream area of the Brantas watershed dried up one day. Farmers were expected to change their cultivation practices to address this water issue however, their presence in the planning meeting discussion was not counted by the public agency representatives, and their input towards the programme was not valued.
This section provides an analysis of the interviews that reveals how the implementation of the programme took place. From the interviews, there was an indication that knowledge was delivered formally, and communication with the farmers was ended with one-way communication.

### 5.2.1 Formal setting of knowledge delivery

The scientists were asked how knowledge of conservation agriculture was delivered. This question was asked not only to give an understanding of how the power was distributed between scientists and farmers, but also to find out whether dialogue and more involvement by the local people, as previously advocated, had transpired and, if so, how:

I did a formal presentation at the village hall. I prepared the materials, I copied everything, gave to farmers and then I explained. Also, informally, I came to their group’s meetings. When I did my presentation, I showed them some examples of land degradation caused by humans’ activities, such as flood and landslide because of incorrect cultivation system. (S2)

I did a presentation. I used PowerPoints, LCD, then I held discussions with farmers. When I delivered [the presentation] I scared them about the danger of landslide and flood. From there I built their awareness, I said, if they don’t start it from now on to conserve their land then it would be a disaster. I showed farmers some photos and pictures of landslides and flood. Then we had socialisation about the conservation
programme, we also socialised our demonstration plots. We rent some plots of farmers’ land, farmers become our labour, obeyed our rules, for the exchange, they could get the products when the harvesting time started. (S1)

The quotes indicate that knowledge of conservation agriculture was delivered in a formal setting. Scientists mainly relied on PowerPoint slides to explain their points of view about how to cultivate the land. Through the pictures shown of floods and landslides, there is an indication that the scientists had tried to explain to the farmers that “incorrect cultivation”, as argued by the scientists, would make the environment end up like the ones in the pictures. Scientists expected that they could change farmers’ ways of thinking and cultivation activities into their scientific ways as they were the ones that could resolve flood and landslide problems. There is an indication that the scientists expected that after the farmers had seen those pictures and adopted scientific conservation techniques, they would apply anything that had been taught by scientists, which would later result in farmers abandoning their local practices. The socialisation at the demonstration plot in Tulungrejo village was to strengthen this indication, as in this plot the scientists applied the rules of conservation agriculture with the farmers, expecting that then “others would follow” (S1). Based on this plot, it can be seen that scientists intended that the whole community of farmers would change their ways and hopefully abandon their local practices. In all, it can be concluded that knowledge was delivered formally through PowerPoint presentations with an expectation that farmers would change their cultivation systems after seeing the pictures in the presentations.

5.2.2 One-way communication

The scientists were asked how they initially ran the programme, in order to discover how they differentiated themselves from other stakeholders. This relates to the argument made by Gieryn (1995) about boundary setting in order to secure the cognitive authority of science. Scientists stated:

> When we discussed about activities in the programme we always had meetings with the main team. With Scientists 1 and 2 (he mentioned names) and the PEBEJ, but the role of PEBEJ was only limited to the administrative matter of the programme. (S3)
S2, S3, the PEBEJ, and I always worked and discussed together things that we would need for the programme and farmers. We did not invite the field person and farmers because they were not allowed to. The field person’s position was only as a field technician and farmers were the executor of the programme. (S1)

It can be seen that scientists dissociate their position with farmers and the field person. Scientists confirmed that only they and the PEBEJ were allowed to be in the planning meetings while others were not, they classified themselves as “the main team”. This could mean that scientists tried to maintain their boundaries with farmers and the field person.

The researcher asked about the role of farmers and the field person at the meetings, and whether they were invited to meetings. The answer was:

No, because we decided first what they might need through the meetings. (S2)

It can be seen from the quote from S2 (with the additional quote from S1, previously) that scientists felt they had the right to decide what was best for farmers without the presence of the farmers themselves at the meetings. The farmers’ involvement was envisaged by the PEBEJ as follows:

I think they should be involved only at the end of this [decision making]. I do not think there would be any advantages if they come to meetings. I think [meetings] only become a burden for them, I fear if coming to meetings became their routine activity, [they] would [address] an objection. (PEBEJ)

The statement that inviting farmers to meetings would give no further advantages indicates that the public agency representatives may not have any willingness to know more about the farmers’ points of views about the programme. There is also an indication that the public agency representatives may try to discuss among themselves how the information was to be shared with the farmers at the end in a way that could convince them to adopt the scientific way of cultivation. Apart from that, knowledge and information can be seen flowing one-way, from the scientists to the farmers scientists decided what is the best for farmers. From the quotes, it also reveals that both the scientists and the PEBEJ could not bear any disturbances that might occur during the programme. Not inviting farmers to the planning meetings seemed
to be the ways to reduce the occurrence of disturbance, as scientists and the PEBEJ could not afford any objections from farmers.

Another indication that the communication was one-way was that during the data collection, the scientists gave the researcher the final reports of the demonstration plot, in which there was a copy of a PowerPoint presentation used by the scientists to deliver knowledge of conservation agriculture to the farmers (Figure 5.2).

Figure 5.2 Some of the presentation materials made by scientists (Source: Provincial Environmental Bureau of East Java, 2010)

The left PowerPoint slide explained points on how the demonstration plot would be implemented, which the scientists delivered in Bahasa Indonesia. This PowerPoint slide also explained the steps of how the programme would run, including an explanation that during the process of cultivation, the field person would become the source of knowledge. Everything that occurred in the field should be discussed with the field person. The right PowerPoint slide explained the variables that would cause the loss of soil, which was delivered by scientists in both English and Bahasa. Those variables were precipitation, the erodibility of land, the slope length, type of crops and the cultivation system. It clearly shows that the scientists expected the farmers to learn a lot from what had been delivered to them, as the sentence “learning by doing” that was on the slide clearly showed an expectation that the farmers should learn about scientific conservation cultivation not vice versa.

These slides were orally explained by scientists to farmers using the Javanese language as it was the farmers’ local language. Even though the use of the local language was part of the evidence showing that scientists wanted to be at the same level as the farmers and did not want to be considered as trying to lecture them (see Section 5.6.2), these slides showed the
opposite view. The use of Bahasa Indonesia and English, which farmers could not understand, as most of them had only completed primary school, is an indication that the scientists would like to be indirectly known as knowledge sources, it was important for them that their position in this knowledge delivery was recognised. It can be seen through the slides that the scientists also tried to explain that the farmers’ way of cultivation and the type of crops they grew had caused the loss of soil. It is also evident that the knowledge was delivered through what can be described as one-way communication from the scientists to the farmers.

5.3 The challenges

An analysis of the interviews reveals that in the implementation of the programme there were several challenges that emerged, for example, the Indonesian hierarchical legal laws, scientists’ lack of commitment and the communication within the team.

5.3.1 Hierarchical institutions

Scientists were asked from where the programme obtained its funding. They said “the fund depends on Surabaya”, which means the fund was obtained from the government. Scientists mentioned Surabaya because Surabaya was the city where the Provincial Environmental Bureau is located. This question was asked in order to understand the impact of having sufficient funds and other infrastructure in the process of governing different knowledge systems (Lemos & Moorehouse, 2005). Nevertheless, what one of scientists explained was:

Our conservation agriculture programme was funded by the government, so if they stop, I have to stop too…multi-year funding is not allowed anymore, now is annually. (S1)

The quote indicates that the programme was run annually and, as previously mentioned, this programme ran from 2010 - 2012, from which it seems that the budget for this programme was reviewed every year. This situation had made the scientists set criteria in order for farmers to continue to be involved in the programme, as they explained:

I selected farmers who could join this programme. They had to be a member of a farmers’ group, own a tilted land, and be able to follow all the requirements in the programme. For example, attending workshops and following all instructions. They also have to be able to nurture and develop the trees given [I do that] so that we could see the results, otherwise it would be messed up. (S2)
There were farmers who rent the land who also contributing to land degradation, but we cannot ask them to join the programme. The ones who can decide about the fate of a land is the owner of that land. So we only involved those who own [the land]. We chose to be safe…we have to make a profit. (S1)

The quotes reveal that scientists did not want to take risks that could jeopardise the implementation of the programme. Even though the scientists knew that there were other farmers who also contributed to land degradation, they tended to choose farmers who could work cooperatively with them. There is an indication that scientists must produce an expected outcome by the end of the year in order to keep the programme going. Thus scientists gave specific requirements and instructions to the farmers involved. In summary, due to the annual budget review held by the government, scientists had to manage the programme so that it would show the desired progress each year. Thus the programme could still receive the funding from the government and keep running.

When the PEBEJ’s representative was asked about this funding matter, he said:

I do not know about the development of the funding matter, but we used to be like that, I mean, multi-years. [however] we have a limitation as a bureau that has a small scale capacity. With this kind of small scale, how long will it take to cover those degraded land? Therefore, we try to make [some kind of] instalments to it, how many we could do in a year. However, at the same time [when the programme implemented] there were new rules from the President which controlled the procurement of goods and services and did not support [this programme]. Well, we cannot do anything about it

A doubt about the completion of the programme in order to address the problem of land degradation is revealed from this quote. In addition, rules relating to the agricultural programmes’ budgeting kept changing. The rules were established by the President of the Republic of Indonesia and these had obviously affected the way the programme was run, which the PEBEJ did not have the capability to control. Overall, from the quotes and how the scientists explained about the budget and the criteria for farmers, it clearly shows that the laws of the agricultural programmes’ implementation in Indonesia was hierarchical, which become a challenge for the provincial government when implementing agricultural programmes in the
local area. Importantly for this programme, the hierarchical legal framework had affected the budget and the way the scientists ran the programme.

5.3.2 Lack of commitment: responsibility and accountability

The scientists were asked how regularly they conducted meetings, as it was hoped this question could lead to a better understanding about public agencies’ accountability for the implementation of the programme. The answers were:

We were not necessarily having a regular meeting. I mean, at the beginning when we made a preparation for this programme we all met quite often. By the time the trees were cultivated by the farmers we rarely met. However, Scientist 2 did monitoring every two weeks, and the field person went to villages every day. (S1)

It depends on how long the programme took. Like for this one for the first three months the meeting was quite often, maybe twice a month. But after that, we rarely met, and I went to the field only once a month and then visited the farmers’ groups also once a month, alternately. (S2)

From these statements, it would appear that the scientists would conduct meetings whenever they thought necessary. Specifically, the pattern was that they met regularly during the first three months of the programme before the trees were cultivated by farmers. By the time the trees were cultivated, the scientists would meet less often. The scientists were asked about how they managed their timetables, which included conducting meetings, and whether their management of time was considered optimal. The answers given varied:

I think so, even though there were some lacks…not all of this team member could be in the field 100%, so if someone asked me what is the name of the farmers group leader I cannot answer that, because I cannot remember. Because we have our own qualification, so not all of us can go to the field. Also with Scientist 2, if he was asked what is the aim of this programme, in detail, I bet he could not answer it. (S3)

I think this team already worked at its best. (S2)
I do not think so…we have so many works to do, so we were not focus. Like today I talked about the agropolitan programme, tomorrow I will talk about something else [another programme]. (S1)

Even though the answers varied, with Scientist 3 tending to blame the different qualifications held by the scientists as causing their lack of mastering both field and administrative matters, it can be seen that the scientists’ lack of responsibility towards the programme was eventually the key to the problem. Their involvement in other agricultural programmes indicates that the scientists were not fully concentrating on the implementation of this programme. There is an indication that the scientists actually faced difficulties in allocating their time to each programme they had to handle, due to the government’s expectations towards them in running several agriculture programmes at the same time. In order to re-check whether there were issues with time allocation by the scientists the researcher asked about what should be improved from the programme’s implementation:

Time allocation. It was difficult to take a little bit of time to the field, because we have other activities at the university [where the scientists are working]. (S3)

Maybe in terms of infrastructure. A bureau like us had a limitation of energy, time…and for this programme, was also a distance. (PEBEJ).

In another interview the PEBEJ representative mentioned that distance also became a problem in implementing the programme. It should be noted that the PEBEJ is located in Surabaya and the programme ran in the Batu area, which took approximately four hours travel to get there. Therefore, it can be concluded that there was also a problem in being committed to the programme. This is because, if the public agency representatives were totally committed to the implementation of the programme, there would not be any issues from a lack of responsibility, accountability or time allocation.
5.3.3 Problem of communication within the team

During the interviews the scientists were asked whether their duties were evaluated and whether the programme still continued. This question relates to the importance of reflexivity highlighted in the process of knowledge governance. In regard to the continuity of the programme the scientists answered:

The problem is, this programme has ended, therefore, we also ended activities in those villages… the field person has stopped working and we left farmers. (S1)

The programme does not continue anymore, but the field person is still working. The farmers group is still asking help to the field person, so we do not leave the farmers… Scientist 2 still pays him, I do not know where he gets the money from. But if I am not mistaken he still pays the field person. (S3)

It became clear that the programme had ended. Nevertheless, what can be seen in these quotes is that Scientist 3 seemed to know more about the condition of the programme in the field than Scientist 1, which indicated that there may be a problem with the communication among the scientists. This problem of communication was further revealed with the answers scientists gave about the existence of an evaluation process.

We always had an evaluation [of our performance], per year, when we wrote the final report. (S1)

Honestly, no, not in written. So, for example, there was a report from a village, I would evaluate that for myself, never wrote it down… I never told my colleagues about the problems in villages because I did not want them to get involved, I did not want to make them busy. (S2)

We never wrote a report about our performance. For example, how farmers reacted and responded to our programme, we put that as our evaluation but we did not write it down. (S3)

The quotes reveal that there was lack of openness and honesty between scientists about how the programme ran. Each scientist, especially Scientists 2 and 3, appeared to have subjectively evaluated themselves and tried to resolve any issues with farmers quietly. Importantly, the responses and reactions of farmers towards the programme were not officially reported. It
seems that farmers’ reactions and other problems that related to social interaction between farmers and scientists were considered as not such important subjects to be reported by scientists to the government, as what mattered the most was how the implementation of the scientific conservation system worked in the field. This also can be seen from the way the final reports were written, as it was found that the reports were focused only on the adoption of conservation techniques in the field with very minimal advice given for the next or future programmes.

5.4 Problematic framing

This overarching theme indicates that framing occurred during the implementation of the programme, in which the scientists had framed that the conservation techniques were about scientific techniques and practices, while also framing that the farmers involved in the programme were commercially driven individuals. The topic of framing is highlighted in the process of knowledge governance, as framing will influence the effectiveness of communication between stakeholders (Carr & Wilkinson, 2005).

5.4.1 Conservation techniques are scientific techniques and practices

When the scientists were asked about the aim of the programme they answered:

The main aim of this programme is to change seasonal plants that farmers used with annual ones that have environmental sustainability aspect. We give farmers knowledge about [the conservation] cultivation system, because, even though they know it already but academically they do not know the composition of fertilisers, pesticides, and the distance between the plants. (S3)

It is about conservation farming. One of the requirements is to do [a] terracing [system], and then annual plants, then having plants that can strengthen the terrace, diversion ditches; then, the use of mulch. Those are the main things. Other than that is up to the farmers. If they do not use organic fertilisers then fine, but we design [the formula of fertilisers] for them, and they have to use it. We used soil analysis [such as] calculating how much fertilisers and pesticides they needed. (S1)
[Farmers in] both villages mostly cultivate potatoes; biologically potatoes cannot hold the soil well, and when rain comes the soil nutrients will be lost straight away. So the aim [of the programme] was to change them to annual crops, because annual crops can keep and hold the soil nutrients well. (S3)

Having sustainability in the environment, specifically agriculture sustainability was clearly the main aim of the programme other than improving the water quality of the Brantas River. In order to manifest this aim, a programme of changing the way farmers cultivated their land was implemented. The scientific conservation agriculture system was believed by scientists to be the best system to be applied, and the farmers’ way of cultivating needed to be corrected. For example, farmers needed to apply the terrace system, diversion ditches, application of mulch, and application of fertilisers that had been formulated beforehand by scientists. This also meant farmers had to change their usual activities from cultivating seasonal crops to annual ones, which become the scientists’ next aim. It seems that farmers were being viewed as people who did not know about agricultural technology or have scientific knowledge of cultivation system. Thus, scientific conservation knowledge was expected to become the source of authoritative knowledge to guide the farmers, which can be seen from the way Scientists 1 emphasised it by saying “they have to use it”.

5.4.2 Farmers are commercially driven individuals

Scientists were asked for their perspectives on the farmers who were involved in the programme. They answered:

Actually farmers knew about [the] terracing system, but they did not want to do it. They are very commercial farmers, they do not want to experiment stuff, so they did not adopt totally [our] conservation system because the cost to do a terracing system is high...[however] I think they would continue to cultivate these apples because apples and vetiver grass are expensive. (S1)

I think farmers wanted to join because this type of cultivation has a good prospect, especially in terms of higher economic value for the apple products compares to other crop products. (S2)
The reason why they joined the programme was not far from economic reasons, I think. Because the market demand for local apples is high and farmers knew that apples are more profitable than other crops. (PEBEJ)

Scientist 1 was opening the judgment about farmers by saying that farmers did not follow the required steps, nor apply the conservation system steps correctly and this, it was argued, could be because of the farmers’ experiments, which turned out to be more costly. Therefore, to outmanoeuvre the anticipated protests from farmers about the required conservation agriculture system being too costly, the scientists had identified apple trees that farmers could cultivate, and vetiver grass that could be sold for a high price in the market. Both the scientists and the PEBEJ also maintained that the economic issue was behind the reason why farmers were happily joining the conservation agriculture programme. The judgment was based on farmers’ knowledge about the price of apple products, which is higher than other crop products, which meant that they would not refuse the incentives that were offered by scientists. On this basis, scientists were confident that farmers would change their practices, as Scientist 1 explained:

A kilo of ANA [type of] apples in the market is around fifteen thousand rupiahs, and the vetiver grass you can make it into perfume, so you could imagine how much money farmers can make from that. So we persuade them to cultivate these apples. (S1)

Hence, scientists sought to persuade farmers to change their cultivation practices, by motivating them with the prospect of money via higher rewards from higher value crops. They persuaded farmers to cultivate apple trees, as the type of ANA apple was expensive to buy in the market, while vetiver grass can be sold by farmers to the perfumery industry. In all, it can be said that the public agency representatives had labelled farmers as commercially driven individuals who were joining the conservation agriculture programme mainly because they knew apples were the most profitable products in the current markets. Therefore, farmers would not turn down the offer from the public agency representatives.
5.5 Local knowledge means local cultivation techniques

Scientists were asked about the inclusion of local knowledge in the implementation of the programme. This question was asked in order to investigate if scientists recognised different knowledge systems and how they influenced their different ways of knowing and engaging in cultivation. The scientists argued that they considered the inclusion of farmers’ local knowledge and explained how:

Yes, it was being considered. So before I introduced the vetiver grass, they explained to me about the asphalt grass, I do not know the latin name of it. That grass is kind of stick on the asphalt, and they said that they had that grass to strengthen the terrace, but the landslide still occurred. So I told them about vetiver grass. I explained that the roots of the vetiver grass can go deep down into the ground and can strengthen the terrace well. Also they were the ones who chose the type of the apple trees that they would like to plant, which was ANA. Because, especially for Tulungrejo village, they were experienced enough for growing this type of apple in their village….and we let them use manure, because that is their tradition. (S2)

We tried to employ our technology with their local knowledge. For example, how they usually did their cultivation system, like the use of manure. (S1)

It can be seen that the extent to which scientists included local knowledge was in terms of letting the farmers choose what type of apple trees they wanted to cultivate, which would be provided by the scientists. Farmers’ choices around crops, however, were significantly constrained as scientists had already decided the type of crops that would be offered to farmers, even before the implementation of the programme started. Scientists maintained that the inclusion of local knowledge also arose from letting farmers use their traditional manure. Hence, it can be concluded that scientists had defined local knowledge as local techniques that farmers usually used in the field. For the scientists, local knowledge was confined to choices and input practices to the cultivation system. In this regard, scientists saw themselves as allowing farmers to participate in the decision making process.
The scientists were asked whether they knew about local traditions and/or rituals adopted by farmers in their cultivation activities and were told that farmers’ traditions were one of their challenges:

Farmers did not want to plant straight away because they waited for certain dates to do so. Because they have intuition, because they think this is about their future, so then they are always finding a day where they feel right to do the cultivation wholeheartedly. This delayed everything…I just think it is only a myth. In my perception, when you get [the plants] then you should cultivate it right away. We gave the plants at the rainy season, if it is postponed for a week you lose a week of raining. (S2)

I heard about that counting days. I mean, farmers were counting days to find the days of cultivation. However, I do not understand, both the local name of it and the reasons behind all that activities. I think that was just part of their beliefs. (S3)

It can be seen that scientists were aware of farmers’ traditions and practices. However, these traditions and practices did not seem to be taken into account by scientists. This can be seen from the answer of Scientist 3 as he still did not understand the reasons why farmers maintained their local practices, and it seemed he also did not find a way to understand, later categorising those practices as “[being] just” part of farmers’ beliefs. Scientist 2 seemed to know more about farmers’ traditions and practices, yet he then categorised them as “a myth” that should not be followed by farmers given the implications of a delay in planting at what was considered the optimal time in the programme’s timeline. The problem in funding and tight timelines, coupled with defining local knowledge as choices and inputs into the cultivation system, meant the farmers’ traditions were seen not only as myths and as a simple activity that can be overlooked, but also a barrier and potential delay to the programme’s implementation rather than an integral part of the farmers’ cultivation systems.
5.6 Trust

The analysis identifies trust as a key theme. While understood as crucial in the implementation of the programme, each stakeholder tended to have a different view on how trust should be established and fostered. As shown below, scientists maintained that farmers’ trust was to be gained through the establishment of a demonstration plot as part of changing farmers’ land practices and using the local language to communicate with farmers. Trust is also a topic that is highlighted in the process of power sharing, in which power that is equally shared will later develop trust between stakeholders (Folke et al., 2005).

5.6.1 Existence of the demonstration plot

As part of changing farmers’ land practices, not only did scientists hold workshops and briefings for farmers, but they also introduced a demonstration plot in Tulungrejo village in order to give a direct example to farmers about correct conservation techniques, and also to help the scientists to change the farmers’ land management practices. The plot was located in Tulungrejo village because the field in this village was more easily reachable than in Sumberbrantas’, as the scientists explained:

We used a plot of land that belonged to one of farmers, around five to ten hectares. Farmer must do the cultivation system using ours and he had to obey the rules. When it came to harvesting time, he can have the products. (S1)

In this demonstration plot, the labour is the farmer himself, we paid him, we gave him all inputs, but he had to follow the rules. We put a clinometer so we can calculate also how much nutrient [from the soil] that was gone along with the water, so farmers can make a comparison. (S3)

Apart from the aim of having this plot to help scientists change the farmers' land management practices, it can be seen that the scientists also tried to gain trust from farmers by establishing this plot. Adopting scientific conservation techniques and putting scientific tools, such as a clinometer, in this plot, are an indication that the scientists attempted to gain farmers’ trust by showing them that the scientific way of cultivation was the most correct, and better, it was expected that all the farmers would follow later.
5.6.2 Using the local language to gain trust

The scientists were asked whether they specified the language they used when they explained or communicated with farmers about conservation agriculture, they answered:

Mostly we talked in Javanese, as we did not want the workshops to be formal. We did not want farmers to feel that we lectured them; we let them felt that they were part of us (scientists), so they would not have any hesitations to ask questions. If we used Bahasa Indonesia we were not sure they would pay attention, because, it seemed that they received our knowledge well but actually they did not get it at all. (S3)

[Used Javanese] so they can understand, so there would be an impression that I respect them. If I used Indonesian, we cannot be close, which make them not trust us. (S2)

It can be seen that using the Javanese language as the farmers’ local language was considered to be important for scientists in gaining farmers’ trust. For scientists, their position with farmers could be at the same level as the local language was used during their interactions. In this matter, it was thought by scientists that the use of the local language could diminish their position as knowledge sources and farmers as knowledge receivers.

5.7 Summary

The provincial government of East Java was concerned about the poor quality of the Brantas River. One way to improve its condition was through establishing a conservation agriculture programme which, at the time, was in line with the deliberations made by the Indonesian central government, along with other countries, in the Bangkok Declaration that was held by the FAO in 2001. The aim of this programme was to change the land management practices of farmers who live in upstream areas of the Brantas River. This programme was held by the PEBEJ, which stated that it offered a different approach in its implementation, and that was the inclusion of the farmers’ participation in the decision making process. For implementing the programme, the PEBEJ invited some scientists from one of the academic institutions in East Java to work with them. Interviews with these public agency representatives had revealed not only how the implementation was actually done, but also the challenges that emerged during the implementation of the programme, and the different perspectives about the inclusion of farmers and their local knowledge.
The theme of the programme implementation identifies that knowledge of conservation agriculture was delivered in formal settings and through one-way communication. Challenges faced by scientists were the existence of hierarchical legal laws relating to the budgeting for agricultural programmes, which affected the way scientists ran the programme; the lack of scientists’ commitment to the programme, and the communication problems within the team. The analysis also identified that, for scientists, local knowledge meant local cultivation techniques, in which traditions and rituals relating to cultivation practices were considered as myths and were not accounted for seriously. Furthermore, the analysis identifies framing as a key theme that was problematic, because for the scientists, conservation techniques were considered to be scientific techniques and practices, and the farmers who were involved in the programme were commercially driven individuals. The analysis also identifies that trust became a key theme as each stakeholder had different views on how trust should be established and fostered. For scientists, the farmers’ trust towards the programme could be gained through the existence of a demonstration plot and using farmers’ local language for communication.

The next chapter provides the analysis of the interview of the field person was who named by the scientists as their mediator with the farmers.
Chapter 6
Role of the Mediator: Field Facts

6.1 Introduction

This chapter presents an analysis of the interviews with the field person. The field person played a key role in the implementation of the conservation agriculture programme. According to the scientists, he was a mediator between the scientists and farmers, in which role he was limited to translating science into knowledge and language usable by farmers. This chapter will contrast what had been stated by scientists about the field person’s role with how the field person saw his duties. Even though there is only one field person and his role appears small, it was crucial for the implementation of the programme, as it was part of the scientists’ attempt to manage the boundaries between them and the farmers. Therefore, the researcher believes that the analysis of the interviews with the field person should stand alone as one single chapter.

6.2 Implementation and its challenges

This theme identifies that the field person’s duties were evidently more than a mediator, as he sometimes had to take up scientists’ duties due to the scientists’ lack of coordination and commitment. The scientists tended to overlook the cultural aspects of the farmers lives when the invitations to meetings were delivered. More than that, the theme identifies that the field person was in a difficult situation as farmers ignored his existence, due to the scientists’ poor time management in conducting the programme.

6.2.1 More than a mediator

The interview with the field person was carried out during the researcher’s stay in Tulungrejo village. To start the conversation, the field person was asked some general questions, for example, how long he had worked as a field person and why he chose that occupation. He was then asked about the conservation agricultural programme and his duties in the implementation of this programme. These questions helped the researcher understand the position of a boundary spanner in mediating stakeholders with divergent knowledge systems (Corburn, 2007). At first, the field person explained about building communication with farmers:
Usually, I would ask questions about farmers’ conditions in farming, such as the crops, harvest, and so on, then I asked whether they faced any difficulties. They usually mentioned about pests and diseases. Then from there I tried to develop the conversation to conservation and environment.

Having had experience of interacting with rural farmers, the researcher noticed that what the field person did was not only to try to build communication, but also try to understand farmers’ ways of thinking and doing, by asking them some general questions, for example, the condition of their day-to-day farming activities. The field person would then start to raise the issue of conservation and make a link with the condition of the environment when he thought it was the right time to speak. This indicates that the field person had a good understanding of how to approach farmers by working to understand their ways of thinking and doing this first. It can be seen that the field person realised that by listening he actually showed respect to the farmers’ perceptions.

Further, the field person explained about his other role, which was taking on the scientists’ work by delivering some presentations to farmers:

[I] delivered with anything that I could find actually. Sometimes only with pen and paper then telling stories, just like that…I know it is not effective. Yes, most of my life I am working in the field so I have knowledge about conservation and environment, but doing that [presentation] I also needed preparation. Scientists sometimes did not let me know that they could not arrive and give a presentation until the last minute, when I rang them like five minutes before the workshops begun then they said that they could not come and asked me to cover their job. They should let me know long before and prepare the presentation for me so my job is just to deliver it.

The field person was disappointed with the scientists’ lack of coordination. This also indicates that the agreement between scientists and the field person did not include having to replace scientists’ duties and deliver some presentations. Some presentations needed to be done late at night and the lack of commitment of the scientists towards the programme had obviously upset the field person.
Moreover, the field person also mentioned about having to monitor the implementation of the programme. When asked whether he went to the field every day, he answered:

No. Everything that has something to do with going to the field depends on the needs. For example, before the field implementation, I could go two to three days in a row to the field. Then I went there again when trees and grass were given, and when they were being cultivated. After three months, I went back there again to check the condition of plants.

Figure 6.1 One of the field person’s duties was witnessing the delivery of apple trees and vetiver grass (Source: Scientists Team, 2012, p. 23)

It can be seen that monitoring the progress of the programme was undertaken as needed. As a person with a background in agriculture, the researcher understood that the first three months were crucial months for crops after being planted, in which the growing process needed to be monitored closely. The quote from the field person that he came back three months after crops were cultivated indicated that there was a problem in conducting the monitoring process, which can be related to the tight budget that made scientists abandon some important actions, including having continuous monitoring. Overall, it can be concluded that the scientists’ lack of coordination and commitment towards the programme had made the work of the field person become more than just being a mediator which, in the first place, was to simply build communication with the farmers and translate scientific knowledge to the farmers. The tight budget conditions also made the work of monitoring by the field person less than optimal.
6.2.2 Overlooking important cultural aspects

Realising during data collection that the farmers were quite busy in the field from early morning until dusk, the researcher asked the field person how he organised his timetable to meet and build communication with farmers. He explained:

I never had a schedule when I met the farmers, I mean like what day what time punctually, except for the workshops. Because I had to search the right time if I want to meet them. Farmers cannot be disturbed from 7am to 6pm as they all head to the field. There was one time the scientists and the PEBEJ invited farmers to come to the village hall, the invitation said that it started after ba’da maghrib but farmers just came right after 8.30ish pm.

It can be seen that the field person also had an understanding of farmers’ timetables as he adjusted his timetable with the farmers’ timetables. Finding the right time to meet farmers was seen as very crucial for the field person not only for meeting them in person but also in developing common ways of thinking in regard to the implementation of the programme. As explained by the field person, the public agency representatives had invited farmers in Sumberbrantas village, for example, to come after ba’da maghrib. Farmers then showed up but not until half past eight in the evening, which was after the specified time. From four thirty in the morning there are five daily prayers for Moslems. Maghrib is the fourth prayer of the day, which starts when the sun sets. In Indonesian time, maghrib starts around a quarter to six to six o’clock in the evenings. Ba’da is an Arabic word which means ‘after’. Therefore, ba’da maghrib means after maghrib, which would have been around half past six. This was the time that the public agency representatives invited farmers to come to the village hall.

Moreover, the fifth prayer for Moslems; Isya’, in Indonesian time, starts at seven o’clock in the evenings. For those who lived in the city, when an event or public meeting was conducted after ba’da maghrib, people would generally put off their Isya’ prayer and would do this prayer after the event or meeting finished. From the interview with the field person it showed that the farmers did both the prayers, Maghrib and Isya’, before they attended the meeting with the public agency representatives. However, as farmers had just gone home from the fields at six o’clock in the evenings, they definitely would have needed a rest and to have dinner with their families first. Therefore, the farmers did not come to the meeting at the expected time. This issue of timing was clearly not well understood by the public agency
representatives. Importantly, this cultural aspect of the farmers’ daily routine was overlooked by them.

6.2.3 Farmers’ ignorance because of scientists’ poor time management

From the interview with the field person, the researcher found that he had 16 years of experience in assisting conservation and agricultural programmes. He had developed his skills not only within Java Island but also another island in Indonesia, Celebes. When asked whether his more than a decade of experience had helped him in assisting with this programme, he stated:

Because I am an informal, I am not an official extension officer whatsoever. This made the farmers receive knowledge that I delivered to them but their behaviour towards farming activities stayed the same. For example, when I told them to do a terracing system they did not do it.

The field person tended to blame his institutional background which made farmers not do what he told them. There was an expectation from the field person that by the time farmers were told to do something that he and the scientists considered was ‘the right way’, the farmers must then follow. It can be seen that the field person was not really aware that farmers may have their own ways of cultivation, which indicates that his attempt to understand ways farmers thought through developing communication in the first place was not properly done. There is an indication that the field person might have missed some crucial points in understanding farmers’ perspectives, which could be due to tight timelines. He explained as follows:

I had a problem with scientists’ time management. Because this programme, from its planning to implementation was always carried out almost at the end of its timeline. For example, the programme was for 2012, but the planning and socialisation were conducted almost at the end of that year. The fact was that this programme should actually be started in July. This condition has put me into trouble.

It can be seen that the implementation of the programme was carried out in a hurry due to the scientists’ poor time management, which had upset the field person. This clearly shows that this had affected the work of the field person, which had become non-optimal. In summary, the position of the field person was very difficult because the farmers ignored his advice and
he also lacked support from scientists because they were not being punctual with the programme’s timetable.

6.3 Exclusion of local traditions, rituals, and practices

The field person was asked whether he knew local practices or traditions of the villages and whether those traditions were considered in the programme.

There are many. Usually it is about the cultivation techniques, sometimes farmers created their own knowledge. For example, the way they mixed their pesticides could not be found in theory. Besides that, at the cultivation season, they not only paid attention to Javanese dates but also to signs from nature. It was like when the scientists expected farmers to start the cultivation in September when the rainy season started. The farmers refused it, because the date was not right and the land was too damp to be planted.

It can be seen that farmers had several local traditions and practices to follow, as the field person mentioned knowledge about mixing pesticides, paying attention to Javanese dates, and signs from nature. Signs from nature and the farmer’s knowledge of mixing pesticides, as argued by the field person, could not be found in the academic literature. This clearly shows that farmers had a completely different visualisation and understanding about their agricultural practices. It can be seen that the way farmers visualised nature also held an important role in the way they used pesticides. Paying attention to Javanese dates gave an indication that the farmers’ activities in the field had sacred meanings and that made them have the courage to refuse the scientists’ requests. Nevertheless, as these meanings and activities were not found in academic literature, scientists tended to dismiss them from the implementation of the programme, as explained by the field person when asked if local knowledge was acknowledged:

No. Scientists aware but they passed it. Scientists mainly explained what the conservation is all about, and what they expected from farmers, only like that.
6.4 Trust

The field person had different perceptions when it came to gaining farmers’ trust. This overarching theme identifies that trust relied on actual results that should have been shown from the demonstration plot, and that trust also can be gained only by using the local language.

6.4.1 Actual results will gain trust

When the field person was asked about the condition of the demonstration plot, an additional activity that scientists had during the implementation of the programme, his answer was:

There should be a demonstration plot that is ready. Ready in terms of it already shows its results, its success. So when we wanted to show farmers, we could refer this plot as a perfect example. So far, there are not yet any demonstration plots that are successful and can be shown to farmers, including plots in this programme. What happened was, in this programme, the plot was just started. It just reached the steps of making terraced landscape and cultivating, for the production result of this plot we have to wait for four to five years. I know the scientists had done research about how many percentages of soil nutrients that will lose if the conservation system is implemented, but farmers do not understand that.

The quote reveals that the problem was not only trying to show scientific conservation techniques in a better way, but also, which concerned the field person, trying to gain farmers’ trust that this scientific experiment could actually deliver better results than local practices. This indicates that farmers’ trust was more reliant on the results that they could physically see, rather than the process of getting these results, in order to make them believe in scientific techniques. But, this was the part that the scientists could not yet show.
6.4.2 More than just using local language

As mentioned above (see Section 5.6.2), the knowledge of conservation agriculture was delivered orally in the Javanese language even though the PowerPoint slides were in English and Bahasa Indonesia. The scientists argued that using the local language would gain the farmers’ trust. The field person was asked his opinion about this:

The way the conservation knowledge was delivered to farmers was not optimal. Farmers were more interested in pictures, not words. Audio visual as well as informal systems are the most effective ones. For example, we divided farmers into several groups, then we used pieces of paper for discussion, then we asked farmers in group A to explain to others, on that paper, what kind of cultivation they did, then we discussed. From there we gave them advice.

It can be seen that the concern was more about the essence of knowledge that the scientists tried to deliver rather than the use of local language. Word-type presentations would not move the consciousness of the farmers towards environmental condition but pictures could. This indicates that pictures/audio visual techniques, as stated by the field person, gave an actual vision; so it effectively caught the farmers’ attention and led to the way farmers understood nature, which, in the end, developed their trust. This way of delivery, as argued by the field person, was supported by the surrounding environment when knowledge was delivered. As the field person explained, it was about the meaning of using an informal system:

You know, like going in a room looks like a class room, then we have a chair and desk like in schools, then we have to face the front class, listening to teachers, that what I meant by formal. Informal would be like the way they are attending their farmers’ group meetings. Sitting down together on the floor, everyone took their turn to have a talk, shared jokes sometimes, but in here we inserted some knowledge too about conservation.

The situation of the farmers can be seen as having an important role in the success of getting the message across to farmers. There is an indication that the message would be more easily delivered and accepted when farmers were put in an environment they were familiar with. This better acceptance of knowledge can be seen as an early indication of having trust. In
6.5 Summary

To implement the conservation agriculture programme in Sumberbrantas and Tulungrejo villages, scientists obtained help from the field person. Scientists maintained that the field person was a mediator between them and the farmers. Nevertheless, what can be found from the interviews was more than what the scientists had explained.

This theme identifies that when the programme was implemented, the role of the field person was more than just a mediator, as he sometimes had to replace scientists in giving presentations to farmers, due to the scientists’ lack of coordination and commitment. Scientists tended to overlook the important cultural aspects of farmers when they conducted meetings. The field person was put in a difficult situation as his existence and advice were ignored by farmers, yet he also had to deal with the scientists’ poor time management in conducting the programme.

When it came to the role of local knowledge in the programme, this shows that farmers’ traditions, which represented different ways of knowing and gave meaning to agricultural activities, were excluded. Trust was also understood differently, in that the actual physical results tended to gain farmers’ trust better than showing farmers the process to obtain those results. Gaining the farmers’ trust was not about using the local language, but more about how to get the essence of the knowledge or message across, which began with the way the knowledge was delivered and supported by the surrounding environment, as the process of developing trust would grow along the way. The next chapter provides an analysis of the interviews with the farmers.
Chapter 7

The Farmers

7.1 Introduction

This chapter presents an analysis of the interviews with farmers who participated in the conservation agricultural programme established by the Provincial Bureau of East Java. The focus is on what farmers explained about how they applied and used the conservation agricultural knowledge and methods, and the practices introduced through the programme. The discussion revolves around the expectation that under the programme the farmers would adopt a terraced cultivation system and move away from cultivation on tilted land. To gain a deeper insight into how farmers have grappled with the change in practices from the past, the discussions also looked deeply into how they had shifted from traditional methods of pest eradication to chemical pesticides. The analysis provided an insight into how “new” and existing knowledge intersected across the epistemological and ontological divides of scientific and local knowledge and how the farmers reconciled the knowledge and practices from the past with the present.

The demography of the education levels in the Tulungrejo and Sumberbrantas villages was quite similar. From the interviews, it was found the education level of most farmers was up to primary school level. Some of them had finished high school; only one had gone to university and gained his bachelor’s degree in agriculture (see Table 7.1)

<table>
<thead>
<tr>
<th>Educational level</th>
<th>Sumberbrantas</th>
<th>Tulungrejo</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Never attended any formal education</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. Primary school</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>3. High school</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>4. University (bachelor)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>20</td>
</tr>
</tbody>
</table>
7.2 Programme implementation

This section provides the farmers’ perspectives about the implementation of the programme. The theme identifies that the farmers viewed was that scientists lacked responsibility, and there was a concern about the inclusion of local knowledge. It is also identified that there was a limitation in sharing information about the programme to farmers.

7.2.1 Lack of responsibility

The farmers were asked about the programme’s implementation, as it was hoped this would lead to the realisation of the scientists’ reflexivity in conducting the programme. To start with, the farmers were asked with whom they communicated most. Farmers in those villages gave different answers. Farmers in Sumberbrantas village said that there had never been any communication or discussion between them and the scientists, as the scientists only came once to deliver information about the programme and the incentives that the farmers would obtain.

It was only a briefing, so it was only one-way communication. Scientists did not ask whether we have questions. The scientists told us to do terracing system, yea, we know that already so the information was not that valuable. (F7 Sumberbrantas)

Scientists had a speech at the village hall, once. After that they sent the apple trees. If they have any messages to us, they delivered it through the village leader, so I never communicate with scientists directly. (F1 Sumberbrantas)

Scientists came and had meeting with us, but there never been any workshops or continuous communication with us in regards to the cultivation of apple trees. (F8 Sumberbrantas)

It can be seen that, as stated by the farmers, the communication was one-way and discussions did not develop between the farmers and the scientists. Strong evidence was provided that the communication between scientists and farmers in Sumberbrantas village was one-way, where the scientists did not offer farmers the opportunity to ask questions about the programme they introduced (see F7 Sumberbrantas). There seems to be an indication that there was an effort from scientists to minimise any objections or criticisms that might be delivered by farmers. Another possible indication is that scientists tried to speed up the implementation of the
programme as the time was ran out (see also Section 6.2.3). This can be seen from the incentives mentioned in the meeting, indicating that scientists attempted to obtain consent from farmers so that the programme could be implemented immediately.

The farmers in the Sumberbrantas village were then asked about the monitoring sessions after the apple trees were planted.

There was one time when the field person came to the village and went to my field. But he only looked for a while and asked whether I had problems or not. I said no because at that time I had no problems at all, then he left. But few weeks after that, problems started to happen, such as fleas. I did not know to whom I should ask for advice. I tried everything to make apples grow, but I could not, I even tried to put some detergents to kill the pests. (F5 Sumberbrantas).

After scientists gave us apple trees, they never came again. There was no communication or further information about apple's cultivation. They never asked how our experience is with this type of commodity, which they should so that the programme ran well. (F9 Sumberbrantas).

There was no discussion at all! I felt this programme is useless because there was no continuous monitoring. (F2 Sumberbrantas)

Despite the quote showing how creative the farmer was in finding an alternative to cure the pests by, for example, applying some detergent to the trees, the quote reveals that the monitoring was not run as the farmers’ expected. It can be seen that farmers wanted more discussion, interaction and communication, rather than being asked whether they were having problems in nurturing the apple trees at that time. It can be concluded that the field person and the scientists lacked responsibility in conducting the monitoring session in Sumberbrantas village.

In contrast to the farmers in Sumberbrantas village, farmers in Tulungrejo village not only received a briefing but also workshops during the implementation of the programme. Farmers mentioned that scientists did communicate with them and said that the field person only came to assist the scientists.
The scientists [made the communication]. The field person only a follower of the scientists. We always ignored the field person, because he only ordered us to do something. The scientists went to the field with us when they came here for the first time, talked and gave example. If only ordering, like the land has to be like this, the medicines should be this one, of course we would ignore. Whatever, do it yourself then. Only ordering but not implementing yourself. (F3 Tulungrejo)

So scientists came to us, they gave workshops. They explained why we need to conserve our land. Then they explained that they would give us apple trees. They explained also about vetiver grass that it will strengthen the terrace’s field and did not disturb the main crops. They explained that we need to change our vegetable crops with apple trees. Their reason was because apple trees only cultivated one time so it would reduce erosion. (F1 Tulungrejo)

It can be seen that the field person did not have any interactions with the farmers when it came to giving examples of what was to be done in the field. The quote reveals that the field person only gave advice about how to carry out tasks but did not undertake an actual demonstration with the farmers, in which interaction and communication could be developed and engaged with from this kind of action. The farmers tended to listen to scientists because the scientists were willing “to get their hands dirty” in the field and gave actual examples of how to apply conservation techniques in front of the farmers. This indicates that the farmers were more respectful and listened to those who “appreciated” their hard work by taking direct action in the field. Similar answers were also given by other farmers, for example, F3, F6, F8, F11, and F13 of Tulungrejo. Nevertheless, this excellent beginning was not followed through with continuous communication and interaction, as intensive communication did not occur.

[The programme has] lack of monitoring. [They] should realise whether this programme was operating or not. [What happened was] the monitoring at the end was done by farmers, we took the shifts. (F1 Tulungrejo).
This programme (the conservation agriculture programme) is actually good enough, just one little thing. For example, the communication is not intense. To be close with the farmers is a good thing. So we can exchange our thoughts. If [they] rarely come then how [they can] understand. (F18 Tulungrejo)

It can be seen that, to some extent the scientists had an excellent start by implementing two-way communication when the programme begun. They held a briefing and workshops, where farmers and they could have two-way discussion about conservation, the need for it, and how to cultivate apple trees and vetiver grass. However, through time, this effort was degraded, as communication was rare and there was no exchange of information between farmers and scientists. Moreover, the way of scientists conducted monitoring in Tulungrejo village was similar to that in Sumberbrantas village, where it was not done intensively. However, farmers in Tulungrejo had the initiative to share the duty of monitoring among themselves. It was also found that farmers then had the initiative to contact the scientists when they faced problems in nurturing the apple trees. They requested one of their colleagues to make a phone call, after which the advice would then be delivered back to the farmers and where they discussed among themselves whether the advice was applicable to them. The quotes reveal that it was more than just a lack of monitoring that the scientists had neglected repeatedly. They also reveal that farmers had strong bonds with their community, in which they would resolve problems they faced together. It can be seen that farmers in Tulungrejo village also expected that continuous communication would occur between them and the scientists.

Figure 7.1 One of scientists (left) introduced the conservation agriculture programme to farmers in Tulungrejo during their regular group meetings. This occurred before all the activities of conservation cultivation and workshops started. This picture shows when scientist arrived for the first time in Tulungrejo village they asked for permission as well as briefly introducing the programme to farmers. (Source: The Provincial Environmental Bureau, 2012)
7.2.2 Concern over inclusion of local knowledge

Considering that the farmers had already experienced implementation of the conservation agriculture system by scientists, they were then asked whether their knowledge in the field, including their traditions, had been recognised. All farmers replied that their knowledge and their traditions were not recognised by the scientists, “They (the scientists) only considered our cultivation system” (F6 Tulungrejo). They were then asked whether there were any differences in what had been delivered by the scientists with what farmers had already known.

In theory, the scientists win, but we as farmers [we] win the practical side. The scientists may not know much about things in the field, but we do, we practise directly in the field. We have a direct contact with weather, pests, and so on. So theory without practice is nonsense. (F6 Tulungrejo)

Scientists need to understand farmers’ experiences so that we can share ideas between their theory and what is going on the field that has been done by farmers so far. Understand Javanese traditions. There is a difference [between] theory and [what is going on in] the field. (F2 Sumberbrantas).

It can be seen that farmers understood well the distinct conditions from what was stated in the academic literature and in the real world, that was their field (similar answers were given by farmers in those two villages, for example, F2, F5, F9, F15 of Tulungrejo and F4, F7, F5 of Sumberbrantas). Farmers kept mentioning about “theory” and “practice”, saying that there was always friction if the farmers and scientists did not discuss these matters together. Thus, the farmers expected that their views and experiences were taken into account in the implementation of the programme, as one of them stated:

[So] we can exchange experience, exchange point of views. Increase in learning [to] others knowledge, so [we] don’t shut down ourselves [to new knowledge]. (F9 Tulungrejo)

In recognising the importance of their traditions and rituals the farmers were asked whether traditions and rituals should be also included, and one of them replied:
Of course! If they asked us to cultivate, then spray but broke Uwas, the results would not be good, it would less. Maybe good, but we did not get the money (from the middlemen) soon. They (the government) must know this. But maybe they do not believe in Uwas, Galengan, I do not know. If they could, they should [know]. I do not know where they originally come from, but they still have the sound of Javanese. (F14 Tulungrejo)

This clearly showed that what the farmers expected from scientists was for them to respect their traditions (most farmers gave similar answers, such as, F12,F13,F17, F18 of Tulungrejo, and F1, F4,F6 of Sumberbrantas). It can be seen that farmers did not mind what knowledge was offered (see Section 7.3.1), but discussions about what actually occurred and how knowledge should be adopted in the field was extremely important to them. Therefore, the farmers and scientists would not only have a mutual understanding about what had been offered in the programme and how it would work out, but it would also enhance the scientists’ understanding about farmers’ traditions and rituals.

7.2.3 Limited sharing of information

From Chapter 2, it can be seen that the aim of the programme was to improve the water quality of the Brantas River. In view of this, the farmers who involved were asked about what the programme was about. This question was important as it would lead to understanding of how the information flowed, and also the accessibility of the stakeholders to information. The farmers answered:

[The scientists] gave information before [we] cultivated the apple trees, like to form the land to terracing [system] and what the benefits of it. (F5 Sumberbrantas)

[The programme] started with the explanation why a conservation is needed, then [the scientists] started to give the plants (apple trees). Also about vetiver grass to strengthen the terrace, [the scientists said] that the roots can strengthen the terrace but won’t disturb the crops. Changing vegetable crops to trees. Their target is conservation, which is farmers who have a tilted landscape but still cultivating vegetable crops. So they gave apple trees and vetiver grass so that they (farmers)
shifted. Apples are only cultivated once, so it can reduce erosion. (F1 Tulungrejo)

It can be seen that the information given to farmers was about the scientific conservation system and what farmers were expected to do; for example, changing land practices and the type of crops they cultivated. It seemed that the information about the Brantas River was never delivered, and this prediction was proven when the farmers were asked whether their cultivation would affect the condition of the river, and the reply was:

Brantas? This field is very far away from Brantas, it (the field) has nothing to do with it (the Brantas River). [There are] only creeks nearby. (F4 Tulungrejo)

It can be seen that farmers lacked knowledge about the geographical position of their field in relation to the Brantas River. Nevertheless, this could not be their fault as information that was supposed to be given to them was not delivered and what was given was limited only to techniques for conserving the arable land. This indicates that the farmers did not have access to information other than cultivation and the incentives that they were to obtain. There is also an indication that the scientists tried to prevent any criticism being made that they could not handle. It seems that if the information had been freely shared with farmers, the motivation might emerge from the farmers to improve their ways of cultivation.

7.3 Differences between knowledge systems

This section gives the farmers’ reaction to the knowledge they had received from the scientists. The theme shows how farmers navigated the two systems, that is, local and scientific, instead of refusing the scientific knowledge about conservation, or accepting the knowledge and leaving behind their own local practices. The theme also shows the farmers’ distinct ways of knowing and ontology compared to the scientists’ ways of knowing.

7.3.1 Navigation of two systems: management of past and present

It is mentioned in Chapter 2, that farmers who were involved in the programme usually cultivated vegetable crops. When they joined the programme, they were directed to cultivate apple trees instead. Therefore, it was expected that there would be a shift of cultivation from vegetable crops to apple trees when the programme was implemented. When the farmers were asked about their cultivation system after the programme was introduced, it was found that they cultivated both crops: vegetables and apples, at the same time and place. They were
cultivating apple trees with vegetable crops underneath. However, the apple trees needed a terraced landscape while the vegetable crops needed a tilted one. Hence, the farmers worked out a way to partly apply both systems. Farmers explained that they cultivated vegetable crops underneath the apple trees so they would have something to harvest every three months while waiting for the apples to grow. Thus, farmers worked their soil to tilt the land a little in order to help the water run through. “I tilted it [the landscape] a little bit so the water still can run, it won’t harm anything compared to the one that I did before, totally tilted.” (F5 Sumberbrantas)

From the technical side, [we] need to see the land condition. If it needs to be terraced then we terraced. Such as from the mountain slope, the scientists [suggested to] measure the degree of the slope, how many seconds of water could drop and such. Maybe [we] should know that, but from farmers, [we] can’t totally [adopt] what the scientists have told us, we need to follow the slope’s direction. (F5 Tulungrejo)

Figure 7.2 The landscape of the terracing system by the farmers in Sumberbrantas village (b), compared to the guideline from the Department of Agriculture (2007, p. 4) applied by the scientists (a)
Figure 7.2 (a), shows the pattern of terracing systems established by the Department of Agriculture (2007, p. 4). It can be seen that the land available for cultivation on every terrace was quite wide in order to give space for the construction of the waterways. Meanwhile, farmers in Sumberbrantas village had their own way of shaping their land. Their land was quite similar to that in Tulungrejo village, the only difference being that those farmers who were involved in the programme and located in Tulungrejo village received vertiver grass to strengthen the terrace. The farmers basically terraced their land; however, as they also cultivated vegetable crops, they tilted the land but only a little. When the waterways should have been made as proposed in image (a), farmers tended to leave the land as it was so that both crops and trees obtained equal water. In her field observations, the researcher noticed the farmers’ perspective about the waterways was that their crops and trees would naturally balance the use of water. In this case, as the vegetable crops needed plenty of running water, the trees would help control the flow of any excessive water as well as hold the contour of the land.

![Image of terraced and tilted land with apple trees and carrots.](image)

**Figure 7.3** While not fully visible from the photo, the farmer has done both systems; terraced and tilted. In this photo, the farmer cultivated apple trees with carrots underneath. The farmer did a terracing system; however, he also tilted the land a little. The photo was taken from direct observation in April 2013.

It can be seen from the quote that farmers had more understanding than the scientists of the condition of the land as they highlighted that not every scientific method could be adopted locally, so it needed common sense in applying methods. In case this applied also to other activities relating to land practices; for example, when asked about pesticides, the farmers’ answer “Everything the same as it was”. What farmers meant was that they still practised mixing the pesticides according to their intuition (to be discussed further in Section 7.3.3) rather than following what had been designed or formulated by science. When the farmers were asked the reason why they preferred using both systems, instead of choosing one of them, the reason given was:
The past experience that [we] think is good, [we] use it until today. [We] combine it with new agriculture technology. For example, applying mulch, [we] didn’t know about this technology before, now we know. Old technology would be by using traditional manure. (F1 Tulungrejo)

We kept the good and left the bad things behind. Like until today my intuition is good so I stick to it, I want better income. If it’s good for my potatoes then it should be good for apples. (F3 Sumberbrantas)

It can be seen that what farmers did in the end was to work it out their own way and try to incorporate these new techniques with their local techniques (other farmers gave similar answers, for example, F5, F7, F10, F16 of Tulungrejo, and F5, F7, F8, F9 of Sumberbrantas). This shows that farmers always searched for the positive sides of the system offered. Even though farmers were tolerant and open to different system of cultivation, they never abandoned their local traditions and rituals, as one of them said:

It does not mean that I do not believe it, but if our ancestors said this week is not a good week for cultivating then it is NOT. Do not try to even trespass against it and keep cultivating. If you trespass it, your crops will not grow. (F3 Tulungrejo, with emphasis)

This is what we feel what is good for us. We are doing these [traditions] for a reason. This is our beliefs. We cannot trespass against it. (F1 Sumberbrantas)

It can be seen that farmers have strong connection with their traditions and rituals. They consider these traditions and rituals as their beliefs and likely to bring good outcomes for them. The quotes also show that farmers had their own fears when it came to the notion of trespassing against traditions. The fear of not perceiving the expected results/production was proven sometimes, when some farmers did manage to break the traditions. As one of them explained:
When I broke the dates, sometimes my crops were not good. Sometimes when I offered the price to the middlemen, these guys tended to play it around, gave me very low price and they did not give me the money right away. One time, when I broke those dates, the seller forgot to give me the money for my crops that I sold to him. (F14. Tulungrejo)

It can be seen that farmers had to bear actual consequences if they broke with traditions. These consequences were clearly not only carried by them but also by their families. The traditions that included their religious values (see Section 7.3.2) might also be the reason for farmers to not go further in trespassing against their traditions. Overall, it can be concluded that farmers, while disagreeing with some of the ways of applying of scientific conservation techniques did not turn them into conflicts. The farmers were being creative and innovative, as shown from the way they merged the scientific systems and their local systems together without leaving their own traditions and rituals. It can be seen that traditions and rituals became their top priority in navigating through these two systems, as the factor of timing in practising these traditions and rituals, as well as the proven consequences, become their references for legitimising their actions.

7.3.2 Ancestors’ traditions imbued with present cultivation practices

It became apparent that some of the rural farmers were not totally open when it came to what they have believed as traditions - a sensitive issue for rural people in Java Island. Therefore, in the Sumberbrantas and Tulungrejo villages, the interviews with the farmers would not start before the researcher became familiar about cultivation practices in these villages. To do this, she mingled with farmers’ wives and their friends every afternoon, shared jokes, and deliberately asked questions about their husbands’ activities in the field. Through this group of wives rich information was gathered about tradition in cultivation practices, which the researcher made reference to and asked about during the interviews.

Nevertheless, to bring up the topic of traditions during interviews was still not an easy task. The researcher began by telling her story about the Javanese traditions in her family, and asked whether the farmers performed the same traditions. This then led to conversations about traditions around cultivation practices. Most farmers were quite surprised that the researcher had knowledge about their culture of cultivation. Farmers were pleased that the researcher acknowledge their way of doing things in regard to traditions, so they were then delighted to explain in detail about their traditions and rituals.
That tradition is our custom. I follow and respect knowledge from our ancestors. Their experience was not just a hundred years, but thousand years. We use that... I respect the suggestion from my parents or grandparents. What I think is, why we have to respect that is because every day, the position of planets and stars out there is changing. The movement of planets and stars influence everything what is on earth. For example, the moon, what certain is the tidal wave influenced by the gravitation of the moon. With this movement will also influence the earth. So, for example, my parents said Monday Kliwon, met the 16th drop, [means] that if you want to cultivate bulbous crops, you have to find the day of fruit drops. If you want to cultivate cabbage, then you have to find the day of leaf drops, and if you want to cultivate tuber roots, such as carrots then you have to find the day of roots drops. It is very complex. There is a particular standard for that. Until today, I am still asking my grandmother or my parents about this. Especially when there is Galengan year, or Javanese people called it 1 Muharram. At certain date of Galengan year I always avoided to start cultivation. It is from my parents’ experience that every Galengan year we should not start cultivation or build a house.

(F1 Tulungrejo)

It can be seen that local agricultural traditions had been carried out for many decades, from generation to generation, stated by this farmer as “thousand years”, which were then embedded in the day to day activities of the farmers. Thousands of years of practising similar traditions become the farmers’ strongest foundation in deciding what to do and what to cultivate in their arable land.

The researcher still tried to capture details of farmers’ traditions, and what they meant for the farmers. It was found that there were certain Javanese and Islamic dates that farmers had to avoid. On those days, farmers were not allowed to do any activities in the fields (see Figure 7.4). The farmers remarked that as those dates moved each year, a careful calculation was needed to ensure that these sacred days were not missed or crossed (see F4 Tulungrejo). Some farmers characterised this calculation as a “prediction”, which means to forecast when these sacred days arrived. In addition, they had to have the consent of other members of the family and colleagues. For example, when a relative had passed away the year before, in the present year, using the Javanese calendar, farmers needed to forecast and decide when his or her
‘Uwas’ date was. This meant that this date was to be avoided for working in the fields. As well as the Uwas date, there are ‘Urakan’ and ‘Galengan’ which also forbid farmers from going to the fields.

Furthermore, farmers’ traditions also included an event called ‘Selametan’. Selametan comes from the word ‘slamet’ in Javanese, which means “survive” in English. This was conducted before and after the cultivation season, in order for farmers to show their gratitude towards the farmers’ God. On this occasion, farmers would gather and send their prayers to God as well as give food to others. For farmers, this event stood as their bridge of hope for the present and next year’s cultivation seasons, which were expected to be more prosperous than before. Farmers also observed Selametan throughout the village. In this case, they would conduct the ceremony by sacrificing their crops and have a parade around the village. This ceremony meant showing their gratitude to their God and also requesting protection from any diseases that might threaten their village.

Figure 7.4 The crops that were sacrificed by farmers of Tulungrejo village, Batu, in the Selametan ceremony. Farmers decorated their crops and showed them around the village as part of the parade on 13th November 2014 (Photo courtesy of Ir. Luki Budiarti).
We have to avoid certain dates, and these dates always moved every year. So we have to be careful when we make a prediction. We will not go to the field when it is the date of Galengan year, the date of 1 Muharram for Muslim people. We also do not do cultivation when it is Urakan, it is the following date of Galengan. Another thing is Uwas, it is the date in the Javanese calendar when our relatives passed away. Sometimes we do Slametan before the harvesting time begins. It is a traditional ceremony by giving food to our neighbours and labours so that the crops from our fields can bring good fortune to us and our land. (F4 Tulungrejo)

<table>
<thead>
<tr>
<th>Javanese dates</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>Uwas</td>
<td>The date that shows the day the elderly passed away in previous years</td>
</tr>
<tr>
<td>Urakan</td>
<td>The following date of Galengan. The date could be at the next following week or month</td>
</tr>
<tr>
<td>Galengan</td>
<td>The new year of Islam</td>
</tr>
</tbody>
</table>
Along with these dates, there was also a combined calculation from the Javanese and ordinary calendars that maintained what type of crops farmers should cultivate in that season (see Table 7.3). Three terms that were used to determine the type of crops, are: ‘tiba oyot’ (root crops), ‘tiba godong’ (leafy crops) and ‘tiba uwoh’ (tuber crops).

Table 7.3. Numbering of calendars according to the farmers

<table>
<thead>
<tr>
<th>Ordinary calendar</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
<th>Saturday</th>
<th>Sunday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>8</td>
<td>6</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Javanese calendar</td>
<td>Legi</td>
<td>Paing</td>
<td>Pon</td>
<td>Wage</td>
<td>Kliwon</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>9</td>
<td>7</td>
<td>4</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Farmers already have the numbers set up each day in the calendars. It was not clear how these numbers were set, as farmers have followed this calculation for decades. What farmers would do was to add the number from the ordinary calendar with the number from the Javanese calendar to decide what type of crops they should cultivate for the next season. For example, when the day was Wednesday (i.e. Legi), farmers have to add the number seven from the ordinary calendar with the number five from the Javanese calendar, from which they will have number 12. This number then helps them decide what type of crops to cultivate.

Overall, it can be seen that the pattern of practising local traditions and rituals was neatly arranged from the beginning to the end of the cultivation process, which showed that these dates had all been through a long process of thinking and observing many (even thousands) years of experience (see quote of F1 Tulungrejo). This included the numbers that had been defined in each day of both calendars; today’s farmers did not know how these numbers were decided upon. The ritual of Selametan clearly shows that farmers’ traditions were not only about how they treated nature but also about religious beliefs, from which it can be concluded that there were three factors that linked together: community (farmers) – nature - religion.

7.3.3 Signs from nature guide local practices

Most of the farmers started to work in the field when they were 17 years old. At the time of the interviews, they were around 50 to 60 years old; thus, it can be concluded that they were quite experienced in cultivation activities. The researcher opened the conversation by asking the farmers how they started their cultivation in the field, and they explained the steps of ploughing the land. When the researcher asked a question about how they processed the pesticides one of the farmers corrected her. This farmer said “Maybe the question is not how
to process but how to mix the medicines” (F1 Tulungrejo). When the question was repeated
the researcher discovered that using or mixing pesticides was not simply a matter of following
what has been written on the pesticide boxes or bottles. The weather, pests, and the condition
of crops turned out to be the determinant factors of how many pesticides that farmers would
mix together.

I have to look at the weather and the condition of the weather. If the
fog suddenly appeared or I found one potato got the diseases, I had to
add a bit more pesticide. (Farmer 3 Sumberbrantas)

I never followed instructions. For me, it is not people who tell crops
but crops tell people. Depends on crops’ condition, what they need.
There are signs for it. Sometimes it can be seen from the back of
leaves. I just randomly seen it. [even] I can see the [crops] condition
from 200 metres away, so I do not need to get close to it. (F15
Tulungrejo)

The quotes reveal that the connection of farmers with nature was quite strong. So strong that
the farmers could specifically identify the kinds of signs from nature that said more pesticides
were needed. That the crops would tell them when and how much pesticides they needed
indicated that the ontology of farmers about nature was something that has its own value, as if
it were a living thing that has its own rights and deserved respect.

Nevertheless, it did not mean that farmers ignored the instructions on the pesticide boxes or
bottles in the first place, as scientists suggested. Farmers explained:

I followed the instruction from the box first, but the results did not
show any good, so I add the dose according to my intuition. (F6
Tulungrejo)

If we follow the instructions from the box, our crops will die. I
wonder why they (the pesticides’ companies) never make the right
dosage. I have to follow my intuition in mixing the medicines. (F3
Sumberbrantas)

The quotes given reveal that following the instructions written on the pesticide’s box or bottle
would only destroy the crops. At first, farmers would follow the instructions; however, they
argued that following the instructions was not efficient and they drew on what they called
“intuition” which was informed by the experience of mixing pesticides for decades. For example:

Usually in one tank of water, I put two spoonful of fungicide and 200 grams of leaves medicines. (F4 Sumberbrantas)

For one barrel I usually put half kilo of fungicides, 100 mL of insecticides and one litre of leaves medicines. That’s the average of the mixture, if the weather is bad then we just add some more, depends on how we feel. (F9 Sumberbrantas)

These quotes clearly show that farmers had used their common sense in accepting and applying new knowledge, which, in this case, was using chemical pesticides. They had noted and observed how following the instructions from the boxes/bottles would end up through experiments that they did repeatedly and examined the results each day (most farmers answered similarly, such as F2,F7, F9, F18 of Tulungrejo, and F3, F7, F8, F10 of Sumberbrantas) . It can be seen that from continuous observation and examination of their experiments, the farmers had decided that the use of pesticides needed to be translated locally, which was combined with their skills of reading nature’s signs. This clearly shows what farmers knew had constructed how farmers knew about the use of pesticides, and vice versa.

It was interesting to discover during the interviews about pesticides that the farmers always referred to the pesticides with their own term, which was ‘obat’ or “medicines” in English. Every time the researcher accidently said the word pesticides, the farmers always corrected with, “Obat you mean?”. It was not clear how referring to pesticides as medicines emerged in the first place. Perhaps it could have been from the term that the government used to translate the scientific language of pesticides when the Green Revolution techniques were first introduced decades ago. Realising that many farmers had only finished or did not finish primary school, a term that was thought to be simple to understand was used. It was so simple that this term medicines was strongly fixed in the farmers’ minds. Referring to pesticides as medicines indicates that the government at that time tried to influence farmers’ mind that only scientific chemicals can cure crop diseases. This also meant only scientific knowledge could answer environmental problems, such as pests. Moreover, from the way farmers mixed the pesticides, there is an indication that the farmers’ way of thinking about pesticides was that by mixing them and adding more whenever needed would instantly cure their crops, as mixing chemicals obviously would result in a stronger chemical reaction. It can be seen too that the farmers’ way of thinking about medicines was constructed from observing and repeatedly
experimenting for many years in order to pursue their own intellectual understanding of pesticides.

### 7.3.4 Decision-making process has a complex social dynamic

From the interviews, it was found that farmers were not alone in deciding which systems would be applied on or to their land. When questioned about what the farmers would do when they had problems in applying the two different cultivation systems they said that they would ask their farmer colleagues and family.

> My family always involved in the discussion about what is going on in our field, especially my wife. Because this is about what we need for our field, and about money that we spent, so we have to discuss it together. (F3 Tulungrejo)

> [Finding help] from the [farmer] colleague. Because they were together with me in the field, so [they] know, [they] understand what is going on in there. It is easier to exchange ideas because together [we] see [the condition]. (F9 Sumberbrantas)

The quotes show that farmers trusted their colleagues and family more. The farmers preferred to discuss their problems with somebody who had a direct and similar experience to them; in this case, it was their colleagues. The farmers thought that it was important to have a discussion with their families as they would also bear the effect of every decision they made. This indicates that farmers were quite thoughtful about their community, as what happened in the field would be mutually shared. It shows that the network links that the farmers valued were those with their kin and within their community.
Figure 7.6 A farmers’ group meeting in Tulungrejo village, which was held on the 5th of every month. As the meetings were always conducted in the evenings around eight o’clock, the farmers would start by having dinner together before they continued with the meetings. In the picture, farmers were filling in the form which was given by the extension officer of the Development of Agriculture. The picture was taken on 5th April 2013 during the field research.

Furthermore, even though farmers valued the advice from their colleagues and family, farmers were still choosing to ignore that advice, “We used good advices” (F4 Tulungrejo). This reveals that what farmers did was to observe and apply the advice they received in their fields and to decide which advice was applicable from results that they received. The process of decision making itself not only showed how trustful farmers were of their communities, but also showed that farmers had to consider many aspects so that the results were accountable for their families and kin. Therefore, it can be seen that local cultivation practices were not only a matter of adopting local techniques, but also a matter of dealing with a complex social dynamic.

7.4 Trust

Trust, yet again, become the key theme when interviews with the farmers were conducted. This theme indicates that being responsible for what had been implemented in the villages was crucial in order to gain farmers’ trust.
7.4.1 Gaining trust requires responsibility

In regard to what scientists had done in Sumberbrantas village, the question was asked about the farmers’ perspective in regard to scientists’ lack of monitoring.

[If] they put something in our village, they should be responsible about it. The government should talk more with us, most of us don’t have any experience of planting apple trees, especially this kind of ANA apple. Even though they asked us what we wanted at that time, [and] we said ANA apple, I thought they would regularly come and check on us, now look what happened. (F7 Sumberbrantas)

[I am] very disappointed. This all useless. What scientists should do was having regular monitoring, at least for the first years, and if there was any improvement they may use our field as the pilot field for other programmes in the future. (F4 Sumberbrantas)

I have to bear the loss because of joining this programme. Scientists ordered us to cultivate the apple trees but they did not mentor us on how to do a proper cultivation. (F8 Sumberbrantas)

It can be seen that farmers had many expectations for this programme. Not only did they expect continuous interaction but also guidance throughout the whole process of conservation cultivation. There was a lot of disappointment and anger detected during the interviews, which indicates that farmers were wholeheartedly ready to adopt this new cultivation system but the scientists had let them down. The farmers were asked whether they thought that scientists were trustworthy after what had happened and one of them replied:

I did when the scientists came here for the first time. Because they did a good deed. But after it went through, I don’t trust them. My trees were dead and they didn’t do anything about it, not even come or asked. (F7 Sumberbrantas)

It can be seen that the lack of monitoring as part of being responsible for the implementation of the programme affected the trust that farmers had in the first place (similar answers to F7 were given also by other farmers of Sumberbrantas, such as F5, F4, F6). The farmers realised that the programme could bring good fortune for their livelihoods, nevertheless they were
more concerned about how those who brought the programme to their village could prove that they were capable enough to be trusted to bring the programme to a satisfactory end.

In contrast to the farmers in Sumberbrantas village, farmers in Tulungrejo village tended to trust scientists because:

We trust the scientists because they came from a university. What they implemented in the village must have been implemented somewhere else and succeeded. Besides that, they kept their promise by giving us apple trees and vetiver grass. (F17 Tulungrejo)

I believe the scientists. They walk the talk. They promised us apple trees, we got apple trees. Besides, they are coming from the university. (F12 Tulungrejo)

I like the incentives. I would believe when there is a proof. Now I still half in half, because there is not any proof yet whether the apple trees would grow according to what they have said in the programme. (F16 Tulungrejo)

It can be seen that due to the intensive communication that was built up earlier, even though it decreased at the end, the farmers had built enough trust in the scientists. There is an indication that the way scientists communicated with the farmers might have been very convincing from which the farmers could conclude that what was implemented in their village must have been implemented and been successful somewhere else. There is also another indication of the limited sharing of information as the farmers seemed not to know that the programme was a pilot programme. Even though it sounded naïve that the farmers trusted scientists due to the scientists being true to their word by giving farmers actual apple trees and vetiver grass, the previous quote about the scientists’ lacking responsibility (see Section 7.3.3) indicated that farmers’ genuine trust in scientists was eventually affected. It can be concluded that in order to be trusted, scientists should not only convince farmers that their programme is good and better than local practices, and stay true to what has been promised - for example, providing apple trees and vetiver grass - but also stay connected and engaged with the farmers throughout the whole process of implementation; most importantly, be responsible until the final stages of the programme.
7.5 Summary

The implementation of the conservation agriculture programme required farmers to shift away from local practices to scientific agricultural practices, in which the adoption of conservation techniques was a must. Interviews with the farmers showed that farmers had their own perspectives about the implementation of the programme. The themes reveal that the implementation lacked responsibility from the scientists, and there was also an indication of limited sharing of information about the programme to the farmers. In addition, the farmers revealed a concern over the inclusion of their knowledge during the implementation of the programme, in which they expected scientists to incorporate their local knowledge.

When there was an expectation from scientists that farmers would adopt scientific conservation techniques and leave their local practices behind, what farmers did instead was to navigate both systems, local and scientific, at the same time and place, as part of their management of past and present practices. The themes reveal that farmers had different ways of knowing and ontology, because their ancestors’ traditions imbued their local practices. Farmers’ ways of thinking can also be seen from the theme that signs from nature guide their local practices, and how the land practices were not only a matter of adopting particular techniques but also a matter of making accountable decisions in front of the farmers’ families and kin. The farmers’ decision-making processes showed this complex social dynamic. Yet again, the subject of trust was raised in the interviews with farmers, in which the theme revealed that gaining trust required scientists to take responsibility for what they had implemented in the villages.

A summary of the themes from the results chapters will be presented next.
Key themes across the Results Chapters

From an analysis of the interviews presented in Chapters 5 to 7, several overarching themes are found. Five key themes can be drawn from those chapters, in which the sub-themes of these key themes are distributed in each chapter. Those five key themes are as follows:

1. **Trust**

   The issue of trust emerged from the interviews. Trust is also the element that Folke et al. (2005) emphasise will emerge when power is equally shared among stakeholders. Each of the actors that were involved in the programme had different interpretations about how trust can be established and fostered. The public agency representatives believed that trust can be gained by using the local language when they had dialogue with farmers. The existence of demonstration plots in order to give a direct example to farmers about the scientific agriculture techniques was also part of the scientists’ attempt to gain trust from the farmers (Chapter 5). The field person, however, had different views from the scientists about gaining the farmers’ trust, in that he said it was more than just using the local language, it was from the way knowledge was delivered that put the farmers in a situation they were comfortable with. He also argued that trust could be gained from providing actual results of the adoption of conservation techniques in the demonstration plot (Chapter 6). Farmers, on the other hand, believed that trust would be gained by being responsible for what had been implemented in their villages, by staying engaged and connected throughout the whole process of implementation and, more importantly, in conducting a monitoring process. (Chapter 7).

2. **Local traditions, rituals and practices**

   This theme provides the overarching analysis of how each stakeholder addressed the farmers’ traditions, rituals and practices as part of local knowledge in the implementation of the programme. Knowledge governance emphasises a different way of knowing and ontology from the stakeholders ways of knowing (Van Buuren, 2009; Castree, 2005; Duncan, 2016; Watson, 2013). The sub-themes indicate that each stakeholder had different interpretations of local knowledge. Scientists had addressed local knowledge as the techniques of local cultivation, and they stated that this local cultivation had been integrated in the implementation of the programme.
With this conception of local knowledge, farmers’ traditions and rituals were considered as only minor activities that should not be given more attention, as they are part of myths (Chapter 5). The field person was attuned to local knowledge as the unity of traditions and practices that farmers had learned from generations; however, the aspect of traditions and rituals had been excluded from the programme (Chapter 6). Farmers described their knowledge of cultivation as including their traditions, rituals and practices, all of which were connected to each other. Their reliance on nature’s signs and the way they framed pesticides as medicines indicated different ways of knowing and ontology from that of scientists in defining each component in the cultivation process. Intermingled with their traditions and cultural practices, their community and colleagues influenced their decision-making process, showing that the farmers’ social dynamic was complex. Importantly, instead of choosing between two cultivation systems, what farmers did was navigate the two systems, local and the scientific, at the same time and place as they managed their past and present practices (Chapter 7).

3. Programme implementation and its challenges

This overarching theme indicates that knowledge of the conservation programme was delivered in a formal setting. Even though in Tulungrejo village scientists had tried to develop their communication with farmers through two-way communication at the beginning, after a time the communication became one-way, which similar to the case in Sumberbrantas village. Several challenges were identified when the programme was implemented, for example, the existence of hierarchical institutions in Indonesia, the lack of scientists’ commitment (Chapter 5), scientists overlooking the farmers’ cultural aspects, farmers’ ignorance due to scientists’ poor time management and the work of the field person being more than just a mediator due to scientists’ lack of coordination and commitment (Chapter 6). From the farmers’ points of view, the scientists lacked responsibility and the farmers also had concerns over the inclusion of their knowledge in the implementation of the programme. The sub-theme reveals that there was also an indication of limited sharing of information with farmers about the aims of the programme (Chapter 7).
4. **Communication**

Agrawal (2005) and German et al. (2010) argue that the way power is deployed can be seen through the way stakeholders engaged in communication, either one-way or two-way. This overarching theme indicates that one-way communication was deployed at the end by scientists in implementing this programme. The problems of communication between public agency representatives were also indicated in the interviews (Chapter 5).

5. **Problematic framing**

The process of knowledge governance, which gives more spaces for the involvement of local knowledge, should be freed from the narrow framing of others’ views, as this can influence the effectiveness of communication between stakeholders (Carr & Wilkinson, 2005). This overarching theme indicates that there were framings that been set by the scientists. For example, the theme reveals that scientists had framed conservation cultivation as scientific techniques and practices only, and framed farmers who were involved in the programme as commercially driven individuals (Chapter 5).

The next chapter will provide a discussion of the key themes that link to the conceptual framework (Chapter 3).
Chapter 8

Discussion

8.1 Introduction

This chapter links the research findings to the conceptual framework, outlined in Chapter 3. This research was conducted to investigate knowledge governance in practice through the implementation of the conservation agricultural programme in two rural villages in East Java, Indonesia. Indonesia committed to improving the quality and quantity of its agricultural products after the Green Revolution, from 1969 to the 1990s, had put its arable land into a critical condition (Adimihardja, n.d; Nugroho, 2011). Not only were farmers under duress when this programme was implemented, but also the agricultural land of Indonesia was degraded due to the way it was being cultivated. Conservation in the agricultural sector was outlined by the Indonesian government as part of a new paradigm to improve the condition of arable land in Indonesia, specifically in Java Island, after the Bangkok Declaration in 2001 (see Section 1.2). Conservation agriculture was also part of the environmental policy programme outlined by the East Java provincial government through its Provincial Environmental Bureau (PEBEJ), to improve the water quality of the Brantas River. This conservation agriculture policy was related to the paradigm outlined by the Government of Indonesia in the Bangkok Declaration. From the Bangkok Declaration in 2001, the Indonesian government then emphasised the important of having rural farmers participating in the decision-making process. The FAO also set guidelines to assist with the implementation of participation (see Section 2.3.2) in agricultural and rural development (Van Heck, 2003). With the new paradigm, and supported by Indonesia’s decentralisation laws (no. 22/1999 and no. 25/2000), it was expected that Indonesia’s local governments and communities could empower themselves to regulate and manage their affairs and the use of their own agricultural resources effectively. Previously, the Indonesian government adopted centralisation laws, through which the central government controlled the use of local natural resources. Therefore, with the adoption of decentralisation laws, it was hoped, local governments and communities could work together to decide how they would effectively use and manage agricultural resources within their area to improve their social and economical livelihood. The Indonesian government’s vision was that local farmers would become the final decision makers in the implementation of agricultural policy. This would be achieved by opening up participation between government and local farmers to encourage power sharing in decision making. Guided by the decentralisation laws and new paradigm in the agricultural sector, the inclusion
of local knowledge became a key aspect of the introduction of conservation practices to agriculture.

In 2008, The East Java province started its conservation agriculture programme, through its Department of Agriculture. However, the results were far from what was expected. Reports from those programmes revealed that implementation had problems. For example, there was no coordination between bureaucrats within the Department of Agriculture and its extension officers who ran the programmes, and a problem with the farmers who did not want to develop communication with the extension officers. Overall, conservation agriculture, which was first introduced by the Department of Agriculture, did not promote participation with local farmers, as the Department of Agriculture had applied one-way communication in the implementation of its programmes. In this case, it wanted to put programmes in place according to the guidelines from the Ministry of Agriculture, without giving any space for the farmers to deliver their ideas and thoughts (see Section 2.5).

Even if participation was included in the Department of Agriculture’s programmes, it can be problematic in its execution (Arnstein, 1969; Bremer and Glavovic, 2013). As shown by Arnstein (1969), participation may seem to give legitimacy to others but not guarantee that everyone involved is empowered (see also Bremer and Glavovic, 2011). Participation can turn into an arena for exerting power and manipulating others (Arnstein, 1969). By not having equal power, there will be a possibility that the benefits of the final decisions only go to certain stakeholders. This can be seen from how Arnstein (1969) configures the levels of participation, to show to what extent local communities have or do not have power in participation (refer to the Arnstein’s ladder in Section 3.2, Figure 3.1). The fact that the conservation agriculture guidelines were delivered top-down from the bureaucrats in the Department of Agriculture to their extension officers, then to the farmers, made it difficult for the inclusion of farmers in the decision-making process. Their local knowledge was also not taken into account, as the government was only concerned with the application of the programmes and fulfilling the requirements that had been set by the Ministry of Agriculture (see Section 2.3.2). As stated by Wesselink et al. (2011), the inclusion of the local community’s perspectives is difficult to achieve if the laws and regulations remain top-down. Hence, even though the designs of participation processes are being improved, the existence of hierarchical laws can affect the quality of the output (Wesselink et al., 2011). In other words, participants may feel disappointed and frustrated about the outcome as it might not represent their interests and consents.
In light of the Department of Agriculture’s failure to adequately incorporate the local knowledge of the farmers as they adopted one-way communication, the Provincial Environmental Bureau of East Java (PEBEJ) introduced a new paradigm for implementing conservation agriculture. The PEBEJ had their own programme of conservation agriculture that scientists joined in order to put this programme into place. PEBEJ (2010) maintained that farmers should be included from the planning stages to the evaluation stages of conservation agriculture programmes so the programmes can be sustained and the environment can be preserved for future generations (see Section 2.5). To achieve this, scientists included local farmers in the process of implementation of the programme.

Two rural villages, Sumberbrantas and Tulungrejo, the focus of this research, were chosen for this pilot programme because they are located upstream of the Brantas River and have many spring water sources within their catchments (see Section 4.3.1). It was believed that the way farmers cultivated their arable land had affected the water quality of the river downstream.

The aim of this research was to investigate knowledge governance in practice. It did so in the context of a government-led conservation agriculture programme, that was piloted in East Java, Indonesia. This programme sought to involve farmers and their knowledge in its development and implementation in order to reach environmental sustainability. It was hoped there would not only be an improvement in environmental conditions but also in farmers’ incomes. What occurred through the programme in these villages provided an opportunity to investigate how farmers encountered scientific knowledge and how the scientists encountered farmers’ local knowledge. Moreover, as conservation agriculture was a new knowledge paradigm for farmers, it was important to investigate their perceptions and how they incorporated (or not) this knowledge within their existing knowledge systems. Therefore, three exploratory research questions were identified to achieve the research aim:

1. How is the conservation agriculture programme delivered in East Java, Indonesia?
2. What are farmers’ perceptions towards the programme of conservation agriculture?
3. How do farmers navigate divergent knowledge systems?

To frame these research questions, a conceptual framework of ‘knowledge governance’ was developed and has been used to frame the analysis of the research findings. Knowledge governance contributes to theorising how divergent knowledge systems could and should be governed in order to gain a deeper understanding about different ways of knowing and to develop better responses to complex environmental problems (Van Buuren, 2009; Van
Kerkhoff, 2013; Van Buuren & Eshuis, 2010). From the literature of knowledge governance, it was identified that there were crucial concepts that needed to be considered: ontology, ways of knowing, power and scales of knowledge (Giebels et al., 2015; Ahlborg & Nightingale, 2012).

The field research was conducted from March to August 2013 (see Chapter 4). There were 35 respondents interviewed, including rural farmers, scientists, a field person and a government agency. Qualitative research methods were used with semistructured interviews. This discussion chapter links the research findings (Chapter 5 - 7) with the conceptual framework in Chapter 3. It is divided into following sections:

Sections 8.2, 8.3 and 8.4 address the research questions directly. This will be followed by an explanation of the main themes across the results chapters, in Section 8.5

Section 8.6 provides a discussion of key aspects of knowledge governance based on key themes from the research findings - ontology, way of knowing, scale of knowledge, and power.

Section 8.7 provides a discussion of knowledge governance and its concepts, proposed by many scholars; these are knowledge integration, knowledge coproduction and coproducive capacities.

Section 8.8 provides an introduction and discussion of coexistence as a new concept of knowledge governance

8.2 How is the conservation agriculture programme delivered in East Java, Indonesia?

The research findings identified themes about how the conservation agriculture programme was delivered, which was in a formal setting. Scientists mainly relied on PowerPoint slides to help their presentations with the expectation that the farmers would change their ways of cultivation after they heard the scientists’ explanations and saw the PowerPoint slides. The presentation materials were in English and Bahasa; however the scientists communicated with the farmers using the farmers’ local language, which was Javanese. The contents of the presentation materials, the way scientists decided what was best for farmers without farmers’ input into planning meetings, and the absence of reflexive dialogue showed that the knowledge was delivered through one-way communication. Even though scientists made an effort to have two-way communication at the beginning of implementation in Tulungrejo
village, in time one-way communication took over. This can be seen from the lack of monitoring and the failure in actively shared information and knowledge with each other. Moreover, during the implementation challenges emerged. The analysis identified themes, such as hierarchical legal laws that affected the way the budget was spent and the way scientists ran the programme. In addition, there was also lack of commitment from the scientists, which was shown by their lack of responsibility and accountability, due to having too many other agricultural programmes to handle. Problems of communication within the team occurred, as the scientists were not honest and open with each other, and tended to hide problems that occurred in the field. From the point of view of the field person, who was constantly in contact with the farmers, the research findings identified themes that showed that the scientists had overlooked important cultural aspects of the farmers’ daily routine. This was revealed through sending invitations to farmers for meetings to be held at the wrong time of day. The field person felt that there was an ignorance from farmers, as they did not do what they had been told to do in adopting the conservation agriculture techniques. The field person also complained about the scientists’ poor time management, which showed how the programme was run in a rush. He was also upset about his role in the programme’s implementation which was far more than a mediator due to the scientists’ lack of coordination and commitment. In all, it was shown that the delivery of the knowledge around conservation agriculture faced many challenges. Yet again, one-way communication was used by the scientists in the implementation of the conservation agriculture programme. Problems occurred not only in communication between scientists but also in their commitment and time management in conducting the programme.

8.3 What are farmers’ perceptions towards the programme of conservation agriculture?

In regard to farmers’ perceptions of the programme, the analysis identified themes such as the scientists’ lack of responsibility. This was shown from the lack of monitoring that was carried out; and the information they shared with farmers that was limited to the techniques of conservation agriculture. Scientists did not explain what the conservation agriculture meant to the condition of the Brantas River (i.e. the main aim of the programme). Farmers were concerned about the lack of inclusion of their knowledge. They expected that their knowledge would be included in the programme after it was realised that farmers and scientists had different perspectives about the cultivation system. In other words, the farmers’ role in the implementation of the programme was quite limited, and obviously their knowledge was not considered.
8.4 How do farmers navigate the divergent knowledge systems?

The analysis identified that instead of leaving their cultivation practices behind as expected by the scientists, what the farmers did was navigated the two systems together, in order to manage both existing and new cultivation practices. For example, farmers who installed the terracing system also adopted the tilted landscape. Farmers cultivated apple trees and crops underneath those trees at the same time and place. This was done in the hope that they still could obtain income from their crops every three months while waiting for the apples to grow. Farmers did not leave their traditions and rituals in the navigation of these systems as they came from the farmers’ ancestors and were embedded in their present practices. Farmers relied on nature’s signs to guide their local practices and did not follow what had been designed by the scientists, and their decision-making process showed their complex social dynamic. This was because the farmers’ final decisions had to represent what they perceived as consent from their community.

8.5 Key themes across the results chapters

Key themes identified from analysis and presented across the results chapters were: trust; programme implementation and its challenges; local traditions, rituals and practices; problematic framing; and communication.

1. Trust

The analysis identified trust as a key theme. It was found that each stakeholder had different views about how trust can be established and fostered. Scientists thought that farmers’ trust could be gained from using their local language to communicate and maintaining a demonstration plot. The field person argued that it was more than just using the local language in order to gain trust. He believed that the way knowledge was delivered through audio-visual tools along with the environment that supported the process of knowledge delivery was far more important in establishing farmers’ trust. He also maintained that actual results from the demonstration plot would gain farmers’ trust rather than the process of having conservation techniques in that plot alone, which during the programme it did not show. Conversely, the farmers maintained that gaining trust required a responsibility to continue the programme to the very end, which included having in-depth and two-way communication, engaging with farmers and conducting appropriate monitoring until the end of the programme.
2. Programme implementation and its challenges

The implementation of the programme had many challenges. These included hierarchical institutions; lack of commitment from scientists due to a lack of responsibility and accountability; and overlooking the important cultural aspects of the farmers’ daily routine, such as the time of day when scientists invited the farmers to attend a briefing. The challenges identified by the field person were the ignorance of farmers towards advice that was given to adopt the conservation agriculture techniques; scientists’ poor time management; the work of the field person, who was more than a mediator due to the scientists’ lack of coordination and commitment; scientists’ lack of responsibility according to farmers; limited sharing of information with farmers; and concern over the inclusion of local knowledge in the programme.

3. Local traditions, rituals and practices

The analysis identified local traditions, rituals and practices as another key theme. Each stakeholder had different views about how these elements should be treated during the implementation of the programme. Scientists argued that local knowledge meant local cultivation techniques, in which the traditions and rituals embedded in them seemed to be simple activities that did not need further consideration as they were parts of myths. The field person was concerned that local knowledge was excluded, specifically, farmers’ traditions and rituals in the implementation of the programme. Farmers’ cultivation practices were imbued with their ancestors’ traditions and they used signs from nature to guide their local practices. These clearly showed the different epistemology and ontology in cultivation practices between local and science (i.e., between farmers and scientists). Farmers’ traditions and rituals guided the navigation of the two cultivation systems to respect the ancestors and bring expected outcomes. The complex social dynamics of farmers was shown from their decision making process. Through this process, it was shown that cultivation practices in rural farming were not only about adopting local techniques but also about considering many aspects so that the results were accountable for farmers’ families and kin.
4. Problematic framing

Problematic framing was identified as a key theme. In this theme, scientists maintained that conservation techniques were mainly about scientific techniques and practices, and farmers were regarded as people who did not know enough about the technology or have sufficient scientific knowledge about their cultivation system. Scientists also maintained that farmers who participated in the programme were commercially-driven individuals. It was for these reasons that apple trees and vetiver grass were provided as they were expensive to buy in the market.

5. Communication

Communication was identified as one of the key themes. From the way scientists and the government conducted planning meetings, implemented the programme, and how the programme was ended, it can be concluded that one-way communication had been adopted. Even though scientists had made an effort by conducting two-way communication with farmers, for example, they tried to meet regularly with farmers in Tulungrejo village at the beginning of the implementation - in time scientists failed to actively share information and knowledge with them. The problem of communication between scientists was also identified. There was no openness or honesty between them. This affected the way scientists presented the final reports of the programme, in which the farmers’ responses or problems in the field were nowhere to be found, as reflexivity was absent.

8.6 Key aspects of knowledge governance

This section links these key themes to the key aspects of knowledge governance set out in Chapter 3: ontology, way of knowing, power and scale of knowledge.

8.6.1 Ontology

Ontology is about what exists in the world. Castree (2005) argues that it is important to understand how people frame nature because, without knowing this, the nature being referred to will not be known. Scholars maintain that the ontology between scientific and local knowledge is quite different (Castree, 2005; Hinchliffe, 2007; Machnaghten & Urry, 1998; Nadasdy, 1999; Fischer, 2005). The ontology that underpins science conceives nature as independent and separated from society. This means that anything that happens in nature is independent from “human imagination, dreams, and schemes” so they need to be removed (Hinchliffe, 2007, p. 8). In contrast, the ontology that underpins local knowledge conceives
nature and society as closely interacting and woven together (Hinchliffe, 2007; Irwin, 2001). This means, nature and society mutually constitute one another until it is not possible to distinguish which one is the beginning and which is the end (Machnaghten & Urry, 1998).

The theme of local traditions, rituals and practices is in line with the statements from these scholars. The research showed that scientists categorised local knowledge as local cultivation techniques. Local traditions and rituals which were embedded in local cultivation practices were not thoroughly considered, as they may not have made sense from some perspectives; for example, one of the scientists considered them as myths, thus they became a challenge for the implementation of the programme. This particular research finding is in line with Hinchliffe’s (2007, p. 8) statement, which farmers’ traditions and rituals are only considered as “imagination and schemes” because scientists could not understand the logic and concrete reasons behind these activities. Therefore, they were dismissed, even though the practice of these traditions and rituals had been undertaken for “thousand [of] years”, as stated by the farmers, and had a key role in creating nature.

However, the research theme identifies that farmers not only have their ancestors’ traditions imbued with meaning, but also that signs from nature were guiding their local practices. These findings are in line with the arguments of Hinchliffe (2007) and Irwin (2001), who state that nature and society interact and are woven together. Through traditions, farmers decided when they would start their cultivation activities, what type of crops that they would cultivate, what days they should not be in the field and when to have the Selametan ritual. These rituals were not only for sending gratitude to their God but also to plead for success in their cultivation. The occurrence of Selametan, which was related to religious beliefs, had also been outlined by Fischer (2005, p. 201), who states that the understandings of a society may be related to “mystical and religious beliefs.”

Notwithstanding the obvious concern about the overuse of pesticides, the extent to which farmers relied on signs from nature to guide them in the mix and use of pesticides, illustrates how nature and the farmers were constructing each other (Hinchliffe, 2007; Irwin, 2001; Machnaghten & Urry, 1998). Farmers’ practices and their apparent incomprehensibility towards suggestions to do otherwise, illustrates how difficult it is to identify whether nature has constructed the farmers’ ways of thinking or vice versa. The way farmers treated nature was also shown from their way of thinking about pesticides as “medicines” that they believed could rapidly cure crops when they mixed and applied them in response to different weather conditions. This way of thinking was believed to come from years of observing and repeating.
experiments to pursue their understanding about pesticides, which then become part of their “culture” to be maintained.

Nadasdy (1999, p. 5) argues that nature for local people was more than just a “product of human intellect” but “as one aspect of broader cultural processes that are embedded in complex networks of social relations, values, and practices which give them meaning.” In other words, to talk about nature and the values of nature, local people must consider their social relations with nature and the values of nature for their group, which they relate to the way they conduct their practices to the environment. The research findings also support those of Nadasdy. It was shown that farmers’ making decisions about cultivation activities must consider advices from their colleagues and families before they made the final decisions in regards to what they would do with their arable land. Farmers had to make sure that their final decision, which determined what they would do to their land, fulfilled everybody’s interests. In this way, the outcome of their agricultural activities would not only give prosperity to their own family but also to the community of their villages. This shows, as Nadasdy stated, how encounters and engagements with nature have become an aspect of the cultural process embedded in farmers’ social relations.

8.6.2 Way of knowing

Way of knowing is an important epistemological concept that underpins knowledge governance (Van Buuren, 2009). Castree (2005) argues that a focus on ways of knowing highlights the various knowledge practices that frame, guide, and constrain how people know the world. These knowledge practices can shape understanding, behaviours, and practices towards nature. Scholars argue that the way science knows the world is through the presumption of an ideal situation: a situation whereby the parameter, it seeks to understand, can be controlled. Through practices that rely on a “formal hypothesis” and repeated variable observation, measurement, calculation, and experimentation, findings are conveyed in formal written texts (Fischer, 2005, p 204; Sillitoe, 2007). Whereas, the local way of knowing the world is through careful observations and common sense in “noting the results of everyday experiences” (Sillitoe, 2007, p. 3), which are “derived from many years of experience” and become “parts of cultural traditions” (Fischer, 2005, p. 201).

In responding to the Indonesian government’s change in policy and in implementing the provincial government’s conservation agriculture programme, scientists presumed that the water quality of the Brantas River could be controlled when the farmers appropriately adopted scientific conservation techniques and practices. The analysis identified how scientists saw
conservation techniques as scientific techniques and practices that relied on particular ways of knowing, which themselves relied on verification, measurement, and calculation. It was assumed that if farmers could verify results with scientists, for example, with the demonstration plot, farmers would be convinced. In supporting the demonstration plot, the scientists included it as their part of the experiments in conservation agriculture by putting in a clinometer - an instrument to measure the angle of a slope, so that the loss of soil nutrients due to the water flow can also be measured. Nevertheless, the analysis showed that farmers had different ways of knowing. Farmers had been making careful observations about the use of pesticides for many years, they knew what worked and what did not work and how to respond to local weather conditions. While their starting point was what was written on the box, they relied on nature to tell them what decisions to make next. As stated by Sillitoe (2007, p. 3), “results of everyday experience”, have shaped these farmers understanding about these scientific chemical products and pesticides and the need for the instructions to be translated locally, which was through noting the signs that nature had sent to the farmers. This way of knowing and engaging with nature is evident in the Tulungrejo farmer’s statement, “It is not people who tell crops but crops tell people” (F15 Tulungrejo). The findings also support Castree’s (2005) argument that farmers’ conception of the world (i.e., ontology) is shaped by knowledge practices.

8.6.3 Power

Another key concept of knowledge governance is that power should be equally shared among stakeholders in the decision-making process. Power sharing would give recognition to the role of local people in the decision and knowledge-making processes. Power sharing also gives opportunities to stakeholders for their opinions to be heard, and they would receive similar information (Edelenbos et al., 2011; Innes & Booher, 2010). Mutual trust, as argued by Folke et al. (2005), can also develop and improve with the occurrence of power sharing. German et al. (2010), with support from Agrawal’s (2005) example about the raikas shepherds in India, argue that without equal power between stakeholders, specifically in giving unequal power to local people, local people might be reluctant, or refuse, to apply the programme in accordance with the government’s wishes.

The analysis identified that although the process started out with efforts from scientists to communicate with farmers through dialogues, one-way communication was adopted by the scientists. Scientists thought that they knew what was best for farmers, even though they never invited farmers to every planning meeting that was held. In addition, the way knowledge was delivered was that the scientists wanted farmers to change their land practices
by adopting the scientists’ scientific conservation techniques, but without any willingness from the scientists, in turn, to learn about the farmers’ perspectives and ways of cultivation. Even though scientists had tried to develop two-way communication with farmers in Tulungrejo at the beginning of the programme’s implementation, eventually they failed to actively share information and knowledge with farmers. In the end, for this village, one-way communication persisted. The findings support German et al. (2010) who say that when one-way communication is adopted, power is not equally shared between stakeholders as power is mostly exercised by higher levels of bureaucrats or policy makers. In this case of a conservation agriculture programme, power was mostly exercised by scientists executing government environmental policy in order to regulate the way farmers treated their arable land. In relation to Arnstein’s (1969) ladder of participation, this programme was at the level of tokenism, in which farmers’ opinions were heard but they still lacked the power to ensure their opinions were considered by the scientists.
Figure 8.1 One-way communication of the implementation of conservation agriculture programme.

Figure 8.1 shows how knowledge was delivered through one-way communication. Scientists expected farmers to follow the guidelines that they had set. Power was not equally shared between scientists, the field person and farmers, as scientists wanted to maintain the implementation of the programme and believed that they knew what was best. Farmers became an absolute receiver of knowledge. Farmers had the opportunity to give their opinion about the programme, but they did not have power to ensure that their opinion was considered by scientists (dashed arrow). Farmers had limited opportunities to speak about their traditions and rituals, as everything about the programme had been decided by scientists from the beginning - what farmers had to do was simply follow instructions. For example, the
discussion between scientists and farmers was only limited to conservation agriculture techniques, apple trees and vetiver grass.

Farmers might not have a voice in the discussion arena nor they would be heard, but from the research findings, it is clear that farmers had ultimate control over what would be done in the field. Scientists directed farmers to apply scientific conservation techniques, however, what farmers did was blend the two systems together, in order to align their existing practices and the new. Farmers worked on their cultivation and conservation systems at the same time and in the same place. Farmers cultivated apple trees with crops underneath the trees, or adopted a terraced landscape but tilted the land a little at the same time. Even though they accepted the conservation system and worked it together with their system, both systems had to still follow the farmers’ traditions and rituals. In other words, traditions and rituals were still the top priority for the farmers in both cultivation systems.

Apart from the case of traditions and rituals, the fact that farmers had ultimate control over how the techniques of cultivation would run was also possibly due to the scientists’ lack of time management and commitment. In this case, scientists did not develop continuous interaction and communication with farmers, nor they did monitor in the field during and before the programme was ended. It was therefore, the farmers who took over the whole process of implementation of the programme in the field. This shows that practicing one-way communication does not mean always putting stakeholders with less power in an unjust position. Farmers in Tulungrejo and Sumberbrantas villages have shown us that they too have the power to decide the future of their land when the scientists and the government (with more power than them) did not function the way they should.

This research finding challenges the argument of German et al. (2010) and of Agrawal (2005) about the refusal of local people to apply the programme expected by the government. The research finding shows that farmers welcomed the programme; however, the application should have been done in accordance with what farmers believed and wanted. Farmers and scientists have different perceptions and ways of knowing about cultivation techniques and their implementation, which may result in friction and refusal to follow the programme. However, farmers could resolve these frictions in a non-violent way and peacefully, by aligning the two cultivation systems together. Farmers accepted the differences between them and scientists, and embraced what was worthwhile from their and the scientists’ knowledge systems.
With a focus on knowledge governance, the research results also challenge the argument from Folke et al. (2005) who state that mutual trust can be developed and improved when power is shared equally. While the link between mutual trust and power is not being questioned, the results show how each stakeholder had a different conception of trust and how trust can be established and fostered. Hence, the findings show that trust is a complex concept especially in communities that retain close religious and cultural relationships. The research findings show that farmers relied on their interaction with communities in developing trust. Farmers’ trust was more linked with having the feeling of good friendship, companionship, sharing similar emotions, and having similar agreement. Meanwhile, scientists were seeing trust only in terms of predicting that farmers would do what the scientists wanted them to do. These facts are strongly in line with the statement of Lucas et al. (2015) that there is only a little focus given to the meaning of trust in the academic literature, because capturing the meaning of trust in reality is so complex, yet scholars, such as Folke et al. (2005) did not give further attention to it.

Research findings are in line with the argument of Lucas et al. (2015), where they state that scholars generally define trust as merely based on rational decision making only, or as the long-term consequences that actors would obtain by making those decisions. For this study, gaining trust from farmers was seen by scientists as the consequences that they would obtain when they decided to have the demonstration plot and deliver the presentation in the local language. Other than the demonstration plot and the presentation, the field person added that the production result from the plot and the surrounding environment when knowledge delivery started could gain farmers’ trust. Scientists and the field person seemed to define trust in a much simpler way than the farmers. The trust that scientists and the field person defined does not have any emotional feeling to it, as the trust that they meant only revolves around the prediction of what farmers would do and what situations would occur, which is in line with Changing Minds (2017).

However, from the farmers’ perspective, gaining trust required responsibility through the implementation of the programme, including continuous communication and engagement with farmers, and also by conducting proper monitoring. This research finding shows that there is emotional feeling in the way farmers described their trust, because continuous communication and engagement relate to “companionship, friendship,..[and] agreement” (Changing Minds, 2017, Introduction, para. 1) between scientists and them on how to maintain the field. Moreover, this research finding supports the argument by Lucas et al. (2015), in which farmers have built their strength, their sociocultural dynamics, and their way
to survive in life by having social interaction, cooperation and interdependence with their families and farmers’ colleagues and community, from which, trust and trustworthiness will proceed. This fact, however, has been neglected by scientists and the government, and moreover, has been given limited attention by some scholars.

In the implementation of the programme, therefore, knowledge exchange between farmers and scientists did not run well, as it was influenced by the different definition of trust that they had. The research finding shows that scientists only shared knowledge about the scientific cultivation system without having further discussion of why the system was necessary to the improvement of water quality in the Brantas River. Not only did the scientists not find further reasons as to why farmers had to have traditions and rituals, but the farmers also were seen to be selective in sharing that information, as they would not discuss it unless they were asked about it. This situation relates to the statement from Levin and Cross (2004), that trust could make people either have a willingness to give useful knowledge or listen and absorb knowledge from others. Strong willingness to give useful knowledge or listen to others knowledge would emerge if strong ties between stakeholders occurred, as they have strong emotional bonds. However, the relationship between scientists and farmers were not well developed, because the way they each define trust is quite different, which influences the way they shared knowledge and information, with no emotional bonds attached. This, however, resulted in not having a common way of thinking and communication between farmers and scientists (Levin & Cross, 2004).

In all, it can be concluded that the development of trust is complex, and this research case has provided some insights into the need to be clear about what trust is and how it should not be taken for granted.

8.6.4 Scale of knowledge

It is argued by Cash et al. (2006b) and Ahlborg and Nightingale (2012) that matching scales of knowledge is always a challenge in the decision-making process. These authors argue that different epistemologies and ontologies need to be considered in governance processes that seek to put knowledge into action on the ground. Cash et al. (2006b) point out that there would always be a challenge in matching the scale of what people know about how the world and what actions should be taken. Scholars, such as Ahlborg and Nightingale (2012), Duncan (2016), Wynne (1992) and Nadasdy (1999), have given examples of how mismatches in knowledge scale have resulted in different conceptions, problems, solutions, and conflicts ended up in conflicts of interest among stakeholders about particular environmental issues.
This mismatch of knowledge scale was identified in this research. For scientists, knowledge in cultivation encompassed cultivation techniques informed by scientific knowledge. It was not influenced by social traditions and local cultural practices; whereas for farmers, cultivation knowledge was about everything, including their ancestors’ traditions and rituals, signs from nature, and social relations that showed through their decision making process. In summary, mismatched scales in knowledge were identified in this research.

8.7. Knowledge governance: the practice

Current theorisation of knowledge governance focuses on how divergent knowledge systems are to be governed through the development of institutional processes. The expectation is that creating, sharing, accessing, or using knowledge will ensure that knowledge is translated into action (Van Kerkhoff, 2013). Scholars, such as Gerritsen et al. (2013) and Van Kerkhoff, maintain that adopting knowledge governance will allow stakeholders to understand more about the divergent knowledge systems that come to bear on environmental issues. Improving how knowledge is governed is expected to ensure that the role of local knowledge is better recognised. This is because knowledge governance encourages dialogue between stakeholders who have different ways of knowing and thinking about particular environmental issues (Van Buuren & Eshuis, 2010). Gerritsen et al. argue that knowledge governance is a promising concept. This is because, it is about being creative and innovative in order to solve environmental problems, as well as developing innovative ways for stakeholders to be involved in order to produce shared knowledge. With these aspirations, knowledge governance involves reflexive learning whereby all stakeholders are expected to learn to challenge previous assumptions, realities that exist, ideas and their routine activities (Gerritsen et al., 2013). It is hoped that by adopting knowledge governance, the role of local knowledge can be recognised, and also local people can learn how to be self-organised, in terms of, being open to different views, new patterns, cultures and ready to engage in any experiments (Gerritsen et al., 2013). Therefore, these formulations of knowledge governance have been conceived to regulate “the development and use of new scientific and technological knowledge” (Gerritsen et al., 2013). On this basis, the involvement of local knowledge in the production of shared knowledge, and the processes of reflexivity required under knowledge governance frameworks, are expected to “enrich” the development of scientific knowledge and “smooth” the implementation of environmental policy in the real world.
Relatedly, the work of Van Buuren and Eshuis (2010, p. 284) in the field of environmental management defines knowledge governance as the process of creating new insights and finding innovative solutions that would tempt actors to leave their “traditional insights and practices, and get away from inert interaction patterns, stalemate negotiations, and interests conflicts.” These authors identify the strategies of knowledge governance as: translating policy problems into questions for research; mobilising knowledge institutes to develop proposals that fit the problem; monitoring the process of fact-finding; and stimulating the spread of knowledge between various pilot projects to enhance the effectiveness of the produced knowledge. It can be seen that this definition and the strategies of knowledge governance, along with its aim and concept as outlined by Van Kerkhoff (2013) and that of Gerritsen et al. (2013) tend to give epistemic weight to scientific knowledge over other knowledge. While it is not being suggested that science does not provide useful and indispensable insights on environmental issues, these conceptions of knowledge governance do not sufficiently capture the extent to which science is a particular way of knowing the world. This contrasts strongly with the epistemology and ontology of local knowledge (Berkes, 2012; Fischer, 2005). Nor do these formulations of knowledge governance sufficiently capture the extent to which epistemologies and ontologies are mutually constitutive (Watson, 2013; Duncan, 2013), which means they are constructing each other in the sense that the ontology of local knowledge describes the meaning of the world which derives from ways that local people know the world, and how they know the world influences what they see as existing in the world (Demeritt, 2002).

Hence, the aims and formulations of knowledge governance outlined by Van Buuren and Eshuis (2010), Gerritsen et al. (2013), and Van Kerkhoff (2013), seem to resonate well in the results themes. Scientists framed conservation techniques as mainly about scientific techniques and practices. These were part of scientists’ way of giving new insights to farmers, as pointed by Van Buuren and Eshuis, so that farmers would abandon their traditional insights and practices. However, with the framing that occurred, along with the framing that regards farmers as commercially-driven individuals, had affected the dialogue between farmers and scientists. This was shown from the key themes of the programme’s implementation and its challenges, where information and knowledge were only shared with farmers in a limited way. The topics of information and knowledge that were shared only highlighted the scientific points of view the farmers were expected to learn and were only about improving farmers’ incomes. Farmers did not learn why they had to apply conservation techniques and how these techniques related to the water condition of the Brantas River. From this current research, it
can be concluded that framing solutions in scientific ways in order to solve environmental problems may help in achieving the aim of knowledge governance, which was to regulate “the development and use of new scientific and technological knowledge” (Gerritsen et al., 2013). However, this put into question the statement from Van Buuren and Eshuis (2010, p. 297) about knowledge governance who said that it would “rationalise the dialogue between stakeholders with different world views and problem perceptions.” This is because, the dialogue then tends to be rationalised in order to validate the epistemological value of certain groups of stakeholders towards other stakeholders who have different world views. For example, scientists opened dialogue with farmers to convince them about the conservation system and how this system could improve farmers’ income/profit.

Moreover, the expectation that stakeholders would leave traditional insights and practices for the creation and innovation of new insights, as argued by Van Buuren and Eshuis (2010), did not occur in this research. The analysis demonstrated that leaving traditional insights and practices was not an option for farmers. On the contrary, the farmers innovated and developed new insights and ways to navigate the scientific knowledge system embedded within the conservation agriculture programme alongside their current cultivation system that was underpinned by their traditions and rituals that influenced their local epistemology and ontology. Farmers had very strong religious beliefs attached to their traditions and rituals when it came to agricultural practices. The research findings revealed that their ancestors’ traditions permeated all their practices, where every activity in the field must follow a certain pattern in order to receive the desired goals. For example, farmers had to cultivate certain crops based on what the result of combination calculation from the calendars said. Farmers were not allowed to be in the field when the dates of Urakan, Uwas or Galengan occurred. They maintained that breaking these rules would affect the expected outcome. Hence, they did not follow the schedule set by the scientists as they believed it was against their traditional rules.

As mentioned earlier, dialogue between scientists and farmers occurred, as expected by Van Buuren and Eshuis (2010). Nevertheless, the framing of a solution in the scientific way, have not only limited the flow of information, but has also constrained the dialogue between scientists and farmers. This dialogue becomes an arena for validating scientific epistemological values, which resulted in the exclusion of farmers’ knowledge, imbued with traditions and rituals. The expectation expressed by Van Buuren and Eshuis that the practice of knowledge governance is to “get away” from “interest conflict[s]” is shown to be challenging in the context of a developing country where traditions and rituals are a way of
life. In this East Java case, overlooking local traditions and rituals eventually created more conflicts between the stakeholders. The new insights through the implementation of scientific knowledge of conservation agriculture did not make the farmers leave their traditions, rituals and practices, and this put scientists into a difficult situation when they implemented the programme. Scientists found these farmers’ traditions and rituals challenging, and this put the scientists and farmers into a “quiet” conflict as they knew that those traditional rituals were one of the issues in the implementation of the programme, but it was never openly mentioned when scientists were speaking to the farmers. This kind of problem due to framing solutions where scientific ways of knowing dominate comes to the fore in the context of a developing country.

Moreover, when local people are involved in the decision-making process, it is expected that they can also become self-organised, as argued Gerritsen et al. (2013), by being open to different views, new patterns, and cultures. The results show that farmers were quite open to the new knowledge that was introduced by the scientists, through their navigation of the two cultivation systems. Farmers were eager to try new things and had experimented by using their knowledge and the scientists’ knowledge together. Nevertheless, this did not happen with the scientists. The analysis demonstrated that scientists in the end had profoundly adopted a one-way communication style, in which they were not eager to learn more about the farmers’ knowledge, nor to try and understand what constituted their choices in the field. Instead, they framed the farmers’ way of doing cultivation as the result of farmers being commercially driven, and one of the scientists maintained that farmers’ traditions were only myths. Therefore, the statement by Gerritsen et al. (2013) about local people needing to be self-organised and open to different views is incompatible with this case in East Java. These farmers’ communities were already open and welcomed new patterns and the different views of scientists; however, the scientists, on the part of the decision makers, were not ready to do so.

Linking the results with the conceptual frameworks has highlighted tensions within the knowledge governance literature to which the researcher now turns. Again, while it is not being argued that science should not play a key role in the implementation of environmental policy, it appears that there are expectations that knowledge governance can and should pave the way for science to ultimately prevail in decision-making and the implementation of environmental policy. This research has shown that science faces many challenges when it “hits the ground”. There are expectations that better knowledge governance, for example with the use of boundary organisations, can more effectively link science with on-ground action.
This would be achieved by producing credible, salient, and legitimate knowledge through improving convening, translating, collaborating, and mediating (Cash et al., 2006b). These expectation, however, are very challenging in the light of linking the results with the concepts epistemology, ontology, power sharing, and the scale of knowledge.

Therefore, the researcher argues that the definition of knowledge governance in the context of environmental management should be revised from the definition that Van Buuren and Eshuis (2010) have outlined, to be “a process of managing different knowledge systems, either formal or informal, in order to overcome the gap between knowledge and action, which includes respecting local knowledge and the elements within them, such as local traditions and rituals”. The goals to be achieved from knowledge governance must be based on consent from all stakeholders, without overlooking others’ beliefs and values. The work of knowledge governance should include sharing and exchanging knowledge, access to information, fluent two-way communication and reflexive learning. More than that, knowledge governance not only needs rural societies to be open to new knowledge but also needs an eagerness from public agency representatives to learn and to be open to other knowledge rather than just scientific knowledge.

Scholars such as Simpson et al. (2015), Cash et al. (2006), Raymond et al. (2010), Innes and Booher (2010), Edelenbos et al. (2011), Callon (1999), Lemos and Moorehouse (2005), Van Kerkhoff and Lebel (2015 and Wyborn (2015) have proposed various concepts in order to accommodate divergent values that underpin different knowledge systems and, especially, to highlight the role of local knowledge. These concepts - education, collaboration, knowledge integration, knowledge coproduction, and coproductive capacities - show varying degrees of interaction, power sharing, and approaches involved in knowledge governance which are similar to the pattern of Arnstein’s (1969) ladder of participation. In the case of East Java’s conservation agriculture programme, it was found there were two different ways of governing knowledge, of which only one provided the inspiration to develop a new concept within the knowledge governance ladder (to be discussed later). The first way of governing knowledge in the implementation of the programme was developed by scientists and this echoed the concept of knowledge integration, even though some components were missing when the integration was undertaken.
8.7.1 Knowledge integration

Scholars argue that within knowledge integration, scientific and local knowledge should be integrated by including local beliefs and values to fill the gaps in scientific knowledge by asking local people to story-tell and express their feelings (Simpson et al., 2015; Innes & Booher, 2010). Knowledge integration is expected to provide mutual understanding between stakeholders, continual communication and negotiation, reflexivity, and the flexibility to change perceptions about new information (Raymond et al., 2010). What must be completed before processes of integration are started is to identify the relevant knowledge types that will be included in the process of integration, so that, experts engage in the integration process will have sufficient relevant experience (Raymond et al., 2010). The analysis showed that the scientists assumed they had integrated local knowledge into the implementation of the programme (Simpson et al., 2015) through including the use of traditional manure, for example, as part of the scientists’ conservation techniques. Using traditional manure filled a gap in the scientific conception of the cultivation system. This was necessary because lack of scientists’ knowledge about how to process organic manure traditionally was covered by the knowledge of the farmers about manure. Mutual understanding, negotiation and changing perceptions about new information, as pointed out by Raymond et al. (2010) for knowledge integration, occurred in the programme. For example, it can be seen from the research findings that the scientists and farmers agreed on the chosen type of apple trees, and the farmers welcomed the new information they received. What seemed to be missing in the programme was the inclusion of farmers’ beliefs and values, and reflexivity, as suggested by Simpson et al. (2015) and Raymond et al.

Nevertheless, the practice of knowledge integration without having these two components of beliefs and values, and reflexivity, is reasonable. This is because the views of mutual understanding and negotiation, as suggested by Simpson et al. (2015) and Raymond et al. 2010), are already unclear in terms of which knowledge, methods, techniques or practices should be mutually understood and negotiated. For example, when investigating this programme, the researcher found that scientists and farmers had a mutual understanding when it came to cultivation techniques. Scientists decided that traditional manure would be included and which type of apple trees could be cultivated. It should be recognised, however, that arriving at decisions on these key aspects of the programme was directed and constrained by scientists and their policy managers. Furthermore, the type of apple tree was incidental and indeed challenged the farmers of Sumberbrantas, as they did not have previous experience in growing these particular trees. It has been shown that in a developing country, integration that
relies on mutual understanding would need to include local beliefs and values, and reflexivity. In this East Java case, the reflexivity was not performed due to two possibilities: scientists may remove it as reflexivity is considered not so important, or because scientists mainly do not know what reflexivity is and how important it is in managing knowledge exchange with farmers. Furthermore, the challenges of negotiation are highlighted in this case when the scale of knowledge and the extent to which epistemologies and ontologies are mutually constitutive are considered. As stated, compromise for farmers on these aspects was non-negotiable because their world is imbued with traditions and rituals, unlike how scientists see the world.

Moreover, in practising knowledge integration, the experts who are engaged need to be carefully selected, so only those who have sufficient relevant experience may be involved in the process of knowledge integration (Raymond et al., 2010). Therefore, it seems that knowledge integration gives room for the practice of selecting knowledge for the benefit of particular groups of stakeholders; for example, selecting which elements of the farmers’ knowledge are suited to the scientists’ knowledge, to make sure that the scientists had enough understanding and experience of those elements. The process of selecting knowledge triggers the problem of what Nadasdy (1999, p. 5) called, the compartmentalisation and distillation of local knowledge, so that local knowledge can be expressed “in the forms that are compatible with the already existing institutions and processes of scientific resource management.”

Distillation does not happen for local knowledge only, as argued by Nadasdy, but also for the different environments that the local people are put in. The concerns raised by Nadasdy are reflected in this research. The analysis shows that scientists were compartmentalising local knowledge into local cultivation techniques, and the elements of values and beliefs were distilled out, as they did not make sense for scientists, nor would the scientists try to learn more about it. Another distillation that scientists did was running meetings in a way farmers had never done before, which was lecture-style (formal setting). In summary, these research findings support the arguments by Nadasdy, who says that the practice of knowledge integration becomes the way for the scientists to “adjust” local knowledge, so that it could be utilised and interpreted within the programme framework and be consistent with the scientific assumptions about agricultural land management.

Moreover, the challenge that Nadasdy (1999) made about the premise that local knowledge is only a gap filler for scientific knowledge, as suggested by Innes and Booher (2010) is echoed in the research themes, in which analysis showed that ancestors’ traditions imbued the farmers’ practices in the field, and their decision making processes represented the holistic preferences of their communities and families, which the farmers had to fulfil. Overall, it is
concluded that the practice of knowledge integration would fail to address the crucial points that have been elaborated in the research themes. For example, it would open the opportunity for compartmentalisation and distillation of local knowledge, which was undertaken by scientists as power holders. The practice of knowledge integration also gave the opportunity for one-way communication to be enforced, as shown in the theme of communication; this clearly showed how the issue of power was not being addressed seriously. More than that, the practice of knowledge integration would not address well the problem of framing, which was shown from the theme of framing. In this case, knowledge integration actually entrenched the practice of framing land techniques towards a particular knowledge – scientific knowledge. Raymond et al. (2010) maintain that knowledge integration must involve mutual understanding between the actors and, obviously, in order to gain this understanding, mutual trust should be gained first. Yet, from the theme of trust, it can be seen that each actor had different perceptions of the meaning of trust, and how to establish and foster it.

Key to this integration was the field person, to help in the implementation of the programme. He became a mediator between scientists and farmers, where parts of his job were translating knowledge in the language that farmers could understand. He became a boundary spanner for the programme. The next section presents the function of the boundary spanner in the field and the role of boundary organisations.

**8.7.2 Managing boundaries**

Management of boundaries is needed when two social worlds with different knowledge systems are working together to integrate and coproduce knowledge. With this management of boundaries, it is hoped that the scale problem can be defined, boundary objects become flexible enough to be used and interpreted by each stakeholders’ language, and the flow of information can be managed (Carr & Wilkinson, 2005; Guston, 2001). Therefore, it is expected that the stakeholders involved would act cooperatively and work collaboratively (Carr & Wilkinson, 2005). Scholars, such as Carr and Wilkinson (2005), maintain that communication is the key in management boundaries, along with commitments of time, sufficient funds, infrastructure and personnel from public agencies. Boundary spanners are believed to be helpful for managing the boundaries (Corburn, 2007) as agents for translating information from local to science/professional terms and back again. Boundary spanners can be professional institutions or local people who have close relations with well-known institutions (Corburn, 2007).
The research findings show that the original reason for having the field person in the programme was to become the boundary spanner, as his responsibility was to mediate between two different knowledge types. However, the research theme of programme implementation and its challenges show a contradiction that complicates the work of the boundary spanner, in terms of the existence of the field person as the boundary spanner in the implementation of the programme.

The research finding identifies that in the decision-making process, farmers mainly relied on their societies and families. In other words, they tended to listen more to their own people and community rather than to outsiders. This was also revealed by how the communication flowed between the stakeholders during the implementation of the programme where, even though the scientists had neglected to develop communication with the farmers in Tulungrejo, the farmers, through one of their colleagues were still trying to build communication with the scientists, especially when they found problems in nurturing the apple trees. They ignored the existence of the field person. From the theme of programme implementation and its challenges, it can be seen in the village of Sumberbrantas that the farmers did not try to contact the scientists, instead they communicated among themselves when they faced problems in nurturing the apple trees and, again, the function of the field person as a boundary spanner was ignored. This indicated that trust in their own people was very important and held in higher regard by the farmers. This fact is in line with the statement from Levin and Cross (2004) and Lucas et al. (2015), in which trust between farmers and their community is very strong, and stronger than that between farmers and scientists, because farmers have built continuous interaction, cooperation and interdependence with their community for decades. Even though farmers in Tulungrejo, for example, obtained advice from the scientists through one of their colleagues, the process of delivering information from the scientists to their colleagues and then to the farmers would give a different emotional feeling when the same information was delivered from the scientists to the field person and then to the farmers. It can be seen that emotional feelings that farmers have towards each other have emerged from decades of companionship and friendship which then gives the sense of comfort in trusting each other (Changing Mind, 2017), which they did not have with the scientists.

Furthermore, the point made by Corburn (2007) that a boundary spanner should be a local person who has close relations with well-known institutions indirectly highlighted the point of building interaction and trust between stakeholders. This research illustrates the importance of fostering trust through social ties and bonds, not necessarily experience and chosen from outside these relations. This is in line with the ideas of Levin and Cross (2004, p.1480) that
strong ties would not only make people trust each other, but would also lead to “greater knowledge exchange, where people would likely to listen to, absorb, and take action on that knowledge”, later leading to the development of “common ways of thinking and communicating”.

The researcher agrees with Carr and Wilkinson (2005) who state that communication is the key in management boundaries, along with commitments of time by the public agencies, funds, personnel and infrastructure. The analysis showed that other than the lack of communication and time management of scientists, lack of responsibility and accountability had also made farmers lose trust in scientists. It seems that the government had put too much pressure on scientists to simultaneously run agriculture programmes other than this conservation programme (see Section 5.3.2), causing neglect of this programme and, importantly, neglect of the farmers. This neglect, not only cause the loss of farmers’ trust, but also the failure of this programme. Moreover, the research finding also supports the argument about framing, in which Carr and Wilkinson state that narrow framing in each of the other groups of stakeholders will influence the effectiveness of the communication among them. The research findings pick up on the theme of framing that was used by scientists. These framings indeed made an impact on the flow of information from the scientists to the farmers. For example, the scientists were only concerned about the adoption of scientific conservation techniques and ignored local values in cultivation, focusing, only on promoting apple trees and vetiver grass, as these would obtain high prices in the market.

Moreover, from the theme of programme implementation and its challenges, the research findings show that the hierarchical institutions had determined the budget spending and how the programme would run. The pressure was on for the scientists, as they had to deliver expected outcomes in such a very short time, as the programme was reviewed annually, and with a tight budget. Therefore, as rightly pointed out by Wesselink et al. (2011), no matter how much effort had been put in to building communication or including local voices by having boundary organisations, for example, this would have had little effect if the laws and legal frameworks remained top-down. It conclusion this research finding can add the argument made by Carr and Wilkinson (2005) about determining the success of boundaries management through recognising the institutional laws that apply in a developing country.

Therefore, when the boundary spanner found problems along the way and was ignored by local people, the question then became, “how can divergent knowledge systems be coproduced in order to create new knowledge that is accountable and applicable to all?”
8.7.3 Coproduction: the foundation of coproductive capacities

Coproduction is claimed to be different from integration, because in coproduction, all elements within knowledge systems are included, harmonised and combined together to create new overarching shared knowledge (Edelenbos et al., 2011). Coproduction highlights the empowerment of local people and validity accorded to their knowledge, two-way communication, and boundary organisations (Callon, 1999; Lemos & Moorehouse, 2005; Corburn, 2007; Aeberhand & Rist, 2009; Sirianni, 2009; Edelenbos et al., 2011).

Nevertheless, the concept of coproduction is challenged by some scholars. Brugnach and Ingram (2012) identify ambiguity as one of the problems in the implementation of co-production, as the final process of decision making may not reflect the preferences of the local people. For example, similar to concerns with integration, it would be unclear in terms of which values are incorporated in the creation of new knowledge (Brugnach & Ingram, 2012). Brugnach and Ingram maintain that to avoid ambiguity, stakeholders should recognise interdependencies, and build good relationships and two-way communication in order to develop trust. Moreover, Turnhout (2010) criticises coproduction in terms of its utopian characteristics, where coproducing new knowledge seems to be easily possible. The expectation that the whole societies would change by avoiding any mistakes is also a concern in the utopian characteristics (Turnhout, 2010). Ahlborg and Nightingale (2012) also criticise the problem of mismatches of knowledge scale that is not sufficiently addressed in current conceptions of coproduction.

Following these criticisms about the concept of knowledge coproduction, the researcher argues that coproducing knowledge, to some extent, can become an imposed concept, where all elements of scientific and local knowledge should, or even must, be together side by side. The analysis showed that scientists excluded local traditions and rituals, as these elements were too complex for scientists to handle, especially when they related to religious views, and most certainly did not align with their calculative and reductionist epistemology. On the other hand, even though farmers welcomed the scientists’ knowledge, it was accepted on their terms and under their institutional rules, before the farmers would apply it. This acceptance with defiance can be seen from the way the farmers navigated both cultivation systems through operating two cultivation systems together and using signs from nature to mix and apply pesticides. If the aspects of local traditions and rituals were forced to be harmonised and combined, without any deeper understanding in advance, then friction and resentment would be likely to occur. This is because when knowledge is coproduced, it means that scientists must follow local traditions and rituals that do not make sense to them while the local people,
to some extent, must abandon their traditions and rituals in order to complete the programme as the scientists expected. In other words, different epistemologies and ontologies between these stakeholders have kept them apart, and coproduced knowledge, to some extent, is too risky to be created.

Therefore, the claim by Turnhout (2010) about the utopian characteristics is reasonable, as new knowledge would be almost impossible to coproduce. Coproduction, like integration, requires epistemological leaps between knowledge systems that can result in key elements of one or the other to be dismissed before these different types of knowledge can work together (Ahlborg & Nightingale, 2012). It was shown in this research that the scientists’ epistemological and ontological commitments had more power than the farmers; however, in practice, the farmers held considerable power and maintained the application of conservation techniques in their own local way.

**8.7.4 Coproductive capacities**

Coproductive capacities are proposed as another concept in governing divergent knowledge systems (Van Kerkhoff & Lebel, 2015; Wyborn, 2015b). Coproductive capacities have coproduction as a foundation for knowledge governance practice. Coproductive capacities also become a way of reconciling divergent perspectives while, at the same time, accepting and working out the differences of perspectives so that science can contribute more to environmental knowledge governance (Van Kerkhoff & Lebel, 2015). It is through coproductive capacities that friction between local and scientific knowledge can be better addressed, because divergent scales become the highlight of this concept along with power sharing, boundary organisations, co-production, commitment and sufficient infrastructure and, especially, funding (Wyborn, 2015b; Van Kerkhoff & Lebel, 2015). There is the presumption that the challenges to be faced in practising co-productive capacities are only from the possibility that scientific knowledge may override local knowledge, authority, and values. Moreover, there is also a concern that the possibility of identifying strengths and weaknesses in both knowledge types, in order to address environmental problems by the relevant scales would challenge the elitism of science (Van Kerkhoff & Lebel, 2015). In summary, Van Kerkhoff and Lebel (2015), and Wyborn (2015b) emphasise history, experience, preconceptions of science and government, positive and trusting relationships, power sharing, boundary organisations, coproduction, divergent scales and commitment and sufficient infrastructure as critical points to develop coproductive capacities.
The researcher tends to agree, with some exceptions, to the points that have been proposed by these scholars in order for the capacities in coproduction to work and develop. Van Kerkhoff and Lebel (2015) argue that the willingness of stakeholders to be involved in collaboration depends on the history, experience, and preconceptions of stakeholders, specifically, towards science and government. This argument is in line with the research findings. For decades, the government system in Indonesia was centralisation. It was then changed to decentralisation within a short period of time without having consideration as to whether the resources in provincial governments in Indonesia would be ready for this new system; for example, the way the provincial government structures their policies and implements them in the field, including agriculture policies. In the case of this study, as stated in Chapter 2, the implementation of the conservation agriculture programme by the PEBEJ, in general, was not new in East Java, specifically in Tulungrejo and Sumberbrantas villages. The conservation agriculture programme was delivered by the local Department of Agriculture before, and the way they implemented the programme was top-down without any consideration towards farmers’ voices and their local values. The PEBEJ’s programme was different because they intended to bring in the key component that was overlooked by the Department of Agriculture - farmers’ involvement. However, it seems that both the PEBEJ, as the representative of provincial government, and the scientists lacked experience in doing so. This can be seen from their thoughts about farmers’ involvement in planning meetings (that it was unnecessary for them), the way they managed the implementation of the programme, which in the end lacked interaction and communication with farmers, and the fact that reflexivity was absent from this programme. Moreover, local values, including traditions and rituals, have been overlook for a long time by the government. Now, with the PEBEJ’s programme, scientists stated they wanted to include these values. However, as they did not have any experience of how to include these local values, because they were used to implementing top-down programme, scientists felt out of their depth with local beliefs and yet again tended to push these aside. The problem of being inexperienced could also be the reason why reflexivity on how the knowledge exchange occurred was absent. On the other hand, farmers had long a history and experience of having government programmes in their village, shaping their concept of science.

Therefore, it was reasonable for farmers to say that scientists (and the government) knew nothing about what was going on the field, as they only knew about the theoretical side of nature (see Section 7.2.2). All of these situations have influenced the way both scientists and farmers communicate with each other. Scientists limited the information and knowledge that
should be exchanged with farmers; farmers limited their information to scientists about traditions and rituals.

Moreover, even though the researcher agrees that in developing capacities in co-production, positive and trusting relationships should be built, unfortunately Van Kerkhoff and Lebel (2015) miss the point of how to synchronise different meaning of trust and perceptions on how to build trust. As stated before (see Section 8.6.3 and 7.4.1), scientists based their meaning of trust around the prediction of what farmers would do and what situations would occur, while for farmers, trust was about agreement, companionship, and friendship that emerge from continuous communication and interaction, showing clearly that emotional feeling is strongly involved. How these differences can be synchronised in order to develop positive relationships is missed by Van Kerkhoff and Lebel (2015).

Furthermore, the researcher tends to agree with the argument from Wyborn (2015b), that commitment and sufficient infrastructure are critical in developing capacities. The research findings show that scientists’ lack of commitment to be fully involved with the programme, was due to insufficient infrastructure, the strict timeline and other tasks that were given to them by the government. Legal rules have caused huge impacts on how the programme ran in the end, which scholars also needed to be concerned with.

As has been discussed in Section 8.7.3, even though boundary organisations are important for coproduction to work, the researcher argues that there has to be, not only clear boundary objects set between stakeholders, but also a reliable local person or institutions who are responsible for managing these boundaries. Moreover, it needs epistemological leaps between knowledge systems in coproduction so that key elements of one or the other would not be dismissed before the different types of knowledge can work together (Ahlborg & Nightingale, 2012). This epistemological leap needs to be researched further, as the practice of coproductive capacities may open the opportunity for one-way communication to be adopted, and the fitting of local knowledge only to what the science practitioners would like to know. In other words, distillation of local knowledge, as previously argued by Nadasdy (1999), may occur once again.

Furthermore, the researcher could not agree more with the point that paying attention to divergent scales is important in building capacities (Van Kerkhoff & Lebel, 2015), as the research finding identifies that mismatch of scale still occurred (see Section 8.6.4) and this has influenced the way scientists and farmers see the problem in agriculture activities. For example, scientists see the programme on a bigger scale, which was the water quality of the Brantas River and agriculture sustainability, while farmers see it as an ordinary programme,
where the government wanted them to cultivate something, other than their ordinary crops, to prevent erosion.

8.8 Coexistence: the next concept of knowledge governance

In light of the tensions identified within the knowledge governance literature, in particular the theorisation of knowledge integration and coproduction, and the findings of this research that was conducted in a culturally rich developing country, the concept of coexistence is proposed as an alternative pathway for knowledge governance practice.

The notion of coexistence is not new and became a political necessity during the Cold War, in “the context of U.S and U.S.S.R relations” (Khaminwa, 2003, p. 1). In general, it is defined by Khaminwa (p. 1) as “a state in which two or more groups are living together while respecting their differences and resolving their conflicts non-violently.” The core of coexistence is the realisation of differences, where the groups involved recognise that there are many differences between them that cannot be reconciled and may become a trigger for larger conflicts (Khaminwa, 2003). Coexistence is mainly about respect, acceptance and embracing diversity and embracing what is worthwhile from the other groups (Khaminwa, 2003). According to Khaminwa (p. 2), the relationship of groups is characterised by unequal power which, even though this unequal relationship between groups “may lack violence, the continuation of unequal relationships, was unlikely to lead to the resolution of conflict.” Therefore, the process of mediation in order to promote mutual recognition of each other’s diversity, as opposed to integration, is encouraged.

The findings of this research show the potential utility of this concept of coexistence in knowledge governance. Even though farmers were on the receiving end of unequal power during the implementation of the programme through the adoption of one-way communication and the values of local traditions and rituals were excluded in the implementation of the programme, this did not make farmers turn away and refuse the scientific knowledge of conservation delivered by the scientists. Farmers welcomed the idea of the scientific conservation system and had positive attitudes towards it, and they tried to work out these scientific techniques together with their local cultivation knowledge and practices. For example, they cultivated their vegetable crops underneath the apple trees, or had a terracing system but also tilted the landscape a little so that the water could provide for their crops’ needs. Farmers realised that there were differences in the ways of knowing the world in agriculture between scientists and them (see Sections 7.2.2 and 7.3); however, they resolved these differences non-violently. Rather than refusing the scientific knowledge of
conservation system, these East Java farmers found ways to navigate two different systems, local and scientific, in the management of their land practices. Farmers accepted the diversity in the knowledge systems and embraced what was worthwhile from both their knowledge and the scientists’ knowledge; one of them said “we kept the good and left the bad things behind” (F3 Sumberbrantas).

The incorporation of coexistence within the knowledge governance ladder signals that local people are not always the ones who do not want to accept and embrace different ways of doing things, or who tend to shut out outsiders when new knowledge is being offered to them, as indicated by Agrawal (2005) and Allendorf et al. (2014) through their examples of the raikas shepherds and Tibetan villagers in northwest Yunnan. From the theme of local traditions, rituals and practices, the research findings show the opposite, in that farmers were ready to accept differences and to work their way through them in order to resolve these differences in their own way, while scientists became the ones who tended to refuse and ignore the farmers’ different perspectives and ways of doing.

The highlight of this concept is the process of mediation between stakeholders with different knowledge systems in order to reach mutual recognition, understanding, and respect of each other’s diversity. It then led to how the boundaries between stakeholders can be managed and so on, which clearly shows the role of boundary spanner is paramount. This becomes the first step to resolve differences in ways of knowing and how these knowledge systems could work together. However, it would be better if the mediator were a person or an institution trusted by the local people, as argued by Corburn (2007), as the research finding also showed that farmers were more trusting of somebody who came from their own community rather than the field person.

Moreover, what should be added into this coexistence concept is the importance of synchronising the meaning of trust and how to foster it between stakeholders, identifying different knowledge scales, and developing power sharing, commitment, and reflexivity. Therefore, problems and challenges that are identified in the results themes, for example, can be appropriately addressed and solutions sought. The researcher tries to picture coexistence together with the existing knowledge governance ladder as below:
Figure 8.2 Coexistence within the ladder knowledge governance

The themes in coproductive capacities are also suitable to be applied in Arnstein’s (1969) ladder of participation. The reason is because in order to reach the level of citizen control, for example, environmental practitioners should understand the history, experience, and preconception of community towards the government or related institutions, which will shape and influence the willingness of stakeholders to engage in participation. The acknowledgement of knowledge scales, and development of quality relationships between stakeholders also work through time, from one level to another. Therefore, the researcher puts coproductive capacities between Arnstein’s (1969) ladder of participation and the knowledge governance ladder, as it applies to both. Moreover, the researcher has coexistence projecting out of the knowledge governance ladder, as more observation to this concept still needs to be done, which opens opportunities for future research to examine, remembering that this concept is also part of the knowledge governance framework.

8.9 Summary

The aim of this research is to investigate knowledge governance in practice through the implementation of a conservation agriculture programme in rural villages in East Java, Indonesia. From the thematic analysis of the results there were themes that can be identified to answer the research questions. For the way that the programme was delivered (Research Question 1), the research findings demonstrate that during the implementation of conservation agriculture, knowledge was shared in a formal setting and through one-way communication.
Scientists mainly relied on PowerPoint slides to help their presentations, which were in English and Bahasa; nevertheless, they only communicated with farmers using the farmers’ local language. During the implementation challenges emerged. The research findings identify themes, such as hierarchical legal laws that affected the way the budget was spent and the way scientists ran the programme; a lack of commitment from the scientists; and problems with communication within the team. From the perspective of the field person who stood as the mediator between scientists and farmers, and was constantly in contact with the farmers, the research findings identify several themes showing that the scientists had overlooked important cultural aspects of the farmers; the farmers ignored the existence of the field person as they did not do what they had been told to do; the poor time management of the scientists as shown in how the programme was run in a rush; and the role of the field person was more than just being a mediator.

For the perspective of the farmers towards the programme of conservation agriculture (Research Question 2), the research themes identify that scientists lacked responsibility, which showed from the lack of monitoring of the programme; the information shared with farmers being limited to the techniques of conservation agriculture, and the reasons for what it meant for the condition of the Brantas River, as the main aim of the programme, not being given to them; concern about the inclusion of local knowledge, where farmers expected their knowledge to be included in the programme, as they realised that the farmers and scientists had different perspectives about the cultivation system.

From the way farmers navigated the divergent knowledge systems (Research Question 3), the research themes demonstrate that instead of leaving behind their cultivation practices that were imbued with local traditions and rituals, as expected by the scientists, what farmers did was navigate the two knowledge systems in order to manage both their past and present practices. Farmers did not abandon their local traditions and rituals because they came from the ancestors, and were then incorporated in their present practices. The farmers relied on nature’s signs to guide their local practices and did not follow what had been designed by the scientists; and their decision-making processes showed their social dynamics.

From the themes that have been identified, it can be concluded that there were five key themes across the research results: trust; local traditions, rituals and practices; programme implementation and its challenges; communication; and problematic framing.
The research themes identified that leaving traditional insights and practices, as suggested by Van Buuren and Eshuis (2010), was not an option for farmers. Rather, scientists deploying scientific knowledge are likely to be better placed for success if they respect local traditions and rituals to ensure the farmers can adopt the techniques of conservation agriculture, alongside the farmers’ local knowledge. As a result, the definition of knowledge governance in the context of environmental management should be revised. The researcher therefore proposes a new definition of knowledge governance within environmental management context as a process of managing different knowledge systems, either formal or informal, in order to overcome the gap between knowledge and action, and to include the respect for local knowledge and the elements within it, such as local traditions and rituals. The goals sought from knowledge governance need to be based on the consent of all stakeholders without overlooking others’ beliefs and values. This means that stakeholders must have mutual understanding, recognition, and respect towards each other’s way of knowing and ontology. Knowledge governance should include sharing and exchanging knowledge, access to information, fluent two-way communication and reflexive learning. More than that, knowledge governance not only needs rural societies to be open to new knowledge but also the eagerness of public agency representatives to learn and be open to other types of knowledge than scientific knowledge.

From the key aspects of knowledge governance identified through the literature review - ways of knowing, ontology, scales and power sharing - the research themes identify that power was not equally shared. However, this unequal power had a unique twist at the end of the programme. It is found that farmers were powerless institutionally, as their voices and values were not taken into account. However, due to the lack of scientists’ commitment and communication between farmers and scientists, farmers then took over the role and were fully responsible for the implementation of the programme in the field, which means the application of one-way communication does not put lay people in a powerless position the whole time. The mismatch scales that are outlined by Ahlborg and Nightingale (2012), Duncan (2016), and Cash et al. (2006), are also echoed in the implementation of the programme through research themes that identify farmers and scientists as having distinct ontologies and ways of knowing in conservation agriculture.
From the results, it can be seen that scientists had adopted knowledge integration without the adoption of reflexivity and inclusion of local beliefs and values. There were two possible reasons why reflexivity was absent: (a) scientists deliberately dismissed the act of reflexivity, or (b) they definitely did not have any idea how important reflexivity was for the programme, nor how it should be conducted. The problem of compartmentalisation and distillation of values within local knowledge, as outlined by Nadasdy (1999), also occurred in the implementation of the programme. The research themes demonstrate that creating new knowledge in the notion of knowledge coproduction (Edelenbos et al., 2011; Callon, 1999; Sirianni, 2009; Lemos & Moorehouse, 2005; Aeberhand & Rist, 2009; Corburn, 2007), which include overarching values between different knowledge systems is, to some extent, difficult to realise, as some values cannot be combined and harmonised, especially values related to religion. The arguments from Turnout (2010), Brugnach and Ingram (2012), and Ahlborg and Nightingale (2012) for having knowledge coproduction would make the process of decision making fall into having the characteristics of utopia, because of the emergence of ambiguity and overlooking the problem of mismatches in scales. The research findings support coproductive capacities from Van Kerkhoff and Lebel (2015), in which the eagerness of farmers and scientists to exchange knowledge, ideas and values, and how they developed relationships when the conservation programme implemented was influenced by their previous history and experience of previous agriculture programmes, and the conception that farmers had about science and the government. The factor of different knowledge scales, commitment and sufficient infrastructure, argued by Wyborn (2015b), also became factors causing this programme to fail.

Having seen the results in the research field, it was then that the researcher proposed the concept of coexistence as the alternative pathway in linking knowledge into action in the knowledge governance ladder. Coexistence stands as an overarching concept within which to find different ways of governing divergent knowledge systems in accordance with different stakeholders’ perspectives and beliefs. This concept highlights mutual understanding and recognition towards each group of stakeholders’ ways of knowing and ontology in order to work out the best resolution of these differences. Working from the starting point of coexistence marks out a new knowledge governance playing field where actors would not only recognise different perspectives and pursue mutual understanding but also find ways to create multiple pathways to sustainability, seeking to somehow overcome different knowledge scales and the divergent worldviews they engender.
Chapter 9
Conclusions

This thesis has developed a conceptual frameworks that draws theoretical insight from the fields of environmental geography, and science and technology studies to investigate knowledge governance in practice, in a developing country - Indonesia. The main concern of this thesis is the governance of the scientific knowledge of the scientists, and the farmers’ local knowledge during the implementation of a conservation agricultural programme to improve the water quality of the Brantas River by changing farmers’ land practices. To address this concern, semistructured interviews with farmers and public agency representatives, including scientists, government representatives and the field person were conducted. The data of interviews was then analysed thematically.

The thematic analysis revealed five key themes and included several subthemes that were reported across the results chapters (Chapter 5 to 7). These five key themes were: trust; local traditions, rituals and practices; programme implementation and its challenges; communication; and problematic framing.

In regard to the way the conservation agriculture programme was delivered, Chapter 5 reveals that during the programme, knowledge was shared by scientists in a formal setting and through one-way communication. During the implementation, some challenges emerged; for example, hierarchical institutional rules, lack of commitment by scientists and problems of communication within their team. Scientists had framed the conservation techniques as scientific techniques and practices, and the farmers involved in the programme as commercially-driven individuals. In regards to local knowledge, the scientists acknowledged local knowledge to be local cultivation techniques, in which the traditions and rituals were overlooked and not valued. In order to gain trust from farmers, the scientists established a demonstration plot to show the process of conservation techniques. They also believed that farmers’ trust could be established by using the local language when communicating with them.

As presented in Chapter 6 on the work of the field person, the subthemes reveals that the field person’s duties involved being more than a mediator, due to the scientists’ lack of commitment to the implementation of the programme which, therefore, meant that the field person had to cover the scientists’ work when they were not available. The field person
claimed the scientists had overlooked the cultural aspects of the farmers in attending meetings. The field person maintained that farmers ignored his advice due to the scientists’ poor time management. The field person also maintained that local traditions and rituals were excluded in the implementation of the programme, and he argued that gaining farmers’ trust was not only by giving actual results from the demonstration plot, but also from the way knowledge was delivered and in an environment that supported the process of knowledge delivery.

Meanwhile, from the perspectives of the farmers, which are revealed in Chapter 7, the implementation of the programme was affected by the lack of scientists’ responsibility, and the farmers were concerned about the inclusion of their knowledge in the implementation of the programme, specifically, their traditions and rituals. There was evidence that information about the programme was only shared in a limited way with farmers. Instead of leaving their local techniques of cultivation, it was revealed that farmers navigated the two cultivation systems, local and scientific, at the same time and place. It also revealed that farmers had a way of thinking and ontology distinct from the scientists’, as their ancestors’ traditions and signs from nature guided their local practices. In the decision-making process the farmers had to deal with their own complex social dynamics, as their final decision had to represent the consent of their family and society. For farmers, trust could be established if scientists were responsible to the end of the implementation of the programme, and that included conducting appropriate monitoring throughout.

Taken together, and linking these themes with the conceptual framework (Chapter 3) that underpinned this research (Chapter 8), the significance of these research findings was outlined in terms of its contribution to the theory of knowledge governance within the context of environmental management, along with the implications of this research to environmental policy as well as recommendations for further study.

9.1 Practical implications

The Indonesian government system was centralised for decades, where rules and the implementation of development programmes were imposed through top down/one-way communication. During this time, local societies had been put into the position of being receivers of knowledge and the only valid source of knowledge was from public agencies, including scientists, bureaucrats and policy makers. Calls for the acknowledgement of local knowledge and consideration for local societies in the decision-making process had become
more frequent, together with a shift in the Indonesian government system to one of decentralisation.

In the agricultural sector it started with the FAO, which not only requested a better environment but also that the governments of all countries in Asia and the Pacific allow local societies to actively participate in any agricultural and rural developments. This had been welcomed by the Indonesian government through its new paradigm of development in agriculture. Since then, gaining a better environment was part of the Indonesian agricultural sector’s aims, as reflected in its conservation programmes. However, the government was more concerned with improvements to the environment so, yet again, they undermined the inclusion of local knowledge in the decision- and knowledge-making process; for example, the implementation of conservation programmes by the Department of Agriculture in which one-way communication still occurred (Chapter 2).

The PEBEJ established its own version of a conservation agriculture programme where the involvement of rural farmers and local knowledge was said to be the highlight to pursue sustainability. It was hoped that including local knowledge would make the difference. The PEBEJ requested help from scientists in order to implement this programme; scientists then had an open dialogue with farmers and attempted to integrate local knowledge with scientific knowledge in the conservation agriculture system. Nevertheless, the programme did not run as expected. The research themes showed that the scientists implemented a one-way communication type when they delivered the knowledge of conservation to farmers, as the Department of Agriculture had done before them. The effort of building two-way communication in Tulungrejo village at the beginning of the programme also ended up as being one-way. It shows that scientists adopted knowledge integration, where reflexivity was absent and the values of local knowledge were distilled and compartmentalised. This shows that scientists had no experience in conducting reflexivity and little understanding of how important knowledge sharing and farmers’ perspectives towards the programme were for evaluating the programme. Local traditions and rituals were foreign for scientists, therefore, as scientists did not know how to include these local values in the programme, putting them aside seemed to be the best options for the scientists. Supposedly, scientists could explore more about farmers’ traditions and rituals; however, they had to face funding and institutional rules that became constraints, which meant scientists had to rush their work to fit it into the tight timeline given by the government. This means they also had to select who could participate in the programme in order to obtain the expected outcome.
Therefore, rearrangements in the implementation of Indonesian agricultural programmes are needed. The Indonesian government needs to revise their legal frameworks relating to the programmes’ budgets and how the programmes are run. Without stable institutions, Indonesia cannot successfully achieve the aims of agricultural programmes, as the way the programmes are implemented will also be constantly changing and putting communities into uncertain situations. This situation will later affect the degree of trust that communities have towards the Indonesian government, and specifically for communities that have relationships with agricultural sector. There is a need for understanding that dealing with local communities is different from having physical projects, such as building community trams. Programmes that include local communities in the decision-making processes always take time, as each community brings its own perspectives to the issues of concern. More attention should be given to the on-ground action, which is the processes of decision in knowledge making that has been undermined until today.

As stated above, both scientists and the government were inexperienced in including local farmers in the decision-making process and having reflexivity of the programme. Therefore, bureaucrats, policy makers and scientists should have gone through a learning process, a workshop; for example, in order to build their awareness of different scales of knowledge, perspectives, and ways of knowing, that they would face when they conduct an implementation of agricultural programmes in the field. Having this awareness, the public agency representatives would not only understand why local knowledge has a holistic value, why power sharing is needed, and how local communities define trust, but they would also learn what reflexivity is and how important it is in the process of knowledge delivery.

Indonesia is a religious country, in which years ago Islam and Hindu have strongly influenced its history. Therefore, ideas that originated from Western countries cannot be simply and easily translated into countries such as Indonesia, where it is not possible to extricate what farmers do and should do from their religious beliefs, traditions, and rituals. Hence, the concept of coexistence is the answer to this complex problem; in practice, coexistence highlights the mutual understanding, recognition and respect to local people’s way of knowing and ontology. It could be argued, however, that if farmers are allowed to practise both cultivation systems and they are not forced to leave harmful but traditional practices behind, their ways of doing cultivation may still be harming the environment. It is for this reason that the role of mediator is needed in order to work closely with farmers to build relationships and trust in order to finally change their ways, even though other elements, such as realising power sharing and commitment still need to be added in this concept. On this
basis of diversity in beliefs, the researcher argues that government should be more focused on how to develop an approach based on this coexistence concept to develop the sustainability of the agricultural programme through local communities.

9.2 Theoretical contribution to knowledge governance

The adoption of knowledge governance is widely known in Western countries and the role of local knowledge in the decision making processes has been highlighted for many years (Van Buuren & Eshuis, 2010; Van Kerkhoff, 2013; Gerritsen et al., 2013; Wynne, 2006). The essence of recent formulations of knowledge governance has recently been to encourage local people to abandon their traditional insights and practices (Van Buuren & Eshuis, 2010). In developing countries, especially in South East Asian countries, (Indonesia, for example), leaving traditional insights and practices is not an option for local people, as the research findings have demonstrated. Practising traditional rules and rituals is a requirement for local people, so that policy makers, including scientists should also consider these rules and rituals before the local people could implement new policies in their villages. Nevertheless, this matter has not been highlighted well in the knowledge governance literature, especially in its definition and characteristics. This research has been conducted in a culturally rich developing country, bringing these issues to the fore and highlighting the tensions in the knowledge governance literature. Based on the results of this research, the definition and the process of knowledge governance within the environmental management context should be revised by including more concern about the aspects of traditional rules and rituals and how policy makers and scientists should appropriately manage them. A new definition of knowledge governance is proposed, as a process of managing different knowledge systems, either formal or informal, in order to overcome the gap between knowledge and action, including respect for local knowledge and the elements within it, such as local traditions and rituals. Specifically, when the governance of knowledge systems is conducted in a developing country it is vital that its local people ensure that traditions and rituals become their top priority. The concept of coexistence in knowledge governance is needed, therefore, where through the practice of this new concept, mutual understanding, recognition, and respect are gained for local people’s way of knowing and ontology.

In reviewing the literature about knowledge governance and investigating the way scholars attempted to link knowledge into action, it can be seen that there are varying degrees of interaction, power sharing, and approaches involved in knowledge governance that are similar to the pattern of Arnstein’s (1969) ladder of participation. Drawing on the ladder of participation by Arnstein, the following ladder of knowledge governance has been proposed.
In reviewing each level within the knowledge governance ladder, it can be seen that the role of local knowledge in the process of decision making is still not well accommodated. Any kind of knowledge governance concept, such as coproduction of divergent knowledge systems in order to coproduce new knowledge that is applicable to all seemed to become an imposed concept, as it means that science must accept the need to apply local rules and traditions, and vice versa. This condition can result in frictions and problems between stakeholders due to their different conception of epistemology and ontology. Based on this investigation, therefore, the researcher proposes coexistence as an alternative pathway of knowledge governance for environmental management. This concept would encourage the governing of divergent knowledge systems by having mutual understanding, recognition, and respect for the perspectives and beliefs of each group of stakeholders, as its stepping stone. Therefore, the key aspect of having a mediator is important in order to work out the best resolution for the differences in each stakeholder group’s way of knowing and ontology. However, this concept still needs other important elements to add, such as power sharing, stable institutional support, reflexivity, commitment by all involved and sufficient infrastructure. The researcher has purposely put coexistence projecting out of the knowledge governance ladder.
governance ladder, as more observation to this concept still needs to be done, opening opportunities for future research to examine, without forgetting that this concept is part of knowledge governance framework.

9.3 Recommendations for future study

This research focuses on an investigation of the process of governing different knowledge systems, in a developing country, through the case of the implementation of a conservation agriculture programme in two rural villages in East Java, Indonesia, established by its provincial government. The concept of “knowledge governance” is used to underpin the conceptual framework of this research.

Based on the research findings, coexistence has been proposed as an alternative pathway for knowledge governance within environmental management, possibly going beyond notions of coproduction. Thus, the researcher expects that this concept would be examined more in future research, specifically in addressing environmental issues and when religious values are embedded in local traditions and rituals, as not all groups of local people are unwelcoming to new knowledge, and they may behave in different ways.

This future study would enrich the literature of knowledge governance, as it would enhance the discussion of how to put knowledge into action, when religious value within local knowledge become its highlight. Having said that, when future study is conducted, caution is needed, as local people in other regions and countries would likely have different ways of doing things, as defined by their own values and religious beliefs. Moreover, as boundary organisations were not found in the investigation of this study, future study may explore and observe more about the existence of boundary organisations in the practice of knowledge governance in a developing country that has rich traditions and religious values.
References


http://mengenalbudayajawa.blogspot.co.nz/2012/05/kebudayaan-dan-kesenian-jawa-timur.html


Appendix 1
Interview Schedule

Appendix 1 includes the list of interview questions to the participants of this research:

A.1 provides list of questions to scientists

A.2. provides list of questions to the Head of Conservation Department, Provincial Environmental Bureau of East Java, as the government representative

A.3 provides list of questions to the field person

A.4 provides list of questions to farmers
### A.1 Interview questions for scientists

**Interview guide for conservation agriculture scientists**

**Interview number:** ............

**Name of interviewee:** .................

**Phone:** .........................

**Date:** ......................... **Time:** .............................

<table>
<thead>
<tr>
<th>No.</th>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Could you please tell me how long you have been working as a scientist/researcher for?</td>
<td>Years</td>
</tr>
<tr>
<td>2.</td>
<td>Were you working for the same organisation all this time?</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>3.</td>
<td>For how long have you concentrated on conservation agricultural science?</td>
<td>Years</td>
</tr>
<tr>
<td>4.</td>
<td>Have you worked on a conservation agriculture system somewhere else?</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>5.</td>
<td>Do your mostly work with farmers?</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>6.</td>
<td>Can you please tell me what the things are that excite you about your work?</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>What are the factors at work that challenge you most?</td>
<td></td>
</tr>
</tbody>
</table>

Specific information (to be filled in when specific information arises):
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. For how long this programme for?</td>
<td>years</td>
</tr>
<tr>
<td>9. According to you, what are your competencies in order to support the</td>
<td></td>
</tr>
<tr>
<td>conservation agriculture programme?</td>
<td></td>
</tr>
<tr>
<td>10. Could you please explain to me about a conservation agriculture</td>
<td></td>
</tr>
<tr>
<td>system?</td>
<td></td>
</tr>
<tr>
<td>11. Could you please explain to me about the programme?</td>
<td></td>
</tr>
<tr>
<td>12. Is there a guideline that is given to you, which you have to follow</td>
<td></td>
</tr>
<tr>
<td>in order to put the</td>
<td></td>
</tr>
<tr>
<td>1. Yes  2. No  3. Not sure</td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
<td>conservation agriculture programme in place?</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>What are the reasons of choosing those villages to become the target of this pilot programme?</td>
</tr>
<tr>
<td>14.</td>
<td>Are you able to explain the knowledge delivery process of conservation agriculture to farmers?</td>
</tr>
<tr>
<td>Specific information:</td>
<td></td>
</tr>
<tr>
<td><strong>Knowledge governance</strong></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>How do you start the process of delivering knowledge about conservation agriculture?</td>
</tr>
<tr>
<td>16.</td>
<td>How do you obtain farmers’ attention in order to engage them with the programme?</td>
</tr>
<tr>
<td></td>
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<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>17.</td>
<td>As this programme has already run, according to you, how did it go?</td>
</tr>
<tr>
<td>18.</td>
<td>How do you build a relationship with the farmers?</td>
</tr>
<tr>
<td>19.</td>
<td>Did you select the farmers who can join the programme? If so, why?</td>
</tr>
<tr>
<td>20.</td>
<td>Is local knowledge being considered in the adoption of this programme?</td>
</tr>
<tr>
<td>21.</td>
<td>If local knowledge is being considered in the adoption of this programme, could you please explain to me what the involvement of local knowledge within this programme is?</td>
</tr>
<tr>
<td>22.</td>
<td>Do you think that farmers in those villages will always adopt a conservation agriculture system after the programme ends?</td>
</tr>
<tr>
<td>23.</td>
<td>From your perspective, what are the reasons why farmers will or will not continue to cultivate using a conservation agriculture system?</td>
</tr>
<tr>
<td>24.</td>
<td>What are the challenges that you are finding during the implementation of this programme?</td>
</tr>
<tr>
<td></td>
<td>Specific information:</td>
</tr>
<tr>
<td>Programme’s team work</td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td></td>
</tr>
<tr>
<td>24. Whom are you working with on this conservation agriculture programme?</td>
<td></td>
</tr>
<tr>
<td>25. Could you please tell me what types of communication media the programme uses?</td>
<td></td>
</tr>
<tr>
<td>26. Are regular meetings carried out?</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>27. Is there any delegation of tasks or duties in order to run the programme?</td>
<td>1. Yes 2. No</td>
</tr>
<tr>
<td>28. What is your role in this team work?</td>
<td></td>
</tr>
<tr>
<td>29. What are your duties?</td>
<td></td>
</tr>
<tr>
<td>27. Do you find difficulties in reaching a consensus at meetings?</td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Options</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>28. Do you have any concerns about the management of information within this organisation?</td>
<td>1. Yes  2. No  3. Not sure</td>
</tr>
<tr>
<td>29. Do you think that this group is working at its best in order to succeed with the programme of conservation agriculture?</td>
<td>1. Yes  2. No  3. Not sure</td>
</tr>
<tr>
<td>31. Does it need an increase in the team’s work performance, especially those involved in this programme? If yes, mention some reasons why.</td>
<td></td>
</tr>
<tr>
<td>32. Who is mainly responsible for the process of delivering the conservation agriculture knowledge to farmers in the field?</td>
<td></td>
</tr>
<tr>
<td>33. Are you involved in the process of choosing the right persons to introduce a conservation agriculture system to farmers?</td>
<td>1. Yes  2. No</td>
</tr>
<tr>
<td>34. Did you make a specification set in order to choose persons who will facilitate the delivery of knowledge?</td>
<td>1. Yes  2. No</td>
</tr>
<tr>
<td>36. Are there any particular facilitations that you provide? If yes, can you please tell me what are they?</td>
<td>1. Yes  2. No  3. Not sure</td>
</tr>
<tr>
<td>38. Are you involved in the process of choosing the facilitator to deliver knowledge of conservation agriculture to farmers?</td>
<td>1. Yes  2. No</td>
</tr>
<tr>
<td>39. Do you think that the facilitator that you currently provide is effective enough to put the programme in place?</td>
<td>1. Yes  2. No  3. Not sure</td>
</tr>
<tr>
<td>40. Are you using Bahasa Indonesia or Javanese when give directions to farmers about the conservation agriculture?</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Question</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>40.</td>
<td>In your opinion, what are the challenges when knowledge of conservation agriculture is being delivered to farmers?</td>
</tr>
<tr>
<td>41.</td>
<td>Do you evaluate the process of knowledge exchange for this programme?</td>
</tr>
<tr>
<td></td>
<td>Specific information:</td>
</tr>
</tbody>
</table>
### A.2 Interview questions for the government representative

**Interview number:**

**Name of interviewee:**

**Phone:**

**Date:**

**Time:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>How long have you been working in this department for?</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>What are your ordinary tasks?</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>How are you involved in the programme of conservation agriculture?</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>What are your competencies that support the programme of conservation agriculture?</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Did you have any background information in conservation agriculture before you were involved in this programme?</td>
<td></td>
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<tr>
<td></td>
<td>Specific information:</td>
<td></td>
</tr>
</tbody>
</table>

**A conservation agriculture system**

<p>| 6.  | According to you, what is a conservation agriculture system?             |         |</p>
<table>
<thead>
<tr>
<th></th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Were you aware of this system before being involved in the programme?</td>
</tr>
<tr>
<td>8</td>
<td>What are the things that have been provided by the government in order to put this programme in place, other than funds?</td>
</tr>
<tr>
<td>9</td>
<td>Do you think that farmers will completely adopt the conservation agriculture system?</td>
</tr>
<tr>
<td>10</td>
<td>According to you, what are the factors that influence farmers’ decisions in order to adopt or not to adopt the conservation agriculture system when the programme ends?</td>
</tr>
<tr>
<td>11</td>
<td>What are the things that the government will do to make sure that farmers will keep adopting a conservation agriculture system?</td>
</tr>
</tbody>
</table>

Specific information:

**Knowledge governance**
<table>
<thead>
<tr>
<th></th>
<th>Question</th>
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</thead>
<tbody>
<tr>
<td>12.</td>
<td>Are you involved in the process of delivering knowledge of conservation agriculture to farmers?</td>
</tr>
<tr>
<td>13.</td>
<td>Were there any formal guides issued by the government about methods/ways to deliver the knowledge of agricultural conservation to farmers?</td>
</tr>
<tr>
<td>14.</td>
<td>According to you, what is the best way to deliver agricultural conservation to farmers?</td>
</tr>
<tr>
<td>15.</td>
<td>To the best of your knowledge, how is the implementation of agricultural conservation delivery to farmers in practice?</td>
</tr>
<tr>
<td>16.</td>
<td>Who is responsible for delivering this programme to farmers in the field?</td>
</tr>
<tr>
<td>17.</td>
<td>Do you also watch the delivery process in the field?</td>
</tr>
<tr>
<td>18.</td>
<td>Do you also choose the ways of how to deliver the knowledge of conservation agriculture to farmers?</td>
</tr>
<tr>
<td>19.</td>
<td>Is this well suited to your expectations as a government representative?</td>
</tr>
<tr>
<td>20.</td>
<td>Is there any continuous evaluation about ways of how to deliver the knowledge of conservation agriculture programme that was chosen?</td>
</tr>
<tr>
<td>21.</td>
<td>Is the involvement of local knowledge important in the adoption of agricultural conservation?</td>
</tr>
</tbody>
</table>
22. Has the involvement of local knowledge been implemented in this programme? If yes, in what ways?

23. Do you think that farmers’ local knowledge should be taken into account in the programme of conservation agriculture?

Specific information:

**Team work**

24. For this programme, who are the people you work with?

25. What is your role within this work team?

26. How do you develop communication with them?

27. Could you please tell me, how does the delegation of tasks work for this programme?

28. What are the challenges faced by this organisation or team, in order to put the programme of conservation in place?

29. Do you think that this organisation or team has worked effectively?

30. Does the team work management need improving? If yes, how?

31. Is a representative from farmers involved in this team work?

Specific information:
<table>
<thead>
<tr>
<th></th>
<th>A conservation agriculture programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>32.</td>
<td>Are you directly involved in the field?</td>
</tr>
<tr>
<td>33.</td>
<td>Who is responsible for choosing the persons who facilitate the delivery of conservation agriculture knowledge?</td>
</tr>
<tr>
<td>34.</td>
<td>What is the government’s expectation to farmers regarding this program implementation?</td>
</tr>
<tr>
<td>35.</td>
<td>Before this programme, was there any survey addressed to farmers to find out farmer’s basic needs. If there was, what are farmer’s basic needs?</td>
</tr>
<tr>
<td>36.</td>
<td>Have farmer’s basic needs already been met by this existing programme implementation? If yes, how was it fulfilled?</td>
</tr>
<tr>
<td>37.</td>
<td>Do you evaluate the work of field persons in this conservation agriculture programme?</td>
</tr>
<tr>
<td>38.</td>
<td>How was their work performance?</td>
</tr>
<tr>
<td>39.</td>
<td>What are the challenges in putting this programme into practice?</td>
</tr>
<tr>
<td>40.</td>
<td>Do you think that this programme should be introduced in different ways?</td>
</tr>
<tr>
<td>41.</td>
<td>Is there any better way regarding the application of conservation agriculture adoption to farming society? If yes, mention some examples.</td>
</tr>
<tr>
<td>42.</td>
<td>Why was the funding being stopped?</td>
</tr>
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<td>---</td>
<td>--------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>43.</td>
<td>Do you think that this programme can be funded again?</td>
</tr>
<tr>
<td>44.</td>
<td>Why the Budget Revenues and Regional Spending isn’t multi years anymore?</td>
</tr>
<tr>
<td></td>
<td><strong>Specific information:</strong></td>
</tr>
</tbody>
</table>
### A.3 Interview questions for the field person

Interview number:

Name of interviewee:

Phone:

Date:   Time:

<table>
<thead>
<tr>
<th>No.</th>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>How long have you been working for?</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>What are your responsibilities?</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Are you going to the fields and talking to farmers every day?</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>What are the topics that you are mostly talk or discuss with farmers?</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Do you have a schedule for a visitation to farmers?</td>
<td></td>
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<tr>
<td>6.</td>
<td>What are the challenges that you found in your work?</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Why did you choose this job?</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>What fascinated you about this job?</td>
<td></td>
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</tbody>
</table>

**Specific information:**

**A conservation agriculture system**

<p>| 9.  | Do you know the term conservation agriculture system before?             |         |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>10.</td>
<td>How do you get involved in this programme?</td>
</tr>
<tr>
<td>11.</td>
<td>Do you think you are competent enough to be involved in this programme?</td>
</tr>
<tr>
<td>12.</td>
<td>Did you get any guidelines, workshops, or training about the conservation agriculture system before the programme began?</td>
</tr>
<tr>
<td>13.</td>
<td>If you did get workshops about a conservation agriculture system, from your perspective, what is conservation agriculture?</td>
</tr>
<tr>
<td>14.</td>
<td>What are the challenges that you are finding in adopting this system?</td>
</tr>
<tr>
<td>15.</td>
<td>From your personal point of view, do you think that farmers will still adopt this system after the programme ends?</td>
</tr>
<tr>
<td>16.</td>
<td>What do you think about this conservation agriculture programme?</td>
</tr>
<tr>
<td>17.</td>
<td>Do you think that this programme should be improved?</td>
</tr>
<tr>
<td>18.</td>
<td>If you think that the conservation agriculture programme should be improved, can you tell me in what way?</td>
</tr>
<tr>
<td>Specific information:</td>
<td></td>
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<tr>
<td>-----------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Knowledge governance</strong></td>
<td></td>
</tr>
<tr>
<td><strong>19.</strong> Who is responsible for delivering knowledge of the conservation agriculture system to farmers?</td>
<td></td>
</tr>
<tr>
<td><strong>20.</strong> How does the process of the introduction to knowledge of conservation agriculture begin?</td>
<td></td>
</tr>
<tr>
<td><strong>21.</strong> Do you get involved in the process of selecting the knowledge delivery of conservation agriculture to farmers?</td>
<td></td>
</tr>
<tr>
<td><strong>22.</strong> Is there any recommended way to deliver knowledge of conservation agriculture? Or you may have your own improvised method?</td>
<td></td>
</tr>
<tr>
<td><strong>23.</strong> Are you using Bahasa Indonesia or Javanese when communicating with farmers?</td>
<td></td>
</tr>
<tr>
<td><strong>24.</strong> Is local knowledge included in the application of agricultural conservation system in this programme? Why or why not?</td>
<td></td>
</tr>
<tr>
<td><strong>25.</strong> According to you, Is that necessary? If yes, in what aspect?</td>
<td></td>
</tr>
<tr>
<td><strong>26.</strong> Was there any local knowledge that you knew already? If yes, what is it?</td>
<td></td>
</tr>
</tbody>
</table>
Specific information:

**Team work**

27. Whom are you working within the conservation agriculture programme?

28. Did you actively join in the discussion related to the delivery process of knowledge of conservation agriculture to farmers?

29. What is your contribution toward this team work?

30. What is the information that you provide to the group from your background or experience in order the adoption of this programme succeeds?

31. How are the tasks delivered in your work team?

32. Do you have any responsibility to report your progress to the group?

33. Are regular meetings carried out?

34. How has the communication worked so far?

35. Are the representatives from farmers involved in the group?

36. Are there any particular things about the work of this group that need to be improved?

**The conservation agriculture programme**
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>37. Who are you working with when the adoption of a conservation</td>
<td></td>
</tr>
<tr>
<td>agriculture system is taking place in the field?</td>
<td></td>
</tr>
<tr>
<td>38. What is your main responsibility?</td>
<td></td>
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<tr>
<td>39. What are the facilities that you provide for the process of</td>
<td></td>
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<tr>
<td>knowledge delivery?</td>
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<tr>
<td>40. How do you think of these facilities are effective?</td>
<td></td>
</tr>
<tr>
<td>41. Do you have any involvement in choosing these facilities to be</td>
<td></td>
</tr>
<tr>
<td>used?</td>
<td></td>
</tr>
<tr>
<td>42. Are you using Bahasa Indonesia or the local language when you</td>
<td></td>
</tr>
<tr>
<td>communicate with farmers?</td>
<td></td>
</tr>
<tr>
<td>43. Do they normally understand your explanation about the application</td>
<td></td>
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<tr>
<td>of this conservation agriculture programme?</td>
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</tr>
<tr>
<td>44. From your perspective, what are the main concerns facing farmers?</td>
<td></td>
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<tr>
<td>45. How does this programme relate to their concerns?</td>
<td>.</td>
</tr>
<tr>
<td>46. What do you think about this programme?</td>
<td></td>
</tr>
<tr>
<td>47. Has any evaluation that has been held about your work?</td>
<td></td>
</tr>
</tbody>
</table>
48. If there is an evaluation about your work, do you get the results of that evaluation?

Specific information:

A.4 Interview questions for farmers

<table>
<thead>
<tr>
<th>No.</th>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Background information</strong></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Size of the family</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Village</td>
<td></td>
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<tr>
<td>6.</td>
<td>Land occupation</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Size of farm land</td>
<td></td>
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<tr>
<td>8.</td>
<td>Major crop</td>
<td></td>
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<tr>
<td>9.</td>
<td>How many years have you been farming?</td>
<td></td>
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<tr>
<td>10.</td>
<td>Do you have any problems with your crop?</td>
<td></td>
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<tr>
<td>11.</td>
<td>If you do have problems with your crops, can you please tell me what are they?</td>
<td></td>
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<tr>
<td>12.</td>
<td>What changes you want to see from your crops?</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Are you joining a farmer group?</td>
<td></td>
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<tr>
<td>15.</td>
<td>If there are benefits from joining a farmer group, can you please tell me what are they?</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Do you think the farmer group that you’ve joined needs to be improved?</td>
<td>1. Yes 2. No 3. Not sure</td>
</tr>
</tbody>
</table>
17. If you think that this farmer group needs to be improved, can you please tell me in what way?

Specific information:

**Local knowledge of cultivation systems**

18. Can you please describe to me the way you cultivate the land from the very beginning?

19. Do you know how long your family or relatives did the cultivation before pesticides and chemical fertilisers were introduced?

20. If you do know, can you please tell me more about it?

21. How long since you adopted the cultivation system that uses chemical pesticides and fertilisers?

22. How do you treat the pesticides before you apply them?

23. From the way you treat the pesticides, are you doing that based on your own intuition or is somebody else is telling you?
<p>| | | |</p>
<table>
<thead>
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<th></th>
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</thead>
<tbody>
<tr>
<td><strong>24.</strong></td>
<td>Do you integrate knowledge of your previous way of cultivation with your current way of cultivation? If you do, in what way?</td>
<td></td>
</tr>
<tr>
<td><strong>25.</strong></td>
<td>Do you do any traditions/rituals before you start or after the cultivation?</td>
<td>Specific information:</td>
</tr>
<tr>
<td><strong>26.</strong></td>
<td>Have you adopted the conservation agriculture system?</td>
<td></td>
</tr>
<tr>
<td><strong>27.</strong></td>
<td>What do you think of this system?</td>
<td></td>
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<tr>
<td><strong>28.</strong></td>
<td>Does the conservation agriculture system make any difference to your land and crops?</td>
<td></td>
</tr>
<tr>
<td><strong>29.</strong></td>
<td>If it does, in what way?</td>
<td></td>
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<tr>
<td><strong>30.</strong></td>
<td>Will you keep adopting the conservation agriculture system when the programme has ended?</td>
<td></td>
</tr>
<tr>
<td><strong>31.</strong></td>
<td>Can you please tell me the reasons why you will, or will not, adopt the conservation agriculture system?</td>
<td></td>
</tr>
<tr>
<td><strong>32.</strong></td>
<td>If you are willing to keep adopting the system, will you combine the system with your previous cultivation system (using pesticides and fertilisers)?</td>
<td></td>
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<tr>
<td><strong>33.</strong></td>
<td>Can you please tell me why?</td>
<td></td>
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<td></td>
<td>Question</td>
<td>1. Yes</td>
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<td>--------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>34.</td>
<td>If you have not adopted the conservation agriculture system, will you be willing to try?</td>
<td></td>
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<tr>
<td>35.</td>
<td>Can you please tell me the reasons why?</td>
<td></td>
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</tbody>
</table>

**Specific information:**

**Perceptions on the conservation agriculture programme**

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>1. Yes</th>
<th>2. No</th>
<th>3. Not sure</th>
</tr>
</thead>
<tbody>
<tr>
<td>36.</td>
<td>How were you involved in the programme at the beginning?</td>
<td></td>
<td></td>
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<tr>
<td>37.</td>
<td>How do you get along with it?</td>
<td></td>
<td></td>
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<tr>
<td>38.</td>
<td>What do you think about the conservation agriculture programme?</td>
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<tr>
<td>39.</td>
<td>How do the persons who are in charge of the programme communicate with you?</td>
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<td>40.</td>
<td>Are they using Bahasa Indonesia or Javanese when they communicate with you?</td>
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<td>41.</td>
<td>What do you think about the information of conservation agriculture that is given to you?</td>
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<td>42.</td>
<td>What would you do if you do not understand it?</td>
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<td>43.</td>
<td>Which language do you find most comfortable to use when you communicate with those persons?</td>
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<td></td>
<td>Question</td>
<td>Answer</td>
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<tr>
<td>44.</td>
<td>Can you please tell me the reasons why?</td>
<td></td>
<td></td>
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<tr>
<td>45.</td>
<td>Are you involved in any discussions provided by the government during this programme?</td>
<td>1. Yes</td>
<td></td>
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<td></td>
<td></td>
<td>2. No</td>
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<td>46.</td>
<td>Could you please explain to me what those discussions are about?</td>
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<td>47.</td>
<td>How do you get along with it?</td>
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<td>48.</td>
<td>How did the discussion first start?</td>
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<td>49.</td>
<td>Does this programme consider the current knowledge of the cultivation system that you have?</td>
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<td></td>
<td>If it does, in what way?</td>
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<td>50.</td>
<td>Do you think that involving your knowledge with the new conservation agriculture knowledge that is given by the government important?</td>
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<tr>
<td>51.</td>
<td>Can you please tell me the reasons why?</td>
<td></td>
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</tr>
<tr>
<td>52.</td>
<td>Does this programme implementation need to be improved?</td>
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<tr>
<td>53.</td>
<td>If it needs to be improved, can you tell me in what way?</td>
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<tr>
<td>54.</td>
<td>Do you think about the programme relates to your need as farmers?</td>
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<td>55.</td>
<td>What are your needs as farmers?</td>
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<tr>
<td>Question</td>
<td>Response</td>
<td></td>
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<tr>
<td>------------------------------------------------------------------------</td>
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<tr>
<td>56. Has this programme finished?</td>
<td></td>
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<tr>
<td>57. If the programme eventually stops without any notice being given to farmers, do you think it was a waste of time being involved in this programme? Why?</td>
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<tr>
<td>Specific information:</td>
<td></td>
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</tr>
<tr>
<td><strong>Perceptions on networking</strong></td>
<td></td>
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<tr>
<td>58. How do you contact the committee of the conservation agriculture programme when you have difficulties with the process of adopting the system?</td>
<td></td>
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<tr>
<td>59. What do you think about the advice that is given to you?</td>
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<tr>
<td>60. Do they visit you frequently?</td>
<td></td>
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<tr>
<td>61. Does your farmers group help you with the process of adopting conservation agriculture?</td>
<td>1. Yes 2. No</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>62. If your farmers' group does help you with the process of adoption, can you please tell me in what way?</td>
<td></td>
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<tr>
<td>63. Which group you prefer to go to seek to information from about the conservation agriculture system (or other cultivation systems)?</td>
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<tr>
<td>64. Can you please tell me the reasons why?</td>
<td></td>
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</tr>
</tbody>
</table>
65. Is your family also involved in your decisions about your agricultural activities from planting to marketing?

66. Can you please tell me the reasons why?

67. Do you think the information that is given to you about a conservation agriculture system is trustworthy?

68. Can you please tell me the reasons why?

Specific information:
Appendix 2

Information Sheets

Appendix 2 provides information sheets that were given to all research participants prior to the interview. All the information sheets were translated in Bahasa Indonesia, the national language of Indonesia.

B.1 Information sheet in English

[Image of the Lincoln University information sheet]

20 February 2013

To: Whom it May Concern

I, Dr. Ronlyn Duncan, hereby declare that Hesthi Nugroho is a student of Lincoln University, Lincoln, Canterbury, New Zealand. She is taking a PhD programme in Environmental Management and her research title is “Adoption of a conservation agriculture system: evaluating knowledge governance in rural villages of East Java, Indonesia.” Hesthi’s research is funded by Lincoln University and New Zealand Government.

To support her research, Hesthi needs to collect information on geographic, political and socio-economic issues around the Brantas River Basin area, and on agricultural policies. She also has to conduct interviews with the potential respondents. Therefore, your support for Hesthi’s research data collection would be much appreciated.

Regards

Dr. Ronlyn Duncan
Main Supervisor
Research Information Sheet

The aim of this project is:

1. To examine the existing knowledge governance model/s of conservation agriculture in East Java, Indonesia
2. To investigate how local knowledge is incorporated into the process of knowledge exchange
3. To observe farmers’ perspectives towards their existing agricultural practices and a new conservation agriculture system.

Your participation:
Answering a set of questions from an interview list during an informal interview session. The time estimation of the interview is 45 minutes to an hour.

Before the interview begins, you will be asked to:

1. Sign the consent form which is provided, as evidence that you understand what the research is about, your role in this research and preservation of your anonymity.
2. Give permission in order to be contacted again for further clarification of today’s interview.

To ensure anonymity the following steps will be taken:

1. Your personal details and contact details will not be used or mentioned in the process of writing up this research.
2. Your name will be changed into a coded name for identification purposes
3. All data from interviews will be stored in a locked cabinet in the researcher’s room and in the researcher’s personal computer, which is protected with a password.
4. In presentations, your name and contact details will not be mentioned
Additional Information:

1. Participation in this research is voluntary and you have the right to withdraw your participation from this research at any time.

2. You have the right to not answer a specific question that is being asked.

3. You may or may not give the researcher permission to record the process of interviewing using a voice recorder.

4. You will be asked to give a permission to be observed during your activity in the farm fields, in the farmers' group meetings, and in the workshops and training sessions of a conservation agriculture program.

5. You are welcome to revise the transcript of your interview before it is used for analysis.

6. You may withdraw from the research at any time, including withdrawal of any information you have provided up until the time the results of interviews will be analysed, which will be September 2013. Beyond this date it will not be possible to extract the data.

7. You may review your transcripts before they are used for analysis, including add or alter the information you have provided until the time the transcripts will be analysed, which will be September 2013. To do this, you can contact the researcher at her email address or phone number which is given below.

8. This research is funded by Lincoln University and the Government of New Zealand.

The project is being carried out by:

**Name of principal researcher**: Hesthi Utami Nugroho

**Contact details**: E-mail: [REDACTED] phone: [REDACTED]

She will be pleased to discuss any concerns you have about participation in the project.

**Name of Supervisors**: Dr. Ronlyn Duncan and Dr. Roddy Hale

**Contact Details**: E-mail: [REDACTED]

The project has been reviewed and approved by the Lincoln University Human Ethics Committee.
Surat Pernyataan


Untuk mendukung penelitian tersebut, Hesti perlu mengumpulkan beberapa informasi, tentang letak geografis, politik dan sosial ekonomi disekitar area DAS Brantas, serta kebijakan pertanian yang pernah dan sedang diterapkan diarea tersebut. Hesti juga harus mengadakan wawancara dengan para responden. Oleh karenanya, dukungan dan bantuan yang diberikan untuk kelancaran Hesti melakukan pengkoleksian data penelitian akan sangat kami harap.

Hormat saya

Dr. Ronlyn Duncan
Dosen Pembimbing Utama

20 February 2013
**Lembar Informasi Riset**

Tujuan dari riset ini adalah:
1. Untuk menguji keberadaan model pengelolaan ilmu pengetahuan dari pertanian berkonservasi di Jawa Timur, Indonesia.
2. Untuk menginvestigasi bagaimana pengetahuan local dimasukkan didalam proses pertukaran ilmu pengetahuan tersebut.
3. Untuk mengamati perspektif para petani terhadap praktek bercocok tanam yang ada saat ini dan terhadap sistem pertanian berkonservasi yang baru.

**Partisipasi Bapak/Ibu berupa:**
Menjawab satu set pertanyaan dari daftar wawancara selama sesi wawancara yang dilaksanakan secara informal. Dengan estimasi waktu wawancara adalah selama 45 menit hingga satu jam.

Sebelum wawancara dilaksanakan, Bapak/Ibu akan diminta untuk:
2. Memberikan ijin untuk dapat dihubungi kembali bila klarifikasi dari hasil interview hari ini diperlukan.

Untuk memastikan kerahasiaan identitas Bapak/Ibu maka beberapa hal dibawah ini akan dilaksanakan:
1. Data pribadi dan nomer kontak Bapak/Ibu tidak akan digunakan atau disebutkan didalam proses penulisan riset ini.
3. Semua data interview akan disimpan didalam kabinet yang terkunci di ruangan si peneliti dan juga tersimpan didalam komputer milik peneliti yang dilindungi dengan adanya password.
4. Didalam presentasi penelitian ini nantinya, nama serta data pribadi Bapak/Ibu tidak akan disebutkan.
Informasi tambahan:

1. Partisipasi dalam penelitian ini sifatnya adalah sukarela dan Bapak/ibu mempunyai hak untuk mengundurkan diri sebagai partisipan didalam penelitian ini.

2. Bapak/ibu mempunyai hak untuk tidak menjawab suatu pertanyaan yang sifatnya sangat spesifik dan pribadi bagi Bapak/ibu.


4. Bapak/ibu akan diminta dengan peneliti agar peneliti dapat mengobservasi kegiatan Bapak/ibu dilapang, dalam pertemuan kelompok tim, dan didalam sesi pelatihan program pertanian berkonservasi.

5. Bapak/ibu dapat meninjau kembali catatan dari hasil wawancara yg telah dilaksanakan sebelum catatan tersebut digunakan untuk dianalisa.


Riset ini dilaksanakan oleh:

Nama peneliti utama : Hesthi Utami Nugroho

Alamat E-mail: no.telpon: E-mail: phone:
Peneliti tersebut akan dengan senang hati membahas hal-hal yang dirasa Bapak/Ibu perlu untuk diperhatikan yang berkaitan dengan posisi Bapak/Ibu sebagai responden dalam riset ini.

Nama para dosen pembimbing: Dr. Roslyn Duncan and Dr. Roddy Hale

Alamat E-mail: E-mail:

Riset ini telah ditinjau dan disetujui oleh Komite Human Ethics, Universitas Lincoln.
B.3 Interview consent form

Interview Consent Form

Name of Project: Adoption of a conservation agriculture system: evaluating knowledge governance in rural villages of East Java, Indonesia.

☐ I have read and understood the description of the above-named project. On this basis I agree to participate as a subject in the project voluntary, and I consent to publication of the results of the project with the understanding that anonymity will be preserved. I also agree to be contacted for further clarification of today’s interview.

☐ I understand that I may withdraw from the research at any time, including withdrawal of any information I have provided up until the time the results of interviews will be analysed, which will be September 2013. Beyond this date it will not be possible to extract the data.

☐ I understand that I may review my transcripts before they are used for analysis, including add or alter the information I have provided until the time the transcripts will be analysed, which will be September 2013.

☐ I agree to be observed in regards to my activities in the meetings of the conservation agriculture programs.

☐ I give permission for the use of a voice recorder to record the interview.

☐ I do not give permission for the use of a voice recorder to record the interview. I prefer the researcher uses the handwritten notes.

Name: ____________________________________________

Signed: ___________________________ Date: ____________
Lembar Persetujuan Wawancara


☐ Saya telah membaca dan mengerti deskripsi dari judul penelitian diatas. Berdasarkan hal tersebut, saya setuju untuk berpartisipasi sebagai responden didalam penelitian ini, dan saya menyetujui terhadap publikasi yang dibuat atas hasil dari penelitian ini dengan pemahaman akan terjemannya kerahasiaan data pribadi saya. Saya juga setuju untuk dapat dihubungi kembali bila hasil dari wawancara hari ini memerlukan klarifikasi.

☐ Saya memahami bahwa memungkinkan bagi saya untuk mengundurkan diri dari bagian penelitian ini, termasuk menarik semua informasi yang telah saya berikan sebelum hasil dari wawancara dianalisis, yaitu pada bulan September 2013. Saat dan setelah bulan tersebut maka tidak dimungkinkan lagi untuk menarik data yang telah saya berikan.

☐ Saya memahami bahwa saya dapat merevisi ulang catatan hasil wawancara saya sebelum digunakan untuk proses analisis, termasuk didalamnya menambah atau mengubah informasi yang saya berikan sampai tiba waktu nya catatan tersebut dianalisis, yaitu pada bulan September 2013.

☐ Saya setuju akan adanya observasi terhadap kegiatan yang saya lakukan di dalam rapat internal para pengurus/ panitia program pertanian berkonservasi

☐ Saya memberi ijin atas penggunaan alat perekam suara untuk merekam jalannya wawancara

☐ Saya tidak memberikan ijin atas penggunaan alat perekam suara untuk merekam jalannya wawancara. Saya lebih nyaman bila peneliti menggunakan catatan tertulis.

Nama: ____________________________

Tanda Tangan: ____________________ Tanggal: ______________
Appendix 3 Brainstorming Diagrams

Appendix 3 provides diagrams as part of brainstorming the key themes across the interview transcripts.
farmers' worldviews

traditional (manyaal concept)

management of agriculture

knowledge of land
cultivation practices
Conservation agriculture programme

It's about implementing pure scientific technology & knowledge to farmers

CA rules:
- Terracing system
- Diversion ditches
- Annual plants
- Land treatment
- Control potholes
- Scientific technology
- Farmers obey rules

CA does not:
- Use 5-10 ha farm land
- Soil sampling technique
- Different

CA proposed today:
- Farmers do not listen
- CA personal fund
- Provincial fund
- Annual budget
- Farmers' own land
- Cake sale
- Must make profit

CA workshops:
- DAAC Premium
- Urgent
- Improve upper stream
- SBY people need Premium order
- Farmers broke law
- farmers need to change cultivation and crops

Socialist movement controls by the fund that was given.

This could be considered a consensus.

CA - CC code
- Emerged from the governor
- Farmers treated land wrongly
- Wrong practices
- No diversion ditches
- Cultivate vegetable crops

CA - CAP code
- Improve DAAC Premium
- Urgent
- Improve upper stream
- SBY people need Premium order
- Farmers broke law
- Farmers need to change cultivation and crops

Different sources of how CAP emerged show there is a problem of communication between public agencies and representatives.

Problem of communication is found along the way of the implementation of CAP.

Opinion of CAP now:
- CAP stops
- Farmers were left
- CAP stops
- continues working
- Guidance continues

Evaluation:
- never written
- never discussed
- never mentioned the need
- keep to each self
- prepare for each self
Farmers are a commercial individual who joined CAP for economic reasons.

- Farmers & CAP
  - farmers know breeding system
  - farmers are commercial people
  - farmers don’t want to change expensive
  - farmers don’t like experimenting expensive
  - farmers want CA for economic reason
  - farmers need apple & vegetable

- There was a limitation access of information &

The way knowledge was delivered showed how farmers were positioned as receivers of the project. Only a strategy to deliver knowledge delivery

- Presentation
- Teaching, guide book
- went to field, gave example

Different sources of the emergence of CAP have put LF into different perspectives, which LF is a matter of technical issue and farmer's belief.

- Local knowledge
  - SC
  - Farmers have lack of their own knowledge
  - Farmers have lack of knowledge

- Cultivation system
  - combine LF w/ S technology
  - traditional measure
  - let farmers choose apple & vegetable grass
  - farmers’ belief is challenged

Lit LF is spring sources
- Farmers have lack of LF

Lk & technical
- LF about technology