

AN ABSTRACT OF THE DISSERTATION OF

Arini Wahyu Utami for the degree of Doctor of Philosophy in Public Policy presented on March 6, 2017.

Title: Community Resilience to Climate Change in Rural Java, Indonesia

Abstract approved: _____

Lori A. Cramer

Climate change increases weather unpredictability, threatens communities whose livelihoods depend on natural resources, such as rural communities. Utilizing a Community Capital Framework (Flora and Flora, 2013) and Governance of Complex Adaptive Systems (Duit and Galaz, 2008), this study concentrated on the role of cultural and political capital in supporting rural communities' resilience to climate change. Specifically, this study inquires: 1) Does staple food diversification as traditional knowledge support community resilience to climate change?; 2) How does a government institution, i.e. via rice subsidy policy, facilitate the practice of staple food diversification as traditional knowledge?; 3) How does political capital play a role in facilitating community resilience to climate change?; and 4) What is the effect of social and human capital on political capital?

Qualitative and quantitative data were collected from three rural communities in Java, Indonesia. Results indicate that cultural and political capital exhibit positive roles in mitigating rural communities' resilience to climate change. However, there remains a lack of realization of climate change's long-term effect and the need for adaptation action, even when communities have noticed changes in climate and the environment. Also, government institutions, in this case via rice subsidies, can go hand in hand with traditional knowledge on local staples to enhance communities' resilience. Moreover, human capital, especially level of education, plays a substantial role in the exercise of political capital in rural communities. Low education level in the studied communities creates a reluctance to participate in policy discourse and a reliance on community leaders in policy-making processes, despite the ongoing decentralization policy that provides broader opportunities for rural communities to participate in development and policy-making.

©Copyright by Arini Wahyu Utami
March 6, 2017
All Rights Reserved

Community Resilience to Climate Change in Rural Java, Indonesia

by

Arini Wahyu Utami

A DISSERTATION

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Philosophy

Presented March 6, 2017
Commencement June 2017

Doctor of Philosophy dissertation of Arini Wahyu Utami presented on March 6, 2017

APPROVED:

Major Professor, representing Public Policy

Head of the School of Public Policy

Dean of the Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

Arini Wahyu Utami, Author

ACKNOWLEDGEMENTS

First of all, all praise is to Allah SWT, the Almighty.

My sincere appreciation goes to Dr. Lori Cramer, my major advisor, for her constant support and example as mentor and teacher. Also to my Committee, Drs. Nancy Rosenberger, Brent Steel, Susan Capalbo, and Jonathan Kaplan, for their patient guidance.

I am very grateful to the School of Public Policy for all of their support, especially the 'real world example' of collaborative learning environment and 'workshop' as Instructor through GTA-ship; as well as to the Department of Applied Economics for the administrative support during my first year at OSU. Also to Fulbright, IIE (Institute of International Education), and AMINEF (American Indonesian Education Foundation) that made my journey in the US possible. I also thank the Tokyo Foundation for providing research funds through SYLFF (Sasakawa Young Leader Fellowship Fund) to conduct fieldwork in Indonesia, and the Faculty of Agriculture, Universitas Gadjah Mada, Indonesia for their assistance during my fieldwork. And not to forget, community leaders and residents of the three villages where I did my fieldwork.

My days in the US have been a 'bittersweet symphony' with these amazing people: VanBuren International House, the Indonesian community, PhD and MPP 2012-2013 cohort, Thesis Club, and everybody I cannot mention one by one for making me feel at home in Oregon. Thanks a million for the life lessons, road trips, hikes, kitchen talks, dinner times, games and movie nights, Thanksgiving turkeys and pies, crabbing, mushroom hunting, the Indonesian nights, badminton-baseball games, and all.

Lastly, I am forever indebted to my parents, brother, sister, nephew, and niece for their endless prayer and encouragement, as well as inspiration to always '*learn something new every day*'.

TABLE OF CONTENTS

	<u>Page</u>
CHAPTER 1. INTRODUCTION	1
Climate Change and Natural Hazards	1
Understanding Community Resilience	2
Research Questions	6
Research Approach	8
Thesis Layout	11
References	13
CHAPTER 2. STAPLE FOOD DIVERSIFICATION: DOES IT MATTER FOR CLIMATE CHANGE RESILIENCE?	18
Abstract	18
Introduction	18
Conceptual and Theoretical Framework	20
Traditional Ecological Knowledge	20
Staple Food Diversification	21
Community Resilience	22
Research Question and Hypothesis	24
Method	24
Study Areas	24
Data Collection	28
Data Analysis	30
Result and Discussion	34
Conclusion	40
References	41
CHAPTER 3. LOCAL STAPLE FOOD VERSUS RICE SUBSIDY: DEVELOPING CLIMATE CHANGE RESILIENCE IN RURAL INDONESIA	45
Abstract	45
Introduction	45
Conceptual and Theoretical Framework	47
Raskin: the Indonesian Rice Subsidy Program	47
Traditional Ecological Knowledge	49
Community Resilience	50
Research Question and Hypothesis	51
Method	52
Study Areas	52
Data Collection	55
Data Analysis	57
Result and Discussion	58
Conclusion	66
References	67

TABLE OF CONTENTS (continued)

	<u>Page</u>
CHAPTER 4. COMMUNITY POLITICAL CAPITAL AND RESILIENCE TO CLIMATE CHANGE: VIEW FROM DECENTRALIZATION ERA IN INDONESIA	72
Abstract	72
Introduction	72
Conceptual and Theoretical Framework	74
The Indonesian Decentralization	74
Community Resilience	76
Political Capital	78
Research Question and Hypothesis	79
Method	80
Study Areas	80
Data Collection	81
Data Analysis	83
Result and Discussion	85
Conclusion	94
References	95
CHAPTER 5. THE ROLE OF SOCIAL AND HUMAN CAPITAL ON COMMUNITY POLITICAL CAPITAL: CASE OF RURAL INDONESIA	100
Abstract	100
Introduction	100
Conceptual and Theoretical Framework	102
The Indonesian Decentralization	102
Political Capital	104
Social and Human Capital	105
Research Question and Hypothesis	106
Method	106
Study Areas	106
Data Collection	108
Data Analysis	109
Result and Discussion	112
Conclusion	119
References	121
CHAPTER 6. GENERAL CONCLUSIONS	124
Summary of Findings	125
Policy Recommendations	129
Validity and Generalizability	132
Limitations	133
Recommendations for Future Research	134
References	135

TABLE OF CONTENTS (continued)

	<u>Page</u>
APPENDIX	
Appendix 1. Variables Definition	137
Appendix 2. Interview guide	140
Appendix 3. Survey questionnaire	147

LIST OF FIGURES

<u>Figure</u>	<u>Page</u>
1.1. Framework of Study	8
2.1. Map of Central Java and Yogyakarta Province	26
3.1. Map of Central Java and Yogyakarta Province	53
3.2. Annual Household and On-farm Income	65
4.1. Typology of Adaptive Governance System (Duit and Galaz, 2008)	77
4.2. Map of Central Java and Yogyakarta Province	81
5.1. Map of Central Java and Yogyakarta Province	107

LIST OF TABLES

<u>Table</u>	<u>Page</u>
2.1. Basic Figures of the Surveyed Villages	27
2.2. Number of Study Participants	29
2.3. Statistics of Staple Food Diversification and Recovery Time from Shocks	32
2.4. Knowledge of Climate Change and Perception about Environmental Changes	34
2.5. Two Stage Least Square (2SLS) Estimation Results	36
3.1. Basic Figures of the Surveyed Villages	54
3.2. Number of Study Participants	56
3.3. Statistics of Rice Subsidy, Staple Food Diversification, and Recovery Time from Shocks	59
3.4. Two Stage Least Square (2SLS) Estimation Results	62
4.1. Statistics of Recovery Time from Shocks and Political Capital Variables	87
4.2. Estimation Results	89
5.1. Estimation Results	113
5.2. Statistics of Political, Social, and Human Capital	114
5.3. Household Head's Educational Attainment	118

CHAPTER 1. INTRODUCTION

"I notice that there is a prolonged dry season every one 'windu' (author's note: eight years). It affects rice harvest and tobacco price." (An elder, Village C, 2015)

CLIMATE CHANGE AND NATURAL HAZARDS

Climate change increases weather unpredictability, heightens minimum and maximum daily temperatures, spurs heavy precipitation (Intergovernmental Panel on Climate Change/IPCC, 2012) and raises the frequency and intensity of such periodical weather anomalies such as the El Nino Southern Oscillation or ENSO (Timmermann et al., 1999). ENSO, which occurs in the Equatorial Pacific, affects precipitation patterns in a large number of countries, including the United States, Peru, Australia, and Indonesia. In Indonesia, ENSO may lower precipitation levels, creating the potential for prolonged periods of drought; or, conversely, may trigger higher levels of precipitation, nurturing conditions that prompt floods and levels of humidity that lead to the proliferation of disease-carrying insects. Studies illustrate that unpredictability in precipitation and other weather elements brought by ENSO harms food production, reduces farmer incomes, and undermines social and ecological resilience (Naylor et al., 2001; Irawan, 2006; Keil et al., 2008).

The effect of climate change, in fact, has gone beyond more severe climate-related natural hazards, such as floods, droughts, and storm surges. Studies show that climate change also indirectly triggers non-climate natural hazards such as volcanic eruptions and earthquakes (McGuire et al., 1997; McGuire, 2012; Compton et al., 2015). Both the climate- and non-climate-related natural hazards imposed by climate change magnify its threat to human systems. Among others, rural communities face a substantial challenge from the unpredictable weather and environmental change, mainly because of the intertwining between their livelihoods with natural resource extraction. In Indonesia, small-scale

farmers comprise more than fifty percent of the farmers' population, which is part of the 35 percent of the nation's work force (Central Bureau of Statistics, 2014). Indonesia is particularly well-suited for investigating community resiliency as climate change imposes a direct effect on their livelihoods.

UNDERSTANDING CULTURAL CAPITAL AND COMMUNITY RESILIENCE

Aside from the threats of climate change, studies have recorded the ability of rural communities to adapt to the changing environment by relying on traditional or indigenous knowledge (e.g. see Boissiere et al., 2013; Olson, 2013; Boillat and Berkes, 2013). Altieri and Koohafkan (2008) show that small, traditional farm households in Africa, Asia, and Latin America inherit and/or develop varied farming techniques that are capable of responding to climate change's impact on the environment and food production. These techniques involve long-standing methods for soil conservation, water harvesting, mixed cropping, agroforestry, early and late planting, wild plant gathering and terracing – techniques that have been passed down from one generation to the next (Deressa et al., 2009; Vignola et al., 2010). Beyond farming strategies, rural households commonly diversify their livelihoods and frequently migrate to gain access to agricultural land, markets, and employment opportunities (Paavola, 2008). As part of larger, ongoing efforts to adapt to changing conditions, they (often by necessity) sell off assets and reduce household consumption (Keil et al., 2008).

These strategies reflect cultural capital held by the rural and indigenous communities. Flora and Flora (2013) describe cultural capital as values and symbols portrayed in the region, such as customs, languages, and rituals, which influence people's way of life, what they value, and how they view the world. According to Bourdieu (2011), cultural capital materializes in three forms: 1) embodied state, i.e. in the form of "long-

lasting disposition of the mind and body” (p. 47), such as knowledge; 2) objectified state, i.e. in the form of goods, which include books, dictionaries, machines, etc.; and 3) institutionalized state, or in the form of objectification, for example educational attainment. Based on this description, cultural capital includes both cultures and legacy that are handed down through generations by social institutions, such as family, school, and social groups in rural communities. Traditional knowledge is thereby an example of cultural capital, especially its embodied state, as traditional knowledge is a body of knowledge, belief systems, traditions, rules, and institutions (Gomez-Baggethun et al., 2013) that is passed from one generation to another, accumulated through years of experience with the human interpersonal relationship as well as in dealing with the environment (Berkes, 1993; Berkes et al., 2000). The literature has embraced traditional knowledge as one key resource for adaptive capacity (Boillat and Berkes, 2013), especially since the practices of traditional knowledge can be related with adaptation strategies to climatic and environmental changes (Colding et al., 2003; Boissiere et al., 2013).

Close to the idea of adaptive capacity is the concept of resilience. Resilience is defined as “the ability of a system to absorb or buffer changes or utilize the changes for its advantage” (Ellis, 1998, p. 14), and at the same time to maintain its ability to function (Traerup, 2012), “without undergoing fundamental changes in its functional characteristics” (Berkes et al., 2003, p. 14). Citing the Resilience Alliance (2002), Berkes et al. (2003) provide three characteristics of resilience: 1) the amount of change the system can buffer and absorb, while keeping similar established function and structure; 2) the capability of self-organization; and 3) the capacity for learning and adaptation (p. 13). According to the IPCC (2012), resilient systems also recover from the impact of hazardous events quickly and efficiently.

Meanwhile, adaptive capacity is the ability to adapt and recover from longer-term climatic and environmental changes (Yohe and Toll, 2002; Henly-Shepard et al., 2015), and thereby relates to the capacity for learning and adaptation. In regard to the strategy for adaptation, Hisali et al. (2011) define adaptation strategies as “responses to actual or expected climatic stimuli (and their effects) that are intended to moderate harm or exploit associated beneficial opportunities” (p. 1246). This means that adaptation strategies are aimed to maintain, or even improve, the current living standards in changing climatic conditions that potentially affect community livelihoods (van Aalst et al. 2008). Adaptation involves adjustment in natural and human systems (Deressa et al., 2009), and more easily conforms to local practices, rather than deviating from them (Urich et al., 2009). In other words, adaptation strategy is specific by context and place, differing across cultures and geography.

In line with the ideas of resilience and adaptive capacity, Duit and Galaz (2008) devise the framework of governance of complex adaptive system (CAS). They elucidate that the capacity of governance systems to deal with CAS involves the tradeoff between exploitation (or what can also be called ‘institutional arrangements’) and exploration (or ‘learning capacity’). Variables that reflect institutional arrangements include the presence of early warning systems, number of community groups or organizations that can be relied on during an emergency, level of trust among stakeholders, and norms of reciprocity, such as giving-receiving and borrowing-lending. Meanwhile, level of education, household’s assets and income, and access to formal (e.g. bank, cooperative) and informal credits (e.g. farmers’ group, neighborhood group) reflect learning capacity. According to Duit and Galaz (2008), a system with strong adaptive capacity needs strong institutions and high learning capacity.

Reflecting on the variables to portray the institutional arrangements and learning capacity, the governance of complex adaptive systems is linked to rural sociology’s

community capital framework (Flora and Flora, 2013). This framework encompasses seven community capitals: social, built, political, human, financial, natural, and cultural capital. Restating the variables on institutional arrangements, membership in social groups and levels of trust are common measures for social capital. Traerup (2012) describes two dimensions in social capital, which includes bonding and bridging social capital. Bonding means social relations between people within an informal network, while bridging is relations among different informal networks and with formal institutions. This relates to political capital that involves organizations and connections in attempts to regulate and distribute resources. Within the community, the exercise of social and political capital in effect creates built capital, which embraces set of regulation and physical facilities to support the communities' life (Flora and Flora, 2013). From the perspective of learning capacity, the variable of educational attainment is integral to human capital, while household's assets and incomes gauge financial capital. Cultural capital can be related to human capital, for one of its components is as transmitted knowledge through generations. Also, tied to the assets and incomes is natural capital, which includes agricultural land, water, and biodiversity (Flora and Flora, 2013). Based on this explanation, this study links social, political, and built capital as integral parts of institutional arrangements, and connects human, financial, natural, and cultural capital as measures of learning capacity.

In the literature, the concept of sustainable livelihood pentangle, which consists of social, built, human, financial, and natural capital, has been used to examine adaptive capacity or resilience to climate change (e.g. Carney, 2003; Knutsson, 2006; Keil et al., 2010; Below et al., 2012). However, following Flora and Flora (2013), cultural and political capital also needs to be addressed in order to build rural community with healthy ecosystem, economic security, and social inclusion. In this regard, this dissertation contributes to the

literature by exploring the community resilience to climate change from the perspective of cultural and political capital.

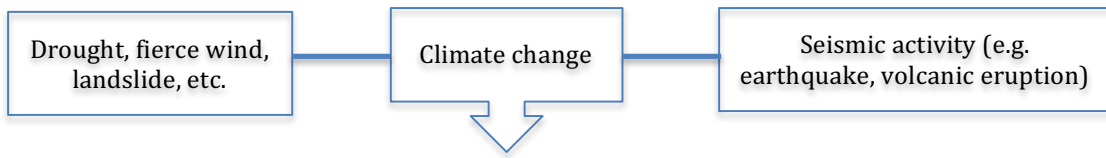
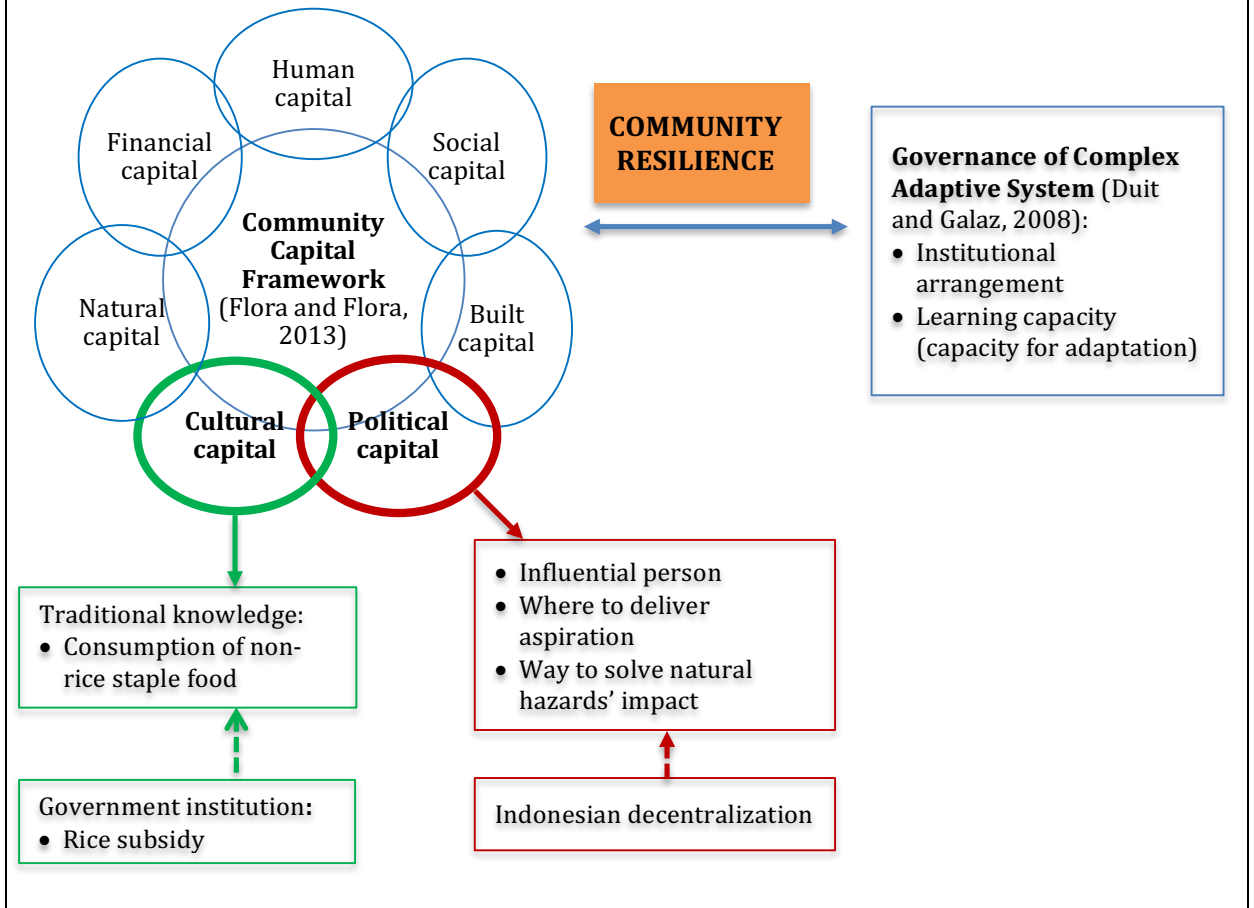
RESEARCH QUESTIONS

This dissertation focuses on the role of cultural and political capital in supporting rural communities' resilience to climate change. While the role of personal and inter-personal connections and the overall power structures in the community will be discussed as elements of political capital, this study will largely focus on staple food diversification practices as a primary aspect of cultural capital. Within the context of this study, staple food diversification is understood as the practice of habitually consuming non-rice staple food, considering that rice is regarded as the Indonesian main staple food. Therefore, this study is composed of four broad research questions:

- 1) Does staple food diversification as traditional knowledge support community resilience to climate change?
- 2) How do government institutions, i.e. via rice subsidy policy, facilitate the practice of staple food diversification as traditional knowledge?
- 3) How does political capital play a role in facilitating community resilience to climate change?
- 4) What is the role of social and human capital on political capital?

It should be noted that while the concept of resilience covers social, economic, and ecological aspects, this study focuses only on social resilience. As indicated in Figure 1.1, in this study, social resilience encompasses aspects of the Community Capital Framework (Flora and Flora, 2013) and Governance of Complex Adaptive Systems (Duit and Galaz, 2008). Governance of complex adaptive system consists of two main elements, i.e.

institutional arrangements and learning capacity, while the community capital framework comprises seven forms of community capital recognized in academic studies: social, built, political, human, financial, natural and cultural capitals. This study will primarily focus on cultural capital and political capital. Traditional knowledge of the consumption of non-rice staple food and the role of rice subsidy policy to facilitate the practice of staple food diversification will constitute dimensions of cultural capital. Moreover, discussion on political capital will focus on its components, including influential person, where to deliver aspiration, and the way the community solves natural hazards' impact. Discussion on the importance of social and human capital will also complement the discussion of political capital.

Disturbance:**Social Resilience:****Figure 1.1.** Framework of Study**RESEARCH APPROACH**

Mixed quantitative and qualitative research methods will accommodate both the “what” and “how” research questions of this study. Accordingly, this study will complement more straightforward analysis from quantitative studies with data gathered from qualitative inquiries (Collier et al., 2010). The mixed research method uses case studies to

collect data and gather insights. Yin (2009) suggests that case study research design is appropriate when the research attempts to study contemporary events. Different from experimental research, a case study approach is also suitable when the researcher does not have control of behavioral events under study. In addition, as a thorough examination of examples of phenomena, Flyvbjerg (2001) argues that a case study is well suited to generate “concrete, context-dependent knowledge” (p. 73).

Yin (2009) provides a detailed guidance to design case study research, whether it is a single- or multiple-case and whether it is a holistic (i.e. single unit of analysis) or embedded (i.e. multiple unit of analysis). Since climate change adaptation varies by culture and geography, a multiple-case study with an embedded design will provide an appropriate approach to answering the research questions. The number of cases in this multiple-case study design should not be equated with the number of observations. Rather, each case study serves as a ‘laboratory’ of observations, in which each case contains its own embedded units of analysis. In this study, multiple cases come from three rural communities in Indonesia. Within each community, community members (i.e. households), community leaders (i.e. village head, hamlet head, neighborhood leader), and government officials (i.e. agricultural extension workers) represent the embedded units of analysis. To achieve the goal of mixed qualitative and quantitative research, some community members or households are interviewed in household surveys and others are interviewed in qualitative in-depth interviews. From the three cases, this study collected 310 observations: 280 from household surveys and 30 from in-depth interviews.

The case studies are focused in rural areas of Java Island, Indonesia. This area is important to study for various reasons. First, Java Island is called the Indonesians’ food barn for its role in producing more than fifty percent of rice in Indonesia (Central Bureau of Statistics, 2015), ever since the post-independence era in 1950s (Hansen, 1972). Rice is

considered the most important commodity in the country, and is regarded as the main staple food for most Indonesians. Hence, this rice culture in Java is important for the study of local staple food diversification. Second, Javanese is the biggest ethnic group in Indonesia, which comprises more than forty percent of the total population (Central Bureau of Statistics, 2015). Lastly, as the country's food barn, Java Island receives significant impact from ENSO (Mulyana, 2002), which threatens rice production and, consequently, food security at the national level. Higher unpredictability of ENSO due to climate change provides an opportunity for the measurement of community resilience in this study.

Among the six provinces in Java, the case studies are conducted in Central Java and Yogyakarta Province, more specifically in three districts namely Banjarnegara in Central Java and Sleman and Gunungkidul in Yogyakarta. From these districts, three rural sub-districts were selected as the study areas: Pagentan in Banjarnegara, Seyegan in Sleman, and Purwosari in Gunungkidul. To enrich the perspective of this study, the three sub-districts were chosen based on variation in geographical characteristics. While Pagentan is situated on Dieng Plateau in the middle of Central Java, Seyegan is topographically flat and Purwosari is a hilly-karst area. From the three sub-districts, one hamlet in each of the sub-district was selected as the study site¹.

Regarding the definition of rural area, this study follows the administrative regions as defined in the Central Bureau of Statistics and District Office of Statistics in Indonesia. Village, a common term for rural area in Indonesia, is understood as a united legal community with territorial boundaries and authorities to regulate and manage their interests based on the local customs (Central Bureau of Statistics, 2014; Law no. 32/2004, Chapter 1, Article 1). Therefore, the context of rural community in this study may differ

¹ In the study areas, hamlet (or also comparable to RW, *Rukun Warga*) is an administrative unit that composes village. Hierarchically, several hamlets (or RWs) compose a village, and number of villages makes up a sub-district. District (or also called regency), which is comparable to county in the U.S., is the next higher level of administrative unit that consists of a number of sub-districts. Next, number of districts composes a province, which is equal to state in the U.S.

from the definition of rural used by the U.S. Bureau of the Census and the U.S. Office of Management and Budgets. With respect to population size, these two U.S. offices define rural areas as any territories with population less than 2,500 people or county with population less than 50,000 people, respectively (Woods, 2005). This is not the case for Indonesia. The three chosen sub-districts (i.e., a smaller administrative unit than district, or county in the U.S.) have populations of more than 5,000 people, and are still categorized as rural sub-district by the Indonesian government.

THESIS LAYOUT

This dissertation is structured in a four-article format, in which the first to the fourth article can be found in Chapter 2, 3, 4, and 5, respectively. Each of the chapters seeks to answer a specific research question, as consistent with the order of the aforementioned research questions. All chapters build their arguments on mixed qualitative and quantitative discussions, where they are guided by the theoretical framework, i.e. governance of complex adaptive system (Duit and Galaz, 2008) and the rural sociology's community capital framework (Flora and Flora, 2013) illustrated in Figure 1.1.

Chapter 2, "Staple Food Diversification: Does It Matter for Climate Change Resilience?", explores the role of staple food diversification as a component of cultural capital in facilitating community resilience to climate change. Staple food diversification is argued to be a form of local traditional knowledge, which when habitually consumed by residents as a non-rice staple food, it enhances community resilience. However, although rural communities are still diligently growing and keeping supplies of maize and cassava, they do not relate such practices with adaptation to climate change. This unconscious manner of adaptation, along with the higher rice consumption, is explored among the

studied communities, along with social and ecological factors that affect the practice of staple food diversification.

Chapter 3, “Local Staple Food versus Rice Subsidy: Developing Climate Change Resilience in Rural Indonesia”, examines the connection between local staple food consumption as traditional knowledge with rice subsidy as a specific government policy. This chapter investigates how rice subsidy facilitates the practice of staple food diversification. Quantitatively, rice subsidy is found to positively facilitate the consumption of local staple food. Qualitative interviews, however, report the tendency of rural communities to consume more rice because of the presence of the rice subsidy. The contradiction between the quantitative and qualitative findings is examined, with evidence that the practice of informal rice subsidy sharing in the studied communities may be a factor. The impacts of these findings on rice consumption and the rice subsidy on staple food diversification is provided.

Chapter 4, “Community Political Capital and Resilience to Climate Change: View from Decentralization Era in Indonesia”, discusses the role of political capital in mitigating community resilience within the context of decentralization era. The chapter examines the uniqueness of the rural Javanese in the way they function within the democratization that followed the Indonesian decentralization policy and its relationship to community resilience, and ultimately social resilience to climate change. The decentralization policy places the pressure on local areas to solve many of its own problems. The role of political context is examined as a factor affecting local culture and political influence as a function of political capital. Further discussion examines the potential impact on social capital that is crucial in developing climate change resilience.

Chapter 5, “The Role of Social and Human Capital on Community Political Capital: Case of Rural Indonesia”, asks how social and human capital affect the exercise of political

capital in rural communities. A key component to social capital is community involvement. In this chapter, involvement in community groups and how the political capital allows these groups to come together to solve the effect of natural hazards is examined. Human capital, such as level of education, is also examined as a factor affecting political capital. Despite the ongoing decentralization policy that hands down mandates for development planning to rural communities, rural people are still reluctant to get involved in policy discourse and rely more on their leaders in the policy-making process. Implications for community resilience to climate change in this context are further discussed in this chapter.

Finally, Chapter 6 is a general conclusion chapter that synthesizes findings from the previous chapters and offers three policy recommendations. The first policy recommendation focuses on production and consumption aspects of staple food diversification; the second recommendation reflects potential knowledge gaps to be filled by the government; and the final recommendation is related to formal and informal education and community resilience. Along with the policy recommendations, limitations and recommendations for future research are provided.

References

- Altieri, Miguel A. and Parviz Koohafkan. 2008. *Enduring Farms: Climate Change, Smallholders and Traditional Farming Communities*. Malaysia: Third World Network.
- Banholzer, Sandra, James Kossin, and Simon Donner. 2014. The Impact of Climate Change on Natural Disasters (in *Reducing Disaster: Early Warning Systems for Climate Change*, edited by Z. Zommers and A. Singh). Springer.
- Below, Till B., Khamaldin D. Mutabazi, Dieter Kirschke, Christian Franke, Stefan Sieber, Rosemarie Siebert, and Karen Tscherning. 2012. Can Farmers' Adaption to Climate Change be Explained by Socio-economic Household-level Variables? *Global Environmental Change* 22: 223-235.
- Berkes, Fikret. 1993. Traditional Ecological Knowledge in Perspective (in *Traditional Ecological Knowledge: Concepts and Cases*, edited by Julian T. Inglis). International Program on Traditional Ecological Knowledge: Ottawa, Canada.

- Berkes, Fikret, Johan Colding, and Carl Folke. 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications* 10(5): 1251-1262.
- Berkes, Fikret, Johan Colding, and Carl Folke. 2003. Introduction (in *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*, edited by Fikret Berkes, Johan Colding, and Carl Folke). Cambridge University Press: Cambridge, United Kingdom.
- Boillat, Sebastian and Fikret Berkes. 2013. Perception and Interpretation of Climate Change Among Quechua Farmers of Bolivia: Indigenous Knowledge as a Resource for Adaptive Capacity. *Ecology and Society* 18(4): 21.
- Boissiere, Manuel, Bruno Locatelly, Douglas Sheil, Michael Padmanaba, and Ermayanti Sadjudin. 2013. Local Perceptions of Climate Variability and Change in Tropical Forests of Papua, Indonesia. *Ecology and Society* 18(4): 13.
- Bourdieu, Pierre. 2011. The Forms of Capital (in *Cultural Theory: An Anthology*, edited by Imre Szeman and Timothy Kaposy). Wiley-Blackwell: United Kingdom.
- Carney, Diana. 2003. *Sustainable Livelihood Approaches: Progress and Possibilities for Change*. Department for International Development. United Kingdom
- Central Bureau of Statistics. 2014. Report on Agricultural Census 2013: Complete Sampling (Laporan Lengkap Hasil Sensus Pertanian 2013: Pencacahan Lengkap). Central Bureau of Statistics: Jakarta, Indonesia.
- _____. 2014. Village Potential Statistics of Indonesia 2014 (Statistik Potensi Desa Indonesia 2014). Central Bureau of Statistics: Jakarta, Indonesia.
- _____. 2015. *Produksi Tanaman Pangan (Food Crops Production)*. Central Bureau of Statistics: Jakarta, Indonesia.
- _____. 2015. *Statistik Politik (Political Statistic)*. Central Bureau of Statistics: Jakarta, Indonesia.
- Colding, Johan, Thomas Elmqvist, and Per Olsson. 2003. Living with Disturbance: Building Resilience in Social-Ecological Systems (in *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*, edited by Fikret Berkes, Johan Colding, and Carl Folke). Cambridge University Press: Cambridge, UK.
- Collier, David, Jason Seawright, and Gerardo L. Munck. 2010. The Quest for Standards: King, Keohane, and Verba's Designing Social Inquiry (in *Rethinking Social Inquiry: Diverse Tools, Shared Standards Second Edition*, edited by Henry E. Brady and David Collier). Rowman and Littlefield: United Kingdom.
- Compton, Kathleen, Richard A. Bennett, and Sigrun Hreinsdottir. 2015. Climate-driven Vertical Acceleration of Icelandic Crust Measured by Continuous GPS Geodesy. *Geophysical Research Letters* 42: 743-750.

- Deressa, Temesgen Tadesse, Rashid M. Hassan, Claudia Ringler, Tekie Alemu, and Mahmud Yesuf. 2009. Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. *Global Environmental Change* 19: 248-255.
- Duit, Andreas and Victor Galaz. 2008. Governance and Complexity: Emerging Issues for Governance Theory. *International Journal of Policy, Administration, and Institutions* 21(3): 311-335.
- Ellis, Frank. 1998. Household Strategies and Rural Livelihood Diversification. *The Journal of Development Studies* 35(1): 1-38.
- Flora, Cornelia Butler and Jan L. Flora. 2013. *Rural Communities: Legacy and Change*. Westview Press: Colorado, USA.
- Flyvbjerg, Bent. 2001. *Making Social Science Matter*. Cambridge University Press: Cambridge, United Kingdom.
- Gomez-Baggethun, Erik and Victoria Reyes-Garcia. 2013. Reinterpreting Change in Traditional Ecological Knowledge. *Human Ecology* 41: 643-647.
- Hansen, Gary E. 1972. Indonesia's Green Revolution: The Abandonment of a Non-Market Strategy toward Change. *Asian Survey* 12(11): 932-946 .
- Henly-Shepard, Sarah, Cheryl Anderson, Kimberly Burnett, Linda J. Cox, John N. Kittinger, and Maka'ala Ka'aumoana. 2015. Quantifying Household Social Resilience: A Place-Based Approach in a Rapidly Transforming Community. *Natural Hazards* 75: 343-363.
- Hisali, Eria, Patrick Birungi, and Faisal Buyinza. 2011. Adaptation to Climate Change in Uganda: Evidence from Micro Level Data. *Global Environmental Change* 21: 1245-1261.
- IPCC. 2012. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* (edited by Field, C. B., V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G. K. Plattner, S. K. Allen, M. Tignor, and P. M. Midgley. Cambridge University Press: Cambridge, UK and New York, USA.
- Irawan, Bambang. 2006. "Anomali Iklim El Nino dan La Nina: Kecenderungan Jangka Panjang dan Dampaknya terhadap Produksi Pangan" (El Nino and La Nina Climate Anomaly Phenomenon: the Longterm Trend and Its Impact on Food Production). *Forum Penelitian Agro Ekonomi* 24(1): 28-45.
- Keil, Alwin, Manfred Zeller, Anastasia Wida, Bunasor Sanim, and Regina Birner. 2008. What Determines Farmers' Resilience towards ENSO-related Drought? An Empirical Assessment in Central Sulawesi, Indonesia. *Climatic Change* 86: 291-307.
- Knutsson, Per. 2006. The sustainable livelihoods approach: A framework for knowledge integration assessment. *Human Ecology Forum* 13(1): 90-99.

- Maxwell, Joseph A. 2013. *Qualitative Research Design: An Interactive Approach 3rd Edition*. SAGE: United States.
- MacCarthy, Michelle. 2012. Playing Politics with Yams: Food Security in the Trobriand Islands of Papua New Guinea. *Culture, Agriculture, Food and Environment* 34(2): 136-147.
- McGuire, W. J., R. J. Howarth, C. R. Firth, A. R. Solow, A. D. Pullen, S. J. Saunders, I. S. Stewart, and C. Vita-Finzi. 1997. Correlation between Rate of Sea-level Change and Frequency of Explosive Volcanism in the Mediterranean. *Nature* 389: 473-476.
- McGuire, Bill. 2012. *Waking the Giant: How A Changing Climate Triggers Earthquakes, Tsunamis, and Volcanoes*. Oxford University Press: Oxford, United Kingdom.
- Mullaney, Emma Gaalaas. 2014. Geopolitical Maize: Peasant Seeds, Everyday Practices, and Food Security in Mexico. *Geopolitics* 19(2): 406-430.
- Olson, Elizabeth Anne. 2013. Anthropology and Traditional Ecological Knowledge: A Summary of Quantitative Approaches to Traditional Knowledge, Market Participation, and Conservation. *Culture, Agriculture, Food, and Environment* 35(2): 140-151.
- Paavola, Jouni. 2008. Livelihoods, Vulnerability and Adaptation to Climate Change in Morogoro, Tanzania. *Environmental Science and Policy* II: 642-654.
- Thompson, Andrea. 2007. Global Warming Might Spur Earthquakes and Volcanoes. Accessed at January 12, 2016 from <http://www.livescience.com/7366-global-warming-spur-earthquakes-volcanoes.html>
- Timmermann, A., J. Oberhuber, A. Bacher, M. Esch, M. Latif, and E. Roeckner. 1999. Increased El Nino Frequency in A Climate Model Forced by Future Green House Warming. *Nature* 398: 694-696.
- Traerup, Sara L. M. 2012. Informal Networks and Resilience to Climate Change Impacts: A Collective Approach to Index Insurance. *Global Environmental Change* 22: 255-267.
- Undang-Undang tentang Pemerintah Daerah (Law on Regional Government), no. 32/2004, Chapter 1, Article 1.
- Urich, Peter B., Liza Quirog, and William G. Granert. 2009. El Nino: An Adaptive Response to Build Social and Ecological Resilience. *Development in Practice* 19(6): 766-776.
- Van Aalst, Maarten K., Terry Cannon, and Ian Burton. 2008. Community Level Adaptation to Climate Change: The Potential Role of Participatory Community Risk Assessment. *Global Environmental Change* 18: 165-179.
- Vignola, Raffaele, Thomas Koellner, Roland W. Scholz, and Tim L. McDaniels. 2010. Decision-making by farmers regarding ecosystem services: Factors affecting soil conservation efforts in Costa Rica. *Land Use Policy* 27: 1132-1142.

Woods, Michael. 2005. *Rural Geography*. SAGE: London, UK.

Yin, Robert K. 2009. *Case Study Research: Design and Methods Fourth Edition*. SAGE: California, USA.

Yohe, Gary and Richard S.J. Tol. 2002. Indicators for social and economic coping capacity – moving toward a working definition of adaptive capacity. *Global Environmental Change* 12: 25-40.

CHAPTER 2. STAPLE FOOD DIVERSIFICATION: DOES IT MATTER FOR CLIMATE CHANGE RESILIENCE?

"We may not have a lot of money here, but we have never been lacking of food"
(A village head, Banjarnegara, 2010)

ABSTRACT

This study explores the role of staple food diversification as traditional knowledge in facilitating community resilience to climate change. Here, staple food diversification is understood as a habitual consumption of non-rice staples (e.g. maize, cassava), given that rice is regarded as the main staple food in Indonesia. Onsite surveys and interviews in three districts in Java Island, i.e. Banjarnegara, Sleman, and Gunungkidul, find that staple food diversification is practiced, partly as a preparation toward unpredictable weather. Meanwhile, two-stage least square (2SLS) estimation shows that staple food diversification is associated with stronger resiliency to natural hazards, especially in Banjarnegara where maize is still valued as the main staples. Despite the hold of tradition and belief around staple food diversification, there are some challenges that weaken its practice. Implication for rural policy in the context of Indonesia is discussed.

Keywords: climate change, community resilience, rural Indonesia, staple food diversification

INTRODUCTION

An effect of climate change, as observed by Timmermann et al. (1999), is the increasing frequency and intensity of the El Nino Southern Oscillation (ENSO). ENSO, which occurs in the Equatorial Pacific, affects precipitation patterns in a large number of countries, including the United States, Peru, Australia, the Philippines, and Indonesia. In Indonesia, ENSO may lower precipitation levels, creating the potential for prolonged periods of drought; or, conversely, may trigger higher levels of precipitation, nurturing conditions that prompt floods and levels of humidity that lead to the proliferation of pests and insects. Studies illustrate that unpredictability in precipitation and other weather elements brought by ENSO harms food production, reduces farmer incomes, and undermines social resilience (Naylor et al., 2001; Irawan, 2006; Keil et al., 2008). In other words, climate change poses a direct effect on the livelihoods of small-scale farmers that comprise more than fifty percent of the farming population in Indonesia, and encompasses 35 percent of the nation's work force (Central Bureau of Statistics, 2014).

Irrespective of climate change, studies have shown the ability of rural communities to adapt to the changing environment by relying on traditional or indigenous knowledge (e.g. Boissiere et al., 2013; Olson, 2013; Boillat and Berkes, 2013). Traditional knowledge is an accumulation of knowledge, practices, and beliefs inherited through generations. Within this body of knowledge, traditional ecological knowledge (TEK) describes the relationships between humans as well as between humans and the environment (Berkes, 1993; Berkes et al., 2000). An example of TEK in Indonesia includes various staple foods consumed by hundreds of different ethnic groups throughout the archipelago, such as sago in Moluccas Island; maize in Timor Island; and tuber roots in Papua Island. As Jhamtani (2008) writes, local staple foods helped minimize hunger in some parts of Indonesia when a prolonged drought in 2005 severely curtailed rice production in the nation. By utilizing their TEK, these communities, especially the elder members, shifted back to non-rice staple food when rice became hard to grow and obtain. This shows that TEK on local staple food diversification is consistent with adaptive management to build social-ecological resilience to unpredictable weather.

Using a mixed qualitative and quantitative approach, this study investigates the role of staple food diversification in facilitating community resilience to climate change. Staple food diversification is understood as a habitual consumption of non-rice staple foods, such as maize and cassava, based on the fact that rice is regarded as the main staple food in Indonesia. This study attempts to further explore the role of staple food diversification as an adaptation strategy to climate change, in line with the idea of livelihood diversification that minimizes risks under uncertainty.

To provide context, the next section illustrates the conceptual and theoretical framework upon which this study is based. This includes the conception of traditional ecological knowledge, staple food diversification, and community resilience. Subsequently,

the method section provides descriptions of the study areas, elaboration of the data collection, and methods of analysis. The results and discussion section presents the result from qualitative interviews and quantitative analysis on the role of staple food diversification to enhance community resilience to climate change.

CONCEPTUAL AND THEORETICAL FRAMEWORK

Traditional Ecological Knowledge

Traditional ecological knowledge (TEK), or traditional knowledge more generally, is an accumulation of knowledge, practices, and beliefs inherited through generations. TEK includes both relationships between humans, and between humans and their environment (Berkes, 1993; Berkes et al., 2000). TEK is thereby consistent with adaptive management to build social-ecological resilience. Adaptive management that emphasizes learning-by-doing is in line with the characteristics of TEK that is accumulated through decades, indeed centuries, of trial-and-error. Meanwhile, social mechanisms of TEK include: “1) generation, accumulation, and transmission of knowledge; 2) the use of local institutions for leadership and rules for social regulation; 3) cultural internalization of traditional practices; and 4) the development of appropriate worldviews and cultural values” (Berkes et al. 2000, p. 1251). These social mechanisms are useful as the community adapts to the changing environment.

Boillat and Berkes (2013) acknowledge TEK as a primary component for adaptive capacity. Around the world, indigenous and rural communities have practiced TEK for generations in the face of climatic variability and climate-related disasters, such as floods, droughts, and strong winds. Communities in Polynesia have commonly practiced polyculture, such as agroforestry, tree gardens, and multiple cropping, to accommodate agricultural loss because of cyclones. In Bangladesh, char-dwellers² have consistently

² People who live on islands made up of river sediment deposit.

applied cover cropping as well as diversified livelihoods with polyculture and animal husbandry to enhance their livelihoods in the face of yearly floods. These mean that indigenous and rural communities are capable of taking active roles in the face of climatic and environmental changes, and should not be labeled “helpless victims” of climate change (Boillat and Berkes, 2013).

Despite the key role of TEK in building community resilience and in supporting resource management (e.g. McDonald and Fleming, 1993; Tobias, 1993), studies report the erosion of TEK because of globalization. More specifically, globalization helps promote the spread of a free-market economy and agricultural technology advancement. Gomez-Baggethun and Reyes-Garcia (2013) provide an example of eroding TEK among Donana’s farmers in Spain after the introduction of mechanized agriculture that replaced the former practices of traditional agriculture. The mechanized agriculture that requires hybrid seeds, chemical fertilizers, and pesticide also creates farmers’ dependency on the market to acquire agricultural inputs. Nonetheless, the effect of globalization varies across places and communities. In Mexico, farmers in the Central Highland region located near Mexico City and Texcoco still consistently breed and grow a local variety of maize (i.e. *criollo* maize), regardless of decades of government pressure to replace local seed with the hybrids (Mullaney, 2014).

Staple Food Diversification

In this study, staple food diversification is defined as a habitual consumption of non-rice staple foods, such as maize and cassava, based on the fact that rice is regarded as the main staple food for most Indonesians. This definition should be distinguished from food diversification, as used by the Indonesian Agency of Food Security. Food diversification, which is measured by desirable dietary pattern, is an ideal balance of food consumption

consisting of carbohydrate, protein and fat that aspires to improve individuals' nutritional intake (Ariani, 2006).

The idea of staple food diversification is in line with the concept of livelihood diversification, which is acknowledged as an adaptation strategy to climate change. Ellis (1998) defines livelihood diversification as “the process by which rural families construct a diverse portfolio of activities and social support capabilities in their struggle for survival and in their way to improve standards of living” (p. 4). This definition encompasses two perspectives of diversification: survival and accumulation. Diversification for survival is driven by viability motives driven by poverty, lack of assets, vulnerability, or disaster. Meanwhile, diversification for accumulation is driven by choices and opportunities available for households to improve their living standards. Hence, livelihood diversification minimizes the risks faced by households in times of uncertainty. When one component of livelihood (e.g. farming) fails because of, for instance, pest outbreak, households can secure income from other components, such as animal husbandry or fisheries. However, livelihood diversification is not limited to income diversification (Ellis, 1998). It also means that households are able to take advantage of social networks (e.g. neighbors, kinship) for support in time of shocks.

Community Resilience

Resilience is defined as “the ability of a system to absorb or buffer changes or utilize the changes for its advantage” (Ellis, 1998, p. 14), and at the same time to maintain its ability to function (Traerup, 2012), “without undergoing fundamental changes in its functional characteristics” (Berkes et al., 2003, p. 14). Citing the Resilience Alliance (2002), Berkes et al. (2003) provides three characteristics of resilience: 1) the amount of change the system can buffer and absorb, while keeping similar established function and structure; 2)

the capability of self-organization; and 3) the capacity for learning and adaptation (p. 13). According to IPCC (2012), resilient systems also recover from the impact of hazardous events quickly and efficiently.

Reflecting on the characteristics of resilience, the concept of adaptive capacity is embedded in the resilience concept. Adaptive capacity is the ability to adapt and recover from longer-term climatic and environmental changes (Yohe and Toll, 2002; Henly-Shepard et al., 2015), and thereby relates to the capacity for learning and adaptation. In regard to the strategy for adaptation, Hisali et al. (2011) define adaptation strategies as “responses to actual or expected climatic stimuli (and their effects) that are intended to moderate harm or exploit associated beneficial opportunities” (p. 1246). This means that adaptation strategies are aimed to maintain, or even improve, the current living standards in changing climatic conditions that potentially affect community livelihoods (van Aalst et al. 2008). Adaptation involves adjustment in natural and human systems (Deressa et al., 2009), and more easily conforms to local practices, rather than deviating from them (Urich et al., 2009). In other words, adaptation strategy is specific by context and place, differing across cultures and geography.

In rural sociology, community resilience can be assessed through the elements of community capital (Keil et al., 2009; Traerup, 2012). Community capital comprised of human capital (e.g. education, experience), natural capital (e.g. land ownership, soil fertility), social capital (e.g. membership in social groups, trust), financial capital (e.g. total household income, access to financial sources), and physical capital (e.g. house ownership), which together build a sustainable livelihood pentangle (Carney, 2003; Knutsson, 2006; Keil et al., 2010; Below et al., 2012). By adding cultural and political capital, all seven types of capital together build a community capital framework that contributes to healthy ecosystems, economic security, and social inclusion for rural communities (Flora and Flora, 2013).

RESEARCH QUESTION AND HYPOTHESIS

This study examines the role of staple food diversification within the frameworks of traditional ecological knowledge (TEK), livelihood diversification, and community capital. Staple food diversification can be seen in a similar manner as livelihood diversification that aims to spread the risks, especially in times of uncertainty. While livelihood diversification is regarded as one adaptation strategy to climate change, the role of staple food diversification has not been much explored. In addition, since rural communities around the world cope and adapt to climate change in a various way (Boissiere et al., 2013), this study will add an insight about the practice staple food diversification in rural Indonesia and its role in supporting community resilience to climate change.

This study set the following research question: does staple food diversification support community resilience to climate change? Similar to the experience of communities in Polynesia and Bangladesh that utilize TEK to cope with natural hazards (Boillat and Berkes, 2013), and also the ability of non-rice staple foods in lowering famine incident in East Nusa Tenggara, Indonesia (Jhamtani, 2008), it is hypothesized that staple food diversification supports community resilience to climate change.

METHOD

Study Areas

This study gathers insights from case studies in three rural communities in Java Island, Indonesia. Java Island is a rice production center, which is responsible for more than 50 percent of the rice produced in Indonesia (Central Bureau of Statistics, 2015). It should be no surprise, then, to assume that those who live in Java would regard rice as their staple food. Nevertheless, there are rural communities in Java that still rely on non-rice staples,

such as cassava and maize, as a mainstay of their diet. As a locale for both rice and non-rice staples, Java Island is an interesting site to study staple food diversification practices. In addition, Java Island is also impacted by the ENSO (Mulyana, 2002), periodical weather anomalies that induce higher precipitation (La Nina) or lower precipitation than normal (El Nino). This is a threat to rice production (Irawan, 2006), since it requires large quantities of water for cultivation.

This study selects three rural communities in Central Java and Yogyakarta Province, specifically in Banjarnegara District in Central Java and Gunungkidul and Sleman District in Yogyakarta. Three rural sub-districts were selected within the three districts as the study sites: 1) Pagentan in Banjarnegara District, Central Java; 2) Purwosari in Gunungkidul District, Yogyakarta; and 3) Seyegan in Sleman District, Yogyakarta (Figure 2.1). The sub-districts are chosen based on variations in geographical characteristics: Pagentan is situated on Dieng plateau of Central Java; Purwosari is a hilly-karst area; and Seyegan is topographically flat. Such differences prompt variations in farming, and consequently, local staple foods. Surveys and interviews were conducted in three villages within the three sub-districts.

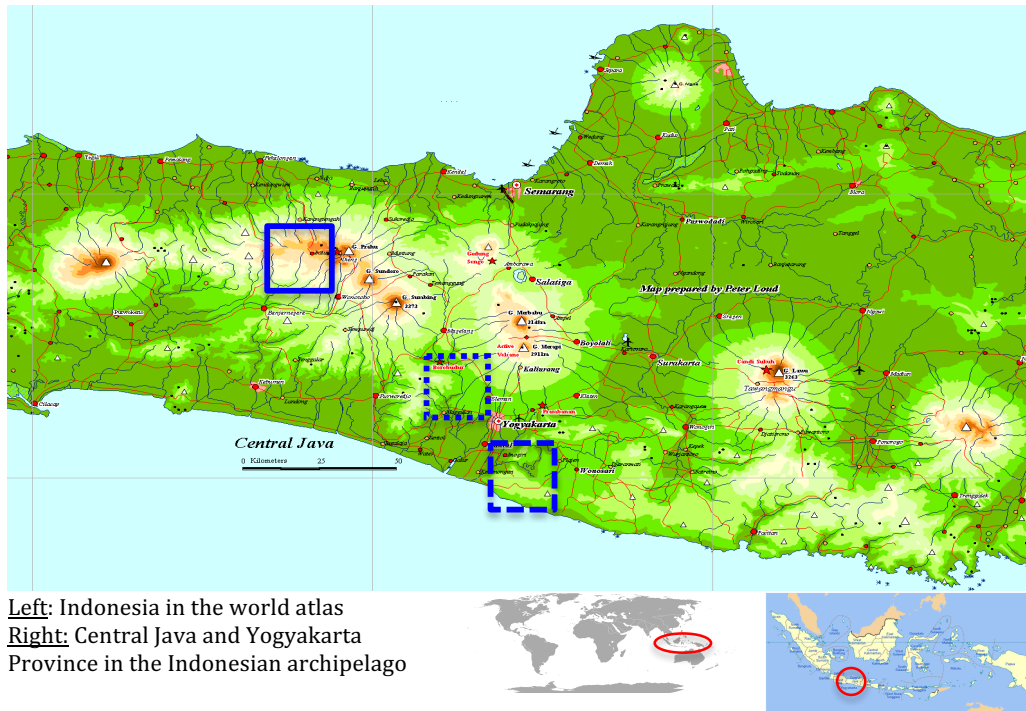


Figure 2.1. Map of Central Java and Yogyakarta Province

Sources: <http://peterloud.co.uk/indonesia/Xindonesia.html>; <http://www.wro2013.org/indonesia/>

Notes:



Village A, Pagentan, Banjarnegara, Central Java

Village B, Purwosari, Gunungkidul, Yogyakarta

Village C, Seyegan, Sleman, Yogyakarta

Village A in Pagentan sub-district, Banjarnegara is located in the western part of Dieng Plateau, a large area in the center of Central Java province known for tourism and vegetable farming. Devoid of irrigation, the village owns only dryland agricultural areas (Table 2.1). Not surprisingly, dryland crops, including maize, vegetables, tobacco, cassava, and sweet potato, are the main commodities. Meanwhile, Purwosari, Gunungkidul, which generally consists of hilly-karst topography, is situated at the southern end of Yogyakarta Province. In Village B, where surveys and interviews were conducted, dryland agricultural land makes up 99.56 percent of the village's arable area. Purwosari statistical yearbook does not contain crop productions. But surveys, interviews, and field observations note that the community grows cassava, dryland rice, maize, groundnut, chili, and other dryland crops. In contrast, Village C of Seyegan, Sleman contains mainly wetland agricultural land

(99.65 percent), which makes wetland-rice the most common crops cultivated in the village.

Table 2.1. Basic Figures of the Surveyed Villages

	Village A, Banjarnegara, Central Java	Village B, Gunungkidul, Yogyakarta	Village C, Sleman, Yogyakarta
Agricultural area (hectares):			
Wetland area	0 (0%)	6.34 (0.44%)	259.23 (99.65%)
Dryland area	410.99 (100%)	1,444.02 (99.56%)	0.91 (0.35%)
Agricultural production (tons):			
Wetland rice	-	NA	3,432.00
Dryland rice	-	NA	-
Maize	1,185.57	NA	437.4
Cassava	768.84	NA	NA
Agricultural commodities:			
Food crop	Maize (white), cassava, sweet potato	Cassava, dryland rice, maize (yellow)	Wetland rice, maize (yellow), cassava
Horticultural crop	Tobacco, cabbage, chili, tomato, green onion, and other vegetables	Groundnut, chili, turmeric, soybean	Chili, groundnut
Main occupation:			
Farmer	67.59%	68.24%	18.39%
Others	Merchant (6.48%) Carpenter (4.63%) Day laborer (4.63%)	Day laborer (16.47%) Carpenter (4.71%) Government official/ businessman/ private employee (7.05%)	Day laborer (27.59%) Businessman (14.94%) Private employee (11.49%)
Side occupation:			
Farmer	17.59%	10.59%	6.90%
Others	Carpenter (10.19%) Merchant (9.26%)	Carpenter (30.59%) Merchant (15.29%)	Merchant (3.45%) Carpenter/ businessman/ cattleman (6.90%)

Source: Pagentan in Figures 2016; Purwosari in Figures 2016; Seyegan in Figures 2016; On-site surveys 2015.

Regarding main occupation, Village A and B in Banjarnegara and Gunungkidul are dominated by farmers (67.59 percent and 68.24 percent, respectively), while day laborer is the most common occupation in Village C in Sleman. This relates to the proximity of Village

C to Yogyakarta city center (15 kilometers or 9 miles), which is the capital of Yogyakarta Province, compared to Village B that is about 40 kilometers (or 25 miles) away from the same city center. Meanwhile, Village A is located 49 kilometers (or 30 miles) away from Banjarnegara town, which is the nearest town and the capital of Banjarnegara district. Farmers again dominate side occupation in Village A, and interestingly in Village C, while carpenter is the most common side job in Village B.

Data Collection

Primary data was collected from surveys and interviews with a total of 310 study participants in the three chosen rural sub-districts in August and September 2015 (Table 2.2). The surveys were conducted with community members or households using a structured questionnaire. The number of total households was obtained by working with local hamlet heads. Determining exact numbers of families per household was difficult for several reasons. First, as stated by hamlet heads, there are many multiple-households living at the same house, but registered as a separate household. Second, there are community members in Village A and B who are listed as hamlet residents, but living outside the community working in seasonal and permanent jobs. Lastly, the list of household members' occupation has been found to inaccurately represent the true condition. In Village B, almost all households register their main occupations as farming, while not all of them farm. In contrast, almost all households in Village C are listed with off-farm occupations (e.g. teacher, trader, private employee), but some of them farm as a side occupation.

Table 2.2. Number of Study Participants

	Village A, Banjarnegara, Central Java	Village B, Gunungkidul, Yogyakarta	Village C, Sleman, Yogyakarta	Study participants
Number of: Registered households in the hamlets	330	177	260	
Surveyed households	108 (32.73%)	85 (48.02%)	87 (33.46%)	280
Interviewed community members	4	3	2	9
Interviewed community leaders	3	6	7	16
Interviewed government officials	1	1	3	5

For these reasons, rather than randomly sampled households from the household register, researchers randomly visited houses in the three surveyed hamlets to sample the survey respondents. Determination of eligible respondents was conducted prior to administering the survey questionnaire. Researchers first asked if the household head was present, or if there was an adult household member (i.e. older than 18 years old) who was available for the survey. After explaining the intention of the survey, respondents were asked if they were a permanent resident of the hamlet and have been living there for at least five years. This pre-checking question is important, since the survey included questions about past events (e.g. natural hazard events, how the community overcame their impacts) besides ongoing conditions.

Concurrent with the household surveys, in-depth interviews were held with a panel of informants, which consists of community members, community leaders, and government officials at the village and sub-district levels (Table 2.2). In addition to interviewing community members, researchers also interviewed notable community members: those who hold influence in the communities, even though do not hold any formal structural leadership position. This includes members of BPD (*Badan Permusyawaratan Desa*, or village consultative assembly), head of PKK women groups (*Pembinaan Kesejahteraan*

Keluarga, or fostering family welfare), head of PAUD pre-school (*Pendidikan Anak Usia Dini*, or early childhood education), farmers' group leaders, and treasurer of one community group. Community leaders, on the other hand, are those who hold formal administrative leadership at the hamlet and village level. This includes village heads, hamlet heads, RW leaders, and RT/neighborhood leaders, who are elected by their community members. Village officials (e.g. village secretary), while in practice working in village offices, formally hold government appointment and do not go through any election. Hence, this study defines both village officials and agricultural extension workers at sub-district level as government officials.

Data Analysis

Analysis consisted of coding field-notes from in-depth interviews, and regression analysis on the survey data, with a variable of interest of frequency of weekly consumption of non-rice staple food. As a dependent variable, this study uses length of recovery time from natural hazards or shocks that represents community resilience. This follows the definition of resilience by the IPCC (2012), that a resilient community recovers quickly from the impact of shocks.

This study estimates two equations: 1) counting each district's effect (equation 2.1); and 2) using interaction terms between each district with staple food diversification (equation 2.2). Running two-stage least square (2SLS) estimation, a variable of amount of rice subsidy received by household per month is included as an instrumental variable, since it is assumed to affect the practice of staple food diversification.

$$RT = \beta_0 + \beta_1 CC + \beta_2 SFD + \beta_3 district_i + u \quad (\text{Equation 2.1})$$

$$RT = \beta_0 + \beta_1 CC + \beta_2 FSD * district_i + u \quad (\text{Equation 2.2})$$

Here, '*RT*' is length of recovery time from natural hazards or shocks; '*CC*' is community capital that contains variables representing social, built, political, human, financial, natural, and cultural capital; '*SFD*' is frequency in consuming non-rice staple foods per week; and '*district*' is dummy variable for district, where $i = 1, 2, 3$, i.e. 1 for Sleman (Village C) as a control, 2 for Gunungkidul (Village B), and 3 for Banjarnegara (Village A). Hypothetically, '*SFD*' is expected to have a negative coefficient, which means that higher frequency in diversifying staple food is associated with shorter recovery time from shocks.

In terms of staple food diversification, there is a contrast difference between the three communities (Table 2.3), as evident from one-way ANOVA (p-value < 0.001) and large effect size (Cohen, 1998). Village A takes a lead in habitual consumption of non-rice staples, in which 92 percent of its household still consistently consumes maize and cassava four times a week. Less than a half (45 percent) of Village B households still consistently consume cassava once a week, and only 2 percent of Village C households are still willing to consume cassava. This difference is closely linked to crop production patterns and agricultural infrastructures in the three districts. Village C enjoys a comparative advantage in rice production due to its flat topography and well-developed irrigation infrastructure. In contrast, Village A and B produce more dryland crops (e.g. cassava, dryland rice, maize) because of the suitability of karst and plateau geographical characteristics to dryland farming. In Village A, maize is mainly consumed by its households, with only a small amount to sell. Meanwhile, households in Village B commonly save and sell cassava, in addition to save their dryland rice produce for household consumption.

Table 2.3. Statistics of Staple Food Diversification and Recovery Time from Shocks

	Village A, Banjarnegara, Central Java	Village B, Gunungkidul, Yogyakarta	Village C, Sleman, Yogyakarta	One-way ANOVA (F- statistics)	Effect size (Eta)
Staple food diversification:					
Frequency in consuming non-rice staple food per week (times)	4.09 ^a	0.71 ^b	0.01 ^c	142.14***	0.71 (large)
Household practicing staple food diversification	92%	45%	2%		
Non-rice staple foods	Maize, cassava	Cassava	Cassava		
Recovery time from natural hazards or shocks:					
Length of time (months)	1.16 ^a	3.95 ^b	0.91 ^a	16.94***	0.33 (medium)
Minimum/maximum time	0 / 36	0 / 30	0 / 12		
Most memorable shocks	Fierce winds, 2002 landslide	Droughts, 2006 earthquake, fierce winds	2010 Merapi volcano eruption, 2006 earthquake, fierce winds		

***] significant at 99% level.

As for the length of recovery time from shocks, Village A and C have experienced a relatively shorter time to recover from natural hazards than Village B. The difference is statistically significant ($p\text{-value} < 0.001$ in one-way ANOVA) with a medium effect size (Table 2.3). It takes about a month for communities in Village A and C to recover from shocks, compared to 3.96 months in Village B. In Village C, the two most memorable natural hazards are the 2006 Central Java and Yogyakarta earthquake³ and 2010 Merapi volcano eruption⁴. Although these events can be categorized as natural disasters, they can be classified as natural hazards or shocks because of their less devastating effects on the studied communities. From the 2006 earthquake and 2010 volcano eruption, Village C was impacted indirectly due to its location, which is 40 kilometers (24.85 miles) from Merapi

³ The 2006 earthquake with a 6.3 Richter scale magnitude incurred a significant devastation in some areas in Central Java and Yogyakarta Province. According to the Ministry of Energy and Mineral Resources (2006) and NASA (2006), it is because of the relatively shallow epicenter of the earthquake, which is about 10 kilometers under the surface.

⁴ Merapi Volcano, located at the border between Central Java and Yogyakarta Province, is one active volcano in Indonesia that erupts periodically. This volcano is known to be a non-explosive volcano, but is feared for its pyroclastic flow. The effect of the 2010 eruption is more apparent due to the large amount of volcanic ashes and sulfur dioxide that the volcano combusted to the atmosphere (NASA, 2010; Ministry of Energy and Mineral Resources, 2010).

Volcano and 45 kilometers (28 miles) from the earthquakes' epicenters. As conveyed in the interviews, the community's livelihoods were disrupted when the events struck, but there were no casualties or property loss.

Residents in Village B also recall the 2006 earthquake as a memorable shock. However, they see the effect incurred by drought as more severe. Due to its karst topography with limited water sources, the community goes through drought every year, usually for three months from August to October. In some years, this could be up to six months. That was the case in 2015 when the surveys and interviews were conducted, where drought had started early in June. Meanwhile, the two most memorable shocks in Village A are fierce winds that happen from time to time and a 2002 landslide that caused several deaths of people from the neighboring hamlet. A few community members in Village B and C also cite fierce winds as memorable natural hazards.

Despite the different natural hazards or shocks experienced by the three communities, these various shocks affect the communities in fairly similar ways: a lack of serious property loss but livelihood disruption. Following the Merapi volcano eruption, farmers were not able to farm because of the volcanic ash that covered their lands. Similar disruption happened in Village A after the landslide, since farmers were afraid to farm, wary of the remaining unstable soil. In the aftermath of the 2006 earthquake, both Village B and C communities recall that they could not go to work and could not get food easily because of disrupted market operations.

Besides the climate-related shocks, this study also includes non-climatic natural hazards in studying community resilience to climate change, as studies show that there is a connection between climate change, warmer earth, and sea level rise with more frequent earthquake and volcanic eruption (McGuire et al., 1997; McGuire, 2012; Compton et al., 2015). The warmer earth, as a consequence of climate change, melts glaciers and warms

ocean temperatures, which raises sea levels and increases water volumes globally. That, in turn, increases the pressure on the earth's crust. Over time, rising pressure increases seismic activity by pulling out the magma from beneath the earth's surface to elevate the risk of earthquakes and volcanic eruptions.

RESULT AND DISCUSSION

This study aims to investigate the role of staple food diversification, a traditional ecological knowledge (TEK), in supporting community resilience to climate change. Firstly, in relation to the trait of adaptation strategy that is aimed to sustain livelihoods against unpredictable weather (Hisali et al., 2011), staple food diversification in rural Java is practiced as an adaptation strategy to the variable weather in a semi-conscious manner. One reason for this is that more than 60 percent households in the three surveyed communities have no knowledge nor heard about climate change (Table 2.4). Even though residents of Village A and B in Banjarnegara and Gunungkidul are accustomed to keep supplies of maize and cassava, they do not relate their habits with climate change. For them, the term climate change is odd, although a majority of the households perceive that there have been environmental changes going on in the last ten years, as seen from the increasing daily temperature, unpredictable rainfall, and hardly determinate seasonal changes that affect their crop production.

Table 2.4. Knowledge of Climate Change and Perception about Environmental Changes

	Village A, Banjarnegara, Central Java	Village B, Gunungkidul, Yogyakarta	Village C, Sleman, Yogyakarta
	Percentage of household answer 'yes'		
Know about climate change	15%	34%	26%
Daily temperature is increasing	81%	73%	84%
Rainfall is unpredictable	82%	84%	87%
Seasonal change is indeterminate	87%	84%	71%
Crop production is unpredictable	90%	88%	40%

In addition, the practice of staple food diversification as a TEK is closely related to local geographical characteristics. Residents of Village C in Sleman do not hold staple food diversification practice. They are traditionally accustomed to consume rice as a main staple food, due to the flat topography that enables rice farming year-round. Even with the threat imposed by more frequent and stronger ENSO that affects rainfall, residents have yet experienced high fluctuation in rice production, most probably because of the support of well-developed irrigation system in Sleman district.

On the other hand, community in Village B has been commonly associated with cassava due to its karst topography that is more profound for farming dryland crops. Nevertheless, farming a combination of cassava and rice is more common as a TEK strategy today. Since rice can only be grown once a year during the rainy season, and cannot be stored for a long period of time, residents still habitually dry and process cassava for a stock. As community members and leaders recall, keeping a supply of dried cassava has longed served as a way to protect the community from the risks posed by a prolonged dry period. With karst topography and limited water sources, the community goes through an annual drought that lasts for three to six months. Droughts longer than four months potentially ruin harvests from the solely rain-fed agricultural land, and so the stock of cassava takes a role as a buffer against the unpredictable weather.

Meanwhile, residents of Village A regard maize as their main staple food, but do not relate their maize stocks with preparation toward unpredictable weather. The residents argue that their area is relatively safe from weather-related hazards. In addition, their agricultural area has sufficient water to irrigate the farms, even during dry season, which makes maize is easily to grow. Compared to Village B community, however, community of Village A still strongly upholds their habit to consume maize. Surveys and interviews note a repeated statement from community members and leaders that they have eaten only after

having a meal with maize. This deviates from the common proverb in Indonesia, “I have not had a meal if I have not eaten rice”. The hold of tradition around maize is described by the farmers’ group association leader, who is also a former village head of 1999-2013:

“In the past, people saw successful local farmers as those who were able to grow maize that is sufficient for both their households’ consumption as well as for selling....”
(Farmers’ group association leader, Village A, 2015).

For Village A community, maize is not only important for its diet, but also for social status.

The role of staple food diversification to positively support community resilience to climate change is further emphasized by the two-stage least square (2SLS) estimation result. It shows that each additional unit of increase in the consumption of non-rice staple food is associated with faster recovery time to shocks by half a month (Table 2.5). This effect is particularly strong in Village A, but weaker in Village B, mainly because Village A households consume maize more often in a week than its counterpart in Village B. This result suggests that staple food diversification potentially supports rural communities’ resilience to climate change through dispersion of risk. As in livelihood diversification, communities have alternatives of staple food when their main staple food fails to grow or to harvest.

Table 2.5. Two Stage Least Square (2SLS) Estimation Results

Time to recover	2SLS, each village effect		2SLS, interaction terms	
	Coefficient	Std. error	Coefficient	Std. error
Endogenous variables:				
Frequency in diversifying staple food	-0.5555***	0.1601		
Frequency in diversifying staple food*dummy Village B			-0.0077	1.3777
Frequency in diversifying staple food*dummy Village A			-0.7112**	0.2951
Instrumental variables:				
Rice subsidy	0.0159	0.0326		
Dummy Village B	0.6133*	0.3317		
Dummy Village A	3.8029***	0.3914		
Rice subsidy*dummy Village B			0.0751***	0.0186
Rice subsidy*dummy Village A			0.6844***	0.0625

Table 2.5. (Continued)

Giving frequency	-0.0047	0.0258	-0.0013	0.0529
Receiving frequency	0.0040	0.0293	0.0069	0.0550
Number of community groups	-0.2215	0.2291	-0.3417	0.2606
Influential person	-0.2880	0.1856	-0.3228	0.2269
Delivering aspiration	-0.0883	0.1315	-0.1123	0.1852
Solving natural hazards' impact	0.3909**	0.1584	0.3866**	0.1569
HH head education	-0.1399*	0.0778	-0.1409*	0.0840
Agricultural risk perception	1.8138***	0.6725	1.6997*	1.0304
HH job	0.7712***	0.2459	0.7979***	0.1822
Number of cattle	-0.0823	0.0591	-0.0453	0.0855
Total agricultural land	1.1013*	0.6668	1.0595**	0.4278
Soil quality	-0.3860**	0.1593	-0.3102	0.2152
Land conservation effort (LCE)	3.8965***	0.9589	3.6843***	1.3967
Wald test	69.19***		94.17***	
R-squared	0.2111		0.2113	
Wu-Hausman (F-test)	3.6604*		3.3499**	

***) significant at 99% level; **) significant at 95% level; *) significant at 90% level.

However, although preserved and strengthened by tradition and belief of the locals, staple food diversification as a TEK faces some challenges that undermine its practice. This includes rural modernization that promotes outmigration of the youth and the presence of rice subsidy program. Rural modernization came with the Indonesian Green Revolution in the late 1960s, which developed transportation and telecommunication infrastructure in rural areas. As a result, the youth started to migrate out from the villages for school or work, gradually creating a lack of productive agricultural workers in rural areas. In Village B, rural modernization that increases outmigration of its youth also indirectly induces soil degradation. In the past, farmers rely on their neighbors to help transport and apply manure onto their land. Today, this social structure is dwindling because of a lack of productive workers in the village. Chemical fertilizer that once was merely additional substance ends up being the primary to replace the lack of manure.

In line with the modernization, Village B residents start to shift away from cassava to rice. Many residents argue that the shift to rice is necessary to keep up with the modernization. One implicit reason is because cassava carries a stigma as an inferior good

that is associated with the poor. Since modernization brings improvements to the community's living standards, rice has become a more suitable staple food to consume. The shift is described by a community leader and a resident:

"We have tradition to consume rice and tiwul (note: processed cassava), but now we consume rice. Because of modernization, rice is easy to get; we can easily buy it, so practical. (In the past) we used to consume what comes from the farm" (A community leader, Village B, 2015).

"Rice is the main staple food now, because of improved living standard" (A resident, Village B, 2015).

Moreover, the relatively more complicated steps to process cassava, compared to the easiness of cooking rice, allows the community to see rice as a more convenient and preferable staple food nowadays. The shift from cassava to rice because of its stigma as an inferior staple food for the have-nots is described in a study by Martianto et al. (2009). Their research found that the decreasing value of non-rice staple foods demotivate people to consume it, as observed in West Sumatra, Central Java, and Southeast Sulawesi Province.

Furthermore, Village A experiences rural modernization as a shift toward commercial vegetables farming. Introduced in the late 1990s along with agribusiness credit program, residents now prefer to grow vegetables commercially, replacing maize as the main commodity. This fact is accentuated by ongoing monkey attacks that sometimes wash-up maize farm, and discourage some farmers from growing maize. However, different from Village B residents that shift to rice for modernity reasons, residents of Village A started to combine maize with rice since the arrival of the rice subsidy program in their village. The subsidized rice, which is intended for only poor households, is in fact shared to almost all households in the village, accustoming the residents to consume rice.

In Village B, the rice subsidy also helps in shaping the habit of consuming rice on a day to day basis. While the residents have been consuming the combination of cassava and rice, rice can only be cultivated once a year during the rainy season. Since this is not

sufficient for a year-long consumption, the subsidized rice then becomes one alternative to obtain rice, magnified by the fact of the rice subsidy sharing practiced as in Village A. Therefore, when asked 'what is their daily staple food,' Village B residents commonly answer rice, although they follow up with statements that they are still consuming cassava occasionally. In contrast, most Village A residents directly state maize as their main staple food, but admit that they now also start to combine maize with rice. This is consistent with previous study regarding the local staple food dynamics in Indonesia. Elizabeth (2015) writes that a shift to rice culture is happening around the nation, especially in the eastern Indonesia of Moluccas, Timor, and Papua Island. More than 90 percent of Moluccas Islanders consume rice today, shifting from sago, a local staple native to the island.

Despite the finding that staple food diversification supports resiliency to climate change, this study also discovers its deterioration as a TEK. Similar to Donana's farmers in Spain that experienced eroding TEK due to globalization (Gomez-Baggethun and Reyes-Garcia, 2013), rural communities in Java undergo rural modernization that alters their livelihoods. This indirectly transforms their social structure, affecting the grasp of TEK in the communities. In Village A, residents shift from community agriculture that prioritizes maize farming to community agribusiness on commercial vegetables farming. With the presence of the rice subsidy program, along with the fact that maize is cultivated as a secondary crop, the residents start to combine maize with rice as their staple. The shift away to rice is operating faster in Village B community, where its residents feel the necessity to call rice their staples, as it is viewed as more congruent with their improved living standards.

Lastly and more importantly, TEK of staple food diversification can be viewed as an integrated-loop of production and consumption. When one aspect is disturbed, the other aspect will follow through to get constricted. In Village A, the consumption of maize remains

valued, but the production is interfered by commercial vegetable farming and ongoing monkey attacks. Residents then start to consume rice along with the local staple, to compensate for the reduced maize that is produced. In Village B, on the other hand, both the production and consumption aspect are disrupted because of soil degradation and modernization that drives outmigration of residents and increases overall living standards. Residents consume more rice today than before, for the reason that cassava is now stigmatized as a staple for the poor.

CONCLUSION

This study investigates the role of staple food diversification in supporting community resilience to climate change. Defined as a habitual consumption of non-rice staples, staple food diversification is found to positively support resiliency to climate change. However, due to lack of knowledge about climate change, the studied communities have yet to fully acknowledge staple food diversification's potency to provide an alternative source of food in times of unpredictable weather. This is despite the residents' traditional practice to grow and keep stock of cassava and maize, along with the belief that the non-rice staples are more fulfilling than rice. Besides the strengthening factors, there are some challenges found to alter the rural communities' practice of diversifying staple food. This includes rural modernization that drives outmigration as well as rice subsidy that contributes in accustoming the residents to consume rice, especially in Village A where rice is not locally grown.

Based on these findings, this study concludes that staple food diversification helps build rural communities' resilience to chronic shock, such as annual drought. This means that the practice can also help in developing the communities' resilience in future acute shocks, including earthquake and volcano eruption. Hence, staple food diversification

should be regarded as an adaptation strategy to climate change, as it potentially becomes an insurance policy against hunger in a time of unpredictable weather. This is particularly important as the threat of climate change increases the risk of both climatic and non-climatic natural hazards (e.g. McGuire et al., 1997; Compton et al., 2015). The findings also show that there is a need to maintain the balance between production and consumption aspects of staple food diversification, in order to preserve as well as encourage the practice. Efforts to encourage the consumption of non-rice staple foods by present and future generations, along with the promotion of the cultivation of local staple crops in the communities are critical to establishing community resiliency to climate change impacts.

References

- Ariani, Mewa. 2006. Diversifikasi Konsumsi Pangan di Indonesia: Antara Harapan dan Kenyataan. (in *Diversifikasi Usahatani Dan Konsumsi: Suatu Alternatif Peningkatan Kesejahteraan Rumah Tangga Petani* edited by Kedi Suradisastra, Yusmichad Yusdja, Masdjidin Siregar, and Ketut Kariyasa). Monograph Series 27: 118-121.
- Below, Till B., Khamaldin D. Mutabazi, Dieter Kirschke, Christian Franke, Stefan Sieber, Rosemarie Siebert, and Karen Tscherning. 2012. Can Farmers' Adaption to Climate Change be Explained by Socio-economic Household-level Variables? *Global Environmental Change* 22: 223-235.
- Berkes, Fikret. 1993. Traditional Ecological Knowledge in Perspective (in *Traditional Ecological Knowledge: Concepts and Cases*, edited by Julian T. Inglis). International Program on Traditional Ecological Knowledge: Ottawa, Canada.
- Berkes, Fikret, Johan Colding, and Carl Folke. 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications* 10(5): 1251-1262.
- Berkes, Fikret, Johan Colding, and Carl Folke. 2003. Introduction (in *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*, edited by Fikret Berkes, Johan Colding, and Carl Folke). Cambridge University Press: Cambridge, United Kingdom.
- Boillat, Sebastian and Fikret Berkes. 2013. Perception and Interpretation of Climate Change Among Quechua Farmers of Bolivia: Indigenous Knowledge as a Resource for Adaptive Capacity. *Ecology and Society* 18(4): 21.
- Boissiere, Manuel, Bruno Locatelly, Douglas Sheil, Michael Padmanaba, and Ermayanti Sadjudin. 2013. Local Perceptions of Climate Variability and Change in Tropical Forests of Papua, Indonesia. *Ecology and Society* 18(4): 13.

- Booth, William James. 1994. On the Idea of the Moral Economy. *American Political Science Review* 88(3): 653-667.
- Bureau of Statistics Banjarnegara District. 2016. Pagentan in Figures 2016 (Pagentan dalam Angka 2016). Bureau of Statistics Banjarnegara District: Banjarnegara, Indonesia.
- Bureau of Statistics Gunungkidul District. 2016. Purwosari in Figures 2016 (Purwosari dalam Angka 2016). Bureau of Statistics Gunungkidul District: Wonosari, Indonesia.
- Bureau of Statistics Sleman District. 2016. Seyegan in Figures 2016 (Seyegan dalam Angka 2016). Bureau of Statistics Sleman District: Sleman, Indonesia.
- Central Bureau of Statistics. 2014. Report on Agricultural Census 2013: Complete Sampling (Laporan Lengkap Hasil Sensus Pertanian 2013: Pencacahan Lengkap). Central Bureau of Statistics. Jakarta, Indonesia.
- _____. 2015. *Produksi Tanaman Pangan (Food Crops Production)*. Central Bureau of Statistics: Jakarta, Indonesia.
- Carney, Diana. 2003. *Sustainable Livelihood Approaches: Progress and Possibilities for Change*. Department for International Development: United Kingdom
- Cohen, Jacob. 1988. *Statistical Power Analysis for the Behavioral Science Second Edition*. Erlbaum: New Jersey, USA.
- Compton, Kathleen, Richard A. Bennett, and Sigrun Hreinsdottir. 2015. Climate-driven Vertical Acceleration of Icelandic Crust Measured by Continuous GPS Geodesy. *Geophysical Research Letters* 42: 743-750.
- Deressa, Temesgen Tadesse, Rashid M. Hassan, Claudia Ringler, Tekie Alemu, and Mahmud Yesuf. 2009. Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. *Global Environmental Change* 19: 248-255.
- Elizabeth, Roosganda. 2015. Strategi Pencapaian Diversifikasi dan Kemandirian Pangan: Antara Harapan dan Kenyataan. *Buletin Iptek Tanaman Pangan* 6(2): 230-242.
- Ellis, Frank. 1998. Household Strategies and Rural Livelihood Diversification. *The Journal of Development Studies* 35(1): 1-38.
- Flora, Cornelia Butler and Jan L. Flora. 2013. *Rural Communities: Legacy and Change*. Westview Press: Colorado, USA.
- Gomez-Baggethun, Erik and Victoria Reyes-Garcia. 2013. Reinterpreting Change in Traditional Ecological Knowledge. *Human Ecology* 41: 643-647.
- Henly-Shepard, Sarah, Cheryl Anderson, Kimberly Burnett, Linda J. Cox, John N. Kittinger, and Maka'ala Ka'aumoana. 2015. Quantifying Household Social Resilience: A Place-Based Approach in a Rapidly Transforming Community. *Natural Hazards* 75: 343-363.

- Hisali, Eria, Patrick Birungi, and Faisal Buyinza. 2011. Adaptation to Climate Change in Uganda: Evidence from Micro Level Data. *Global Environmental Change* 21: 1245-1261.
- IPCC. 2012. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* (edited by Field, C. B., V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G. K. Plattner, S. K. Allen, M. Tignor, and P. M. Midgley. Cambridge University Press: Cambridge, UK and New York, USA.
- Irawan, Bambang. 2006. "Anomali Iklim El Nino dan La Nina: Kecenderungan Jangka Panjang dan Dampaknya terhadap Produksi Pangan" (El Nino and La Nina Climate Anomaly Phenomenon: the Longterm Trend and Its Impact on Food Production). *Forum Penelitian Agro Ekonomi* 24(1): 28-45.
- Jhamtani, Hira. 2008. *Lumbung Pangan: Menata Ulang Kebijakan Pangan* (Food Barn: Reformulate Food Policy). Insists Press: Yogyakarta, Indonesia.
- Keil, Alwin, Manfred Zeller, Anastasia Wida, Bunasor Sanim, and Regina Birner. 2008. What Determines Farmers' Resilience towards ENSO-related Drought? An Empirical Assessment in Central Sulawesi, Indonesia. *Climatic Change* 86: 291-307.
- Knutsson, Per. 2006. The sustainable livelihoods approach: A framework for knowledge integration assessment. *Human Ecology Forum* 13(1): 90-99.
- Martianto, Drajat, Dodik Briawan, Mewa Ariani, and Nita Yulianis. 2009. Percepatan Diversifikasi Konsumsi Pangan Berbasis Pangan Lokal: Perspektif Pejabat Daerah dan Strategi Pencapaiannya. *Jurnal Gizi dan Pangan* 4(3): 123-131.
- McDonald, Miriam and Brian Fleming. 1993. Community-Based Economic Development and Resource Management in the Hudson Bay Area (in *Traditional Ecological Knowledge: Concepts and Cases*, edited by Julian T. Inglis). International Program on Traditional Ecological Knowledge: Ottawa, Canada.
- McGuire, W. J., R. J. Howarth, C. R. Firth, A. R. Solow, A. D. Pullen, S. J. Saunders, I. S. Stewart, and C. Vita-Finzi. 1997. Correlation between Rate of Sea-level Change and Frequency of Explosive Volcanism in the Mediterranean. *Nature* 389: 473-476.
- McGuire, Bill. 2012. *Waking the Giant: How A Changing Climate Triggers Earthquakes, Tsunamis, and Volcanoes*. Oxford University Press: Oxford, United Kingdom.
- Ministry of Energy and Mineral Resources. 2006. *Gempa Bumi di Daerah Istimewa Yogyakarta* (Earthquake in Yogyakarta Special Region). Retrieved on February 22, 2016 from <http://esdm.go.id/berita/geologi/42-geologi/687-gempa-bumi-di-daerah-istimewa-yogyakarta.html>.
- . 2010. *Gunung Merapi – Sejarah Letusan* (Mount Merapi – Eruption History). Retrieved on February 22, 2016 from <http://www.vsi.esdm.go.id/index.php/gunungapi/data-dasar-gunungapi/542-g-merapi?start=1>.

- Mullaney, Emma Gaalaas. 2014. Geopolitical Maize: Peasant Seeds, Everyday Practices, and Food Security in Mexico. *Geopolitics* 19(2): 406-430.
- Mulyana, Erwin. 2002. "Hubungan Antara ENSO Dengan Variasi Curah Hujan Di Indonesia" (The Relation Between ENSO and Rainfall Variability in Indonesia). *Jurnal Sains dan Teknologi Modifikasi Cuaca* 3(1): 1-4.
- NASA. 2006. *Magnitude 6.3 Quake in Central Java*. Retrieved on February 22, 2016 from <http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=16767>.
- _____. 2010. *Eruption at Mount Merapi, Indonesia*. Retrieved on February 22, 2016 from <http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=46881>.
- Naylor, Rosamond L., W.P. Falcon, D. Rochberg, and N. Wada. 2001. "Using El Nino/Southern Oscillation Climate Data to Predict Rice Production in Indonesia". *Climatic Change* 50: 255-265.
- Olson, Elizabeth Anne. 2013. Anthropology and Traditional Ecological Knowledge: A Summary of Quantitative Approaches to Traditional Knowledge, Market Participation, and Conservation. *Culture, Agriculture, Food, and Environment* 35(2): 140-151.
- Timmermann, A., J. Oberhuber, A. Bacher, M. Esch, M. Latif, and E. Roeckner. 1999. Increased El Nino Frequency in A Climate Model Forced by Future Green House Warming. *Nature* 398: 694-696.
- Thompson, Andrea. 2007. Global Warming Might Spur Earthquakes and Volcanoes. Accessed at January 12, 2016 from <http://www.livescience.com/7366-global-warming-spur-earthquakes-volcanoes.html>
- Tobias, Terry. 1993. Stereotyped Village Economies and the Pinehouse Harvest Research (in *Traditional Ecological Knowledge: Concepts and Cases*, edited by Julian T. Inglis). International Program on Traditional Ecological Knowledge: Ottawa, Canada.
- Traerup, Sara L. M. 2012. Informal Networks and Resilience to Climate Change Impacts: A Collective Approach to Index Insurance. *Global Environmental Change* 22: 255-267.
- Urich, Peter B., Liza Quirog, and William G. Granert. 2009. El Nino: An Adaptive Response to Build Social and Ecological Resilience. *Development in Practice* 19(6): 766-776.
- Van Aalst, Maarten K., Terry Cannon, and Ian Burton. 2008. Community Level Adaptation to Climate Change: The Potential Role of Participatory Community Risk Assessment. *Global Environmental Change* 18: 165-179.
- Yohe, Gary and Richard S.J. Tol. 2002. Indicators for social and economic coping capacity – moving toward a working definition of adaptive capacity. *Global Environmental Change* 12: 25-40.

CHAPTER 3. LOCAL STAPLE FOOD VERSUS RICE SUBSIDY: DEVELOPING CLIMATE CHANGE RESILIENCE IN RURAL INDONESIA

*"I think people started to eat more rice since the arrival of rice subsidy in this village".
(A notable community member, Village A, 2015)*

ABSTRACT

This study investigates the role of rice subsidy program as a government policy in facilitating the consumption of local staple food and its impact on climate change resiliency. The consumption of local staples is termed staple food diversification, based on the fact that rice is regarded as the main staple food in Indonesia. Onsite surveys and interviews were conducted in three villages within three districts in Java Island, namely Banjarnegara, Gunungkidul, and Sleman. Analysis with two-stage least square (2SLS) estimation on the survey data suggests that higher amounts of rice subsidy received by households are associated with more consumption of non-rice staple foods in Banjarnegara and Gunungkidul. However, although the communities still uphold the value of the local staples, namely maize and cassava, they admit that rice consumption is more prevalent today, with the one factor shaping this habituation as the rice subsidy. Rationale for this contradiction is discussed.

Keywords: climate change, community resilience, staple food diversification, rice subsidy

INTRODUCTION

Community livelihoods in Indonesia are affected by a cyclical climate anomaly known as the El Nino Southern Oscillation (ENSO). ENSO is a natural phenomenon that occurs periodically in the surrounding areas of the Pacific Ocean, but lately has become more frequent and stronger because of climate change (Timmermann et al., 1999). In Indonesia, two types of ENSO events, El Nino and La Nina, reduce precipitation below and or increase it above normal levels. Studies illustrate that unpredictability in precipitation and other weather elements brought by ENSO harms food production, reduces farmer incomes, and undermines social resilience (Naylor et al., 2001; Irawan, 2006; Keil et al., 2008). Coupled with climate change, ENSO threatens communities whose livelihoods depend on natural resources, such as rural communities. This includes small-scale farmers that comprise more than fifty percent of the farming population in Indonesia, and comprises 35 percent of the nation's work force (Central Bureau of Statistics, 2014).

In accordance with climate change, rural communities exhibit the capacity to adapt to the changing environment by exercising their traditional knowledge (e.g. Boissiere et al., 2013; Olson, 2013; Boillat and Berkes, 2013). As an accumulation of knowledge, practices, and beliefs inherited through generations, an example of traditional knowledge in Indonesia is the existing local staple foods that are varied across the archipelago. For instance, sago is native for Moluccas and Papua Islands, while maize is a common staple in Timor Island. These local staple foods have contributed in minimizing hunger in some parts of Indonesia, for example when in 2005 a prolonged drought severely limited national rice production (Jhamtani, 2008). With knowledge about local staples, the communities, especially the elder members, shifted back to non-rice staples as alternative sources of staples other than rice. In other words, traditional knowledge of local staple food has the potential to enhance community resilience to unpredictable weather.

Furthermore, traditional knowledge has also been regarded to be able to contribute to scientific knowledge (Berkes, 1993; DeWalt, 1994) and the policy making process. An example includes the incorporation of farmers' traditional knowledge in the farming system in Kentucky, which advances agricultural technology and increases crop productivity (DeWalt, 1994). In addition, the incorporation of Eskimo's traditional knowledge into scientific methods are shown to improve the accuracy of bowhead whale census in the north coast of Alaska (Huntington, 2000). Traditional knowledge also plays an important role in decision-making on wildlife resource management in Inuit communities in northern Canada (McDonald and Fleming, 1993).

This study examines the following question: what role does the rice subsidy program, as a government policy, have in facilitating the consumption of local staple foods (traditional knowledge) within the scope of climate change resiliency? As traditional knowledge, the habitual consumption of local staples, such as maize and cassava, is termed

staple food diversification, based on the fact that rice is regarded as the main staple food in Indonesia⁵. With this research question, how a government institution goes hand in hand with traditional knowledge will be examined. The elaboration of how a government program facilitates the practice of traditional knowledge will add insight to the literature, adding to previous studies about the incorporation of traditional knowledge to the policymaking process. Furthermore, the connections between government policies and traditional knowledge may provide important insights to local communities on how to enhance their overall resiliency.

The next section illustrates the conceptual and theoretical framework, which includes a history of the rice subsidy program in Indonesia, as well as elaboration about traditional knowledge and community resilience. Subsequently, the method section provides descriptions of the study areas, data collection, and methods of analysis. The results and discussion section presents the findings from quantitative analysis on the role of rice subsidy program on staple food diversification practices, that will be joined by qualitative data collected from interviews. As a note in going forward, the terms staple food diversification and consumption of local staples will be used interchangeably.

CONCEPTUAL AND THEORETICAL FRAMEWORK

Raskin: The Indonesian Rice Subsidy Program

Rice subsidy program in Indonesia was formally enacted in 1998, during the 1997/1998 economic crises that severely struck the country. The economic crises were accentuated by the occurrence of 1997/1998 El Nino, which caused a severe drought that

⁵ The definition of staple food diversification should be distinguished from food diversification, as used by the Indonesian Agency of Food Security. Food diversification, which is measured by desirable dietary pattern, is defined as an ideal balance of food consumption that consists of carbohydrate, protein and fat that aspires to improve individuals' nutritional intake (Ariani, 2006). Meanwhile, staple food diversification is the diversification in staple food only, such as rice, maize, and cassava.

impacted rice production in Indonesia to plummet. In addition, these events were worsened by the concurrent nationwide civilian unrest in Indonesia. The unrest, demanding the termination of the authoritarian regime that had ruled Indonesia for more than thirty years, went hand-in-hand with the drought and a steep decline in rice production that led to food scarcity across the nation. The economic crisis also doubled the nation's poverty rate from 11.34 percent in 1996 to 24.7 percent in 1998 (Swastika and Supriyatna, 2008). This confluence of events created a bitter national mood among the long-term poor and new poor who found themselves in need of food. Food shortages, in fact, became the driving forces behind the government's decision to initiate a rice subsidy program.

The rice subsidy program was enacted to reduce the burden that food expenditures placed on poor families (Trinugroho et al., 2011). It was initially intended as a social emergency relief package for the poor during economic crises, which was subsequently refashioned as a social protection net after the economy rebounded. The program was called OPK (*Operasi Pasar Khusus*, or "special market operation") from its enactment in 1998 to 2002. It was renamed Raskin (*Beras untuk Rakyat Miskin*, or "rice for poor families") in 2002 to reflect its broader mission to strengthen food security in Indonesia (Hastuti and Maxwell, 2003; Sudirman and Yonekura, 2013). It is implemented by subsidizing the price of medium quality rice, which enables poor families to purchase ten to twenty kilograms of rice per month at a price below the market price.

In practice, Raskin has been unable to reach its goal of providing low-price rice for the poor (Hastuti et al., 2012). One main reason is the already-rooted practice of sharing the subsidized rice in many communities since the era of OPK. The economic crises created new poor families that were not initially intended to be beneficiaries of the OPK, causing strikes in local communities toward the unfairness of the rice subsidy distribution. Many communities overcame this unfairness problem by sharing the subsidized rice with all

families in the community, or alternatively, rotating the recipients (Hastuti and Maxwell, 2003). While the rice subsidy program is considered successful in stabilizing rice prices and demand, its implementation remains flawed due to repeating the patterns first implemented during OPK. As discovered during our fieldwork, this pattern also exists in the three studied communities, although they are separated by more than fifty kilometers (or 33 miles).

Traditional Knowledge

In general, traditional knowledge is an accumulation of knowledge, practices, and beliefs inherited through generations. Within this concept, traditional ecological knowledge (also known as TEK) includes both relationships between humans, and between humans and their environment (Berkes, 1993; Berkes et al., 2000), and is thereby consistent with adaptive management to build social-ecological resilience. Adaptive management emphasizes learning-by-doing and is consistent with the characteristics of TEK that relies on decades, indeed centuries, of trial-and-error. TEK also embraces social mechanisms, including the use of local institutions, cultural internalization, and the development of worldviews (Berkes et al. 2000).

Berkes (1993) argues that despite the different characteristics between TEK and western scientific knowledge, both are potentially complementing each other. He elucidates the characteristics of TEK in comparison to scientific ecological knowledge (in brackets): “1) TEK is mainly qualitative (vs. quantitative); 2) TEK has an intuitive component (vs. purely rational); 3) TEK is holistic (vs. reductionist); 4) TEK considers mind and matter in unity (vs. separation of mind and matter); 5) TEK is moral (vs. value-free); 6) TEK is spiritual (vs. mechanistic); 7) TEK is based on empirical observations and accumulation of facts by trial-and-error (vs. experimentation and systematic deliberate accumulation of fact); 8) TEK is

based on data generated by resource users themselves (vs. by specialized researchers); 9) TEK is based on diachronic data, i.e. long time-series on information on one locality (vs. synchronic data, i.e. short time-series over a large area)” (p. 4). Another feature of TEK is its flexibility to adjust to the changing environment, or that TEK is hybrid and dynamic in nature, and capable of adapting to new ecological and socioeconomic conditions (Gomez-Baggethun et al., 2013). These features highlight the potential role of TEK in developing community adaptive capacity and resilience to climatic and environmental changes.

Boillat and Berkes (2013) acknowledge TEK as a primary component for adaptive capacity. Around the world, indigenous and rural communities have practiced TEK for generations in the face of climatic variability and climate-related disasters, such as floods, droughts, and strong winds. Altieri and Koohafkan (2008) show that small/traditional farm households in Africa, Asia, and Latin America develop and or inherit varied farming systems that are applicable in facing the changing climate and environment, such as water harvesting, mixed cropping, agroforestry, wild plant gathering, terracing, and so on. Other examples include soil conservation and early/late planting (Deressa et al. 2009; Vignola et al. 2010).

Community Resilience

Resilience is defined as “the ability of a system to absorb or buffer changes or utilize the changes for its advantage” (Ellis, 1998, p. 14), and at the same time to maintain its ability to function (Traerup, 2012), “without undergoing fundamental changes in its functional characteristics” (Berkes et al., 2003, p. 14). Citing the Resilience Alliance (2002), Berkes et al. (2003) provides three characteristics of resilience: 1) the amount of change the system can buffer and absorb, while keeping similar established function and structure; 2) the capability of self-organization; and 3) the capacity for learning and adaptation (p. 13).

According to IPCC (2012), resilient systems also recover from the impact of hazardous events quickly and efficiently.

Community resilience is closely related to people's livelihoods (Berkes et al., 2003). Livelihoods are understood as the capabilities, assets (both material and social resources), and activities required to sustain the households (Osborne et al., 2008). From the perspective of rural sociology, this definition suggests that livelihoods are comprised of human capital (e.g. education, experience), natural capital (e.g. land ownership, soil fertility), social capital (e.g. membership in social groups, trust), financial capital (e.g. total household income, access to financial sources), and physical capital (e.g. house ownership), which together build a sustainable livelihood pentangle (Carney, 2003; Knutsson, 2006; Keil et al., 2010; Below et al., 2012). By adding cultural and political capital, all seven types of capital together build a community capital framework that contributes to healthy ecosystems, economic security, and social inclusion for rural communities (Flora and Flora, 2013).

RESEARCH QUESTION AND HYPOTHESIS

This study examines the inter-related issues of local staple food and rice subsidy program within the frameworks of traditional knowledge and community resilience. The literature has embraced the integration of traditional knowledge into scientific knowledge and policymaking process, but how government institutions facilitate the practice of traditional knowledge needs more exploration. Therefore, this study inquires: how does rice subsidy program as a government institution play its role in facilitating the practice of staple food diversification? Based on the previous studies that traditional knowledge can work alongside the scientific knowledge and in the policymaking process, it is hypothesized that the reverse link is also applied, which states that rice subsidy can positively support the practice of staple food diversification as traditional knowledge.

METHOD

Study Areas

This study gathers insights from case studies in three rural communities in Java Island, Indonesia. Java Island is chosen, as it is a rice production center that delivers more than 50 percent of the rice produced in Indonesia (Central Bureau of Statistics, 2015). In spite of this fact, Java is also home to various ethnic and sub-ethnic groups (Central Bureau of Statistics, 2015; Koentjaraningrat, 1989) with various staples. As a locale for both rice and non-rice staples, Java Island is an interesting site to study staple food diversification practice around the rice subsidy program.

Three rural communities in Central Java and Yogyakarta Province are selected, specifically in Banjarnegara District in Central Java and Gunungkidul and Sleman District in Yogyakarta. In the three districts, the agricultural sector employs a considerable percentage of small-scale farm households with land holdings of less than one hectare, i.e. 73.78 percent in Banjarnegara, 75.40 percent in Gunungkidul, and 92.40 percent in Sleman (Agricultural Census Central Java Province, 2013; Agricultural Census Yogyakarta Province, 2013). Next, three rural sub-districts were selected within the three districts based on variations in topography: 1) Pagentan in Banjarnegara District, Central Java is a hilly-plateau area; 2) Purwosari in Gunungkidul District, Yogyakarta is a hilly-karst area; and 3) Seyegan in Sleman District, Yogyakarta is a flat area (Figure 3.1). Such differences prompt variations in farming, and consequently, local staple foods. Surveys and interviews were conducted in three villages within the three sub-districts.

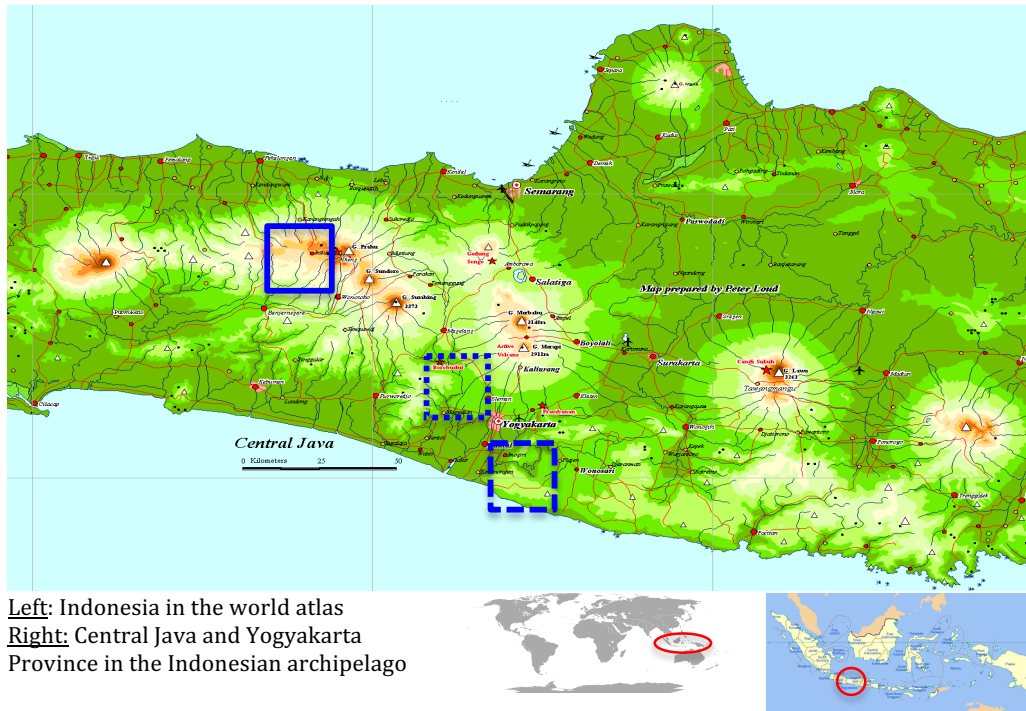


Figure 3.1. Map of Central Java and Yogyakarta Province

Sources: <http://peterloud.co.uk/indonesia/Xindonesia.html>; <http://www.wro2013.org/indonesia/>

Notes:



Village A, Pagentan, Banjarnegara, Central Java

Village B, Purwosari, Gunungkidul, Yogyakarta

Village C, Seyegan, Sleman, Yogyakarta

Village A in Pagentan sub-district, Banjarnegara is located in the western part of Dieng Plateau, a large area in the center of Central Java province known for tourism and vegetable farming. Devoid of irrigation, the village owns only dryland agricultural areas (Table 3.1). Not surprisingly, dryland crops, including maize, vegetables, tobacco, cassava, and sweet potato, are the main commodities. Meanwhile, Purwosari, Gunungkidul, which generally consists of hilly-karst topography, is situated at the southern end of Yogyakarta Province. In Village B, where surveys and interviews were conducted, dryland agricultural land makes up 99.56 percent of the village's arable area. Purwosari statistical yearbook does not contain crop productions. But surveys, interviews, and field observations note that the community grows cassava, dryland rice, maize, groundnut, chili, and other dryland crops. In contrast, Village C of Seyegan, Sleman contains mainly wetland agricultural land

(99.65 percent), which makes wetland-rice to be the most common crops cultivated in the village.

Table 3.1. Basic Figures of the Surveyed Villages

	Village A, Banjarnegara, Central Java	Village B, Gunungkidul, Yogyakarta	Village C, Sleman, Yogyakarta
Agricultural area (hectares):			
Wetland area	0 (0%)	6.34 (0.44%)	259.23 (99.65%)
Dryland area	410.99 (100%)	1,444.02 (99.56%)	0.91 (0.35%)
Agricultural production (tons):			
Wetland rice	-	NA	3,432.00
Dryland rice	-	NA	-
Maize	1,185.57	NA	437.4
Cassava	768.84	NA	NA
Agricultural commodities:			
Food crop	Maize (white), cassava, sweet potato	Cassava, dryland rice, maize (yellow)	Wetland rice, maize (yellow), cassava
Horticultural crop	Tobacco, cabbage, chili, tomato, green onion, etc.	Groundnut, chili, turmeric, soybean	Chili, groundnut
Main occupations:			
Farmer	67.59%	68.24%	18.39%
Others	Merchant (6.48%) Carpenter (4.63%) Day laborer (4.63%)	Day laborer (16.47%) Carpenter (4.71%) Government official/ businessman/ private employee (7.05%)	Day laborer (27.59%) Businessman (14.94%) Private employee (11.49%)
Side occupations:			
Farmer	17.59%	10.59%	6.90%
Others	Carpenter (10.19%) Merchant (9.26%)	Carpenter (30.59%) Merchant (15.29%)	Merchant (3.45%) Carpenter/ businessman/ cattleman (6.90%)

Source: Pagentan in Figures 2016; Purwosari in Figures 2016; Seyegan in Figures 2016; On-site survey 2015.

Village A and B in Banjarnegara and Gunungkidul are dominated by farmers (67.59 percent and 68.24 percent, respectively, while day laborer is the most common occupation in Village C in Sleman. This relates to the proximity of Village C to Yogyakarta city center (15 kilometers or 9 miles), which is the capital of Yogyakarta Province, compared to Village B

that is about 40 kilometers (or 25 miles) away from the same city center. Meanwhile, Village A is located 49 kilometers (or 30 miles) away from Banjarnegara town, which is the nearest town and the capital of Banjarnegara district. Farmers again dominate side occupation in Village A, and interestingly in Village C, while carpenter is the most common side job in Village B.

Data Collection

Primary data was collected from surveys and interviews with a total of 310 study participants in the three chosen rural sub-districts in August and September 2015 (Table 3.2). The surveys were conducted with community members or households using a structured questionnaire. The number of total households was obtained by working with local hamlet heads. Determining exact numbers of families per household was difficult for several reasons. First, as stated by hamlet heads, there are many multiple-households living at the same house, but registered as a separate household. Second, there are community members in Village A and B who are listed as hamlet residents, but living outside the community working in seasonal and permanent jobs. Lastly, the list of household members' occupation has been found to inaccurately represent the true condition. In Village B, almost all households register their main occupations as farming, while not all of them farm. In contrast, almost all households in Village C are listed with off-farm occupations (e.g. teacher, private employee), but some of them farm as a side occupation.

Table 3.2. Number of Study Participants

	Village A, Banjarnegara, Central Java	Village B, Gunungkidul, Yogyakarta	Village C, Sleman, Yogyakarta	Study participants
Number of: Registered households in the hamlets	330	177	260	
Surveyed households	108 (32.73%)	85 (48.02%)	87 (33.46%)	280
Interviewed community members	4	3	2	9
Interviewed community leaders	3	6	7	16
Interviewed government officials	1	1	3	5

For these reasons, rather than randomly sampled households from the household register, researchers randomly visited houses in the three surveyed hamlets to sample the survey respondents. Determination of eligible respondents was conducted prior to administering the survey questionnaire. Researchers first asked if the household head was present, or if there was an adult household member (i.e. older than 18 years old) who was available for the survey. After explaining the intention of the survey, respondents were asked if they were a permanent resident of the hamlet and have been living there for at least five years. This pre-checking question is important, since the survey included questions about past events (e.g. natural hazard events, how the community overcame their impacts) besides ongoing conditions.

Concurrent with the household surveys, in-depth interviews were held with a panel of informants, which consists of community members, community leaders, and government officials at the village and sub-district levels (Table 3.2). In addition to interviewing the commoners, researchers also interviewed notable community members: those who hold influence in the communities, even though they do not hold any formal structural leadership position. This includes members of BPD (*Badan Permusyawaratan Desa*, or village consultative assembly), head of PKK women groups (*Pembinaan Kesejahteraan*

Keluarga, or fostering family welfare), head of PAUD pre-school (*Pendidikan Anak Usia Dini*, or early childhood education), farmers' group leaders, and treasurer of one community group. Community leaders, on the other hand, are those who hold formal administrative leadership at the hamlet and village level. This includes village heads, hamlet heads, RW leaders, and RT/neighborhood leaders, who are elected by their community members. Village officials (e.g. village secretary), while in practice working in village offices, formally hold government appointment and do not go through any election. Hence, this study defines both village officials and agricultural extension workers at sub-district level as government officials.

Data Analysis

In order to investigate the role of rice subsidy program in facilitating the practice of staple food diversification, this study utilizes a mixed qualitative and quantitative approach. In addition to coding field-notes from the qualitative interviews, a quantitative analysis with two-stage least square (2SLS) estimation is run on the survey data. In doing so, this study focuses on two critical variables: 1) frequency in consuming non-rice staple per week; and 2) amount of rice subsidy received by household per month. For dependent variable, a variable of length of recovery time from natural hazards or shocks is included to portray community resilience. This follows the definition of resilience by the IPCC (2012), i.e. resilient community recovers quickly from the impact of shocks.

Questions in the survey included specific items related to amount of rice subsidy received per month. To measure staple food diversification, respondents were asked what staple foods they consume habitually and the frequency in consuming non-rice staple food per week, if the household consume staple foods other than rice. Finally, recovery time from shocks were measure in terms of length of time perceived to recover, as well as specific

types of shocks experienced (e.g., winds, landslide, drought, earthquake, volcano eruptions). Differences across communities were also assessed.

The 2SLS enables a continuous analysis of the effect of rice subsidy on local staples consumption, where rice subsidy is included as an instrumental variable. The 2SLS estimates two equations: 1) counting each district's effect (equations 3.1 and 3.3); and 2) using interaction terms between each district with staple food diversification and rice subsidy (equations 3.2 and 3.4).

First stage:

$$SFD = \gamma_0 + \gamma_1 CC + \gamma_2 RS + \gamma_3 district_i + v \quad (\text{Equation 3.1})$$

$$SFD * district_i = \gamma_0 + \gamma_1 CC + \gamma_2 RS * district_i + v \quad (\text{Equation 3.2})$$

Second stage:

$$RT = \beta_0 + \beta_1 CC + \beta_2 SFD + \beta_3 district_i + u \quad (\text{Equation 3.3})$$

$$RT = \beta_0 + \beta_1 CC + \beta_2 FSD * district_i + u \quad (\text{Equation 3.4})$$

Here, '*SFD*' is frequency in consuming non-rice staples per week; '*CC*' is community capital that contains variables representing social, built, political, human, financial, natural, and cultural capital; '*RS*' is the amount of rice subsidy received by household per month; '*district*' is dummy variable for district, where $i = 1, 2, 3$, i.e. 1 for Sleman (Village C) as control, 2 for Gunungkidul (Village B), and 3 for Banjarnegara (Village A); and '*RT*' is length of recovery time from natural hazards or shocks. In the estimation, '*RS*' is expected to have a positive coefficient in the first stage equation, for rice subsidy is hypothesized to positively facilitates the practice of staple food diversification.

RESULTS AND DISCUSSION

In order to investigate the role of rice subsidy program in facilitating the practice of staple food diversification, this study utilizes a mixed qualitative and quantitative approach that collects data from surveys and interviews. Survey data shows that while rice subsidy distribution exhibits similar patterns, local staples consumption is varied across the three

communities (Table 3.3). With respect to rice subsidy, more than 80 percent of households in the three communities receive rice subsidies, with amounts varying between three to four kilograms per household per month. On the other hand, Village A takes a lead in habitual consumption of non-rice staples, in which 92 percent of its household still consistently consumes maize and cassava four times a week. Less than a half (45 percent) of Village B households still consistently consume cassava once a week, and only 2 percent of Village C households are consuming non-rice staple. The difference is statistically significant, as evident from one-way ANOVA (p -value < 0.001) and large effect size (Cohen, 1998).

Table 3.3. Statistics of Rice Subsidy, Staple Food Diversification, and Recovery Time from Shocks

	Village A, Banjarnegara, Central Java	Village B, Gunungkidul, Yogyakarta	Village C, Sleman, Yogyakarta	One-way ANOVA (F- statistics)	Effect size (Eta)
Rice subsidy:					
Amount of rice subsidy received per month (kilograms)	4.71 ^a	5.38 ^b	3.64 ^b	11.73***	0.28 (small)
Household receiving rice subsidy	93%	87%	82%		
Staple food diversification:					
Frequency in diversifying staple food per week (times)	4.09 ^a	0.71 ^b	0.01 ^c	142.14***	0.71 (large)
Household practicing staple food diversification	92%	45%	2%		
Non-rice staple foods	Maize, cassava	Cassava	Cassava		
Recovery time from shocks:					
Length of time (months)	1.16 ^a	3.95 ^b	0.91 ^a	16.94***	0.33 (medium)
Minimum/maximum time	0 / 36	0 / 30	0 / 12		
Most memorable shocks	Fierce winds, 2002 landslide	Droughts, 2006 earthquake, fierce winds	2010 Merapi volcano eruption, 2006 earthquake, fierce winds		

*** significant at 99% level.

Variation in staple food diversification practice across the three communities is closely linked to crop production patterns in the three districts. Sleman district enjoys a

comparative advantage in rice production due to its flat topography and well-developed irrigation infrastructure. In contrast, Gunungkidul and Banjarnegara districts produce more dryland crops because of the suitability of karst and plateau geographical characteristics to dryland farming. Hence, rice has been a mainstay of residents' diet in Village C of Sleman, while cassava has been closely associated with community in Village B of Gunungkidul and maize is adhered to community in Village A of Banjarnegara.

As for the length of recovery time from shocks, Village A and C have experienced a relatively shorter time to recover from natural hazards than Village B. The difference is statistically significant ($p\text{-value} < 0.001$ in one-way ANOVA) with a medium effect size (Table 3.3). It takes about a month for communities in Village A and C to recover from shocks, compared to 3.96 months in Village B. In Village C, the two most memorable natural hazards are the 2006 Central Java and Yogyakarta earthquake and 2010 Merapi volcano eruption. Although these events can be categorized as natural disasters because of their devastating effects, the studied community in Village C was impacted indirectly due to its location, which is 40 kilometers (24.85 miles) from Merapi Volcano and 45 kilometers (28 miles) from the earthquakes' epicenters. As conveyed in the interviews, the community's livelihoods were disrupted when the events struck, but there were no casualties or property loss.

Residents in Village B also recall the 2006 earthquake as a memorable shock. However, they see the effect incurred by drought as more severe. Due to its karst topography with limited water sources, the community goes through drought every year, usually for three months from August to October. In some years, this could be up to six months. That was the case in 2015 when the surveys and interviews were conducted, where the drought had started early in June. Meanwhile, the two most memorable shocks in Village A were fierce winds that happen from time to time and a 2002 landslide that caused several

deaths of people from the neighboring hamlet. A few community members in Village B and C also cite fierce winds as memorable natural hazards.

Despite the different natural hazards or shocks experienced by the three communities, these various shocks affect the communities in fairly similar ways: a lack of serious property loss but livelihood disruption. Following the Merapi volcano eruption, farmers in Village C were not able to farm because of the volcanic ash that covered their lands. Similar disruption happened in Village A after the landslide, since farmers were afraid to farm, wary of the remaining unstable soil. In the aftermath of the 2006 earthquake, both Village B and C communities recall that they could not go to work and could not get food easily because of disrupted market operations.

Besides the climate-related shocks, this study also includes non-climatic natural hazards in studying community resilience to climate change, as studies show that there is a connection between climate change, warmer earth, and sea level rise with more frequent earthquake and volcanic eruption (McGuire et al., 1997; McGuire, 2012; Compton et al., 2015). The warmer earth, as a consequence of climate change, melts glaciers and warms ocean temperatures, which raises sea levels and increases water volumes globally. That, in turn, increases the pressure on the earth's crust. Over time, rising pressure increases seismic activity by pulling out the magma from beneath the earth's surface to elevate the risk of earthquakes and volcanic eruptions.

The variables of rice subsidy and consumption of non-rice staples are then run against length of recovery time from shocks, in order to estimate the role of rice subsidy to facilitate staple food diversification practice. Two stage least square estimation shows that rice subsidy is associated with higher consumption of non-rice staples in Village A and B. An additional kilogram of rice subsidy received by household increases frequency in consuming non-rice staples by 0.6840 per week in Village A and by 0.0763 per week in

Village B (Table 3.4). This results support the hypothesis that rice subsidy as a government institution positively facilitates the practice of traditional knowledge, in this case staple food diversification.

Table 3.4. Two Stage Least Square (2SLS) Estimation Results

Time to recover	2SLS, each village effect		2SLS, interaction terms	
	Coefficient	Std. error	Coefficient	Std. error
Endogenous variables:				
Frequency in diversifying staple food	-0.5555***	0.1601		
Frequency in diversifying staple food*dummy Village B			-0.0077	1.3777
Frequency in diversifying staple food*dummy Village A			-0.7112**	0.2951
Instrumental variables:				
Rice subsidy	0.0159	0.0326		
Dummy Village B	0.6133*	0.3317		
Dummy Village A	3.8029***	0.3914		
Rice subsidy*dummy Village B			0.0751***	0.0186
Rice subsidy*dummy Village A			0.6844***	0.0625
Giving frequency	-0.0047	0.0258	-0.0013	0.0529
Receiving frequency	0.0040	0.0293	0.0069	0.0550
Number of community groups	-0.2215	0.2291	-0.3417	0.2606
Influential person	-0.2880	0.1856	-0.3228	0.2269
Delivering aspiration	-0.0883	0.1315	-0.1123	0.1852
Solving natural hazards' impact	0.3909**	0.1584	0.3866**	0.1569
HH head education	-0.1399*	0.0778	-0.1409*	0.0840
Agricultural risk perception	1.8138***	0.6725	1.6997*	1.0304
HH job	0.7712***	0.2459	0.7979***	0.1822
Number of cattle	-0.0823	0.0591	-0.0453	0.0855
Total agricultural land	1.1013*	0.6668	1.0595**	0.4278
Soil quality	-0.3860**	0.1593	-0.3102	0.2152
Land conservation effort (LCE)	3.8965***	0.9589	3.6843***	1.3967
Wald test	69.19***		94.17***	
R-squared	0.2111		0.2113	
Wu-Hausman (F-test)	3.6604*		3.3499**	

***) significant at 99% level; **) significant at 95% level; *) significant at 90% level.

Nonetheless, interviews lead to a different outcome, in which the rice subsidy is pointed out as one factor that shapes the accustoming of rice consumption in the studied communities. One notable elder in Village A states:

"I think people in this community started to eat more rice since the arrival of rice subsidy in this village." (A notable community member, Village A, 2015).

This statement is validated by community members in the surveys and interviews. In Village B, residents commonly answer rice when asked about their staple food, although follow up with statements that they are still consuming cassava occasionally. In contrast, most Village A residents directly state maize as their main staple food, but admit that they started to combine maize with rice. When residents of the two communities were asked why they consume more rice than before, rice subsidy comes up often as an answer.

The contradiction between quantitative and qualitative findings can be explained through the fact of rice subsidy sharing in the studied communities. Similar with findings from a previous study that assessed the implementation of rice subsidy program (Hastuti and Maxwell, 2003), this study also finds that rice subsidy is shared with most residents, excluding the rich and the very rich families, even when the communities are aware that the subsidized rice is intended only for the poor. As evident from the survey data, households in the three communities receive, on average, four to six kilograms of rice subsidy per month (Table 3.3), less than the regulated amount of ten to twenty kilograms per household per month. Surveys and interviews reveal that community leaders and members, including poor households, agree to share the rice subsidy to non-beneficiaries for three reasons. First, each household has similar responsibilities to contribute cash⁶ in village and hamlet development. Second, as common in other places, the rice subsidy is shared to avoid conflicts and jealousies in the communities. Lastly, the sharing reflects a mutual help in the communities. A statement from hamlet head of Village B sums it up:

“The decision (to share rice subsidy) was made based on the willingness of the Raskin beneficiary to share the rice to his/her neighbors, for the local culture holds that sharing food with neighbors is a symbol of mutual help. Things will be different for BLT (Bantuan Langsung Tunai, or direct cash transfer). It will be inappropriate to

⁶ Money collected from each household in the community, used to fund infrastructure development, such as building roads or improving sewage. Although the amount of contribution is voluntary in some communities, all household has a social responsibility to contribute.

share money from BLT with neighbors.” (Hamlet head, Village B, 2015).

With every household in the studied communities having access to rice, rice consumption is gradually accustomed. Because the residents now consume rice, both as main staple and as supplementary for cassava or maize, the effect of rice subsidy program on staple food diversification practice is enhanced. Supposed that Village A and B residents decide to deliver the subsidized rice to the beneficiaries only, there would be households who do not have access to rice consumption. In Village A, the non-beneficiaries would stick to maize, considering the loyalty of the residents to maize. In Village B, since rice has been a complementary for cassava, residents would need to buy more rice. This way, the effect of rice subsidy on the consumption of local staples would be less intensified.

Rice subsidy, however, does not operate alone in reshaping the staple food consumption habit. There are agricultural and non-agricultural forces at play. Agricultural-related factors in Village B come as an intertwining problem involving monkey attacks and soil degradation. Uncertain and or declining crop productivity because of the monkey attacks and poor soil fertility demotivate many residents to farm their lands. Younger farmers then prefer to shift to day laborer, since it provides more steady income. Consequently, less and less cassava is produced in the community. In Village A as well, monkeys attack maize farms, threatening the production of the local's staple, and discourages local farmers from growing maize. On top of that, maize is no longer cultivated as a main commodity as in the past, since vegetable farming was introduced in the late 1990s. While maize is grown mainly for household consumption, vegetables are commercially sold, providing the residents with higher income. Compared to its counterpart in Village B and C, residents of Village A earn higher annual on-farm income, which mostly comes from seasonal farming (Figure 3.2). As a total of on-farm income of IDR 13 million, more than 40 percent is comprised of seasonal farming income.

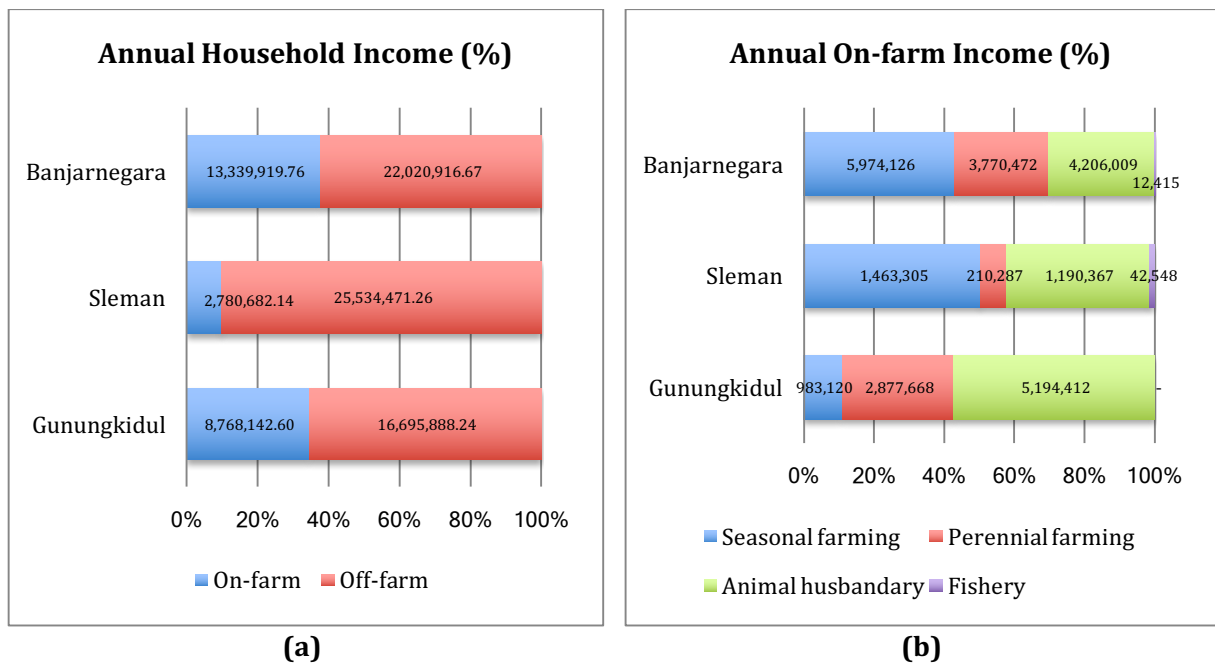


Figure 3.2. Annual Household and On-farm Income: **(a)** Proportion of On-Farm and Off-Farm Income on Total Household Income; **(b)** Proportion of Seasonal Farming, Perennial Farming, Animal Husbandry, and Fishery on Total Farming Income

Furthermore, a non-agricultural factor of rural modernization contributes in reshaping the way the communities, especially Village B residents, perceiving their local staples. Along with rural modernization since the late 1960s that developed transportation and telecommunication infrastructure in rural areas, the youth of Village B also started to migrate out for school and work. The off-farm jobs provide higher income than the on-farm (Figure 3.2), and are claimed to improve the community's living standard. In line with that, Village B residents start to shift away from cassava to rice, as a way to keep up with the modernization. Besides, rice is seen to be more suitable staple food to consume today, since cassava is stigmatized as an inferior good (Martianto et al., 2009) and staple for the have-nots.

These findings indicate that rice subsidy program has an unintended consequence of accustoming the rice consumption. As shown by the 2SLS estimation, however, the presence of rice subsidy is a positive aid for community resilience, although indirectly

through its effect on the consumption of local staples. This can be explained by the fact of rice subsidy sharing in the communities. Hence, despite the critique that rice subsidy sharing has always been a flaw in the implementation of rice subsidy program, this study shows that the sharing practice unexpectedly provides a positive outcome. Explanation of the positive association between rice subsidy and the local staples consumption may lie, again, on the rice subsidy sharing practice. Since the amount of rice subsidy received by household is less than ten to twenty kilograms per month, Village A and B residents combine the rice with maize and cassava to compensate the deficiency in the main staple foods consumption. This effect is particularly strong in Village A; whose residents explicitly declare that rice is less fulfilling than maize. Similarly, for some Village B residents that farm, cassava is perceived to provide more energy than rice.

CONCLUSION

This study explores the role of rice subsidy program as a government policy in facilitating the consumption of local staples as traditional knowledge. This study reveals that rice subsidy contributes in accustoming the residents to consume rice. However, quantitative estimation with two-stage least square (2SLS) shows that rice subsidy positively supports community resilience through its aid to the habitual consumption of non-rice staples. A rationale to explain this contradiction is the fact that rice subsidy is shared among most households in the studied communities. With all households gaining access to rice consumption, the effect of rice subsidy on staple food diversification practice is reinforced.

The rice subsidy program remains necessary in the effort of developing rural community resilience to climate change. First, as in line with the idea of staple food diversification that provides alternatives source of food in the time of unpredictable

weather (Jhamtani, 2008), rice subsidy program also potentially contributes to complement the consumption of local staples. This embodies a form of diversification in food consumption (Ariani, 2006), since rice contains different nutrients than the local staples. Additionally, rural communities apply their local wisdom to share the subsidized rice to most households, which in fact benefits the communities themselves. A touch of local wisdom in the implementation of rice subsidy program enables the government institution to facilitate the practice of traditional knowledge of staple food diversification in a positive manner.

References

- Altieri, Miguel A. and Parviz Koohafkan. 2008. *Enduring Farms: Climate Change, Smallholders and Traditional Farming Communities*. Malaysia: Third World Network.
- Ariani, Mewa. 2006. Diversifikasi Konsumsi Pangan di Indonesia: Antara Harapan dan Kenyataan. (in *Diversifikasi Usahatani Dan Konsumsi: Suatu Alternatif Peningkatan Kesejahteraan Rumah Tangga Petani* edited by Kedi Suradisastra, Yusmichad Yusdja, Masdjidin Siregar, and Ketut Kariyasa). Monograph Series 27: 118-121.
- Below, Till B., Khamaldin D. Mutabazi, Dieter Kirschke, Christian Franke, Stefan Sieber, Rosemarie Siebert, and Karen Tscherning. 2012. Can Farmers' Adaption to Climate Change be Explained by Socio-economic Household-level Variables? *Global Environmental Change* 22: 223-235.
- Berkes, Fikret. 1993. Traditional Ecological Knowledge in Perspective (in *Traditional Ecological Knowledge: Concepts and Cases*, edited by Julian T. Inglis). International Program on Traditional Ecological Knowledge: Ottawa, Canada.
- Berkes, Fikret, Johan Colding, and Carl Folke. 2000. Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications* 10(5): 1251-1262.
- Berkes, Fikret, Johan Colding, and Carl Folke. 2003. Introduction (in *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*, edited by Fikret Berkes, Johan Colding, and Carl Folke). Cambridge University Press: Cambridge, United Kingdom.
- Boillat, Sebastian and Fikret Berkes. 2013. Perception and Interpretation of Climate Change Among Quechua Farmers of Bolivia: Indigenous Knowledge as a Resource for Adaptive Capacity. *Ecology and Society* 18(4): 21.

- Boissiere, Manuel, Bruno Locatelly, Douglas Sheil, Michael Padmanaba, and Ermayanti Sadjudin. 2013. Local Perceptions of Climate Variability and Change in Tropical Forests of Papua, Indonesia. *Ecology and Society* 18(4): 13.
- Bureau of Statistics Banjarnegara District. 2016. Pagentan in Figures 2016 (Pagentan dalam Angka 2016). Bureau of Statistics Banjarnegara District: Banjarnegara, Indonesia.
- Bureau of Statistics Central Java Province. 2013. Report on Agricultural Census 2013: Complete Sampling (Laporan Lengkap Hasil Sensus Pertanian 2013: Pencacahan Lengkap). Bureau of Statistics Central Java Province: Semarang, Indonesia.
- Bureau of Statistics Gunungkidul District. 2016. Purwosari in Figures 2016 (Purwosari dalam Angka 2016). Bureau of Statistics Gunungkidul District: Wonosari, Indonesia.
- Bureau of Statistics Sleman District. 2016. Seyegan in Figures 2016 (Seyegan dalam Angka 2016). Bureau of Statistics Sleman District: Sleman, Indonesia.
- Bureau of Statistics Yogyakarta Province. 2013. Report on Agricultural Census 2013: Complete Sampling (Laporan Lengkap Hasil Sensus Pertanian 2013: Pencacahan Lengkap). Bureau of Statistics Yogyakarta Province: Yogyakarta, Indonesia.
- Central Bureau of Statistics. 2014. Report on Agricultural Census 2013: Complete Sampling (Laporan Lengkap Hasil Sensus Pertanian 2013: Pencacahan Lengkap). Central Bureau of Statistics: Jakarta, Indonesia.
- _____. 2015. *Produksi Tanaman Pangan (Food Crops Production)*. Central Bureau of Statistics: Jakarta, Indonesia.
- _____. 2015. *Statistik Politik (Political Statistic)*. Central Bureau of Statistics: Jakarta, Indonesia.
- Carney, Diana. 2003. *Sustainable Livelihood Approaches: Progress and Possibilities for Change*. Department for International Development: United Kingdom
- Cohen, Jacob. 1988. *Statistical Power Analysis for the Behavioral Science Second Edition*. Erlbaum: New Jersey, USA.
- Compton, Kathleen, Richard A. Bennett, and Sigrun Hreinsdottir. 2015. Climate-driven Vertical Acceleration of Icelandic Crust Measured by Continuous GPS Geodesy. *Geophysical Research Letters* 42: 743-750.
- Deressa, Temesgen Tadesse, Rashid M. Hassan, Claudia Ringler, Tekie Alemu, and Mahmud Yesuf. 2009. Determinants of farmers' choice of adaptation methods to climate change in the Nile Basin of Ethiopia. *Global Environmental Change* 19: 248-255.
- DeWalt, Billie R. 1994. Using Indigenous Knowledge to Improve Agriculture and Natural Resource Management. *Human Organization* 53(2): 123-131.
- Ellis, Frank. 1998. Household Strategies and Rural Livelihood Diversification. *The Journal of Development Studies* 35(1): 1-38.

- Flora, Cornelia Butler and Jan L. Flora. 2013. *Rural Communities: Legacy and Change*. Westview Press: Colorado, USA.
- Gomez-Baggethun, Erik and Victoria Reyes-Garcia. 2013. Reinterpreting Change in Traditional Ecological Knowledge. *Human Ecology* 41: 643-647.
- Gomez-Baggethun, Erik, Esteve Corbera, and Victoria Reyes-Garcia. 2013. Traditional Ecological Knowledge and Global Environmental Change. *Ecology and Society* 18(4): 72.
- Hastuti and John Maxwell. 2003. Rice for the Poor Families (RASKIN): Did the 2002 Program Operate Effectively? *SMERU Field Report*. SMERU Research Institute: Jakarta, Indonesia.
- Hastuti, Bambang Sulaksono, and Sulton Mawardi. 2012. Tinjauan Efektivitas Pelaksanaan Raskin dalam Mencapai Enam Tepat. *Kertas Kerja (Working Paper)*. SMERU Research Institute: Jakarta, Indonesia.
- Huntington, Henry P. 2000. Using traditional ecological knowledge in science: Methods and applications. *Ecological Applications* 10(5): 1270-1274.
- IPCC. 2012. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* (edited by Field, C. B., V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G. K. Plattner, S. K. Allen, M. Tignor, and P. M. Midgley. Cambridge University Press: Cambridge, UK and New York, USA.
- Irawan, Bambang. 2006. "Anomali Iklim El Nino dan La Nina: Kecenderungan Jangka Panjang dan Dampaknya terhadap Produksi Pangan" (El Nino and La Nina Climate Anomaly Phenomenon: the Longterm Trend and Its Impact on Food Production). *Forum Penelitian Agro Ekonomi* 24(1): 28-45.
- Jhamtani, Hira. 2008. *Lumbung Pangan: Menata Ulang Kebijakan Pangan* (Food Barn: Reformulate Food Policy). Insists Press: Yogyakarta, Indonesia.
- Keil, Alwin, Manfred Zeller, Anastasia Wida, Bunasor Sanim, and Regina Birner. 2008. What Determines Farmers' Resilience towards ENSO-related Drought? An Empirical Assessment in Central Sulawesi, Indonesia. *Climatic Change* 86: 291-307.
- Knutsson, Per. 2006. The sustainable livelihoods approach: A framework for knowledge integration assessment. *Human Ecology Forum* 13(1): 90-99.
- Koentjaraningrat, R.M. 1989. *Javanese Culture*. Oxford University Press: New York, USA.
- Martianto, Drajat, Dodik Briawan, Mewa Ariani, and Nita Yulianis. 2009. Percepatan Diversifikasi Konsumsi Pangan Berbasis Pangan Lokal: Perspektif Pejabat Daerah dan Strategi Pencapaiannya. *Jurnal Gizi dan Pangan* 4(3): 123-131.
- McDonald, Miriam and Brian Fleming. 1993. Community-Based Economic Development and

- Resource Management in the Hudson Bay Area (in *Traditional Ecological Knowledge: Concepts and Cases*, edited by Julian T. Inglis). International Program on Traditional Ecological Knowledge: Ottawa, Canada.
- McGuire, W. J., R. J. Howarth, C. R. Firth, A. R. Solow, A. D. Pullen, S. J. Saunders, I. S. Stewart, and C. Vita-Finzi. 1997. Correlation between Rate of Sea-level Change and Frequency of Explosive Volcanism in the Mediterranean. *Nature* 389: 473-476.
- McGuire, Bill. 2012. *Waking the Giant: How A Changing Climate Triggers Earthquakes, Tsunamis, and Volcanoes*. Oxford University Press: Oxford, United Kingdom.
- Ministry of Energy and Mineral Resources. 2006. *Gempa Bumi di Daerah Istimewa Yogyakarta* (Earthquake in Yogyakarta Special Region). Retrieved on February 22, 2016 from <http://esdm.go.id/berita/geologi/42-geologi/687-gempa-bumi-di-daerah-istimewa-yogyakarta.html>.
- _____. 2010. *Gunung Merapi – Sejarah Letusan* (Mount Merapi – Eruption History). Retrieved on February 22, 2016 from <http://www.vsi.esdm.go.id/index.php/gunungapi/data-dasar-gunungapi/542-g-merapi?start=1>.
- Ministry of Agriculture. 2010. *Satu Dasawarsa Kelembagaan Ketahanan Pangan di Indonesia* (A Decade of Food Security Institution in Indonesia). Agency of Food Security: Jakarta, Indonesia.
- NASA. 2006. *Magnitude 6.3 Quake in Central Java*. Retrieved on February 22, 2016 from <http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=16767>.
- _____. 2010. *Eruption at Mount Merapi, Indonesia*. Retrieved on February 22, 2016 from <http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=46881>.
- Naylor, Rosamond L., W.P. Falcon, D. Rochberg, and N. Wada. 2001. "Using El Nino/Southern Oscillation Climate Data to Predict Rice Production in Indonesia". *Climatic Change* 50: 255-265.
- Olson, Elizabeth Anne. 2013. Anthropology and Traditional Ecological Knowledge: A Summary of Quantitative Approaches to Traditional Knowledge, Market Participation, and Conservation. *Culture, Agriculture, Food, and Environment* 35(2): 140-151.
- Osbahr, Henny, Chasca Twyman, W. Neil Adger, and David S.G. Thomas. 2008. Effective Livelihood Adaptation to Climate Change Disturbance: Scale Dimensions of Practice in Mozambique. *Geoforum* 39: 1951-1964.
- Sudirman, A.R. and Hitoshi Yonekura. 2013. *Implementation of the Subsidized Rice for the Poor (RASKIN) in South Konawe District, Indonesia*. Retrieved at January 12, 2014 from <http://ir.library.tohoku.ac.jp/re/bitstream/10097/56366/1/0288-6855-2013-44-11.pdf>
- Swastika, D.K.S. and Yana Supriyatna. 2008. The Characteristic of Poverty and Its Alleviation

- in Indonesia. *Forum Penelitian Agro Ekonomi* vol. 26(2): 103-115.
- Timmermann, A., J. Oberhuber, A. Bacher, M. Esch, M. Latif, and E. Roeckner. 1999. Increased El Nino Frequency in A Climate Model Forced by Future Green House Warming. *Nature* 398: 694-696.
- Thompson, Andrea. 2007. Global Warming Might Spur Earthquakes and Volcanoes. Accessed at January 12, 2016 from <http://www.livescience.com/7366-global-warming-spur-earthquakes-volcanoes.html>
- Tobias, Terry. 1993. Stereotyped Village Economies and the Pinehouse Harvest Research (in *Traditional Ecological Knowledge: Concepts and Cases*, edited by Julian T. Inglis). International Program on Traditional Ecological Knowledge: Ottawa, Canada.
- Traerup, Sara L. M. 2012. Informal Networks and Resilience to Climate Change Impacts: A Collective Approach to Index Insurance. *Global Environmental Change* 22: 255-267.
- Trinugroho, I., Sutomo, and Asri Laksmi Riani. 2011. The Efficiency of Public Service Obligation for Food Subsidy in Indonesia: Review of Cost Structure Analysis. *Perspectives of Innovations, Economics, and Business* vol. 7(1): 45-47.
- Vignola, Raffaele, Thomas Koellner, Roland W. Scholz, and Tim L. McDaniels. 2010. Decision-making by farmers regarding ecosystem services: Factors affecting soil conservation efforts in Costa Rica. *Land Use Policy* 27: 1132-1142.

CHAPTER 4. COMMUNITY POLITICAL CAPITAL AND RESILIENCE TO CLIMATE CHANGE: VIEW FROM DECENTRALIZATION ERA IN INDONESIA

"We prefer to self-help ourselves than waiting for the government's aid..."
(Hamlet head, Village B, 2015)

ABSTRACT

This study explores the role of political capital in facilitating rural community resilience to climate change within the context of decentralization era in Indonesia. Decentralization gives mandates to local government, including village governments, to create their own development planning, which consequently requires rural community's participation in the policymaking process. Using a mixed qualitative and quantitative method, we collect data through surveys and interviews in three districts in Java Island, i.e. Banjarnegara, Sleman, and Gunungkidul. Ordinary least square regression shows that as a form of political capital, higher utilization of community's own resources in solving natural hazards' impact is associated with higher resiliency. However, more attempts to deliver aspirations through community groups results in lower resilience, mainly because the power structure in the studied communities is still dominated by community leaders and influential figures, rather than community groups, which is seen as the highest entity for decision-making in the communities. Implication for rural policy will be discussed.

Keywords: climate change, community resilience, decentralization, political capital

INTRODUCTION

Climate change increases the frequency and intensity of periodical weather anomalies such as the El Nino Southern Oscillation or ENSO (Timmermann et al., 1999). ENSO, which occurs in the Equatorial Pacific, affects precipitation patterns in a large number of countries, including the United States, Peru, Australia, and Indonesia. In Indonesia, ENSO may lower precipitation levels, creating the potential for prolonged periods of drought; or, conversely, may trigger higher levels of precipitation, nurturing conditions that prompt floods and levels of humidity that lead to the proliferation of pests and insects. Studies illustrate that unpredictability in precipitation and other weather elements brought by ENSO harms food production, reduces farmer incomes, and undermines social resilience (Naylor et al., 2001; Irawan, 2006; Keil et al., 2008).

Rural communities are threatened by the unpredictable weather, mainly because of the intertwining between its livelihoods with natural resources. Moreover, considering that

small-scale farmers compose 55.33 percent of Indonesian farmers, and about 35 percent of the work force (Central Bureau of Statistics, 2014), the effect of unpredictable weather on livelihoods is deemed significant in this region. Nevertheless, studies have recorded the ability of rural communities to adapt to the changing environment by practicing traditional or indigenous knowledge (e.g. see Boissiere et al., 2013; Olson, 2013; Boillat and Berkes, 2013). With respect to the relationship among humans, rural communities hold norms and values to regulate and distribute resources that embody organization, connection, voice, and power, which constitutes political capital (Flora and Flora, 2013).

This study attempts to understand the relationship between political capital and community resilience within the context of decentralization era in Indonesia. More specifically, the role of political capital in facilitating community resilience to climate change will be investigated using a governance framework of complex adaptive system (Duit and Galaz, 2013). The decentralization policy was enacted in 1999 and delivered mandates for the rural communities to determine its fate in the development process. Since the implementation of the decentralization policy, studies have described that decentralization helps in reshaping rural community's political capital in development matters (e.g. Beard and Dasgupta, 2006; Beard, 2007, Bebbington et al., 2004; Rosyadi, 2004). However, the connection between political capital and climate change resiliency needs more elaboration.

The next section will present a conceptual and theoretical framework, which includes illustration of Indonesian decentralization, community resilience, and political capital. It will be followed by the research question and hypothesis, and subsequently, the method section, which explains study areas, data collection, and data analysis. Results and discussion will follow, and the conclusion will describe policy implications of this study.

CONCEPTUAL AND THEORETICAL FRAMEWORK

The Indonesian Decentralization

The establishment of decentralization in Indonesia was partly driven by monetary crisis that hit Asia, including Indonesia, in 1997/1998. The crisis created a negative citizens' mood, which resulted in a nationwide civilian unrest, demand for replacement of the authoritarian ruling regime with a more democratic government system. Through the monetary crisis and subsequent civilian unrest, the Indonesian government realized that centralized government systems, as imposed by the authoritarian regime, has weakened their capacity to deal with global challenges (Rasyid, 2007) and failed to distribute wealth equally amongst regions. The fall of the authoritarian government marked a new beginning in the governance system in Indonesia. Motivated by the need to distribute authorities and resources to the regional government, decentralization policy was established in the late 1990s.

Indonesian decentralization, known domestically as "regional autonomy", was formally enacted through Laws 22 of 1999 on Regional Government and 25 of 1999 on the Fiscal Balance between the Central and Regional Government. The laws mandate that the central government distribute authorities to the district and municipal government, the third-tier government level in Indonesia. As an exception, the central government keeps its authorities on monetary, defense and security, religious affairs, foreign policies, and judiciary affairs (Alm and Bahl, 1999). In the meantime, provincial government, which lies between national and district levels, remains a limited-autonomous region still responsible to the central government.

Indonesia implements three types of decentralization, i.e. administrative, fiscal, and political decentralization. According to Falleti (2005), administrative decentralization delegates administrative and social services delivery, such as education, health, and social

welfare, to regional government. Fiscal decentralization relates to sets of policies aimed to generate revenue or fiscal autonomy for the regional government. Meanwhile, political decentralization gives more authority for the local government to conduct its reign and represent its regions. In short, the Indonesian decentralization helps in reshaping regional development and policy to adjust to the diversity of local regions, since the regional government has the authority to plan its own development based on the local resources.

From the political perspective, decentralization is a precondition to increase public participation (Antlov, 2003b; Marley, 2003) and it broadens the opportunity for the local citizens to participate in regional development. Besides enabling direct election for regional leaders (i.e. governor, reagent, mayor) and regional house of representative, regional government is also able to recruit its administrative officials. Hence, different than the past mechanism that favors top-down appointment, local citizens are now dominating the corresponding region, as regional leaders, members of the local assembly, and administrative officials. Haug (2007) studies Dayak ethnical groups in West Kutai district, East Kalimantan province, and writes that decentralization has significantly increased Dayak people participation in West Kutai development.

Regarding political capital at the local level, collective action and community driven development in urban and rural settings in Java are improved since the enactment of decentralization (Beard and Dasgupta, 2006). Similarly, Beard (2007) writes that decentralization increases households' participation in governance, social welfare, and infrastructure development. However, comparing three rural communities in Central Java, Jambi, and East Nusa Tenggara Provinces, Bebbington et al. (2004) argue that power structures in the villages are heavily involved in the implementation of decentralization.

Community Resilience

Resilience is “the ability of a system to absorb or buffer changes or utilize the changes for its advantage” (Ellis, 1998, p. 14), and at the same time to maintain its function (Traerup, 2012), “without undergoing fundamental changes in its functional characteristics” (Berkes et al., 2003, p. 14). Citing the Resilience Alliance (2002), Berkes et al. (2003) provide three characteristics of resilience: 1) the amount of change the system can buffer and absorb, while keeping similar function and structure; 2) the capability of self-organization; and 3) the capacity for learning and adaptation (p. 13). Resilience consists of intertwining social and ecological aspects (Urich et al., 2009), in which social resilience relates to social systems and institutions in the communities.

The characteristics of resilience are inherent in the governance framework of complex adaptive systems (Duit and Galaz, 2008). Specifically, they argue that the governance capacity to deal with complex adaptive systems is a function of exploitation (or institutional arrangement) and exploration (or learning capacity). Regarding exploitation, Duit and Galaz (2008) write that it is explained by trust, norms of reciprocity, network structures, institutional rules, and support from government institutions. Meanwhile, exploration involves information accumulation about ongoing conditions in the environment, experimentation of new rules, institutions, or policies, and the necessary resources, such as monetary and human capital. Based on this description, there are four types of governance: 1) rigid, i.e. high exploitation, low exploration; 2) robust, i.e. high exploitation, high exploration; 3) flexible, i.e. low exploitation, high exploration; and 4) fragile, i.e. low exploitation, low exploration (Figure 4.1). Rigid governance is similar to state-dominated governance (strong institutions but low learning capacity), while the flexible type is parallel to network-based governance (weak institutions but high learning

capacity). In this typology, resilient governance system is characterized by strong institutions and high learning capacity (exhibited in the upper right quadrant of Figure 4.1).

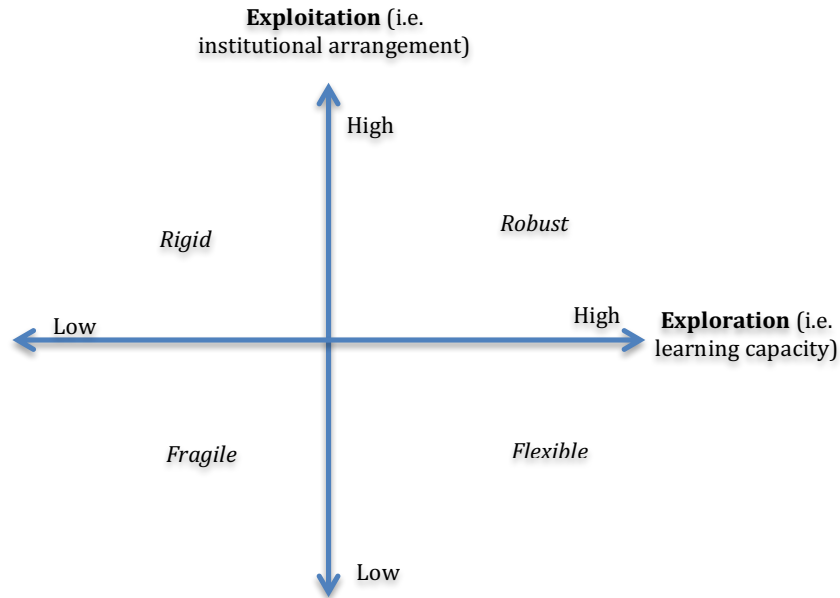


Figure 4.1. Typology of Adaptive Governance System (Duit and Galaz, 2008)

Elements of institutional arrangement and learning capacity of the governance framework of complex adaptive system can be connected to rural sociology's community capital framework (Flora and Flora, 2013). While institutional arrangements are made of social, political, and built-institution capital, learning capacity consists of human, financial, natural, and cultural capital. Social, built, human, financial, and natural capital are known as a sustainable livelihood pentangle (Carney, 2003; Knutsson, 2006; Below et al., 2012), which is often linked to community resilience in the literature (e.g. Berkes et al., 2003; Keil et al., 2010). Flora and Flora (2013) then add political and cultural capital, since the seven capitals together actualize rural communities with healthy ecosystems, economic security, and social inclusion.

Political Capital

Political capital includes “organizations, connections, voice, and power as citizens turn shared norms and values into standards that are codified into enforced rules, regulations, and resource distributions” (Flora and Flora, 2013, p. 144). These can then be embodied into built, social, cultural, and financial capital through the exercise of power. Besides institutionalized and physical forces, exercising power may also take the form of influence. It is not uncommon to find an influential person who can easily shift decision-making in a rural community, even when he/she does not hold any formal elected position.

The definition of political capital, which contains bottom-up approaches of policymaking, can be further linked to technologies of citizenship (Cruikshank, 1999). Technologies of citizenship are understood as discourses, strategies, and programs directed to embrace individuals to be active politically and possess the capability of self-government. Within this idea, Cruikshank (1999) highlights self-help as one technology that attempts to empower the powerless – target group of the government policy. Similarly, Young (2000) emphasizes the quality of citizens’ participation in democracy by promoting the notion of reasonableness and inclusion. Reasonableness includes the exchange of ideas, opinions, and criticism, which requires open-mindedness and willingness to listen to others’ arguments. Meanwhile, inclusion is about involving every citizen affected by the policy into the decision-making process, including the minorities and the disadvantaged groups. With reasonableness and inclusion, broad scopes of public or citizens are encouraged to play an active role in democracy.

Furthermore, Jessop (2002) argues that there has been an “increasing role of self-organizing governance to correct both market and state failures” (p. 252). It means that non-state actors are now having a bigger role in policymaking process. This links to policy network approach, which analyzes “a set of formal institutions and informal linkages

between government and other actors” (Rhodes, 2008) with decentralized and horizontal relations (Adam and Kriesi, 2007). Based on this description, governmental organizations are no more the central actor in the policy process, although they still hold the authority to manage the interdependent relations in joint problem solving in the policy-making process. Even when the authority is in the hands of governmental organizations, McGuire and Agranoff (2010) assert that relationships among actors in the network are non-hierarchical, mostly mutually beneficial, and not dominated by any parties. Hence, network effectiveness depends on the actors’ abilities to mobilize support from both internal network participants and external stakeholders.

RESEARCH QUESTION AND HYPOTHESIS

Studies about political capital in the literature are frequently derived from the perspective of social capital (e.g. Rosyadi et al., 2004; Beard and Dasgupta, 2006) and use qualitative approaches (e.g. Bebbington et al., 2004; Antlov, 2003). Also, studies illustrate the reshaping of political capital due to decentralization in the case of development, but how political capital configures rural community resilience to climate change has not been explored. Hence, this study examines political capital through mixed quantitative and qualitative lenses, within the frameworks of governance of complex adaptive systems (Duit and Galaz, 2008) and rural sociology’s community capital (Flora and Flora, 2013). Given these approaches, the research question becomes: What role does political capital play in facilitating community resilience to climate change?

To operationalize political capital’s concept, three variables are derived from the definition of political capital (Flora and Flora, 2013), while categorization of the variables follows Duit and Galaz’s (2008) explanation on the institutional arrangement aspect of their framework (vertical axis in Figure 4.1). High institutional arrangement, which supports high

resiliency, is reflected by high self-organization by the community (upper part of the vertical axis in Figure 4.1). In contrast, low institutional arrangement, which conforms low resilience, shows a state-dominated governance – or in rural communities' context, leader-dominated community (lower part of the vertical axis in Figure 4.1). Thus, for the role of political capital within institutional arrangements, it is hypothesized that a high level of political capital is associated with higher resilience to climate change.

METHOD

Study Areas

This study gathers insights from case studies in three rural communities in Central Java and Yogyakarta Province in Java Island, Indonesia. The two provinces are dominantly inhabited by the Javanese, the largest ethnic group in Indonesia that comprises more than forty percent of the total population (Central Bureau of Statistics, 2015). Despite this majority, Javanese culture is varied by region, where coastal, flat, and plateau topography mark the differences (Koentjaraningrat, 1989). Therefore, this study selects three sub-districts based on variation in geographical characteristics: 1) Pagentan in Banjarnegara District, Central Java that is situated on a hilly-plateau area; 2) Purwosari in Gunungkidul District, Yogyakarta, which is a hilly-karst area; and 3) Seyegan in Sleman District, Yogyakarta with flat topography (Figure 4.2). Besides diversity in pattern of livelihoods and local cultures, such differences are expected to also prompt diversity in political capital. Within each of the sub-districts, one hamlet is chosen purposively as the study sites, i.e. Village A in Banjarnegara, Village B in Gunungkidul, and Village C in Sleman.

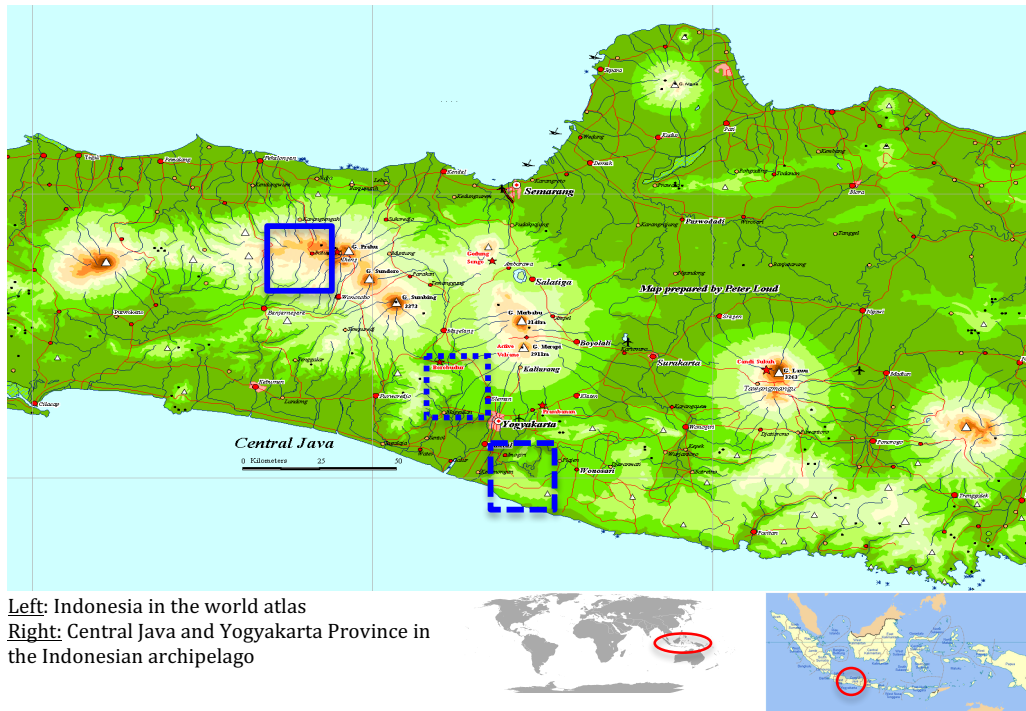


Figure 4.2. Map of Central Java and Yogyakarta Province

Sources: <http://peterloud.co.uk/indonesia/Xindonesia.html>; <http://www.wro2013.org/indonesia/>

Notes:



Village A, Pagentan, Banjarnegara, Central Java

Village B, Purwosari, Gunungkidul, Yogyakarta

Village C, Seyegan, Sleman, Yogyakarta

Data Collection

Primary data was collected from surveys and interviews with a total of 310 study participants in the three-chosen rural sub-districts. The surveys were conducted with community members or households using a structured questionnaire, and collected data from 32.73 percent, 48.02 percent, and 33.46 percent households of the corresponding hamlets in Banjarnegara, Gunungkidul, and Sleman districts, respectively. Local hamlet heads provided the researchers with household register data. However, the household registers were not used as sampling frames for several reasons. First, according to hamlet heads, there were many multiple-households who live at the same house, while administratively registered as two or three separate households. These households commonly share incomes, expenses, and foods, and call themselves one household. Second,

there are community members in Village A and B who are listed as the hamlets' residents, but live outside the community working in seasonal and permanent jobs. Some of them return home at the beginning of planting season, but most of them visit once a year during the Idul Fitri holiday season⁷. Lastly, the register was found to inaccurately represent the household members' occupations. In Village B, almost all households register their main occupations as farming, but not all farm. Oppositely, almost all households in Village C are listed with off-farm occupations (e.g. teacher, private employee), but the survey found many households who farm.

For these reasons, rather than randomly sampling households from the households' register, we randomly visited houses in the three surveyed hamlets to sample the survey respondents. Determination of eligible respondents was conducted prior to administering the survey questionnaire. Researchers first asked permission for the survey if the household head was present, or if there was an adult household member (i.e. older than 18 years old) who was available for the survey. After explaining the intention of the survey, respondents were asked if they were a permanent resident of the hamlet and have been living there for at least five years. This pre-checking question is important to determine if respondents have enough knowledge about the community. As the survey progressed, there are questions about past events as well as ongoing conditions related to the past, such as natural hazard events and their effects on the community.

Concurrently, in-depth interviews were held with a total of 30 panel of informants, which consists of community members (nine people), community leaders (16 people), and government officials at the village and sub-district level (five people). Besides the commoners, we also interview notable community members who are influential in the

⁷ Rather than Christmas, holiday season in Indonesia occurs around Idul Fitri, a holiday celebrated by Muslim community around the globe. Idul Fitri holiday is different year by year, since it is determined by Islamic calendar rather than Gregorian calendar. Although Indonesia celebrates all religious holiday of the six biggest religions (i.e. Islam, Christian, Catholic, Hindu, Buddhism, Confucianism), Idul Fitri is considered the biggest holiday of the year because of the dominant Muslim community in the country.

communities. This includes member of BPD (*Badan Permusyawaratan Desa*, or village consultative body), heads of PKK women group (*Pembinaan Kesejahteraan Keluarga*, or fostering family welfare), head of PAUD (*Pendidikan Anak Usia Dini*, or early childhood education), farmers' group leaders, and treasurer of one community group. Meanwhile, community leaders are those with formal administrative leadership at the hamlet and village level, and obtain the positions by election. This includes village heads, hamlet heads, RW (*Rukun Warga*, residents' association) leaders, and RT (*Rukun Tetangga*, neighborhood association) leaders. Village officials, such as village secretary, while in practice working in village offices, formally hold government appointment and do not go through election. We define both village officials at village level and agricultural extension workers at sub-district level as government officials.

Data Analysis

To operationalize the concept of political capital, three variables are derived based on Flora and Flora's (2013) definition of political capital: 1) influential person in the hamlet, which reflects power structure in the community; 2) alternative of where to deliver policy aspiration, which shows voice as well as connection between community members and leaders, notable persons, community groups, and government offices/officials; and 3) the manner in which the community solved the impact of shocks or natural hazards, which reflects organization and community's connection among its members as well as with outside entities, such as local government and non-governmental organizations (NGOs).

The three variables are ordinal, but can be treated as continuous since they contain five categories of measurement (Finney and Distefano, 2006). Determination of the five categories for the variables follows Duit and Galaz's (2008) elaboration on institutional arrangement (or exploitation) aspect of their typology: higher categories on the upper part

of the vertical axis reflect higher political capital, while lower categories denote lower political capital. In more detail, higher category in the influential-person variable shows 'more than one influential entities (i.e. community groups, besides community leader and notable person)', reflecting a distributed power structure in the community; lower category means domination of influence by community leaders, or concentrated power structure. Here, 'community leaders' are positioned in the lower category than 'notable persons', because community leaders own their influence due to formal elected positions; while notable persons are influential although do not hold any elected position in the community.

For the delivering-aspiration variable, higher category denotes 'community groups' and 'village office' as trusted entities to decide policy and rules in the community; lower category reflects entities with lower or no capacity at all to decide policy and rules, such as 'neighbors, friends, and or relatives'. In this variable, 'government officials/offices outside the community' is in the lower category due to their lower influence to decide and change policy in the community. According to surveys and interviews, community groups' meetings hold the highest legitimacy in making final decision on the community's issues. Village office holds the second highest legitimacy, as it includes both community leaders and village officials, including village secretary as a local government official. Community leaders, even with *de-jure* and *de-facto* power, cannot make the final decision on the community's issue by themselves without consulting other village officials and community groups' meetings. Lastly, for the variable of solving natural hazards' impact, higher category shows high self-help and -organization within the community, including the community's relation with outside entity. Oppositely, lower category represents low self-organization in the community, which includes 'do nothing' and 'solve the impact by self.'

To analyze the survey data, ordinary least square (OLS) regression is run: 1) counting each district's effect (equation 4.1); and using interaction terms between district

number and political capital variables (equation 4.2). As the dependent variable, length of recovery time from natural hazards or shocks is included to measure community resilience. This follows the definition of resilience by the Intergovernmental Panel on Climate Change/IPCC (2012), i.e. resilient community recovers in a timely manner from shocks. In this relationship, it is hypothesized that higher political capital is associated with shorter recovery time from shocks, which means higher resiliency.

$$RT = \beta_0 + \beta_1 CC + \beta_2 Pol_i + \beta_3 district_j + u \quad (\text{Equation 4.1})$$

$$RT = \beta_0 + \beta_1 CC + \beta_2 Pol_i * district_j + u \quad (\text{Equation 4.2})$$

Here, '*RT*' is the length of recovery time from shocks that measures community resilience; '*CC*' consists of variables representing social, built, human, financial, natural, and cultural capital; '*Pol*' is the three political capital variables – *i* denotes influential person, delivering aspiration, and solving natural hazards' impact; and '*district*' number *j* = 1, 2, 3 – 1 for Sleman (Village C), 2 for Gunungkidul (Village B), and 3 for Banjarnegara (Village A). Hypothetically, '*Pol*' is expected to have a negative coefficient, meaning that higher political capital leads to shorter recovery time from shocks.

RESULT AND DISCUSSION

In discussing the role of political capital in facilitating community resilience to climate change, this section presents the result of quantitative analysis using Ordinary Least Square (OLS) that will be combined with qualitative interviews. As shown in Table 4.1, Village A and C of Banjarnegara and Sleman districts have relatively shorter time to recover from shocks than Village B of Gunungkidul. The difference is statistically significant (p-value <0.001 in one-way ANOVA) with a medium effect size (Cohen, 1988). It takes about a month for communities in Village A and C to recover from shocks, compared to 3.96 months in

Village B. In Village C, the two most memorable shocks are the 2006 Central Java and Yogyakarta earthquake and 2010 Merapi volcano eruption. Although these events can be categorized as natural disasters because of their devastating effects, Village C was impacted indirectly due to its location, which is 40 kilometers (24.85 miles) from Merapi Volcano and 45 kilometers (28 miles) from the earthquakes' epicenters. As conveyed in the interviews, the community's livelihoods were disrupted when the events struck, but there were no casualties or property loss. Residents in Village B also recall the 2006 earthquake as a memorable shock, although its effect is less severe than the drought they experienced every year. Meanwhile, the two most memorable shocks in Village A are fierce winds that happen from time to time and a 2002 landslide that caused several deaths of residents from the neighboring hamlet.

Table 4.1. Statistics of Recovery Time from Shocks and Political Capital Variables

	Village A, Banjarnegara, Central Java	Village B, Gunungkidul, Yogyakarta	Village C, Sleman, Yogyakarta	One-way ANOVA (F- statistic)	Effect size (Eta)
<u>Recovery time from shocks:</u>					
Length of time (months) ^a	1.16	3.95	0.91	16.94***	0.33 (medium)
Most memorable shocks	Fierce winds, 2002 landslide	Droughts, 2006 earthquake, fierce winds	2010 Merapi volcano eruption, 2006 earthquake, fierce winds		
<u>Political capital:</u>					
Influential person ^b				6.28***	0.21 (small)
1=a community leader	62.04%	56.47%	59.77%		
2=a notable person	16.67%	4.71%	3.45%		
3=more than one community leader/notable person	15.74%	15.29%	24.14%		
4=community group(s)	-	12.94%	4.60%		
5=more than one entity, including community leader, notable person, and community group(s)	-	7.06%	-		
Delivering aspiration ^b				11.69***	0.28 (medium)
1=to neighbor, friend, relative	75.92%	52.94%	58.62%		
2=to government officials/offices outside the community	-	-	-		
3=to community leader(s)	18.52%	14.12%	12.64%		
4=to village office	1.85%	-	-		
5=to community group(s)	3.70%	32.94%	5.75%		
Solving natural hazards' impacts ^b				2.16	0.12 (small)
1=do nothing	-	-	-		
2=by self	35.19%	49.41%	66.67%		
3=by community	14.81%	1.18%	6.90%		
4=by self and community	17.59%	22.35%	13.79%		
5=by self, community, and getting support from outside entities	16.67%	20.00%	8.05%		

a) Average months per district; b) Percentage of respondent answer the corresponding categories.

Despite the different natural hazards or shocks experienced by the three communities, these various shocks affect the communities in fairly similar ways: a lack of serious property loss but livelihood disruption. Following the Merapi volcano eruption, farmers in Village C were not able to farm because of the volcanic ash that covered their lands. Similar disruption happened in Village A after the landslide, since farmers were afraid to farm, wary of the remaining unstable soil. In the aftermath of the 2006 earthquake, both Village B and C communities recall that they could not go to work and could not get food easily because of disrupted market operations. Moreover, besides climate-related shocks, non-climatic shocks (e.g. earthquake, volcanic eruption) are also important for this study. Some studies have shown that there is a connection between climate change, warmer earth, and sea level rise with more frequent earthquake and volcanic eruption (McGuire et al., 1997; McGuire, 2012; Compton et al., 2015).

The recovery time variable is then placed as a dependent variable in the estimation of political capital variables. The result shows that how the community delivers aspiration and solves the impact of natural hazards significantly affect community resilience, especially in Village A and B. In Village A, delivering aspiration to community leaders, village office, and community groups is associated with shorter recovery time to shocks by 0.5958 month (Table 4.2). Interestingly, solving the impact of natural hazards by utilizing the community's own resources is associated with shorter recovery time to shocks, compared to solving it with government's aid. This effect is particularly apparent in Village B, which receives regular aid from the outside entities because of its annual drought. Overcoming the impact of natural hazards by utilizing Village B community's own resources is associated with shorter time to recovery by 0.6349 month.

Table 4.2. Estimation Results

Recovery time (Dependent variable)	OLS, dummy variable village (robust)		OLS, interaction terms (robust)	
	Coefficient	Std. error	Coefficient	Std. error
Influential person	-0.2722	0.1877		
Delivering aspiration	-0.0821	0.1337		
Solving natural hazards' impact	0.3507**	0.1636		
Dummy Village B	1.2291*	0.7422		
Dummy Village A	-0.7249	0.6968		
Influential person*dummy Village C			-0.1712	0.1901
Influential person*dummy Village B			-0.4923	0.4018
Influential person*dummy Village A			-0.1342	0.2375
Delivering aspiration*dummy Village C			0.0697	0.1249
Delivering aspiration*dummy Village B			0.0385	0.3308
Delivering aspiration*dummy Village A			-0.5958***	0.1978
Solving natural hazards' impact*dummy Village C			0.0515	0.1691
Solving natural hazards' impact *dummy Village B			0.6349**	0.2975
Solving natural hazards' impact *dummy Village A			0.2905	0.2453
Other independent variables:				
Giving-receiving ratio	0.0001	0.0322	-0.0047	0.0326
Number of community groups	-0.1911	0.2215	-0.1060	0.2299
Rice subsidy	-0.0958	0.1665	-0.0817	0.1680
HH head education	-0.1051	0.0788	-0.1222	0.0784
Agricultural risk perception	0.1609*	0.0964	0.1301	0.0947
HH job	0.7007***	0.2632	0.7265***	0.2700
Number of cattle	-0.1093**	0.0534	-0.1277**	0.0573
Total agricultural land	0.9666	0.7154	1.0869	0.7270
Soil quality	-0.0597*	0.0353	-0.0753**	0.0332
Frequency to consume non-rice staple	-0.1562	0.1238	-0.1792	0.1164
Land conservation effort	0.3030***	0.0935	0.3367***	0.0938
F-test	5.67***		5.27***	
R-squared	0.2537		0.2604	

***) significant at 99% level; **) significant at 95% level; *) significant at alpha 90% level.

Meanwhile, influential-person variable does not significantly affect community resilience. This can be linked to power structures in the three communities that are dominated by community leaders, as shown by more than 55 percent of respondents who answer community leaders as influential entity in policymaking processes (Table 4.1). Despite this similarity, the fieldwork notes that the three communities are in fact showing variation in their communities' power structure. First, Village A has a very strong figure that has been the community leader for generations. Residents rely on the leadership of this

figure, as the leader and his family have been able to keep the community united and harmonious. In contrast, the power structure in the community in Village C is more dispersed. Besides hamlet head and RT leaders, community members also count on the leadership of community organization leaders, such as farmers' groups and women group leaders. Lastly, in contrast to Village A community that tends to rely on a single community figure, community of Village B claims that there are many influential community leaders. Besides the hamlet head, there are also RT/neighborhood and RW/residents' association leaders who are considered influential. Furthermore, 7.06 percent households in Village B state that there is a sharing power structure between community leaders, influential persons, and community groups in the community, compared to none in Village A and C.

Strong influential figures in the studied communities can be linked to an aristocratic culture in the Javanese community. Koentjaraningrat (1960) writes that Javanese community holds a social stratification: "*wong cilik*" or the lower level, i.e. peasants and the commoners; and "*priyayi*" or the higher level, i.e. administrative bureaucracy, educated people. Aristocracy is rooted from historical fact that Indonesia consisted of hundreds of kingdoms, until it was unified under Majapahit kingdom, which centered in Java, in the 13th century. During the Dutch colonization era between the 16th to mid-19th century, aristocratic culture persisted (Brown, 2003), and was integrated into the bureaucracy of the Dutch colonial regime (Antlov and Cederroth, 1994). Even now, some kingdoms remain in existence and are well-acknowledged, although they have no political power under the Republic of Indonesia.

After gaining independence in 1945, the first ruling government helped sustain the aristocratic culture through an authoritarian style of government that dominated rural communities. Although villages' rights to organize themselves are recognized with Laws 22 of 1948 on Regional Government, 1 of 1957 on Basic Regional government, and 19 of 1965

on Village Government (Antlov, 2003), top-down decision making was common. Jay (1956) describes that villages never challenged decisions made by the upper government level. Aristocracy also persisted during the succeeding regime, the New Order between 1960s and 1990s. The regime placed higher interest on village government (Antlov and Cederroth, 1994), and enacted Law 5 of 1979 on Village Governance. This further narrowed villages' authority to govern, since all decisions have to be approved by sub-district and district government (Antlov, 2003). At the same time, while there is a Village Consultative Assembly (*Lembaga Musyawarah Desa*) that is supposed to be a separate body from the village officials, it was *ex-officio* headed by village head. This further emphasized the power of village head within the village.

Currently, aristocracy and social stratification are not as strong as in the past. Community leaders claim that policymaking at the RT/RW, hamlet, and village level have been done more democratically. The old laws that authorize top-down decision making for villages have been replaced by laws that regulate decentralization. The laws deliver mandates for the villages to organize themselves, including creating their own development planning. In Village B and C, policy aspirations for development planning are usually initiated at RT level through regular RT meetings. Community leaders take a role as a discussion initiator, and community members give further inputs.

"Initiative comes from RT leader, and residents give inputs and feedbacks" (RT leader, Village C, 2015).

"In the (RT) meeting, everybody delivers their ideas. (There are) no community member coming to RT leader (to deliver his/her aspiration). Everything is (discussed) through RT meeting" (RT leader, Village B, 2015).

Subsequently, decisions from each RT are then brought to community meetings at the hamlet level. Lastly, villages will embrace policy aspirations from all hamlets, and manifest them into a document called RPJM (*Rencana Pembangunan Jangka Menengah*, midterm

development planning). Development planning in RPJM is then communicated to sub-districts and district government for funding. More often, however, community members independently collect cash to fund the development planning in their hamlets.

“We prefer to self-help ourselves than waiting for the government’s aid. Aid is in fact creates turmoil, jealousy, disuniting the community..... Community self-help works so well, through arisan (i.e. rotating saving and credit association), jimpitan (i.e. small amount of cash collected in regular basis from all community members; it is used as a community’s saving)” (Hamlet head, Village B, 2015).

Nonetheless, the long history of aristocracy, compared to the relatively new decentralization policy, may explain the lack of individuals’ initiative to deliver policy aspiration. This is reflected from 75.92 percent, 52.94 percent, and 58.62 percent of households in Village A, B, and C, respectively, who choose to share their policy aspiration to neighbors, friends, or relatives (Table 4.1), entities with no power to influence and decide communities’ policies. In addition, even though there are residents who state that they deliver their aspiration to community leaders, community groups, or village office, a theme of obedience to community leaders is frequently cited. This is consistent with political cultures in Javanese tradition as illustrated by Anderson (1990). He writes that Javanese views unity as an important element to develop a strong community. Unity is achieved through harmonious living, including obedience to community leaders. In order to build a resilient community, community leaders take a substantial role to unite community members.

This coherence with Anderson’s (1990) study that takes place during the post-independence and authoritarian government era is noteworthy. Even after nearly two decades of a more democratic and decentralized government, cultural factors are still adhered. Flora and Flora (2013) argue that this is not unusual among rural communities. Because of more intimate horizontal interpersonal relationship, rural communities often

lean toward the status quo. Bebbington et al. (2004) add that this tendency is caused by the intertwining between village's local culture with the village level governance.

Furthermore, the three communities are better-able to overcome the impact of natural hazards with their own resources, rather than waiting for government aids. The aforementioned statement by hamlet head in Village B supports this argument, in addition to similar statements by residents in the surveys and interviews. More than 60 percent of residents in the three communities recall that they solved the impact of natural hazards by themselves and or through mutual help with other residents in the communities (Table 4.1). Community members got together for mutual help (*gotong royong*) to overcome the impact of fierce winds and the 2006 earthquake that damaged some houses in Village C. Meanwhile, residents of the studied community in Village A helped search for the deceased in the 2002 landslide, who are residents of the neighboring hamlet. In Village B, residents are accustomed to helping each other in overcoming the annual water scarcity because of drought. In the past, as some older members of the community recall, residents looked for water in other areas together. Today, as the local government provides water supplies during the dry months, residents share the water with all households. Priority is given to the elders and households with many family members.

Overall, these findings show that decentralization has been operating in rural areas, where rural communities are now able to discuss and construct their own development planning, and even put together development funds independently. In relation to the democratization process, this represents the notion of technologies of citizenship (Cruikshank, 1999), where rural communities own the capacity of self-governance and self-help. However, the findings also exhibit a uniqueness of the Javanese communities regarding the notion of reasonableness and inclusion (Young, 2000). Rather than prioritizing the sharing of ideas, opinion, and criticism, the studied communities hold their

own concept of democratization, which is through the upholding of the value of harmonious society. This translates into obedience to community leaders, peaceful discussion in community groups, and the habit of not individually initiating policy ideas, as reflected in the influential-person and delivering-aspiration variables. In this case, local culture strongly colors the implementation of decentralization and the process of democratization in rural areas.

Furthermore, the studied communities hold better self-organization in solving the impact of natural hazards, which is a valuable asset to develop resilience to climate change. In contrast with initiatives to discuss policy that mainly comes from community leaders, initiative to overcome adversity comes from individuals as well as the overall community. This is seen in how the communities solved the impact of natural hazards, by acting right away without waiting for the government's aid. This capacity for self-organization infers that social capital, which sourced from solid interpersonal relationship in rural communities, is a good support for the exercise of political capital.

CONCLUSIONS

This study attempts to explore the role of political capital in facilitating community resilience to climate change within the perspective of the Indonesian decentralization. We find that initiatives to deliver policy aspirations to community groups or village offices are associated with shorter recovery from natural hazards, or in other words, higher resiliency. Similarly, overcoming the impact of natural hazards with communities' own resources is also linked to higher resiliency. Meanwhile, the person identified as influential entity in the village does not affect the community's resiliency, most likely due to the Javanese political culture that still carries a legacy to aristocracy. While rural communities started to get accustomed to policy discussion to construct their own development planning, this

illustrates how local culture is intermingled with the exercise of democratization in the Javanese communities.

To conclude, rural communities own the potency to take an active role in developing resiliency to climate change with their capacity for self-governance, self-help, and self-organization. In this regard, the Indonesian government could take on complementary action, such as delivering information about the ongoing climatic and environmental changes through, for instance, extension services. Expectedly, rural communities' improved knowledge will empower them, creating self-help citizens that are able to set their own adaptation strategies to climate change with their own resources. This, concurrently, will also increase their participation in policymaking processes in accordance with climate change.

References

- Adam, Silke and Hanspeter Kriesi. 2007. *The Network Approach* (in *Theories of the Policy Process, Second Edition*, edited by Paul A. Sabatier). Westview Press: Colorado, USA.
- Alm, James and Roy Bahl. 1999. *Decentralization in Indonesia: Prospects and Problems*. Retrieved at December 2, 2013 from http://aysps.gsu.edu/publications/1999/990601_IndonesiaReport.pdf
- Anderson, Benedict. 1990. *Language and Power: Exploring Political Cultures in Indonesia*. Cornell University press: New York, USA.
- Antlov, Hans and Sven Cederroth. 1994. Introduction (in *Leadership on Java: Gentle Hints, Authoritarian Rule*, edited by Hans Antlov and Sven Cederroth). Curzon Press: Surrey, United Kingdom.
- Antlov, Hans. 2003. Village Government and Rural Development in Indonesia: The New Democratic Framework. *Bulletin of Indonesian Economic Studies* 39(2): 193-214.
- _____. 2003b. Not Enough Politics! Power, Participation and the New Democratic Polity in Indonesia (in *Local Power and Politics in Indonesia: Decentralisation and Democratisation*, edited by Edward Aspinall and Greg Fealy). Institute of Southeast Asian Studies: Singapore.
- Beard, Victoria and Aniruddha Dasgupta. 2006. Collective Action and Community-driven Development in Rural and Urban Indonesia. *Urban Studies* 43(9): 1451-1468.

- Beard, Victoria A. 2007. Household Contributions to Community Development in Indonesia. *World Development* 35(4): 607-625.
- Bebbington, Anthony, Leni Dharmawan, Erwin Fahmi, and Scott Guggenheim. 2004. Village Politics, Culture, and Community-driven Development: Insights from Indonesia. *Progress in Development Studies* 4(3): 187-205.
- Below, Till B., Khamaldin D. Mutabazi, Dieter Kirschke, Christian Franke, Stefan Sieber, Rosemarie Siebert, and Karen Tscherning. 2012. Can Farmers' Adaption to Climate Change be Explained by Socio-economic Household-level Variables? *Global Environmental Change* 22: 223-235.
- Berkes, Fikret, Johan Colding, and Carl Folke. 2003. Introduction (in *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*, edited by Fikret Berkes, Johan Colding, and Carl Folke). Cambridge University Press: Cambridge, United Kingdom.
- Boillat, Sebastian and Fikret Berkes. 2013. Perception and Interpretation of Climate Change Among Quechua Farmers of Bolivia: Indigenous Knowledge as a Resource for Adaptive Capacity. *Ecology and Society* 18(4): 21.
- Boissiere, Manuel, Bruno Locatelly, Douglas Sheil, Michael Padmanaba, and Ermayanti Sadjudin. 2013. Local Perceptions of Climate Variability and Change in Tropical Forests of Papua, Indonesia. *Ecology and Society* 18(4): 13.
- Brown, Colin. 2003. *A Short History of Indonesia: The Unlikely Nation?* Allen and Unwin: Australia.
- Carney, Diana. 2003. *Sustainable Livelihood Approaches: Progress and Possibilities for Change*. Department for International Development: United Kingdom
- Central Bureau of Statistics. 2014. Report on Agricultural Census 2013: Complete Sampling (Laporan Lengkap Hasil Sensus Pertanian 2013: Pencacahan Lengkap). Central Bureau of Statistics: Jakarta, Indonesia.
- _____. 2015. *Statistik Politik (Political Statistic)*. Central Bureau of Statistics: Jakarta, Indonesia.
- Cohen, Jacob. 1988. *Statistical Power Analysis for the Behavioral Sciences Second Edition*. Erlbaum: New Jersey, USA.
- Compton, Kathleen, Richard A. Bennett, and Sigrun Hreinsdottir. 2015. Climate-driven Vertical Acceleration of Icelandic Crust Measured by Continuous GPS Geodesy. *Geophysical Research Letters* 42: 743-750.
- Cruikshank, Barbara. 1999. *The Will to Empower*. Cornell University Press: New York, USA.
- Duit, Andreas and Victor Galaz. 2008. Governance and Complexity: Emerging Issues for Governance Theory. *International Journal of Policy, Administration, and Institutions* 21(3): 311-335.

- Ellis, Frank. 1998. Household Strategies and Rural Livelihood Diversification. *The Journal of Development Studies* 35(1): 1-38.
- Falleti, Tulia G. 2005. A Sequential Theory of Decentralization: Latin American Cases in Comparative Perspective. *American Political Science Review* 99(3): 327-346.
- Finney, Sara J. and Christine Distefano. 2006. Nonnormal and Categorical Data in Structural Equation Modeling (in "*Structural Equation Modeling: A Second Course*" edited by Gregory R. Hancock and Ralph O. Mueller). Information Age Publishing: USA.
- Flora, Cornelia Butler and Jan L. Flora. 2013. *Rural Communities: Legacy and Change*. Westview Press: Colorado, USA.
- Haug, Michaela. 2007. Kemiskinan dan Desentralisasi di Kutai Barat: Dampak Otonomi Daerah terhadap Kesejahteraan Dayak Benuaq (Poverty and Decentralization in West Kutai: Impact of Regional Autonomy on Dayak Benuaq Well-being). *Laporan Penelitian (Research Report)*. CIFOR: Bogor, Indonesia.
- IPCC. 2012. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* (edited by Field, C. B., V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G. K. Plattner, S. K. Allen, M. Tignor, and P. M. Midgley. Cambridge University Press: Cambridge, UK and New York, USA.
- Irawan, Bambang. 2006. "Anomali Iklim El Nino dan La Nina: Kecenderungan Jangka Panjang dan Dampaknya terhadap Produksi Pangan" (El Nino and La Nina Climate Anomaly Phenomenon: the Longterm Trend and Its Impact on Food Production). *Forum Penelitian Agro Ekonomi* 24(1): 28-45.
- Jay, Robert R. 1956. Local Government in Rural Central Java. *The Far Eastern Quarterly* 15(2): 215-227.
- Jessop, Bob. 2002. *The Future of the Capitalist State*. Polity Press: Massachusetts, USA.
- Keil, Alwin, Manfred Zeller, Anastasia Wida, Bunasor Sanim, and Regina Birner. 2008. What Determines Farmers' Resilience towards ENSO-related Drought? An Empirical Assessment in Central Sulawesi, Indonesia. *Climatic Change* 86: 291-307.
- Knutsson, Per. 2006. The sustainable livelihoods approach: A framework for knowledge integration assessment. *Human Ecology Forum* 13(1): 90-99.
- Koentjaraningrat, R.M. 1960. The Javanese of South Central Java (in "*Social Structure in Southeast Asia*" edited by George Peter Murdock). Quadrangle Books: Illinois, USA.
- _____. 1989. *Javanese Culture*. Oxford University Press: New York, USA.
- Maley, Michael S. 2003. New Rules, Old Structures and the Limits of Democratic Decentralisation (in *Local Power and Politics in Indonesia: Decentralisation and*

- Democratisation*, edited by Edward Aspinall and Greg Fealy). Institute of Southeast Asian Studies: Singapore.
- McGuire, Bill. 2012. *Waking the Giant: How A Changing Climate Triggers Earthquakes, Tsunamis, and Volcanoes*. Oxford University Press: Oxford, United Kingdom.
- McGuire, Michael and Robert Agranoff. 2010. Networking in the Shadow of Bureaucracy (in *The Oxford Handbook of American Bureaucracy*, edited by Robert F. Durant). Oxford University Press: New York, USA.
- McGuire, W. J., R. J. Howarth, C. R. Firth, A. R. Solow, A. D. Pullen, S. J. Saunders, I. S. Stewart, and C. Vita-Finzi. 1997. Correlation between Rate of Sea-level Change and Frequency of Explosive Volcanism in the Mediterranean. *Nature* 389: 473-476.
- Ministry of Energy and Mineral Resources. 2006. *Gempa Bumi di Daerah Istimewa Yogyakarta* (Earthquake in Yogyakarta Special Region). Retrieved on February 22, 2016 from <http://esdm.go.id/berita/geologi/42-geologi/687-gempa-bumi-di-daerah-istimewa-yogyakarta.html>.
- . 2010. *Gunung Merapi – Sejarah Letusan* (Mount Merapi – Eruption History). Retrieved on February 22, 2016 from <http://www.vsi.esdm.go.id/index.php/gunungapi/data-dasar-gunungapi/542-g-merapi?start=1>.
- Mulyana, Erwin. 2002. “Hubungan Antara ENSO Dengan Variasi Curah Hujan Di Indonesia” (The Relation Between ENSO and Rainfall Variability in Indonesia). *Jurnal Sains dan Teknologi Modifikasi Cuaca* 3(1): 1-4.
- NASA. 2006. *Magnitude 6.3 Quake in Central Java*. Retrieved on February 22, 2016 from <http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=16767>.
- . 2010. *Eruption at Mount Merapi, Indonesia*. Retrieved on February 22, 2016 from <http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=46881>.
- Naylor, Rosamond L., W.P. Falcon, D. Rochberg, and N. Wada. 2001. “Using El Nino/Southern Oscillation Climate Data to Predict Rice Production in Indonesia”. *Climatic Change* 50: 255-265.
- Olson, Elizabeth Anne. 2013. Anthropology and Traditional Ecological Knowledge: A Summary of Quantitative Approaches to Traditional Knowledge, Market Participation, and Conservation. *Culture, Agriculture, Food, and Environment* 35(2): 140-151.
- Rasyid, Ryaas. 2007. Otonomi Daerah: Latar Belakang dan Masa Depan (Regional Autonomy: Background and Its Future) in *Desentralisasi dan Otonomi Daerah* (Decentralization and Regional Autonomy) edited by Syamsuddin Haris. LIPI Press: Jakarta, Indonesia.

- Rhodes, R.A.W. 2008. Policy Network Analysis (in *The Oxford Handbook of Public Policy*, edited by Robert E. Goodin, Michael Moran, and Martin Rein). Oxford University Press: New York, USA.
- Rosyadi, Slamet, Regina Birner, and Manfred Zeller. Creating Political Capital to Promote Devolution in the Forestry Sector – A Case Study of the Forest Communities in Banyumas District, Central Java, Indonesia (in *Land Use, Nature Conservation and the Stability of Rainforest Margins in Southeast Asia*, edited by Gerhard Gerold, Michael Fremerey, and Edi Guhardja). Springer: Germany.
- Timmermann, A., J. Oberhuber, A. Bacher, M. Esch, M. Latif, and E. Roeckner. 1999. Increased El Nino Frequency in A Climate Model Forced by Future Green House Warming. *Nature* 398: 694-696.
- Traerup, Sara L. M. 2012. Informal Networks and Resilience to Climate Change Impacts: A Collective Approach to Index Insurance. *Global Environmental Change* 22: 255-267.
- Urich, Peter B., Liza Quirog, and William G. Granert. 2009. El Nino: An Adaptive Response to Build Social and Ecological Resilience. *Development in Practice* 19(6): 766-776.
- Young, Iris. 2000. *Inclusion and Democracy*. Oxford University Press: New York, USA.

CHAPTER 5. THE ROLE OF SOCIAL AND HUMAN CAPITAL ON COMMUNITY POLITICAL CAPITAL: CASE OF RURAL INDONESIA

ABSTRACT

Unpredictable weather imposed by climate change necessitates rural communities to develop their capacity for self-help, which is conceived as political capital. Adding to the collection of literature that discuss political capital from the point of view of social capital, this study attempts to inquire how social and human capital affect the exercise of political capital in rural Indonesia. Data is collected through surveys and interviews in three districts in Java Island, i.e. Banjarnegara, Gunungkidul, and Sleman. To operationalize the concept of political capital, three variables are derived from its definition (Flora and Flora, 2013): 1) influential person; 2) alternative of where to deliver policy aspiration; and 3) manner of how the community solved the impact of natural hazards. In addition, involvement in community groups depicts social capital, and household head's educational attainment denotes human capital. Analysis with ordinary least square (OLS) regression shows that human capital is a stronger predictor for political capital than social capital. Implications for community resiliency to climate change are discussed.

Keywords: climate change, human capital, political capital, social capital

INTRODUCTION

Climate change creates unpredictable weather patterns, including increases in the frequency and intensity of periodical weather anomalies such as El Nino Southern Oscillation or ENSO (Timmermann et al., 1999). Being a natural-cyclical phenomenon, ENSO sways precipitation patterns in the Equatorial Pacific areas, including Indonesia. Lower precipitation levels followed by El Nino, one of the ENSO events, creates prolonged droughts; while higher levels of precipitation may induce floods and or conditions with higher humidity that nurtures the proliferation of unwanted insects. In Indonesia, impacts from ENSO have harmed food production, reduced farmer incomes, and weakened social resilience (Naylor et al., 2001; Irawan, 2006; Keil et al., 2008). Moreover, considering that small-scale farmers compose 55.33 percent of Indonesian farmers, and about 35 percent of the work force (Central Bureau of Statistics, 2014), the effect of unpredictable weather on livelihoods is deemed significant.

Accordingly, rural communities, whose livelihoods are intertwined with natural resources, need to develop their capacity for self-help to be able to support themselves in times of unpredictable weather. Self-help is embodied in political capital, which includes norms, values, organization, connection, voice, and power to regulate and distribute resources in rural communities (Flora and Flora, 2013). In Indonesia, decentralization policy, enacted in 1999, opens the opportunity for the rural communities to exercise their political capital. In contrast with decades of top-down policy under the authoritarian regime, rural communities are now delivered mandates to create their own development planning through bottom-up approaches. Regarding community's participation and collective action in their development, studies have reported that decentralization changes the nature of citizens' participation in Indonesia (e.g. Beard and Dasgupta, 2006; Beard, 2007, Bebbington et al., 2004; Rosyadi et al., 2004). Among others, it increases households' participation in governance, social welfare, and infrastructure development (Beard, 2007). Within these studies, social and human capital are inherent in the exercise of political capital.

Building on this body of knowledge, this study seeks to investigate how social and human capital affect the implementation of political capital in rural communities. Utilizing mixed qualitative and quantitative methods, involvement in community groups reflecting social capital, and household head's educational attainment as evidence of human capital will be examined. Concurrently, the concept of political capital is represented by three variables derived from the definition of political capital (Flora and Flora, 2013): 1) influential person in the hamlet; 2) alternatives of where to deliver aspiration; and 3) manner in which the community solved the impact of shocks or natural hazards. This approach supplements previous studies in the literature, which frequently discuss political

capital from the perspective of social capital (e.g. Rosyadi et al., 2004; Beard and Dasgupta, 2006), with an additional discussion on human capital.

The paper will proceed by first elaborating the conceptual and theoretical framework, which includes illustration of the Indonesian decentralization and political capital. The research question and hypothesis will follow. Next, the methods section explains the study areas, data collection, and data analysis. The results and discussion will focus on the quantitative analysis that is complemented by qualitative findings from the interviews. Lastly, the conclusion will describe policy implications of this study.

CONCEPTUAL AND THEORETICAL FRAMEWORK

The Indonesian Decentralization

The establishment of decentralization in Indonesia is partly driven by monetary crisis that hit Asia, including Indonesia, in 1997/1998. The crisis created a negative citizens' mood, which resulted in a nationwide civilian unrest, demanding for the termination of the authoritarian ruling regime with a more democratic government system. The monetary crisis and subsequent civilian unrest created a realization by the Indonesian government that centralized government systems, as imposed by the authoritarian regime, had weakened their capacity to deal with global challenges (Rasyid, 2007). The fall of the authoritarian government marked a new beginning in the Indonesian governance system, including the enactment of decentralization in the late 1990s. Its main motivation is the need to distribute authorities and resources to the regional government, since the centralized system failed to distribute wealth equally amongst regions.

Indonesian decentralization, known domestically as "regional autonomy", is formally enacted through Laws 22 of 1999 on Regional Government and 25 of 1999 on the Fiscal Balance between the Central and Regional Government. The laws mandate the central

government to distribute authorities to the district and municipal government, the third-tier government level in Indonesia. As an exception, the central government keeps its authorities on monetary, defense and security, religious affairs, foreign policies, and judiciary affairs (Alm and Bahl, 1999). In the meantime, provincial government that lies between national and district level remains a limited-autonomous region still responsible to the central government.

Indonesia implements three types of decentralization, i.e. administrative, fiscal, and political decentralization. According to Falleti (2005), administrative decentralization delegates administrative and social services delivery, such as education, health, and social welfare, to regional government. Fiscal decentralization relates to sets of policies aimed to generate revenue or fiscal autonomy for the regional government. Meanwhile, political decentralization gives more authority for the local government to conduct its polity and represent its regions. The Indonesian decentralization helps in shaping the regional development and policy to adjust to the diversity of local region, since the regional government has the authority to plan its own development based on its natural and human resources.

From the political perspective, decentralization broadens the opportunity for the local citizens to participate in regional development. Besides enabling direct election for regional leaders, i.e. governor, reagent, and mayor, regional government is also able to recruit its administrative officials. Hence, different than the past mechanism that favors top-down appointment, local citizens are now dominating the corresponding region, as regional leaders, members of the local assembly, and administrative officials. Haug (2007) studies Dayak ethnical groups in West Kutai district, East Kalimantan province, and writes that decentralization has significantly increased Dayak people participation in West Kutai development.

Political Capital

Flora and Flora (2013) write that political capital includes “organizations, connections, voice, and power as citizens turn shared norms and values into standards that are codified into enforced rules, regulations, and resource distributions” (p. 144). These can then be embodied into built, social, cultural, and financial capital through the exercise of power. Besides institutionalized and physical forces, exercising power may also take the form of influence. It is not uncommon to find an influential person that easily shift decision making in a rural community, even when he/she does not hold any formal elected position.

The definition of political capital, which contains bottom-up approach of policymaking, can be further linked to technologies of citizenship (Cruikshank, 1999). Technologies of citizenship are understood as discourses, strategies, and programs directed to encourage individuals to be active politically and possess the capability of self-government. Within this approach, Cruikshank (1999) highlights self-help as one technology that attempts to empower the powerless – target group of the government policy. Furthermore, Young (2000) emphasizes the quality of citizens’ participation in democracy by promoting the notion of reasonableness and inclusion. Reasonableness includes the exchange of ideas, opinions, and criticism, which requires open-mindedness and willingness to listen to others’ arguments. Meanwhile, inclusion is about involving every citizen affected by the policy into the decision-making process, including the minority and the disadvantaged groups. With reasonableness and inclusion, broad scopes of public or citizens are encouraged to play an active role in democracy.

Furthermore, Jessop (2002) argues that there has been an “increasing role of self-organizing governance to correct both market and state failures” (p. 252). It means that non-state actors are now having a bigger role in the policymaking process. This links to

policy network approach, which analyzes “a set of formal institutions and informal linkages between government and other actors” (Rhodes, 2008) with decentralized and horizontal relations (Adam and Kriesi, 2007). Based on this description, governmental organizations are no longer the central actor in the policy process, although they still hold the authority to manage the interdependent relations in joint problem solving in the policy-making process. Even when the authority is in the hands of governmental organizations, McGuire and Agranoff (2010) assert that relationships among actors in the network are non-hierarchical, mostly mutually beneficial, and not dominated by any parties. Hence, network effectiveness depends on the actors’ abilities to mobilize support from both internal network participants and external stakeholders.

Social and Human Capital

Social and human capital are entwined within the discussion of political capital. For social capital, the concept of bridging social capital is the closest relation with political capital (Flora and Flora, 2013; Traerup, 2012). Bridging social capital is relations among different informal networks within a community, with groups outside the community as well as with formal institutions. Traerup (2012) terms bridging social capital as a vertical connection, in comparison to bonding social capital that can be viewed as a horizontal connection for it relates individuals and groups within an informal network. In regard to resilience to unpredictable weather, Traerup (2012) argues that both horizontal bonding and vertical bridging between the networks and formal institutions can potentially strengthen community resilience to idiosyncratic (e.g. death, sickness) and covariate shocks (e.g. natural hazards).

Furthermore, human capital is understood as inseparable assets possessed by every person, including health, experience, educational attainment, leadership, and skills (Flora

and Flora, 2013). Based on this definition, human capital is a crucial aspect in the exercise of political capital, especially along with the increasing role of non-state actors in policymaking (Jessop, 2002; Adam and Kriesi, 2007). In this regard, Dewey (1956) asserts that education is a sufficient condition to create citizens who are capable of participating in the policymaking process. In other words, citizens who are capable of self-help (Cruikshank, 1999) and self-organization.

RESEARCH QUESTION AND HYPOTHESIS

Using a mixed quantitative and qualitative approach, this study focusses on political capital within the rural sociology's community capital framework (Flora and Flora, 2013). As noted above, political capital is an important variable in local community resiliency efforts. The exercise of political capital in rural communities has always been intertwined with bonding and bridging social capital, yet little research empirically examines the relationship to enhancing or inhibiting community resilience. Furthermore, this study attempts to examine the role of human capital on the exercise of political capital in rural communities. Thereby, the research question inquires: how does social and human capital affect political capital, which is a key component to community resiliency? Based on previous studies about the positive effect of decentralization on community's collective action in the development, this study hypothesizes that social and human capital positively affect political capital.

METHOD

Study Areas

Using case study research design, this study gathers insights from three rural communities in Central Java and Yogyakarta Province in Java Island, Indonesia. The two

provinces are dominantly inhabited by the Javanese, the largest ethnic group in Indonesia that comprises more than forty percent of the total population (Central Bureau of Statistics, 2015). Within the ethnic group, however, Javanese culture is varied in dialect, ritual, art, and food by regional topography (Koentjaraningrat, 1989). This variation is expected to provide diversity of perspective in political capital. Three rural sub-districts in Central Java and Yogyakarta Province are selected by variations in geographical characteristics: 1) Pagentan in Banjarnegara District, Central Java is a hilly-plateau area; 2) Purwosari in Gunungkidul District, Yogyakarta has hilly-karst geography; and 3) Seyegan in Sleman District, Yogyakarta is topographically flat (Figure 5.1). To conduct surveys and interviews, one hamlet is chosen purposively within each of the sub-districts as the study sites, i.e. Village A in Banjarnegara, Village B in Gunungkidul, and Village C in Sleman.

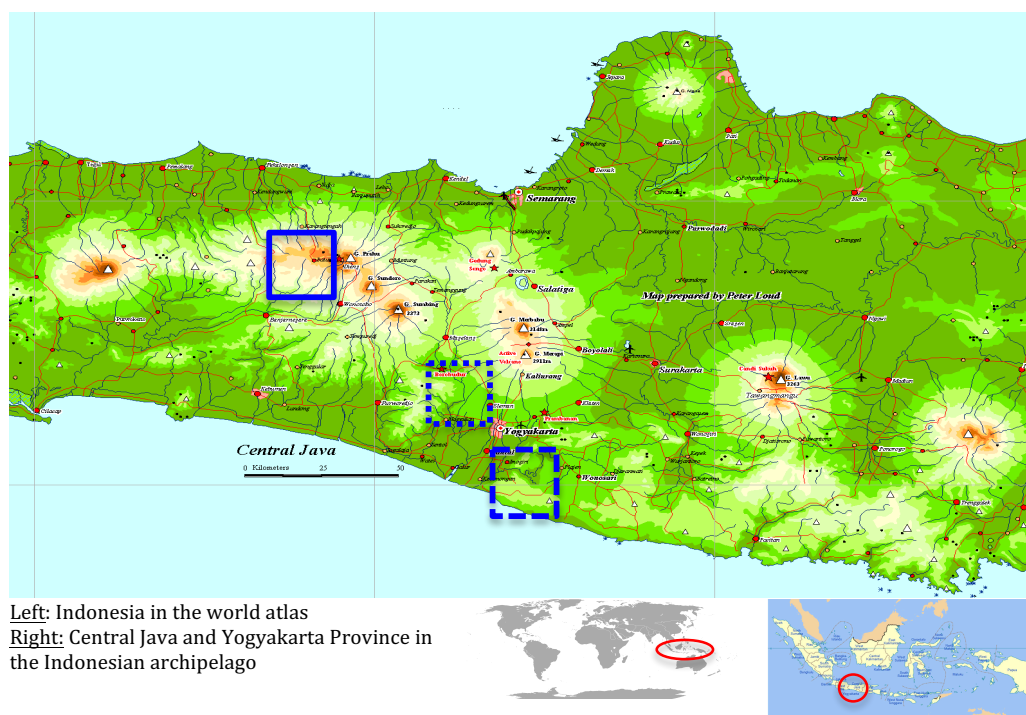


Figure 5.1. Map of Central Java and Yogyakarta Province

Sources: <http://peterloud.co.uk/indonesia/Xindonesia.html>; <http://www.wro2013.org/indonesia/>

Notes:



Village A, Pagentan, Banjarnegara, Central Java
 Village B, Purwosari, Gunungkidul, Yogyakarta
 Village C, Seyegan, Sleman, Yogyakarta

Data Collection

Data were collected from surveys and interviews with a total of 310 study participants in the three hamlets of the chosen rural sub-districts. The surveys were conducted with community members or households using a structured questionnaire, and collected data from 32.73 percent, 48.02 percent, and 33.46 percent households of the corresponding hamlets in Banjarnegara, Gunungkidul, and Sleman districts, respectively. Local hamlet heads provided the researchers with household register data. However, the household registers were not used as sampling frames for several reasons. First, according to hamlet heads, there were many multiple-households who live at the same house, while administratively registered as two or three separate households. These households commonly share incomes, expenses, and foods, and call themselves one household. Second, there are community members in Village A and B who are listed as the hamlets' residents, but live outside the community working in seasonal and permanent jobs. Some of them return home at the beginning of planting season, but most of them visit once a year during the Idul Fitri holiday season. Lastly, the register was found to inaccurately represent the household members' occupations. In Village B, almost all households register their main occupations as farming, but not all farm. Oppositely, almost all households in Village C are listed with off-farm occupations (e.g. teacher, trader, private employee), but survey found many households who farm.

For these reasons, rather than randomly sampling households from the households' register, we randomly visited houses in the three surveyed hamlets to sample the survey respondents. Determination of eligible respondents was conducted prior to administering the survey questionnaire. Researchers first asked permission for the survey if the household head was present, or if there was an adult household member (i.e. older than 18 years old) who was available for the survey. After explaining the intention of the survey,

respondents were asked if they were a permanent resident of the hamlet and have been living there for at least five years. This pre-checking question is important to determine if respondents have enough knowledge about the community. As the survey progressed, there are questions about past events as well as ongoing conditions related to the past, such as natural hazard events and their effects on the community.

Concurrently, in-depth interviews were held with a panel of informants, which consists of community members (nine people), community leaders (16 people), and government officials at the village and sub-district level (five people). Besides the commoners, we also interview notable community members who are influential in the communities. This includes member of BPD (*Badan Permusyawaratan Desa*, or village consultative body), heads of PKK women group (*Pembinaan Kesejahteraan Keluarga*, or fostering family welfare), head of PAUD (*Pendidikan Anak Usia Dini*, or early childhood education), farmers' group leaders, and treasurer of one community group. Meanwhile, community leaders are those with formal administrative leadership at the hamlet and village level, and obtain the positions by election. This includes village heads, hamlet heads, RW (*Rukun Warga*, residents' association) leaders, and RT (*Rukun Tetangga*, neighborhood association) leaders. Village officials, such as village secretary, while in practice working in village offices, formally hold government appointment and do not go through election. We define both village officials at village level and agricultural extension workers at sub-district level as government officials.

Data Analysis

To operationalize the concept of political capital, three variables are specified following Flora and Flora's (2013) definition of political capital: 1) influential person in the hamlet, which reflects power structure in the community; 2) alternative of where to deliver

policy aspiration, which shows voice as well as connection between community members and leaders, notable person, community groups, and government offices/officials that portray bonding and bridging social capital; and 3) the manner of which the community solved the impact of shocks or natural hazards, which reflects organization and community's connection among its members as well as with outside entities, such as local government and non-governmental organizations (NGOs), which again embody bonding and bridging social capital. These variables are treated as continuous variables since they each contain five categories of measurement (Finney and Distefano, 2006). More specifically, a higher category in the influential-person variable shows 'more than one influential entity (i.e. community groups, besides community leader and notable person)', reflecting a distributed power structure in the community; lower category means domination of influence by community leaders, or concentrated power structure. Here, 'community leaders' are positioned in the lower category than 'notable persons', because community leaders own their influence due to formal elected positions. In contrast, notable persons are influential even though do not hold any elected position in the community, and are thereby assumed to be in the higher category than the formal community leaders.

For the delivering-aspiration variable, the higher category denotes 'community group(s)' and 'village office' as trusted entities to decide policy and rules in the community, reflecting stronger bonding and bridging social capital; the lower category reflects entities with lower or no capacity at all to decide policy and rules, such as 'neighbors, friends, and or relatives'. In this variable, we put 'government officials/offices outside the community' in the lower category due to their lower influence to decide and change policy in the community. According to surveys and interviews, community groups' meetings have the highest legitimacy in making final decision on the community's issues. Village office holds the second highest legitimacy, as it includes both community leaders and village officials,

including village secretary as a local government official. Community leaders, even with *de-jure* and *de-facto* of power, cannot make the final decision on the community's issue by themselves without consulting other village officials and community groups' meetings. Lastly, for the variable of solving natural hazards' impact, the higher category shows high self-help and -organization within the community, including the community's relation with outside entity, which portrays bonding and bridging social capital. Oppositely, the lower category represents low self-help or weaker bonding and bridging connections, which includes 'do nothing' and 'solve the impact by self.'

To analyze the relationship between political, social, and human capital, ordinary least square (OLS) regression is run (equation 5.1). In the estimation, ' PC_{ij} ' is political capital variable i at district j ; where i = influential person, delivering aspiration, and solving natural hazards' impact; and j = Banjarnegara, Gunungkidul, and Sleman. ' SC_j ' and ' HC_j ' are human and social capital variables at district j , represented by number of community groups the household involved and household head's educational attainment, respectively (Duit and Galaz, 2008; Gbetibouo, 2009; Below et al., 2012; Flora and Flora, 2013). Human capital uses household head's education, rather than educational attainment of other household members, since surveys and interviews record the tendency of policy decision-making for the hamlets/villages that is made in men/household heads group, rather than in women/wives group. Hypothetically, ' SC_j ' and ' HC_j ' are expected to have a positive coefficient, meaning that higher involvement in community groups and higher educational attainment are associated with higher exercise of political capital.

$$PC_{ij} = \beta_0 + \beta_1 SC + \beta_2 HC + u \quad \text{(Equation 5.1)}$$

RESULT AND DISCUSSION

This study seeks to delve on the role of social and human capital in the exercise of political capital in rural communities. Ordinary least square (OLS) regression is run, in which it analyzes number of community groups that the household joined and household head's educational attainment against political capital variables in each districts. While involvement in community groups does not significantly affect how the residents perceive influential figures and deliver aspirations, it positively affects the way the community solves the effect of natural hazards, especially in Village B (0.4509) and C (0.4991) (Table 5.1). The more community groups the households of Village B and C joined, the higher the likelihood of their residents to solve the effect of natural hazards by mobilizing communities' resources, as well as attempting to obtain support from outside entities. However, the relationship was statistically insignificant for Village A (0.2892). Here, the insignificance of the community-group variable for Village A links to the fact that its residents are involve in fewer community groups than their counterparts in Village B and C (see Table 5.2). RT/neighborhood groups are not as common in Village A as they are in Village B and C. While communities of Village B and C hold regular community meetings, hamlet and other community meetings are held irregularly in Village A, depending on need. According to surveys and interviews, even when all Village A's residents are invited to the meetings, many are unwilling to come.

Table 5.1. Estimation Results

Dependent variables	Number of community groups		HH head's education	
	Coefficient	Std. error	Coefficient	Std. error
Influential person:				
Village A	0.0843	0.0982	0.1048***	0.0236
Village B	0.0976	0.1667	0.1567***	0.0332
Village C	0.0329	0.1314	0.1159***	0.0274
Delivering aspiration:				
Village A	0.1878	0.1392	0.0883***	0.0320
Village B	-0.0558	0.2126	0.2093***	0.0453
Village C	0.0355	0.1953	0.1819***	0.0459
Solving natural hazards' impact:				
Village A	0.2892	0.2237	0.1544***	0.0453
Village B	0.4509**	0.1764	0.1869***	0.0362
Village C	0.4991***	0.1392	0.1105***	0.0254

***) significant at 99% level; **) significant at 95% level.

Table 5.2. Statistics of Political, Social, and Human Capital

	Village A, Banjarnegara, Central Java	Village B, Gunungkidul, Yogyakarta	Village C, Sleman, Yogyakarta	One-way ANOVA (F- statistic)	Effect size (Eta)
Political capital:					
Influential person ^a				6.28***	0.21 (small)
1=a community leader	62.04%	56.47%	59.77%		
2=a notable person	16.67%	4.71%	3.45%		
3=more than one community leader/notable person	15.74%	15.29%	24.14%		
4=community group(s)	-	12.94%	4.60%		
5=more than one entity, including community leader, notable person, and community group(s)	-	7.06%	-		
Delivering aspiration ^a				11.69***	0.28 (medium)
1=to neighbor, friend, relative	75.92%	52.94%	58.62%		
2=to government officials/offices outside the community	-	-	-		
3=to community leader(s)	18.52%	14.12%	12.64%		
4=to village office	1.85%	-	-		
5=to community group(s)	3.70%	32.94%	5.75%		
Solving natural hazards' impacts ^a				2.16	0.12 (small)
1=do nothing	-	-	-		
2=by self	35.19%	49.41%	66.67%		
3=by community	14.81%	1.18%	6.90%		
4=by self and community	17.59%	22.35%	13.79%		
5=by self, community, and getting support from outside entities	16.67%	20.00%	8.05%		
Most memorable shocks	Fierce winds, 2002 landslide	Droughts, 2006 earthquake, fierce winds	2010 Merapi volcano eruption, 2006 earthquake, fierce winds		
Social and human capital:					
Number of community groups the HH joined	0.69	1.38	1.32	16.62***	0.33 (medium)
HH head's education level (years)	6.05	7.00	8.70	15.49***	0.32 (medium)

a) Percentage of respondent answer the corresponding categories.

The lack of significance of community group on influential-person and delivering-aspiration variables can be explained by the concentrated power structure in the studied communities. More than half of respondents in the three communities state community leaders as influential entities in the policymaking processes (Table 5.2), justifying the power of community leaders in the communities. In addition, more than 50 percent of respondents have yet to deliver their policy aspiration to village officials or to community groups. This is especially apparent in Village A, as a consequence of a very strong influential figure who has been the community leader for generations. Similarly, residents of Village B and C see community leaders as influential figures. Nonetheless, Village B tends to have a more dispersed power structure than Village C, where 7.06 percent of its households presume more than one influential entity, including community leaders, influential persons, and community groups, compared to none in Village C. This explains the high proportion of Village B residents who deliver their aspiration in community groups (32.94 percent), compared to Village C (5.75 percent) and A (3.70 percent).

As far as the solving-natural-hazards'-impact variable, the relatively mild shocks of natural hazards experienced by Village A may explain the lack of statistical significance of the community-group variable. When asked about the most memorable shocks in the community, Village A residents usually come up with an initial statement that their area is relatively safe from natural hazards. Only a large landslide in 2002 and some occasional fierce winds ever occurred in the community, without any casualties. Village B and C communities, on the other hand, experienced a 6.3-Richter-Scale earthquake in 2006. Although the natural hazards did not incur serious property loss and casualties because of the communities' distant location to the earthquake's epicenter, the communities are affected by disrupted markets that impede food distribution. Besides the earthquake, Village B also undergoes a recurring drought for three to six months every year due to their

karst topography, while community in Village C are influenced by 2010 Merapi Volcano eruption. Impact of these natural hazards, according to the communities, is solved within the communities through mutual help. The communities work together to clean up fallen trees, repair broken houses, or look for water and grass for their cattle. The more serious natural hazards striking Village B and C, along with their efforts through mutual help to overcome the natural hazards' impact, explains the significance of the community-group variable.

As for human capital, household head's educational attainment is used as a measure. In brief, Village C has the highest household head's education level (8.70 years) than Village A (6.05 years) and B (7.27 years) (Table 5.2). Interestingly, this variable is a strong positive predictor for the three political capital variables (Table 5.1). In all districts, an additional year of household head's education is associated with a higher tendency of reliance on community groups. Specifically, the higher the education level, the more likely the households will state community groups as the most influential entities and will deliver their aspiration through community groups, rather than rely on community leaders in the policymaking processes. Higher education level is also related to the willingness of the households to exercise both the bonding and bridging social capital in solving the impact of natural hazards. This means that besides utilizing the households and the communities' resources, they will also reach out to the outside entities, such as local government.

The significance of the household heads' education relates to the fact that household heads take a substantial role in the exercise of political capital within the three communities. According to some interviewees, there is a distribution of roles between household heads (i.e. husband or any oldest male in the household) and housewives in performing community affairs. While household heads take more of a role in infrastructure development and security, housewives join in women groups and look after social issues,

such as health, food security, early childhood education, and skill training for women.

Hence, discussion on the exercise of political capital in the studied communities can be approached from the perspective of household heads' education.

"Household heads' meeting (usually) delivers information from the village government, (and also) discusses RT development." (RT Leader, Village B, 2015).

"Some housewives (women) involve in the hamlet meeting, but passive..... We (women) take care of social issues, such as children and senior health program, early childhood education; the men handle the infrastructure development." (PKK Women Group Leader, Village B, 2015).

Furthermore, figures on the household head's educational attainment also explains the insignificance of involvement in community groups on influential-person and delivering-aspiration variables. The relatively low education level of the household heads, which on average is less than high school, may be one reason for the concentrated power structure in the studied communities, as well as reluctance to deliver policy aspiration among the residents. Even though there are household heads with college education (i.e. more than twelve years of education), they are fewer than those with elementary and middle school education. This is more apparent in Village A, where 76.85 percent of its household heads have elementary school education (Table 5.3). Household heads with elementary school education is fewer in Village B (45.88 percent) and C (27.59 percent). Village C, in fact, exceeds the other communities in case of high school education of its household heads (41.38 percent), compared to 3.70 percent in Village A and 12.94 percent in Village B.

Table 5.3. Household Head's Educational Attainment

Educational attainment	Village A, Banjarnegara, Central Java	Village B, Gunungkidul, Yogyakarta	Village C, Sleman, Yogyakarta
0 year	10.19%	9.41%	8.05%
1 – 6 years	76.85%	45.88%	27.59%
7 – 9 years	5.56%	31.76%	21.84%
10 – 12 years	3.70%	12.94%	41.38%
More than 12 years	3.70%	-	1.15%

In the case of higher education, however, Village A has more household heads with college degree (3.70 percent) than Village B (none) and C (1.15 percent). Unfortunately, the studied communities, especially Village A and B whose location are more remote than Village C, report the many youths who migrate permanently outside the villages. Usually, these youths went to school and or college outside the villages, then did not return to their villages after graduating, for jobs at the cities. Surveys record this pattern, where there are only two household members with college graduates in Village A and B, compared to seven household members in Village C. From interviews, community leaders in Village A and B have also mentioned this outmigration phenomenon. Only those older than 40 years old, with usually lower education level, remain in the villages.

Besides the low education level, however, there are other factors at play to explain the concentrated power structure. First, the presence of a lingering aristocratic culture and social stratification, which have always been part of the Javanese communities (Koentjaraningrat, 1960; Beard and Dasgupta, 2006), even before the pre-colonialism era in the 16th century. During the colonialism era, aristocracy was emphasized by the colonialist to maintain its reign, limiting the rural communities' authority to govern. Even more, the authoritarian government, which ruled between 1965 and 1998, restricted decision-making by village government with Law 5 of 1979 on Village Governance (Antlov and Cederroth, 1994). Consequently, rural communities in Indonesia, including the Javanese, have grown used to centralized style of government. Today, aristocracy and social stratification are not

as intense as in the past, but rural communities have yet accustomed to discourse in policy decision-making. Even after the old law was replaced with the decentralization policy, and rural communities are delivered a mandate to determine their own development planning, reliance on community leaders still persists.

Another factor is the political culture in the Javanese communities, where unity is viewed as important in developing a strong community (Anderson, 1990). For the Javanese, unity is achieved through harmonious living, including obedience to community leaders and avoidance of open arguments. Meanwhile, Flora and Flora (2013) assert that rural communities indeed often incline toward status quo, mainly due to the more intimate interpersonal relationship among their members. In this case, Bebbington et al. (2004) add that local culture usually tints the way the village is governed, as seen from their study in villages in Central Java and Jambi Provinces.

CONCLUSIONS

This study seeks the connection between political, social, and human capital, especially on how social and human capital affect the exercise of political capital in rural communities. There are two primary findings of this study. First, it is found that involvement in community groups (social capital) affect the manner of which the community solved the effect of natural hazards, especially in Village B and C whose communities hold regular community meetings. The community-group variable is insignificant in Village A, mainly because its community does not hold a regular community meeting and natural hazards encountered by the community are relatively mild, compared to those that occur in Villages B and C. Second, and maybe the most interesting finding, is the strong significance of household head's level of education (human capital) on all political capital variables. Higher level of education of the household head is associated with

perceiving community groups as influential entities, rather than individual community leaders, and delivering aspiration in community groups. Higher education also leads to stronger bonding as well as bridging social capital, as seen in the willingness to solve the effect of natural hazards with the community's own resources, as well as reaching out to outside entities for aid.

Results indicate that household heads in the studied communities attain six to eight years of education, on average, which is a lower education level than high school. This may explain the tendency of the communities to rely on their leaders in policymaking process, as seen from the high proportion of households who state community leaders as the most influential entity in policymaking and the low percentage of households who deliver their policy aspiration. The substantial power of community leaders, along with the unwillingness of community members to deliver policy aspiration, justifies the lack of statistical significance of the community-group variable on influential-person and delivering-aspiration variables.

Overall, the strong effect of education (human capital) on the exercise of political capital draws attention to the need of improving the quality of education in the villages. Rural communities in remote areas, such as the communities of Village A and B, often have no nearby high school, and even less access to college. The rural youth have no other choice than moving outside the communities for school and college. Furthermore, lack of employment in the villages has been exhibited as a major reason for outmigration of the youth, or also known as brain drain. In order to attract the educated youths to stay or return to the village, the government thereby needs to create employment opportunities in rural areas, besides broadening access to high school and college education. As this study has shown, aspiration toward decentralized and democratized rural communities needs a complementary action of better educating the rural people. Prospectively, higher educated

rural communities will participate better in the ongoing decentralization policy in Indonesia, besides capable of self-help and self-organize themselves in coping with the unpredictable weather.

References

- Adam, Silke and Hanspeter Kriesi. 2007. The Network Approach (in *Theories of the Policy Process, Second Edition*, edited by Paul A. Sabatier). Westview Press: Colorado, USA.
- Alm, James and Roy Bahl. 1999. *Decentralization in Indonesia: Prospects and Problems*. Retrieved at December 2, 2013 from http://aysps.gsu.edu/publications/1999/990601_IndonesiaReport.pdf
- Anderson, Benedict. 1990. *Language and Power: Exploring Political Cultures in Indonesia*. Cornell University press: New York, USA.
- Antlov, Hans and Sven Cederroth. 1994. Introduction (in *Leadership on Java: Gentle Hints, Authoritarian Rule*, edited by Hans Antlov and Sven Cederroth). Curzon Press: Surrey, United Kingdom.
- Beard, Victoria and Aniruddha Dasgupta. 2006. Collective Action and Community-driven Development in Rural and Urban Indonesia. *Urban Studies* 43(9): 1451-1468.
- Beard, Victoria A. 2007. Household Contributions to Community Development in Indonesia. *World Development* 35(4): 607-625.
- Bebbington, Anthony, Leni Dharmawan, Erwin Fahmi, and Scott Guggenheim. 2004. Village Politics, Culture, and Community-driven Development: Insights from Indonesia. *Progress in Development Studies* 4(3): 187-205.
- Below, Till B., Khamaldin D. Mutabazi, Dieter Kirschke, Christian Franke, Stefan Sieber, Rosemarie Siebert, and Karen Tscherning. 2012. Can Farmers' Adaption to Climate Change be Explained by Socio-economic Household-level Variables? *Global Environmental Change* 22: 223-235.
- Central Bureau of Statistics. 2014. Report on Agricultural Census 2013: Complete Sampling (Laporan Lengkap Hasil Sensus Pertanian 2013: Pencacahan Lengkap). Central Bureau of Statistics: Jakarta, Indonesia.
- _____. 2015. *Statistik Politik (Political Statistic)*. Central Bureau of Statistics: Jakarta, Indonesia.
- Cruikshank, Barbara. 1999. *The Will to Empower*. Cornell University Press: New York, USA.
- Dewey, John. 1927. *The Public and Its Problems*. Swallow Press/Ohio University Press: Ohio, USA.

- Duit, Andreas and Victor Galaz. 2008. Governance and Complexity: Emerging Issues for Governance Theory. *International Journal of Policy, Administration, and Institutions* 21(3): 311-335.
- Falleti, Tulia G. 2005. A Sequential Theory of Decentralization: Latin American Cases in Comparative Perspective. *American Political Science Review* 99(3): 327-346.
- Finney, Sara J. and Christine Distefano. 2006. Nonnormal and Categorical Data in Structural Equation Modeling (in "*Structural Equation Modeling: A Second Course*" edited by Gregory R. Hancock and Ralph O. Mueller). Information Age Publishing: USA.
- Flora, Cornelia Butler and Jan L. Flora. 2013. *Rural Communities: Legacy and Change*. Westview Press: Colorado, USA.
- Gbetibouo, Glwadys Aymone. 2008. Understanding Farmers' Perceptions and Adaptations to Climate Change and Variability. *IFPRI Discussion Paper 00849*. International Food Policy Research Institute.
- Haug, Michaela. 2007. Kemiskinan dan Desentralisasi di Kutai Barat: Dampak Otonomi Daerah terhadap Kesejahteraan Dayak Benuaq (Poverty and Decentralization in West Kutai: Impact of Regional Autonomy on Dayak Benuaq Well-being). *Laporan Penelitian (Research Report)*. CIFOR: Bogor, Indonesia.
- Irawan, Bambang. 2006. "Anomali Iklim El Nino dan La Nina: Kecenderungan Jangka Panjang dan Dampaknya terhadap Produksi Pangan" (El Nino and La Nina Climate Anomaly Phenomenon: the Longterm Trend and Its Impact on Food Production). *Forum Penelitian Agro Ekonomi* 24(1): 28-45.
- Jessop, Bob. 2002. *The Future of the Capitalist State*. Polity Press: Massachusetts, USA.
- Keil, Alwin, Manfred Zeller, Anastasia Wida, Bunasor Sanim, and Regina Birner. 2008. What Determines Farmers' Resilience towards ENSO-related Drought? An Empirical Assessment in Central Sulawesi, Indonesia. *Climatic Change* 86: 291-307.
- Koentjaraningrat, R.M. 1960. The Javanese of South Central Java (in "*Social Structure in Southeast Asia*" edited by George Peter Murdock). Quadrangle Books: Illinois, USA.
- _____. 1989. *Javanese Culture*. Oxford University Press: New York, USA.
- McGuire, Michael and Robert Agranoff. 2010. Networking in the Shadow of Bureaucracy (in *The Oxford Handbook of American Bureaucracy*, edited by Robert F. Durant). Oxford University Press: New York, USA.
- Naylor, Rosamond L., W.P. Falcon, D. Rochberg, and N. Wada. 2001. "Using El Nino/Southern Oscillation Climate Data to Predict Rice Production in Indonesia". *Climatic Change* 50: 255-265.

- Rasyid, Ryaas. 2007. Otonomi Daerah: Latar Belakang dan Masa Depan (Regional Autonomy: Background and Its Future) in *Desentralisasi dan Otonomi Daerah (Decentralization and Regional Autonomy)* edited by Syamsuddin Haris. LIPI Press: Jakarta, Indonesia.
- Rhodes, R.A.W. 2008. Policy Network Analysis (in *The Oxford Handbook of Public Policy*, edited by Robert E. Goodin, Michael Moran, and Martin Rein). Oxford University Press: New York, USA.
- Rosyadi, Slamet, Regina Birner, and Manfred Zeller. Creating Political Capital to Promote Devolution in the Forestry Sector – A Case Study of the Forest Communities in Banyumas District, Central Java, Indonesia (in *Land Use, Nature Conservation and the Stability of Rainforest Margins in Southeast Asia*, edited by Gerhard Gerold, Michael Fremerey, and Edi Guhardja). Springer: Germany.
- Timmermann, A., J. Oberhuber, A. Bacher, M. Esch, M. Latif, and E. Roeckner. 1999. Increased El Nino Frequency in A Climate Model Forced by Future Green House Warming. *Nature* 398: 694-696.
- Traerup, Sara L. M. 2012. Informal Networks and Resilience to Climate Change Impacts: A Collective Approach to Index Insurance. *Global Environmental Change* 22: 255-267.
- Young, Iris. 2000. *Inclusion and Democracy*. Oxford University Press: New York, USA.

CHAPTER 6. GENERAL CONCLUSIONS

Climate change, which increases the propensity of unpredictable weather, threatens community livelihoods, especially rural communities whose livelihoods are intertwined with natural resources extraction. In spite of the threat, rural communities own the capacity to cope with the changing environment by devising and implementing their traditional knowledge. This, in rural sociology, is known as cultural capital, as reflected in the culture and legacy passed down from one generation to another (Flora and Flora, 2013). Besides traditional ecological knowledge related to food production, the knowledge also includes relationships among people, such as rural institutions and norms of giving and receiving, which portray political and social capital. With this traditional knowledge, rural communities preserve and promote their resiliency to the changing climate and environment.

Utilizing a Community Capital Framework (Flora and Flora, 2013) and Governance of Complex Adaptive Systems (Duit and Galaz, 2008), this study concentrated on the role of cultural and political capital in supporting rural communities' resilience to climate change. Cultural capital was represented by staple food diversification as a form of traditional knowledge related with local geographical characteristics and farming practices. Meanwhile, the role of personal and inter-personal connections, and the overall power structures in the community reflected elements of political capital. Given these conceptualizations, this study examined four research questions: 1) Does staple food diversification as a traditional knowledge support community resilience to climate change (Chapter 2)?; 2) How do government institutions, i.e. via rice subsidy policy, facilitate the practice of staple food diversification as traditional knowledge (Chapter 3)?; 3) How does political capital play a role in facilitating community resilience to climate change (Chapter

4)?; and 4) What is the role of social and human capital on political capital (Chapter 5)?

Community resilience to climate change was measured by the length of recovery time to natural hazards, both climatic and non-climatic. This follows the definition of resilience from the Intergovernmental Panel on Climate Change/IPCC (2012) that resilient systems recover from shocks in a timely manner. Non-climatic natural hazards are also counted, following studies that find the relationship between the warmer earth with more frequent earthquake and volcanic eruption (McGuire et al., 1997; McGuire, 2012; Compton et al., 2015).

The research questions are answered through case studies that incorporate quantitative and qualitative methods. In addition to data collected through surveys and statistical publications, this study also gathered perspectives from in-depth interviews with a panel of informants comprising community members, community leaders, and government officials. Three sub-districts in Central Java and Yogyakarta Province of Java Island, Indonesia are selected purposively based on variation in geographical characteristics. Java Island is the main rice producer in Indonesia, and thereby provides an interesting study site to research staple food diversification between rice and non-rice. Java Island is also affected by El Nino Southern Oscillation (ENSO) (Mulyana, 2002), and so it provides study areas that are influenced by unpredictable weather patterns. Furthermore, while the three sub-districts are mainly inhabited by people of the Javanese ethnic group, the Javanese itself is diverse in culture and tradition. This supplies a variety of perspectives on political and social capital in this study.

Summary of Findings

There are three key findings based on the posed research questions. First, cultural and political capital exhibit positive roles in mitigating rural communities' resilience to

climate change, as reflected in Chapters 2 and 4 of this study. Nevertheless, there is still a lack of realization of climate change's long-term effect and the need for adaptation action, even when rural communities have noticed changes in climate and the environment. Secondly, as told in Chapter 3, government institution, in this case rice subsidy, can go hand in hand with traditional knowledge on local staples to enhance communities' resilience. Finally, human capital, especially level of education, plays a substantial role in the exercise of political capital in rural communities. As presented in Chapter 5, low education level in the studied communities creates a reluctance to participate in policy discourse and a reliance on community leaders in policy-making processes, despite the ongoing decentralization policy that provides broader opportunities for rural communities to participate in development and policy-making.

Interestingly, cultural capital, or in this regard staple food diversification, potentially takes an important role in enhancing rural community resilience to climate change. Nevertheless, rural communities, in practice, have yet to acknowledge the staple food diversification's potency to provide alternative source of foods in the time of unpredictable weather. Rural communities still hold the belief that non-rice staple foods are more fulfilling, and keep the tradition to grow and store the harvested staple crops. Yet, a gradual shift toward consuming more rice is still happening. In the studied communities, some forces to push the shift include monkey attacks, soil degradation, commercial vegetable farming, rural modernization, and rice subsidy policies.

While the two-stage least square estimation suggests that higher amounts of rice subsidy received by household is associated with more consumption of non-rice staples, residents believe that they started to eat more rice due to the arrival of the rice subsidy program. Surprisingly, the negative force of rice subsidy toward the pattern of staple food consumption, however, is reversed by the practice of rice subsidy sharing. Viewed as a local

wisdom in the studied communities, the subsidized rice is, by general consensus, shared to most households in the communities, rather than delivered to poor households only. This accentuates the positive effect of rice subsidy on staple food diversification practices. At the same time, however, it redeems the rice subsidy's deed in shifting the pattern of local staple consumption.

With respect to political capital, rural communities are better off in overcoming the impact of natural hazards with their own resources, rather than utilizing government aid. This is reflected in the communities' preferences for self-help, such as in helping each other during droughts and in collecting cash to fund infrastructure development in the villages. The other aspects of political capital, however, including the community's power structure and the way the community members deliver aspirations, show no effect on community resilience. This portrays the uniqueness of rural Javanese that rely on their community leaders in the policy-making process, even after more than a decade of the enactment of decentralization in Indonesia. According to Anderson (1990), the Javanese upholds community's harmony above political discourse in order to build resilience.

Lastly, both involvement in community groups and household head's education, which each represent social and human capital, respectively, positively affect the political capital variables. Involvement in community groups lead to the exercise of bonding and bridging social capital in solving the impact of natural hazards, where rural communities will overcome the effect of natural hazards with both their own resources as well as aids from outside entities. Meanwhile, household head's education level is a strong predictor for implementing political capital. More educated household heads will view community groups as the most influential entity and will be willing to deliver policy aspirations in community groups. However, the survey finds that household heads in the studied communities hold a relatively low education level. This explains the unwillingness of

residents to deliver policy aspiration as well as their reliance on community leaders in the policy-making process.

This study concludes that traditional knowledge, such as staple food diversification, helps establishing rural communities' resilience in chronic hazard events (e.g. annual drought). From this experience with chronic events, the traditional knowledge is expected to also support the development of rural communities' resilience to acute hazards event, such as earthquake and volcanic eruption. Nevertheless, it is important to note that while traditional knowledge in this study is found to positively support resilience, some knowledge may also prohibit adaptive capacity due to lack of flexibility in the practice of the traditional knowledge.

The staple food diversification practice is rooted in the local tradition to consume local staples that are cultivated by the family farms. In its progression, there are external factors (i.e. monkey attacks, soil degradation, commercial vegetable farming, rural modernization, and rice subsidy policies) that confound the traditional practice. The good news for food diversification and local community resiliency is that no matter how the shift to rice culture is occurring, the residents still hold the value of their local staples as one of their tradition.

Similarly, the practice of political capital in the studied communities is heavily influenced by the local culture. Political capital, as used in this study, indicates a slower rate of cultural change than is mandated; that is, even though decentralization has taken place, many residents are hesitant to utilize the new political structure. This may be a result of historical institutionalism⁸ path dependency, whereby residents are unfamiliar with how to proceed under a new political structure.

⁸ Historical institutionalism is one paradigm in new institutionalism that assumes path dependency in institutional developments (Hall and Taylor, 1996; Peters et al., 2005). It views institutions not only as an organization, but also includes norms, rules, and informal procedures embedded in the organization. For the

Overall, the frameworks of community capital (Flora and Flora, 2013) and governance of complex adaptive systems (Duit and Galaz, 2008) introduced in Chapter 1 and used throughout this dissertation, have been useful to study rural community resilience to climate change in Indonesia. The community capital framework (Flora and Flora, 2013) includes the role of cultural and political capital, in addition to the well-known human, social, natural, financial, and built/physical capital, in the development of healthy, prosper, and inclusive community. The governance framework of complex adaptive systems (Duit and Galaz, 2008) helps deepen the understanding of the political capital aspect of this study, especially in the promotion of adaptive community. The cultural and political capital components of the framework have based the discussion on rural community resilience to climate change, and are intermingled with the other five community capitals. For this study in particular, not only are cultural and political capital intertwined with social, human, natural, financial, and built capital in the communities, but they are also shaped by external forces, such as the government policy. In other words, utilizing the two frameworks allowed for a greater examination and understanding of the interrelated socio-ecological issues confronting rural community resilience to climate change. With their capacity to encompass a mixed qualitative and quantitative approach, the two frameworks will also be useful to guide future studies that examine rural community resilience.

Policy Recommendations

Based on the overall findings, this study proposes three policy recommendations. In the spirit of preserving the tradition of staple food diversification, the first recommendation is based on the findings from staple food diversification and rice subsidy studies (Chapters

actors, institution affects “identities, self-image, and preferences of the actors” (Hall and Taylor, 1996). Peters et al (2005) criticize that while historical institutionalism provides descriptive framework in policy changes, it is unable to deeply explain and predict the changes.

2 and 3). Meanwhile, the second and the third recommendations are built from the findings of political capital studies (Chapters 4 and 5), as well as how they relate to the staple food diversification study.

As the first recommendation, both production and consumption aspects of staple food diversification should be maintained, and perhaps enhanced, since the two are interconnected and both were found to be hampered. On the production side, disruption in the cultivation of local staple crops caused by monkey attacks urges the need for improved forest conservation. Community members and leaders in Village B state that monkeys started to attack their farms after the conversion of local forest from traditional crops into teak⁹ plantations. Although not directly stated among residents of Village A regarding the cause of monkey attacks, looking at the vast agricultural areas on the surrounding Dieng plateau of Village A, there is an indication that monkey attacks are related to a similar forest clearing for commercial vegetable farming.

From the point of view of consumption, rebuilding the local staples' images as a proper staple food is a necessary step. At the least, there is a need to create a realization among the communities of the potential role of local staple crops to provide alternative source of foods in the time of unpredictable weather. As observed in Village B, the residents reluctantly eat cassava due to the stigma that it is an inferior good, and is low in value relative to the people's rising standard of living. In fact, the Indonesian government established a national program on food diversification acceleration in 2009, but its implementation is still lacking. Even when the program includes an aspect of improvement in local staple foods' utilization, it is, in practice, translated into activities that process local crops into snacks. One practical idea to rebuild the local staples' image is to accustom the

⁹ Highly valuable trees that are well-grown in Gunungkidul. Teak provide raw materials for furniture home-industry, an important livelihood in the studied community.

consumption of cassava, maize, and other local staples to the younger generations, including preschool, kindergarten, and elementary school children. In this regard, women groups play substantial roles for their assignment as main actors in the food diversification acceleration program, in addition to their traditional role in administering child welfare programs.

Next, in accordance with the existing Indonesian decentralization policy and political capital in the village level governance, there is a need for the national government to establish a program to disseminate information about climate change to all community members. Extension service outreach about climate change for the general public is an example. The interviewed agricultural extension workers mention that there was a field school program on climate change; yet it is implemented only on a few selected sub-districts, villages, and farmer attendees. This may explain the remaining high proportion of villagers who do not have any knowledge about climate change. The climate change extension education could function in concert with the Indonesian decentralization policy that delivers mandates of development planning to rural communities, and is designed to build climate change readiness at the village level.

And lastly, better participation of rural communities in the Indonesian decentralization era necessitates broadened educational facilities, particularly high school and college education, in rural areas. This recommendation considers the strong impulse of education level on the exercise of political capital, yet remaining low education level attained by household heads in the studied communities. The idea of distance learning and open university should be considered, although it requires complementary action to improve telecommunication infrastructure at the rural level. Dewey (1956) notes that education is necessary in the making of citizens who actively participate in the policy-making process. While decentralization is aspired toward the democratization of the society, education is crucial within the process. In addition to the aim to be able to

participate in the decentralization, education is also expected to shape the realization about climate change and its long-term consequences, and ultimately building overall community resilience to a variety of climate and non-climate shocks.

Validity and Generalizability

Following the validity checklist from Maxwell (2013), this study attains validity through triangulation and respondent validation. Triangulation necessitates the collection of data and information from various sources in order to minimize the measurement bias. In achieving the goal, this study collects quantitative and qualitative data from surveys and interviews, as well as gathers statistical data and reviews government documents. The primary data from surveys and interviews and secondary data from statistics and government documents enable information crosschecking and further support facts and evidence. In addition, the collection of numerical data enables testing and supporting claims. Moreover, the purpose of respondent validation is to check or solicit feedback about information or data gathered from other people, in order “to avoid misinterpretation of particular meanings” (Maxwell, 2013, p. 126). Respondent validation in this study is realized through the panel informant structure of the in-depth interviews. Particular information from community members and leaders are crosschecked through a follow-up interview with the local government officials, or vice versa. For example, information mentioned by community members and leaders about government programs on climate change was crosschecked with local government officials, which was followed up with further questions about the description of the existing program.

This study is potentially generalizable to other rural communities facing similar challenges from climatic and environmental change. This is because, first, climate change is a broad-scale phenomenon that affects different areas and communities throughout the

world. Second, rural and indigenous communities around the world have been shown to possess and practice traditional knowledge to adapt to climatic and environmental changes (e.g. see Altieri and Koohafkan, 2008; Boillat and Berkes, 2013). Some of this knowledge is applicable in different communities in different parts of the world. For example, traditional knowledge about the growing of such local staple foods as yams in Papua New Guinea (MacCarthy, 2012) and maize in Mexico (Mullaney, 2014) in the face of a changing climate. This practice may hold value for farmers in other locales and continents who are also seeking to adapt their agricultural practices to alterations in temperature and precipitation patterns. Lastly, studies have also reported the erosion of traditional knowledge across different communities due to a growing dependency by rural communities on agricultural inappropriate technologies brought in from elsewhere (Olson, 2013; Gomez-Baggethun and Reyes-Garcia, 2013). Besides raising this issue, this study also provides insights about potential actions to reverse the trend, as observed during the fieldwork.

Limitations

This study is limited in taking perspective from Java Island only, while in fact, the Indonesian archipelago is very diverse in culture, including in staple food diversification and political culture. Even though cassava and maize are known to be consumed in many parts of the archipelago as staple foods besides rice, this study has yet to study sago, which is known to be the local/traditional staple food in the eastern Indonesia of Maluku and Papua Islands. In addition, despite the similar decentralization policy throughout the nation, the exercise of political capital is deemed varied by local cultures and tradition (Bebbington et al., 2004).

Recommendations for Future Research

There are at least four suggestions that can be proposed for future research. First, conducting a study in communities that are accustomed with sago as local staples will be necessary to add to the discussion about staple food diversification in Indonesia.

Alternatively, a study on communities with cassava (and or other tuber-root crops) and maize as local staples in non-Javanese communities, such as in Sulawesi and East Nusa Tenggara Islands (Jhamtani, 2008), will provide additional insights regarding the local staple foods. Secondly, studies on the effect of rice subsidy on local staple food consumption can be extended using panel data at the national level. The national level study will complement the findings from this community level study, in addition to testing the communities' claim that they started to eat more rice since the arrival of rice subsidy program in their villages. Next, there is also a need to conduct a study on non-Javanese communities to gather more perspective on political capital at the village level, in accordance with the Indonesian decentralization policy.

And lastly, a study to determine the level of community resilience to climate change needs to also be conducted. One alternative is to develop an index of community resilience, which can use both the frameworks of community capital (Flora and Flora, 2013) and governance of complex adaptive systems (Duit and Galaz, 2008). From the perspective of policy makers and stakeholders, the use of a single index may help draw attention to the issue and assist in guiding the conversation utilizing a similar language. Based on this conversation, local policy makers and stakeholders will be able to develop a discussion toward specific variables composing the index, in order to evaluate the performance of each variable (Briguglio et al., 2009).

References

- Altieri, Miguel A. and Parviz Koohafkan. 2008. *Enduring Farms: Climate Change, Smallholders and Traditional Farming Communities*. Malaysia: Third World Network.
- Anderson, Benedict. 1990. *Language and Power: Exploring Political Cultures in Indonesia*. Cornell University press: New York, USA.
- Bebbington, Anthony, Leni Dharmawan, Erwin Fahmi, and Scott Guggenheim. 2004. Village Politics, Culture, and Community-driven Development: Insights from Indonesia. *Progress in Development Studies* 4(3): 187-205.
- Boillat, Sebastian and Fikret Berkes. 2013. Perception and Interpretation of Climate Change Among Quechua Farmers of Bolivia: Indigenous Knowledge as a Resource for Adaptive Capacity. *Ecology and Society* 18(4): 21.
- Briguglio, Lino, Gordon Cordina, Nadia Farrugia, and Stephanie Vella. 2009. Economic Vulnerability and Resilience: Concepts and Measurements. *Oxford Development Studies* 37(3): 229-247.
- Dewey, John. 1927. *The Public and Its Problems*. Swallow Press/Ohio University Press: Ohio, USA.
- Duit, Andreas and Victor Galaz. 2008. Governance and Complexity: Emerging Issues for Governance Theory. *International Journal of Policy, Administration, and Institutions* 21(3): 311-335.
- Flora, Cornelia Butler and Jan L. Flora. 2013. *Rural Communities: Legacy and Change*. Westview Press: Colorado, USA.
- Gomez-Baggethun, Erik and Victoria Reyes-Garcia. 2013. Reinterpreting Change in Traditional Ecological Knowledge. *Human Ecology* 41: 643-647.
- Hall, Peter A. and Rosemary C. R. Taylor. 1996. Political Science and the Three New Institutionalisms. *Political Studies* XLIV: 936-957.
- IPCC. 2012. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* (edited by Field, C. B., V. Barros, T. F. Stocker, D. Qin, D. J. Dokken, K. L. Ebi, M. D. Mastrandrea, K. J. Mach, G. K. Plattner, S. K. Allen, M. Tignor, and P. M. Midgley. Cambridge University Press: Cambridge, UK and New York, USA.
- Jhamtani, Hira. 2008. *Lumbung Pangan: Menata Ulang Kebijakan Pangan* (Food Barn: Reformulate Food Policy). Insists Press: Yogyakarta, Indonesia.
- Maxwell, Joseph A. 2013. *Qualitative Research Design: An Interactive Approach 3rd Edition*. SAGE: United States.

- MacCarthy, Michelle. 2012. Playing Politics with Yams: Food Security in the Trobriand Islands of Papua New Guinea. *Culture, Agriculture, Food and Environment* 34(2): 136-147.
- Mullaney, Emma Gaalaas. 2014. Geopolitical Maize: Peasant Seeds, Everyday Practices, and Food Security in Mexico. *Geopolitics* 19(2): 406-430.
- Mulyana, Erwin. 2002. "Hubungan Antara ENSO Dengan Variasi Curah Hujan Di Indonesia" (The Relation Between ENSO and Rainfall Variability in Indonesia). *Jurnal Sains dan Teknologi Modifikasi Cuaca* 3(1): 1-4.
- Olson, Elizabeth Anne. 2013. Anthropology and Traditional Ecological Knowledge: A Summary of Quantitative Approaches to Traditional Knowledge, Market Participation, and Conservation. *Culture, Agriculture, Food, and Environment* 35(2): 140-151.
- Peters, B. Guy, Jon Pierre, and Desmond S. King. 2005. The Politics of Path Dependency: Political Conflict in Historical Institutionalism. *The Journal of Politics* 67(4): 1275-1300.

Appendix 1. Variables Definition

Observed variables	Definition	Sources	Descriptive Statistics					Effect size (Eta)
			Village A, Banjar-negara	Village B, Gunung-kidul	Village C, Sleman	Minimum	Maximum	
<u>Dependent variable:</u>								
Time to recover	Length of time to recover from the impact of natural hazards/disasters, both physically and mentally (e.g. trauma); in months	IPCC (2012); Duit and Galaz (2008)	1.16	3.95	0.91	0	36	0.33 (medium)
<u>Independent variables:</u>								
1. Frequency in diversifying staple food	Frequency to consume non-rice staple per week; coherent with the idea of livelihood diversification	Ellis (1998); Paavola (2008); Osbahr et al. (2008); Li et al. (2013)	4.09	0.71	0.01	0	7	0.71 (large)
2. Rice subsidy	Amount of rice subsidy received by the household per month; in kilogram	Duit and Galaz (2008)	4.71	5.38	3.64	0	20	0.28 (medium)
3. Influential person	Categorical variable: 1=a community leader (e.g. hamlet head, RT leader); 2=a reputable person; 3=more than 1 community leader/reputable person; 4=community group; 5=more than 1 entity, including community leader/reputable person/community group	Flora and Flora (2013); Adam and Kriesi (2007); Rhodes (2008)	1.43	1.99	1.57	0	5	0.21 (small)
4. Delivering aspiration	Categorical variable: 1=neighbor/friend/relative in this hamlet/village; 2=government official/office; 3=community leaders; 4=village office; 5=community group meeting	Flora and Flora (2013); Adam and Kriesi (2007); Rhodes (2008)	1.56	2.60	2.36	0	5	0.28 (medium)
5. Solving natural hazards' impact	Categorical variable: 1=do nothing; 2=by self; 3=by community; 4=by self and community; 5=by self,	Flora and Flora (2013); Adam and Kriesi	2.69	2.94	2.49	0	5	0.12 (small)

		community, and get support from outside (e.g. government, NGOs)	(2007); Rhodes (2008)						
6.	Number of community groups	Number of community groups the HH joined, and that can be relied during shocks	Duit and Galaz (2008); Below et al. (2012)	0.69	1.38	1.32	0	5	0.33 (medium)
7.	HH head education	Latest education obtained by household head; in years	Gbetibouo (2009); Below et al. (2012)	6.05	7.05	8.70	0	16	0.32 (medium)
8.	Giving frequency	Frequency in giving gifts/food to neighbors in the last month	Duit and Galaz (2008); Hanh et al. (2009)	5.59	6.05	4.24	0	30	0.12 (small)
9.	Receiving frequency	Frequency in receiving gifts/food from neighbors in the last month	Duit and Galaz (2008); Hanh et al. (2009)	5.32	5.85	3.23	0	30	0.18 (small)
10.	Agricultural risk perception	Simple average of respondents' agreement (i.e. answer 'yes=1') to eight statements that temperature is increasing, rainfall becomes unpredictable, seasonal change becomes unpredictable, crop production becomes unpredictable, agricultural land becomes drier, agricultural land is harder to plow, water volume becomes unpredictable, and pest outbreak is more frequent. Exploratory factor analysis was conducted, and then the eight variables were chosen based on the best Cronbach Alpha (0.7698)	Grothmann and Patt (2005); Duit and Galaz (2008); Vignola et al. (2010); Rogers et al. (2012)	6.34	6.55	4.19	0	8	0.48 (large)
11.	HH job	Total number of jobs owned by household head and members; proxy for household's labor capacity	Keil et al. (2008)	3.13	3.55	2.70	1	8	0.23 (small)
12.	Number of cattle	Total number of cattle (i.e. commonly raised for saving: cow, buffalo, and goat) owned by the HH	Deressa et al. (2009)	3.89	2.71	0.38	0	19	0.47 (large)
13.	Total agricultural land	Total of wetland, dry land, and home garden (as it is also used for farming) owned by the HH; in hectares	Keil et al. (2008); Deressa et al. (2009)	0.35	0.54	0.08	0	4.01	0.32 (medium)

14. Soil quality	Simple average of respondents' valuation (i.e. 'lowest =1' to 'highest=5') on soil color, easiness to plow, soil fertility, microorganism, and soil depth. Exploratory factor analysis was conducted, then the five variables were chosen based on the best Cronbach Alpha (0.8776)	Keil et al. (2008); Below et al. (2012)	16.14	12.38	8.14	0	23	0.49 (large)
15. Land conservation effort	Simple average of respondents' statement (i.e. answer 'yes=1') that they practice organic farming, manure application, water efficient farming, mixed cropping, cover cropping, crop rotation, legume rotation, terracing, contour farming, integrated farming, and adjusting crop with season. Exploratory factor analysis was conducted, then the eight variables were chosen based on the best Cronbach Alpha (0.8607)	Altieri and Koohafkan (2008); Vignola et al. (2010)	4.92	4.56	1.29	0	10	0.51 (large)

Appendix 2. Interview Guide

A. For government officials

Good [morning/day/afternoon]. My name is _____. I am a college student conducting a research about community resilience to unpredictable weather. I would like to learn about the strategies the government (local or central) and the communities use in times of unpredictable weather. In the next few weeks, I will conduct surveys in hamlet [insert name of place], sub-district [insert sub-district name] in this district. Besides interviewing the community leaders and members in hamlet [insert name of place], I would like to ask you few questions about government policy (i.e. agricultural subsidies and disseminated agricultural technologies) during times of changing climate/weather. The interview will take about one hour. Do you have time now to talk, or is there a day/time that would work better for you an interview? [If not now, date/time: _____]

I would like to audio tape our conversation today, if you are fine with that. This audio tape recording is optional, and I would not record our conversation if you were uncomfortable. I also would like to have your verbal consent before we do our interview. This verbal consent is intended to protect the confidentiality of information you will share with me and also state that this research is not intended to inflict any harm. Your participation is voluntary, and you may stop at any time. For further detail, please contact Dr. Lori Cramer from Sociology Program, School of Public Policy, Oregon State University, who is the Principle Investigator for this study. Her contact number is +1-541-737-5382 and email address lcramer@oregonstate.edu. Also, you may contact Arini Wahyu Utami, who is the graduate student leading this study, with Indonesian contact number +62-274-516656 and email address utamia@onid.oregonstate.edu.

First, I would like to know a general information of your position and your position responsibilities.

1. Province: _____ District: _____
2. Institution: _____
3. What is your position in this institution?
4. What are your position responsibilities?
5. How long have you been in this position?

Let us go on to the interview questions. This first part will be about community's experience in facing the unpredictable weather and how they utilize their traditional knowledge to cope with disasters caused by the unpredictable weather.

i) Community resilience to climate change and traditional ecological knowledge (TEK)

1. In the issues of changing climate/weather pattern, how do the local government perceive and handle these issues?
2. The changing climate/weather pattern is believed by some to cause more frequent unpredictable weather and to effect communities' livelihoods:
 - a) In your observation, what were the impacts of this changing climate/weather pattern to the local community in this district in the last 10-20 years?
 - b) What is/are the most memorable natural disaster(s)/shock(s) for you?
 - c) How serious is the impact?

Probe: do you think that natural disasters (e.g. drought, flood, strong wind, pest outbreak) have become more frequent?
3. Can you explain if there is any traditional practice (in agriculture, food security, land and water conservation, etc.) that is held by the community to cope with unpredictable weather?
 - a) Is land conservation considered as traditional practice in this district (or at least, some parts of the district)?
 - b) Is staple food diversification considered as traditional practice in this district (or at least, some parts of the district)?
4. How did the community utilize the traditional practices to cope with natural disaster/shocks caused by unpredictable weather?
 - a) What is the role of land conservation in enhancing community capacity to face the unpredictable weather?
 - b) What is the role of staple food diversification in enhancing community capacity to face the unpredictable weather?
5. For the serious impacts of the unpredictable weather, how did the community respond to the natural disaster/shocks?
 - a) Did they ask for help from the local government or did they self-organize by themselves?
 - b) How long did it take to relieve from the impacts of natural disaster/shocks?

Now, let us move on to the next part about government program, regulation, and support on the issue of unpredictable weather, and their relations with the utilization of traditional knowledge in the rural communities. I would like to also learn about the mechanism available in the rural communities to deliver their policy recommendations to the local government.

ii) Political capital and policy network

1. Can you explain if there is **any government program** that delivers knowledge to the community about the changing climate/weather pattern (e.g. field school, movement for system of rice intensification (SRI), etc.)?
2. Can you explain if there is **any government support** to the community in times of weather-related natural disaster/ shock (e.g. harvesting failure, pest outbreak, etc.)?
3. a) Can you explain if there is any formal regulation in the district regarding the practice of land conservation (e.g. government program or regulation)?
b) Can you explain if there is any formal regulation in the district regarding the practice of staple food diversification (e.g. government regulation or “*Peraturan Pemerintah*” on food diversification)?
4. a) Can you explain about the implementation mechanism of agricultural input subsidy (i.e. hybrid seed, fertilizer, and pesticide) in this district?
b) Can you explain about the implementation mechanism of rice subsidy in this district?
5. Do you think the subsidies are conflicting or complementing (incorporating) the practice of local/traditional knowledge in rural communities?
a) Do you think that agricultural input subsidy strengthen or weaken the practice of traditional knowledge, particularly land conservation? How?
b) Do you think that rice subsidy strengthen or weaken the practice of traditional knowledge, particularly staple food diversification? How?
6. What is the mechanism for the community members to deliver their policy recommendation to the local government or government officials in this district?
7. Do community group play a role as a forum for delivering policy recommendation from rural communities?
a) Do farmers groups play a role as a forum for delivering policy recommendation from rural farmers? How?

- b) Do women groups (e.g. PKK) play a role as a forum for delivering policy recommendation from rural women? How?

B. For community leaders and members

Good [morning/day/afternoon]. My name is _____. I am a college student conducting a research about community resilience to unpredictable weather. I would like to learn about what practices or policies that have been done by this community to adapt to unpredictable weather pattern. This includes adaptation strategies in agricultural practices and household management. Your contact information was obtained from [sub-district officials for community leaders] [community leader for community members]. The interview will take about one hour. Do you have time now to talk, or is there a day/time that would work better for you an interview? [If not now, date/time: _____]

I would like to audio tape our conversation today, if you are fine with that. This audio tape recording is optional, and I would not record our conversation if you were uncomfortable. I also would like to have your verbal consent before we do our interview. This verbal consent is intended to protect the confidentiality of information you will share with me and also state that this research is not intended to inflict any harm. Your participation is voluntary, and you may stop at any time. For further detail, please contact Dr. Lori Cramer from Sociology Program, School of Public Policy, Oregon State University, who is the Principle Investigator for this study. Her contact number is +1-541-737-5382 and email address lcramer@oregonstate.edu. Also, you may contact Arini Wahyu Utami, who is the graduate student leading this study, with Indonesian contact number +62-274-516656 and email address utamia@onid.oregonstate.edu.

First, I would like to know a general background of your position.

1. Province: _____ District: _____
Sub-district: _____ Hamlet: _____
2. How long have you been living in this community?
3. How long have you been in this position? (*Only for community leaders*)

Let us go on to the interview questions. This first part will be about community's experience in facing the unpredictable weather and how they utilize their traditional knowledge to cope with disasters caused by the unpredictable weather.

i) Community resilience to climate change and traditional ecological knowledge (TEK)

1. In your opinion, do you think that the climate/weather patterns are changing?
Probe: Do you think that the weather is getting warmer now compared to the periods before 2000? Do you think that seasonal changes are hard to determine today?
2. In your observation, does natural disaster become more frequent in the last 10-20 years?
 - a) What is/are the most memorable natural disaster(s)/shock(s) for you?
 - b) What were the impacts of this changing climate/weather pattern on **your household's livelihoods**? How serious?
 - c) What were the impacts of this changing climate/weather pattern on **this community's livelihoods**? How serious?
3.
 - a) How does your household cope with the changing climate/weather pattern?
 - b) How does this community cope with the changing climate/weather pattern?
4.
 - a) In times of weather-related natural disaster, how long does your household relieve from the disaster impacts?
 - b) How long does this community relieve from the disaster impacts?
5.
 - a) What can your household learn from the disaster?
 - b) What can this community learn from the disaster?
6. What are traditional practices related to agriculture (e.g. land and water conservation, staple food diversification, etc.) that are common in this community?
 - a) Is land conservation commonly practiced in this community? How?
 - b) Is staple food diversification commonly practiced in this community? How?

Note: may skip questions 7b and 8b if staple food diversification is absence in the community.
7. What do you think of the role of the traditional practices to cope with unpredictable weather?
 - a) What is the role of land conservation to enhance community resilience to unpredictable weather?
 - b) What is the role of staple food diversification to enhance community resilience to unpredictable weather?
8. Can you explain the ways this community does to preserve the traditional practices?

- a) How does this community preserve the practice of land conservation?
- b) How does this community preserve the practice of staple food diversification?

Now, let us move on to the next part about government program, regulation, and support on the issue of unpredictable weather, and their relations with the utilization of traditional knowledge in the rural communities. I would like to also learn about the mechanism available in the rural communities to deliver their policy recommendations to the local government.

ii) Political capital and policy network

1. Can you explain if there is **any government program** that delivers knowledge to the community about the changing climate/weather pattern (e.g. field school, movement for system of rice intensification (SRI), etc.)?
2. Can you explain if there is **any government support** to the community in times of weather-related natural disaster/ shock (e.g. harvesting failure, pest outbreak, etc.)?
3. a) How do norms (or sanctions) work in this community regarding the practices of land conservation?
b) How do norms (or sanctions) work in this community regarding the practices of staple food diversification?
4. a) Can you explain about the implementation mechanism of agricultural input subsidy (i.e. hybrid seed, fertilizer, and pesticide) in this community?
b) Can you explain about the implementation mechanism of rice subsidy in this community?
5. Do you think the subsidies are conflicting or complementing (incorporating) the practice of local/traditional knowledge in rural communities?
a) Do you think that agricultural input subsidy strengthen or weaken the practice of traditional knowledge, particularly land conservation? How?
b) Do you think that rice subsidy strengthen or weaken the practice of traditional knowledge, particularly staple food diversification? How?
6. What is the mechanism for the community members to deliver their policy aspiration to the local government or government officials in this district?
7. Do community group play a role as a forum for delivering policy recommendation from rural communities?

- a) Do farmers groups play a role as a forum for delivering policy recommendation from rural farmers? How?
- b) Do women groups (e.g. PKK) play a role as a forum for delivering policy recommendation from rural women? How?

Appendix 3. Survey Questionnaire

SURVEY QUESTIONNAIRE

“Community Resilience to Climate Change in Rural Indonesia”

Arini W. Utami (School of Public Policy, Oregon State University, USA)

Supported by Faculty of Agriculture, Gadjah Mada University, Yogyakarta, Indonesia

District : SL / GK / BN

Village/Hamlet :

Sub-district :

Date : July / August 2015

A. HOUSEHOLD GENERAL LIVELIHOODS

No	Status	M/F	Age (yo)	Education (years)	Main occupation	Side occupation	Income* (IDR)
	HH head						

Note: *) only for off-farm income

B. HOUSEHOLD FARMING AND ASSETS

This section inquires household's farm production and cost, which will be used to estimate household farm income.

Given the diversification nature of rural farm households, the questions will include seasonal and annual crops, animal husbandary, and fishery (note: each diversification activity may not be applicable to all topographies. For instance, fishery is common only in Sleman).

B.1. Agricultural land holding

No	Status	Wetland	Dryland	Homegarden	Total
1.	Self-owned				
2.	Renting				
	Rent (IDR/year)				
3.	Sharecropping				
	Share of return (%)				
	Share of input (%)				
Total					

Crop rotation:

B.2. Seasonal crop:

Planting area (m ²)	Crops	Production				Labor		
		Amount (kg)	Value (IDR) or Price (IDR/kg)	For self consumption (%)	Sold* (%)	Family (day x hours x person)	Non-family (day x hours x person)	Wage (IDR)

Note: *) please ask and make note on trading system of the crops' harvest (e.g. ijon, tebasan, dry, etc.)

Planting area (m ²)	Crops	Seeds*		Fertilizers*					Pesticides*	
		Amount (kg)	Value (IDR)	Urea (amount; value)	TSP (amount; value)	NPK (amount; value)	Manure (amount; value)	Others (amount; value) (amount; value) (amount; value)

Note: *) please ask and identify with "S" if seeds, fertilizers, and pesticides are made or produced by the household

How much did you receive agricultural inputs subsidies in the last year? (Please note all other fertilizers recieved)

Seeds: kg; Urea: kg; NPK:kg; Pesticide: bottle/sachet

B.3. Annual crops:

Planting area (m ²)	Crops	Production				Labor		
		Amount (kg)	Value (IDR) or Price (IDR/kg)	For self consumption (%)	Sold* (%)	Family (day x hours x person)	Non-family (day x hours x person)	Wage (IDR)

Note: *) please ask and make note on trading system of the crops' harvest (e.g. ijon, tebasan, dry, etc.)

Planting area (m ²)	Crops	Seedlings*		Fertilizers*					Pesticides*	
		Amount (kg)	Value (IDR)	Urea (amount; value)	TSP (amount; value)	NPK (amount; value)	Manure (amount; value)	Others (amount; value) (amount; value) (amount; value)

Note: *) please ask and identify with "S" if seeds, fertilizers, and pesticides are made or produced by the household

B.3. Animal husbandary

Animals	Numbers	Ownership (S/B)*	Buying price (IDR)	Today's value (IDR)	Costs				Production		
					Family (day x hours x person)	Non-family (day x hours x person)	Wage (IDR)	Feed, vitamins, etc. (IDR)	Value (2-1)	Income from selling (IDR)	Manure, eggs, etc. (IDR)
			-1-	-2-							
Cow											
Buffalo											
Goat											
Chicken											
Duck											

Note: *) "S" for self-owned; "B" for shared-ownership (nggaduh)

B.4. Fishery

Compound area (m ²)	Fishes	Seedlings		Labor			Feed, vitamins, etc. (IDR)	Production	
		Amount (number s)	Value (IDR)	Family (day x hours x person)	Non-family (day x hours x person)	Wage (IDR)		Amount (kg)	Value (IDR) or Price (IDR/kg)

B.5. Other costs

1. Marketing cost :
2. Land tax :
3. Water :
4. Traditional ceremony :
5. Depreciation cost :

Equipments	Numbers	Buying price (IDR)	Today's value (IDR)	Length of use (years)	Maximum length of use (years)
Hoe					
Sickle					
Pesticide applicator					
<i>Bajak</i>					
<i>Garu</i>					
Tractor					

B.6. Assets and access to credits

1. Please list and value the assests below:

Assets	Value (IDR)
House	
Informal saving in community groups (e.g. farmers group, cooperatives)	
Formal saving in banks (e.g. BPR, BRI)	
Vehicles (e.g. car, pick-up truck, motorcycle, bicycle)	
Valuable trees (e.g. teak, albisia)	
Lands (e.g. agricultural land, homegarden)	

2. When needed, can you easily access credits, either informal or formal? **Yes / No**
3. Which credit source you would prefer? (*Please rate from (1) as the most preferable to (5) as the most unpreferable*)
 (....) relatives (....) neighbors/friends (....) community groups (....) banks (....) others

C. CLIMATE CHANGE

This section inquires about the community's perception about climate change, its impact as natural disasters, and community's experiences in dealing with the shocks created by changing climate/weather pattern.

1. Do you know about climate change? **Yes / No**

Please explain:

Where do you get information about climate change? (*answer may be more than one*): a. TV b. Newspaper
 c. Magazine d. Radio e. Street billboard f. Others:.....

2. In your opinion, in this area within the last 10-20 years:

- | | | |
|---|----|-----|
| a. Daily temperature is increasing | No | Yes |
| b. Rainfall is more unpredictable | No | Yes |
| c. Seasonal changes are more unpredictable (e.g. causing difficulty in determining early planting season) | No | Yes |
| d. Crop production is more unpredictable | No | Yes |
| e. Natural disasters (i.e. flood, drought, strong wind) have become more frequent | No | Yes |
| f. Soil has become drier | No | Yes |
| g. Agricultural lands are harder to plow | No | Yes |
| h. Water (i.e. from irrigation, well, or rainfall) volumes are unstable; too much in rainy | No | Yes |

season, but not enough in dry season

- i. Pest attacks and outbreaks have become more frequent No Yes

3. In the past, did you get warning from community leaders or government officials/institutions before the occurrence of natural disaster (i.e. flood, drought, strong wind)? **Yes / No**

How?

4. In your experience, what weather-related disaster(s) (i.e. flood, drought, strong wind) or other shock(s) (e.g. pest outbreak) have seriously affect (*please probe to at least one of the most recent serious event*):

Your household: **Year:**

Your community: **Year:**

5. What is the scale of the impact of the disaster or shock?

Your household: a. very low b. low c. medium d. high e. very high

Your community: a. very low b. low c. medium d. high e. very high

6. What did your household do to cope with the weather related disasters or shocks?

.....

For probing, for example:

- a. Resolve it by ourselves (in the household and or in the community)
- b. Asking for help from relatives/neighbors/friends in the community
- c. Asking for help from relatives/neighbors/friends outside the community
- d. Asking for help from the local government
- e. Access informal or formal credits (please explain:)
- f. Others (please specify:)

7. How long are you felt relief from the disaster/shock? years or months (*circle one*)

8. From that experience, what do you think of the capability of this community for self-organization in times of future disaster or shock?

a. very weak b. weak c. medium d. strong e. very strong

D. LAND CONSERVATION AND STAPLE FOOD DIVERSIFICATION

This section inquires about the practice of land conservation and staple food diversification in the community.

1. What is soil color on your agricultural land?

a. red b. brown c. somewhat dark d. dark e. very dark

2. What is the level of easiness to plow your land?

a. very hard b. hard c. somewhat easy d. easy e. very easy

3. What is soil fertility level on your land?

a. very infertile b. infertile c. somewhat fertile d. fertile e. very fertile

4. How many worms and other soil microorganism are there in your land?

a. rare b. few c. somewhat d. many e. a lot

5. How deep is your land can be plowed?

a. 10 cm b. 15 cm c. 20 cm d. 25 cm e. 30 cm

6. Do you think that environmental conservation affect the sustainability of agricultural productivity? **Yes / No**

7. Do you think that land conservation needs to be continuously carried out, and if necessary is made as social institution in the community? **Yes / No**

Reason:

.....

8. Do you practice land conservation on your land? **Yes/No** (*Probe with example, terracing, contour farming, multiple cropping, water efficient farming, crop rotation, organic farming, adding manure, composting paddy straw, etc.*)

What is the most important land conservation your household applied **on your land**?

.....

9. In your opinion, what is the most important land conservation **for this community**?

.....

10. Does your household combine staple food with food other than rice? **Yes/No**

If answer YES, rice with; frequency: times per week or month (*circle one*)

E. FARMERS GROUP AND OTHER COMMUNITY GROUPS

This section inquires about the involvement of household in farmers group and the role of farmers group and other community groups in times of shock.

E.1. Farmers Group

1. Are you a member of farmers group? **Yes** (farmers group name.....) / **No**

Reason:

Role in the farmers group: **member / leader / secretary / treasurer / section**

2. When did you first get involved in farmers group? **Year**

3. Are there regular meetings for farmers group? **Yes** (every.....) / **No**

4. Do you always attend the meeting? **Yes / No**

How frequent? times within the last year

Reason why attend or not attend:

5. What are topics discussed during the farmers group meeting?

Please rate with number 1-5, from the most frequently discussed (1) to very rarely or never been discussed (5)

(....) Farming practices or agricultural issues

(....) Community issues

(....) Farmers group issue

(....) Agricultural marketing

(....) Others (please specify.....)

6. From who do you usually get or inquire information about agricultural issues?

Please rate with number 1-7, from the most frequent source (1) to very rarely (7)

(....) Agricultural extension workers (....) Farmers group and or Farmers group leader

(....) Other government officials (....) Community leaders (e.g. village head, hamlet head, RW/RT head, etc.)

(....) Other farmers/friends/neighbors (....) Agricultural inputs store/suppliers

(....) Others (please specify.....)

7. Do you think that farmers group is useful in managing community agriculture in this community (e.g. in plowing, irrigation water management, planting, etc.)? **Yes / No**

8. Do you think that you can rely on farmers group in times of weather-related disaster or shock? **Yes / No**

How?

9. Do you think that farmers group is useful as a forum to exchange ideas and deliver policy aspirations? **Yes / No**
(*Probe: policy aspiration can simply come from local community's problem, such as improving hamlet/village road*)

How?

E.2. Community Groups and Trust

1. What are other community groups you and other household members join in this community, besides farmers group?
.....
.....
.....
2. In times of disaster/shock, which community groups identified above could you rely on for help?
Please circle whenever apply:
.....for: moral support / cash / mutual help (e.g. rebuilding house) / others
.....for: moral support / cash / mutual help (e.g. rebuilding house) / others
.....for: moral support / cash / mutual help (e.g. rebuilding house) / others
.....for: moral support / cash / mutual help (e.g. rebuilding house) / others
.....for: moral support / cash / mutual help (e.g. rebuilding house) / others
3. What is the frequency of giving and receiving between your household and neighbors/friends/relatives in this community?
In one month average, **your family giving:** times/month; **your family receive:** times/month
4. What is the frequency of borrowing and lending cash between your household and neighbors/friends/relatives in this community?
In one year average, **your family borrow:** times/year; **your family lend:** times/year
5. How does this community trust each other in the matter of borrowing and lending cash?
a. very untrustful b. untrustful c. somewhat trustful d. trustful e. very trustful
6. Compared to people in other communities (e.g. other hamlets), how do you trust people in this community in the matter of borrowing and lending cash?
a. trust people in other communities more b. similarly trust people here and there
c. trust people in this community better
7. Do you agree with a statement that people in this community are selfish?
a. very disagree b. disagree c. somewhat agree d. agree e. very agree
8. How do you think the level of trust in this community has changed within the last 3 years?
a. greatly decreasing b. decreasing c. similar d. increasing e. greatly increasing
9. Do you receive rice subsidy (i.e. Raskin)? **Yes** (amount: kg per month; price: per kg) / **No**

F. POLICY NETWORK

This section inquires about institutions, person, or groups that deem important for the household, to measure the household's policy network.

1. Which government institutions are most important for your household's livelihoods?
Please rate with number 1-6, from the most important (1) to least or not important (6)
 (....) Sub-district and Village Office
 (....) Office of Agriculture / Agricultural Extension Office
 (....) Agency of Food Security
 (....) Agency of Development Regional Planning
 (....) Agency of Meteorology, Climatology, and Geophysics
 (....) Others (please specify)
2. How often do you and your household members visit Sub-district and Village Office?
 In average, times per month or year (*circle one*)
 Distance between your house and Village Office: km; Travel cost: IDR
 Distance between your house and Sub-district Office: km; Travel cost: IDR
 Purpose: administrative / non-administrative (e.g. reporting issues, delivering aspirations, attending socialization, others)
3. How often do you and your household members visit government institutions at the district level?
 In average, times per month or year (*circle one*)
 Distance between your house and district capital: km; Travel cost: IDR
 Purpose: administrative / non-administrative (e.g. reporting issues, delivering aspirations, attending socialization, others)
4. Who do you and your household members go to (or most likely will go to) when having a policy idea or aspiration to deliver? *Please rate with number 1-6, from the most likely to go to (1) to the least likely to go to (6)*
 (....) Neighbors/friends/relatives in this community
 (....) Community leaders (i.e. hamlet head, RW/RT head)
 (....) Community groups meeting
 (....) Sub-district and Village Office
 (....) Government officials/offices (please specify)
 (....) Others (please specify)
5. In your opinion, which entity (institution, individual person, or community group) that hold the most influence in this community (e.g. so that any policy ideas/aspirations will be realized by his influence)?
