COMMUNITY CAPACITY ON RAINWATER HARVESTING IMPLEMENTATION IN BANDUNG, INDONESIA

THESIS

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DOUBLE MASTER DEGREE PROGRAMME

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and
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ABSTRACT

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Community capacity is needed to identify when designing water management policy. The stressed in policy making is not only physical and financial resources, but also human and social resources are important to identify (Few, 2003). Based on water resources problem in Bandung, local government should find the alternatives approach of water management. Rainwater harvesting that implement in community level can be the alternatives that fit with Bandung condition. Even the communities have experienced with this method and it is approved as a cheap, easy, and solves water problems, rainwater harvesting is still not implemented in Bandung communities. This research aims to identify community capacity, identify contribution of community capacity in rainwater harvesting, and draw guidelines for future rainwater harvesting implementation. Based on community capacity and social capital theory, the assessment is worked on intellectual, social network, and political capital criteria. The analysis is synthesized from some government documents, newspaper, interviews, and researcher experience. Descriptive analysis is used to explain phenomenon in Bandung community capacity related with rainwater harvesting method. From the analysis, it is found that social capital in Bandung community is still insufficient for implementing rainwater harvesting. However, it also found that there are some factors that potential to support rainwater harvesting. Based on these potentials factors, some guidelines to implement rainwater harvesting in Bandung is explored.

***Keywords**: community capacity, water management, rainwater harvesting*

GUIDELINE FOR USING THESIS

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This master thesis is completed as a partial fulfillment of the requirements for the Master Degree from Institut Teknologi Bandung and University of Groningen. I am interested with water management problems in Bandung as my hometown. Since government cannot solve this complex problem alone, community participation is an opportunity for problem solution. Therefore, the research is aimed to explore the readiness of community to participate in social program. It is expected to give some recommendation for policy making in water management.

On this occasion, I would like to thank God for blessing me in finishing my thesis. I also give my greatest thankful for everybody giving supports to me in in this thesis process. I would like to address my special thanks to my supervisors, Dr. Mona Abdelwahab (RuG) and Ir. Teti A. Argo, MES, PhD (ITB) for guiding me on my thesis work. Respectively, I also would like to address my thanks to all my lecturers and faculty staff members in ITB and RuG. I also would like to express my appreciation for National Development and Planning Board (Bappenas) and the Netherland Education Support Office (NESO) through StuNed program for giving me institutional and financial support. My great appreciation also addressed for all my respondents. It completed my thesis. Special gratitude I dedicated for all friends DD ITB 2009-2011 for sharing great moments in Bandung, Groningen, and anywhere. I would also like to convey thanks to my colleagues in Ministry of Public Works for all support.

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ABBREVIATION

Number	Term	Description
1	WEPA	Water Environment Partnership in Asia
2	PDAM	Perusahaan Daerah Air Minum – Indonesian Regional water utility company
3	UNEP	United Nations Environmental Programme
4	ICWE	The International Conference on Water and Environment
5	UNCED	United Nations Conference on Environment and Development
6	SWITCH	Sustainable Water Management in the City of the Future
7	MDGs	Millenium Development Goals
8	WSSCC	Water Supply and Sanitation Collaborative Council
9	PAMSIMAS	Penyediaan Air Minum dan Sanitasi Berbasis Masyarakat – Drinking water and sanitation provision program based on community
10	CSE	Centre for Science and Environment
11	SNI	Standar Nasional Indonesia – Indonesia National Standard
12	DPKLTS	Dewan Pemerhati Kehutanan dan Lingkungan Tatar Sunda – Council of people who concerned with forest and environment in Sunda area (Sunda is a races dominated in Bandung area)
13	RTRW	Rencana Tata Ruang Wilayah – Spatial Planning
14	RT	Rukun Tetangga - community organization

CHAPTER 1. INTRODUCTION

1.1 Background

Despite the fact that it is a country rich with water resources, Indonesia still faces water problems. According to WEPA (2011), Indonesia contributes 6% of the world's water and about 21% of water resources in Asia Pacific regions. This is the effect of being an archipelago country and located in the equator. As an archipelago, Indonesia is surrounded by the sea with all its resources. Moreover, Indonesia is located in the equator that has a great amount of rainfall in most area. This is an important asset that can be used as water resources. However, the abundance of water resources has not ensured water provision for all citizens. Based on World Bank report (2009), only 18% of the urban population in Indonesia has access to the water served by government. Instead of fulfilling the water needs, this abundance of water caused negative impacts, such as flood. It has become worse due to the rapid development in Indonesia. This current situation causes continuous problems: flood in the rain season and drought in the dry season.

These water problems are not only taking place in lowland, but also in highlands like Bandung. Located at 768 meters above the sea level and surrounded by mountains, Bandung gets high rate of rainfall. In 2005 the rainfall rate in Bandung is 190.2 mm/year, and the rain falls almost every day, around 20 days per month (Jawa Barat dalam Angka, 2006). However, this abundant water resource cannot fulfill water provision in Bandung. PDAM[1] service is only accessible for approximately 65% of Bandung City residents (Yamani, 2008) and 14% of Bandung Regency (Parlindungan, 2009). In addition the PDAM water provision has only served small part of Bandung, in north and west. Other population, especially those living in south and east Bandung, have to find other water

[1] Perusahaan Air Minum Daerah (PDAM) is Indonesian regional water utility company

sources, for instance from rivers, wells, springs, or even from water bargainer who usually provide more expensive water.

Unfortunately, in the future it will be more difficult access these water resources. PDAM stated that the water resources, especially from springs, continue to decrease by about 5 liter per second per year (Kompas, 2008). This is the product of the rapid development in Bandung, in both regency and municipality of Bandung. For example land use change and deforestation in Bandung municipality causes decreasing of water catchment area in south Bandung regency. Consequently, rain water is not absorbed into the ground and instead spreads to the impermeable land, which results in floods in rain season and drought in the dry season in almost all area in Bandung.

These complex water problems brings to the awareness to handle this problems integrated. Water problems solution needs comprehensive program to restore the natural function that takes long time. Based on the water integrated management concept, both of Bandung municipality and regency government have already planned several long-term programs, such as building retention ponds and artificial lake, preserving catchment area, protecting the forest, and bounding the urban development (Bandung Municipality Spatial Planning, 2004 and Bandung regency strategies for flood prevention 2011-2025). But a short term program is also necessary to help people to cope with the water supply problem today. An alternative solution for water problem in Bandung has to be found.

Moreover, some international agreements, such as the “Agenda 21” and “Dublin statement” also support innovative approaches that involve community participation in water management. Few (2003) also argued that there is a growing tendency for local participation in global threads. Moreover, it becomes the main principle of integrated water management. Accordingly, it influences the search for alternative water problem solution in Bandung.

One of the alternative solutions that fit with Bandung condition and integrated water management principles is rainwater harvesting method. It is a method for gathering, accumulating, and storing rainwater from the roof of building or some

areas prepared on the ground. It requires simple and cheap treatment because it can use local equipment. Actually, rainwater harvesting has been implemented in local community since the 9th or 10th Century in the form of the small-scale collections of rainwater from roofs and simple brush dam constructions (UNEP, 1982).

Rainwater harvesting method is easy to implement in household or community. In general it can provide significant contribution to the urban water management and help to prevent floods as well. However, the successful of rainwater harvesting method depends on community contribution. Community will implement this method if they have sufficient capacity. Therefore, to ensure the sustainability of rainwater harvesting implementation, it is better to identify community capacity. This is important as an input to policy making when rainwater harvesting will be mass implemented.

1.2 Problem Statement

Integrated water management requires innovative solutions that involve community participation to cope with water problems. Based on Bandung condition, rainwater harvesting can be one of the best solutions, which is basically dependent on community participation. Accordingly, it is important to identify and evaluate the community capacity which influencing the implementation of rainwater harvesting in Bandung.

1.3 Research Question

Based on the problems explained above, several questions are raised:

1. What is the capacity of Bandung community towards rainwater harvesting?
   This question addresses the social capital of Bandung community that affects their capacity to implement rainwater harvesting.

2. What is the potential future of rainwater harvesting implementation in Bandung?

   This question will be answered by evaluate the connection between Bandung community capacity and the rainwater harvesting implementation that will help to determine influence factors for future rainwater harvesting.

3. What is the recommendation for policy maker to implement rainwater harvesting in Bandung?

   Based on indicators from community capacity assessment, some guidelines are provided for policy maker as an input for rainwater harvesting or the other water management program in Bandung.

1.4 Research Objective

The objectives of this research are:

1. To identify Bandung community capacity through an assessment of social capital criteria
2. To identify the contribution of community capacity in rainwater harvesting
3. To draw guidelines for future rainwater harvesting implementation in Bandung community.

1.5 Research Significance

This research aims to contribute towards the development of water management and urban planning theories through highlight alternatives, particularly rainwater harvesting, which requires the involvement of community participation. It also attempts to facilitate the communication process for policy makers in the community, to assist community participation in other water management programs.

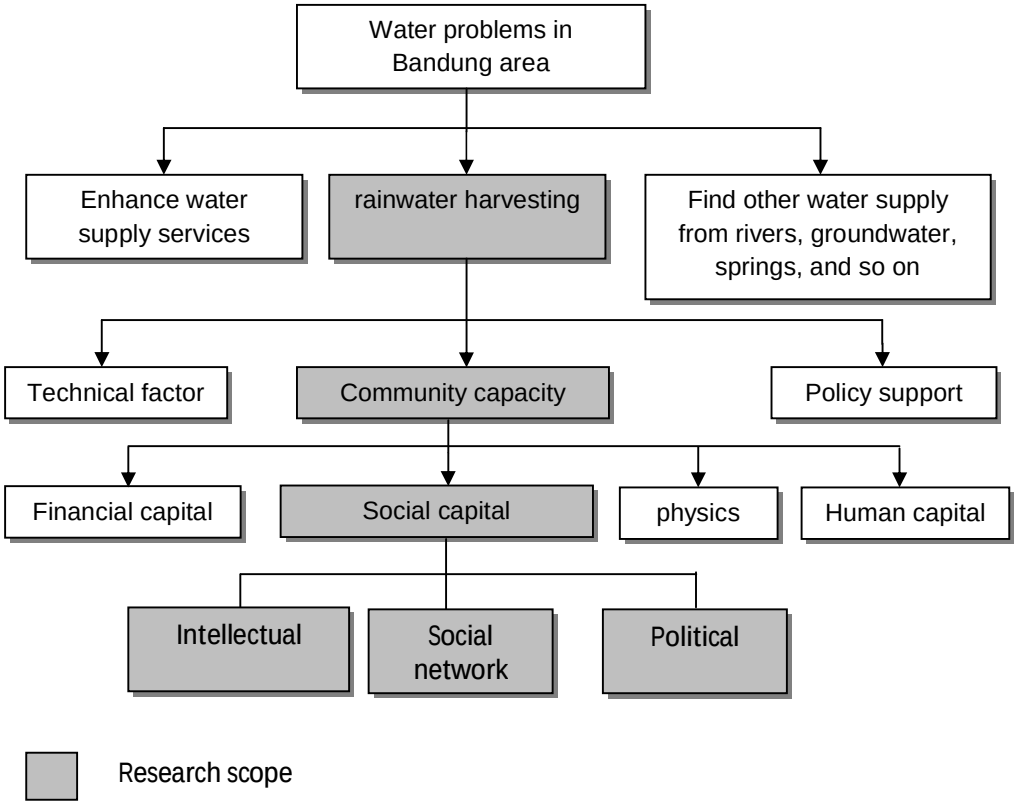
1.6 Research Scope

The scope of the research is limited to:

a. water management problem in Bandung area, both of municipality and regency area
b. rainwater harvesting method as the alternative solution for Bandung water problem
c. community capacity as the influence factor for rainwater harvesting implementation

This limitation of research is drawn in figure 1.1

Figure 1.1. Research scope



1.7 Methodology

There are four main activities conducted in this research: research background and development, literature review, data collection, and data analysis. Data collection and literature review are done simultaneously to build theoretical base of water management, rainwater harvesting, and community capacity (Chapter 2) and to elaborate in the analysis (Chapter 3). Data are collected through two methods: secondary data collection and interview. This research is conducted with descriptive analysis approach using field research techniques. Descriptive analysis is chose because this approach is appropriate to portray the reality in the community and helps to get better understanding about the phenomenon within community. Moreover, field research is the chosen technique because it is suitable to explore community in certain places, which is community in Bandung. Further explanation about methodology in each activity in this research is described below.

1. Data collection

   Data is collected through two sources: secondary data, interview, and researcher experience. Secondary data is collected from books, journals, articles, theses, newspaper, and internet sources. Furthermore, depth interview is used to complement data for analysis. The field interview involves asking questions, listening, expressing interest, and recording what was said (Neuman, 2000). Accordingly, this research will conduct the unstructured, nondirective, and in depth interviewing that are usually used in the field research to obtain as much information. Therefore, the interview is guided by several questions, and then an open-ended answer is expected from the respondents. Finally, researcher experience could be one of the data resources because the researcher comes from the same location with respondents and has lived in this city for years.

   The interview focuses on neighborhood scale of community which in Indonesia calls Rukun Tetangga (RT). Rukun Tetangga (RT) is the smaller scale of community institution in Indonesia. It consists of 30-50 household based on spatial location. Even though this organization is built by the local

community, it is acknowledged and developed by government, based on Regulation of Public Affair Ministry Number No.7/1983. It is chose because this institution is the main medium where people may interact with others.

The activity of interview is divided into several steps:

- Determining local community location for field research. In this research, field research is conducted in Dayeuhkolot, Panghegar, and Lombok Street. According to the explanation about flood location in Chapter 2, these areas are often attacked by flood and some areas are not covered by water provision from PDAM. Moreover, the areas chosen to represent how different background community can cope with water problem, such as different geographical location, socio-economic condition, and water problem. In short, the variation of location may reflect all community capacity in Bandung.
- Determining the interviewee and arranging appointment with them. The interviewee should be able to represent the community. Therefore, the interviewees chosen are those who have influence, active, and caring their community. In this research, six respondents are chosen from three field research. They are community leader (RT leader), public figure, and caretaker of community organization (RT) with assumption that these people are able to represent their community. The interview results from each respondent are compared to establish the validation of the interpretation.
- Constructing detailed list of questions to identify the institutional capital in the community and the implementation of rainwater harvesting. List of questions can be seen on the appendix.
- Conducting the interview through telephone. Due to the limitation of researcher while researcher live in other country and unable to come to the field, the interview is conducted by telephone. This interview has a limitation because researcher cannot see the expression of respondent. However, most of information can be obtained through the answers given by respondents over the telephone. The interview process is recorded and written.

- Transferring the records into transcription and typing the notes into the readable form.
- Coding the interview transcription into categories based on the theoretical framework in Chapter 2.
- Doing the data triangulation to verify validity of data by incorporating different viewpoints and methods. Wolcott (1988) suggests that triangulated techniques are helpful "for cross-checking or ferreting out varying perspectives on complex issues and events" (p. 192). In this research the triangulation is incorporated interview comparison between at least two respondents in the same community, researcher interpretation while living in Bandung, and news collection from local newspaper.
- The selected data based on these categories are ready to analyze.

2. Data analysis

   After collecting data, data is analyzed by descriptive analysis approach. Descriptive analysis is a simple but important tool to describe social phenomenon. In this research, descriptive analysis is used to identify community capacity in Bandung related with rainwater harvesting methods.

   Data analysis consists of several steps:

   - Deepening theoretical background, especially about social capital that influence the community capacity
   - Interpreting the reflection of each category in social capital. The interpretation results the indication to assess social capital that related with rainwater harvesting
   - Exploring all the materials (secondary data from literature review, newspapers, government documents, interview transcription, notes, and researcher experience) to find out the indication of social capital
   - Categorizing the indication into each category of social capital: intellectual, social network, and political capital that related with rainwater harvesting implementation
   - Assessing the relation of community background with social capital to identify influence factors in rainwater harvesting

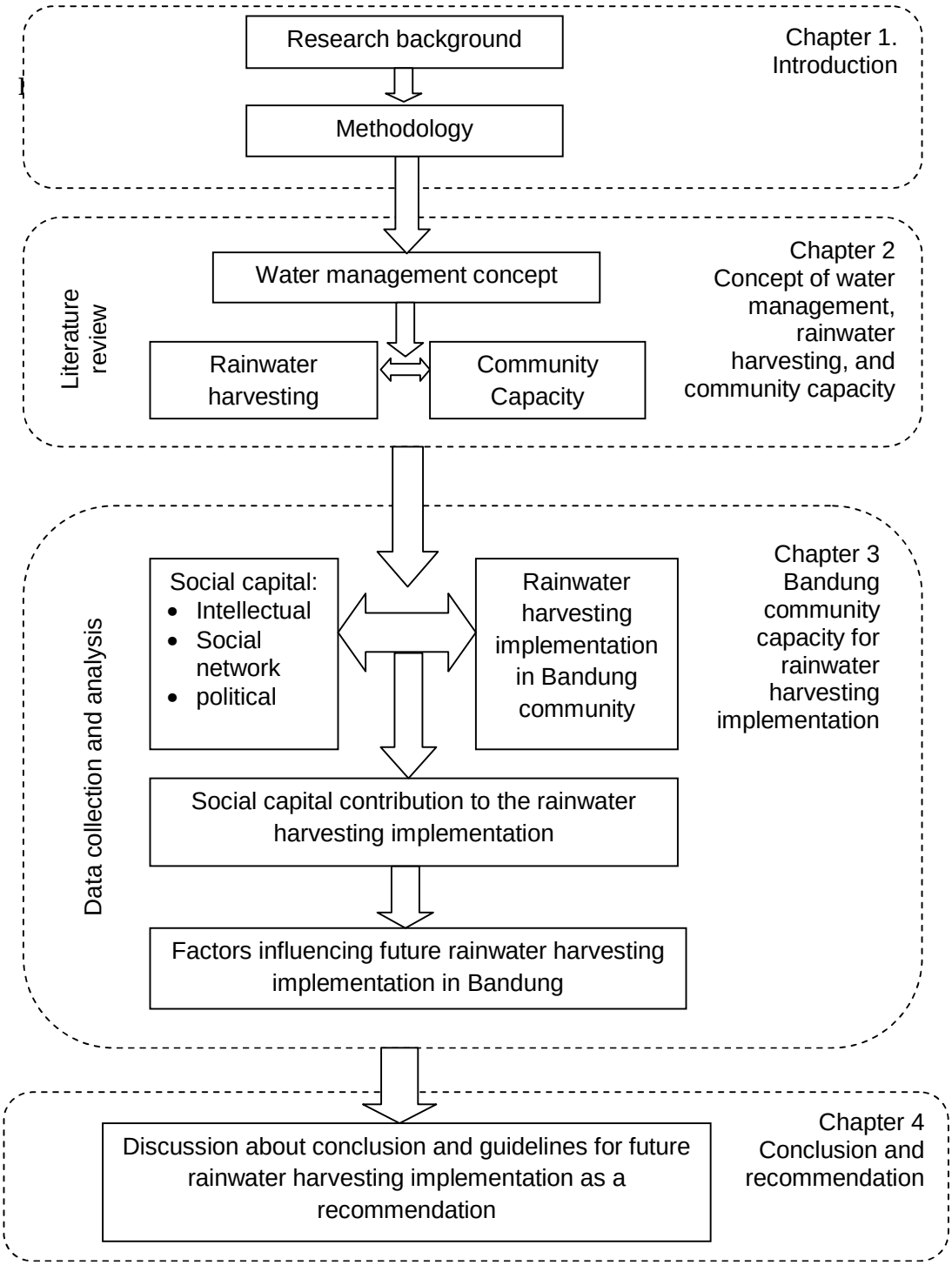
- Developing guidelines for implementation of rainwater harvesting in Bandung based on factors that influence the social capital.

The description about the assessment of social capital and the relation with rainwater harvesting is served in Chapter 3. Finally the guidelines for future rainwater harvesting in Bandung community are drawn in chapter 4 as the recommendation.

1.8 Research Structure

This research consists of four chapters. These four chapters include four main research activities: introduction, literature review, data collection, and data analysis. First of all, chapter 1 reviews research background and development. Secondly, chapter 2 explores the literature on water management, rainwater harvesting, and community capacity. Accordingly, a theoretical framework to approach community capacity that influences the rainwater harvesting implementation is introduced in this chapter. Finally, data collection is described and analyzed in chapter 4. Then, the conclusion and recommendation is discussed in chapter 5. This structure is drawn in this figure 1.2.

Figure 1.2 Research Structure



CHAPTER 2. WATER MANAGEMENT AND COMMUNITY CAPACITY AS AN INFLUENCE FACTORS FOR RAINWATER HARVESTING IMPLEMENTATION

This chapter reviews literature on water management, rainwater harvesting, and community capacity to approach an understanding about water problem in Bandung and highlight the potential of rainwater harvesting implementation. The first section discusses water management to get basic understanding about water problem and emphasize alternative water resources problem, including Bandung water problem and its solution. Furthermore, the exploration of alternative solution for water problem in Bandung highlights the rainwater harvesting method. The following section discusses about rainwater harvesting method, including definition, requirement, and example of rainwater harvesting implementation, are thus reviewed here. Moreover, the implementation of rainwater harvesting needs participation from the community. Therefore, the next explanation is about community capacity as the influenced factor in rainwater harvesting implementation. Due to the extensive literature on community capacity, following discussion on this issue is oriented to find out social capital that are considerably significant to attain the successful of rainwater harvesting. Finally, it explained some criteria used to assess social capital in Bandung community.

2.1. Water management

Water management becomes an important consideration in most countries because it is getting decrease due to the rapid development. Some international agreements highlight community participation and the search of innovative method in seeking new solution for water resources. These agreements influence Indonesia’s water management as well. New solutions that involve community

and innovative but suitable with Indonesia condition should be sought. This explanation can be seen below.

Water resources problem

No doubt that water is one of the most precious resources for every living thing, for instance drinking, daily basis activities, not to mention other needs like industry and agriculture. Nowadays, water demand is increasing as an effect of population growth. Hinrichsen in World Water Development Report 3 (2009) said that the growth of the world's population about 80 million people a year, is proportional to an increase in water demand by about 64 billion cubic meters a year. However, water resources are finite and not renewable. Therefore, water resources should be managed carefully.

Even though water resources are limited, it also can cause several disasters if it is not well managed. Human activities such as urban development can cause flood, agricultural or industrial land uses may deplete ground water, degrade water quality, or drain (Woltjer, 2007). Nowadays, human activities are increasing as an excess of population growth. Development and population growth requires more land to be cultivated and causes environmental stress on water. Parker (1999) also argued that urbanization worsens floods by reducing the permeability of ground surfaces and increasing runoff rates. Consequently, there are a growing number of disasters caused by water.

Furthermore, the importance of water resources and the negative impacts of rapid development cause the increasing concern of water management. Some countries discuss and search the best alternative solution to keep the water resources from degradation. Next section discusses about some agreement from countries that concern with water resources problems.

The international water management consideration

International consideration about the importance of water management rose in 1992, as it stated in "Dublin Statement" (ICWE, 1992) and "Agenda 21" (UNCED, 1992). Those documents present early international consideration about better methods to manage water resources to serve people without damaging the environment. "Dublin Statement" introduces new approach to the "assessment, development, and management of freshwater resources" that elaborated into several numbers of principles (ICWE, 1992):

1. Water resources are limited and renewable, yet essential to sustain life, development and the environment.
2. Water development and management should be based on a participatory approach, involving all actors at all levels, such as local community, Water Company, government.
3. Women play a central role in the provision, management and safeguarding of water.
4. Water has an economic value in all its competing uses and should be recognized as an economic good.

These are expectedly basic principles for countries to manage water resources problem.

Then, UNCED followed up this recommendation in "Agenda 21" in some more detailed action program. One of this agenda's objectives is to develop "environmentally sounds management of water resources for urban use" (SWITCH, 2006). The specific program of water resources management elaborated in chapter 18, which is entitled "*Protection of the quality and supply of freshwater resources: Application of integrated approaches to the development, management and use of water resources" (*UNCED, 1992, paragraph 18). The general aim of this chapter is "*to make certain that adequate supplies of water of good quality are maintained for the entire population of this planet, while preserving the hydrological, biological and chemical functions of ecosystems, adapting human activities within the capacity limits of nature and combating*

vectors of water-related diseases" (UNCED, 1992, paragraph 18.2). This means that water resources management should be integrated with environment and human activities. In addition, "Agenda 21" gives priority of flood prevention and control measures with innovative technologies, which include local technologies (UNCED, 1992). This opens an opportunity for local community involvement in water management according to their abilities.

In fact, the targets of Agenda 21 principles have not been achieved by far. Until 2002 the urban population not served with water supply only increased from 103 million to 158 million people and urban population not served with sanitation only increased from 458 million to 566 million (WHO-UNICEF Joint Monitoring Programme, 2004). Therefore, United Nation at the Millennium Summit in September 2000 obtained Millennium Declaration. The declaration aimed to achieve Millennium Development Goals (MDGs) at 2015. MDGs consist of eight goals to alleviate poverty in the world's poorest countries (UN, 2000), which include the goalt to "*Halve the proportion of people without sustainable access to safe drinking water and basic sanitation*" (Goals no. 7: Ensure Environmental Sustainability, target no. 10).

To achieve this goal, water management should be improved, especially in urban area where most of water problems occur. It brings several projects, programs and approaches to improve water management. One of these efforts is the "Bellagio Statement□, formulated by the Environmental Sanitation Working Group of the WSSCC (Water Supply and Sanitation Collaborative Council) in 2000. There are some principles necessary proved to achieve the goal to safe environmental sanitation and healthy urban water system (WSSCC, 2000):

1. The main goals of new approach should consider the human dignity, quality of life and environmental security. Moreover, the approach should be responsive and accountable to the needs and demands in the local setting.
2. All stakeholders should be involved in the program. It is in line with good governance principles.

3. Waste should be considered a resource, and its management should be holistic and form part of integrated water resources, nutrient flows and waste management processes.
4. Sanitation program should be kept to the minimum practicable size (household, community, town, district, and city).

All of these principles in international commitment brings to the integrated urban water management approach that consider all parts of water cycle, requirements of water, local context, stakeholders, and sustainability principles (Mitchell in SWITCH, 2006)

Water management in Indonesia

"Dublin Statement" and "Agenda 21" has affected water management in Indonesia. It is because international fund, such as World Bank, repositioned their funding policy for many programs in Indonesia. Furthermore, World Bank took a central role to develop and promote new approaches in resources management, including water resource, based on these international statements. The approaches also aim to achieve the MDGs target, which Indonesia government aims to reduce number of population who don't have access to the drinking water and basic sanitation services into 50% in 2015 (PAMSIMAS, 2009).

There are some strategies to achieve the MDGs target, including privatization of PDAM and community-based water provision program. Privatization of PDAM is expected to treat water as an economic goods, therefore water use should be efficient. However, so far PDAM service still not sufficient to achieve the target. According to World Bank report (2009), PDAM services only reach around 18% population in Indonesia. Moreover, World Bank funding in many local level programs, especially in poor settlement that helps to enhance their access in water supply. One of the programs funded by World Bank is PAMSIMAS[2]. PAMSIMAS is a community based program held in 15 provinces from 33

[2] Penyediaan Air Minum dan Sanitasi Berbasis Masyarakat (PAMSIMAS): drinking water and sanitation supply program on community based.

provinces in Indonesia, especially in the poorest area. The aim of this program is to provide drinking water and sanitation system for poor people. Even though this program covered 110 municipalities/regency and 5,000 villages (PAMSIMAS, 2009), the other areas are still facing water problems.

However, these government strategies are still far from target achievement. It is still difficult for many people to access water and it is getting worse because of water supply degradation. Consequently, community has to seek alternative solution for their water problem by themselves. It brings to the search of innovative approaches to find other water resources. Considering the facts of degradation in quality and quantity of water surface and ground water in Indonesia in response rapid development, rainwater hereby can be one of the best solutions. This method provide alternative water resources for area that not accessed by government water provision. It also helps to reduce water runoff. Therefore, it is important to explore the possibility of rainwater harvesting implementation.

2.2. Rainwater harvesting

Rainwater harvesting is suitable in areas with high rate of rainfall and limited water supply system. It is an activity to collect, store, and use rainwater from some impermeable surfaces, such as rooftop, yards, parking lots, before rainwater reaches the aquifer. This collection of rainwater could be used for several activities as washing, flushing, watering the garden, etc. In large scale, rainwater harvesting could also reduce runoff when the rain falls. It is important for municipalities with combined sewer systems, because excess runoff during heavy rain leads to the discharge of raw sewage from outfalls when treatment plant capacity cannot handle the combined flow (Helmreich B & Horn H. in Hamonangan, 2011). Asdak (2007) states that the amount of harvested rainwater is varied, depending on the topography of catchment area and the ability of surfaces to hold the water. Rainwater that could be harvested is between 30% of rainfall from pervious and flat surfaces until 90% from impervious and sloped

surfaces. Rooftops also represent a large portion of paved-over areas in a city (40%), where rainfall cannot be absorbed into the ground (OPWD, 1994).

According to Asdak (2007), there are two general methods to collect the rainwater: roof and ground catchments. Roof catchment is a method to drain rainwater from the top of the building. The ground catchment collects rainwater from the impermeable surfaces on the courtyard, road, parking lot, and so on. Asdak (2007) divides the equipment of rainwater harvesting into three part, collector, conveyor, and storage. Collector is the roof or other impermeable surfaces where the rain falls in. Then, the rainwater is collect in the conveyor, such as gutter. Sometimes the collection of rainwater still contains of pollutant, from coal burning buildings to bird feces. Therefore, the conveyor is usually equipped with filter, to separate the pollutant from water. The pollutant is streamed into the drainage system, and clean water is stored in the storage. The example of collecting rainwater from the roof can be seen on figure 2.1

Figure 2.1 Illustration of rainwater harvesting method

Source: the innovation diaries, http://www.theinnovationdiaries.com/811/rainwater-harvesting-techniques/

Rainwater harvesting has already applicable in many location, for example in India, Singapore, and Indonesia itself. They have succeeded to harvest rainwater, especially in urban areas. They used rainwater for daily activities. Furthermore, rainwater harvesting is also proved reducing flood by hold the rainwater before it enter to the river or other discharge area. This is the explanation about the implementation of rainwater harvesting:

India

According to the rainwater harvesting website[3], the implementation of rainwater harvesting in India is initiated by Centre for Science and Environment's (CSE). They work within communities affected with water problems and try to find the solution. According to the rainwater harvesting website, CSE succeeded in implementing sixteen models of rainwater harvesting in several urban areas, based on the geographical and geological characteristics. For example, models in sedimentary terrain are different from hilly terrain. They also use different forms of rainwater collection, such as rooftop and surface water harvesting.

Based on CSE monitoring in eleven from sixteen models projects, it shows that rainwater harvesting causes the increasing of quality and quantity of groundwater. It means that rainwater harvesting could benefit for groundwater recharge. Even though, this impact of rainwater to the groundwater discharge requires depth investigation.

Singapore

Another country that succeeded to implement rainwater harvesting according to the rainwater harvesting website is Singapore. Located near Indonesia, Singapore also has high rate of rainfall, it is about 2400 mm per year or 200 mm per month. Furthermore, the spatial planning in Singapore has provided adequate water catchment areas as requires, around 50% of their land. However, this abundance of water still could not fulfill water needs in Singapore. Nowadays, almost 40-45% of water supply is from outside Singapore.

Singapore is a small country that has limited land resources. Consequently, most of Singapore residents live in high-rise buildings. Therefore, Singapore government utilizes these high-rise buildings by placed a light roofing to catch the rainwater. Rainwater from the roof is collected in separate cisterns on the roofs

[3] www.rainwaterharvesting.org

and use for water daily needs (UNEP, 2010). Furthermore, based on rainwater harvesting website, Singapore has an advanced technology using modified computer program. It can adjust the volume of water to be pumped and also determine the frequency of such pumping.

Recent study demonstrates that the rainwater harvesting implementation in high-rise building could save 4% of the water used. Furthermore it also saving energy costs required for pumping water from the ground. As a result, from 742 hectares land, consists of 49,000 flats, it could save $ 0.21 per meter cubic water use (UNEP, 2010). Hence, Singapore could save much money from energy and water saving because of rainwater harvesting.

Indonesia

Indonesia Ministry of Environment has already developed twelve methods to collect the rainwater that can be use by all stakeholders, from central, region, until local level. Based on Indonesia Ministry of Environment Regulation Number 12 of 2009, the twelve methods of rainwater harvesting are:

1. Ponds or container to collect rainwater from the roof. This method is simple but it can fulfill basic water need.
2. Retention ponds in open land, such as sports fields, parking area, yards, and road. It designed for restrain runoff to the river or ditch
3. Ditch or trench surrounding farms, mainly in the flat area. it also can be used for other cultivation like fisheries
4. Ponds in the backyards. It needs a place to build the ponds.
5. Water catchment area by using porous paving block or grass block in the yards or parking lot
6. Embankment to keep the erosion in the yard. It also keeps the rainwater in the yards, so the rainwater doesn't directly flow to the river. Moreover, this method may increase groundwater supply

7. Soil pit. It digs 1 m X 2 m X 1,5 m hole in the yard area. the hole is covered by soil that can be use for plan trees or organic waste disposal.
8. Landscape design by built basins or small ditches in the yards for aquaculture or yard's ornament
9. The establishment of conservation area. Government could establish water catchment area as the conservation area. This area could also be use as rainwater harvesting area.
10. Retention ponds area or artificial lake in settlement area. the water could be cultivated as drinking water or irrigation
11. Revitalization of lake or dam. Lake or dam is a big rainwater harvesting system that integrates the hydrology system with ecology system. Collection of rainwater in this place could keep the ecosystem sustainability
12. Forest and plant. Big trees in the forest or plantation support the water cycle, which catch and store the rainwater in the ground. This method also includes replanting in urban or rural area.

In short, there are big ranges of rainwater harvesting methods that means by the government. However, some methods could be done on the community level, like the methods implemented in the yards. It means that the government expects community involvement in the rainwater harvesting activity. Furthermore, government also provides the technical guidelines for those who want to build infiltration wells in order to collect rainwater in the yard (SNI[4] No SNI 03-2453-2002).

Even though there are regulations and guidelines to harvest the rainwater, this method is still rarely implemented in Indonesia. Although several the rainwater harvesting implementations are found in rural areas or in individual house, it is still hard to find the implementation in urban areas. For example, rainwater harvesting has been implemented in Klamalu village, Sorong Regency, West Papua and Sukaraja village, East Lombok Regency, West Nusa Tenggara (location can be seen on figure 2.2). Program in Klamalu village is initiated by

[4] Standar Nasional Indonesia (SNI) – Indonesia National Standard: government guidelines

UNICEF as a part of UNICEF program for local community sanitation enhancement. To support sanitation program in Klamalu, UNICEF helped local community to build the water tank to restore the rainwater (UNICEF, 2008). Hence, local community has access to clean water. The other example of rural area that already implemented rainwater harvesting is Sukaraja village, East Lombok regency, West Nusa Tenggara. West Nusa Tenggara is an area in Indonesia that has a high rate of rainfall (1000-2500 mm per year) but for 3-4 months only (Alkasuma et al in Surahman et al, 2011). According to Surahman et al (2011), local communities in Sukaraja village has a tradition to collect rainwater, especially for irrigating their rice field. Rainwater is collected by placing private small water tank in the higher place of their rice fields. The rainwater collects in the rain season, and it is used in the dry season. They use the collected water to irrigate their rice field, bathing their cattle, and other water needs. This method is privately implemented, even though almost all farmers use it in their land. This tradition has been applied for years and used for their agricultural activities.

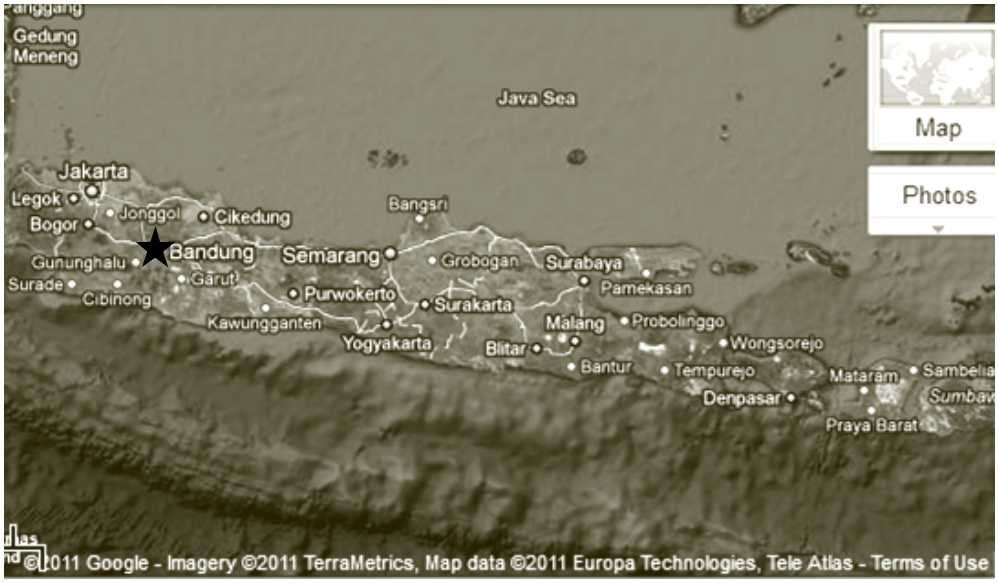
Figure 2.2 Location of rainwater harvesting implementation sample

Source: google map

According to its benefit, Indonesia should encourage the implementation of rainwater harvesting, especially in the area that faces water problem. Furthermore, Bandung is one of the cities in Indonesia (Location can be seen on figure 2.2) that actually has some suitable characteristics to implement rainwater harvesting, such

as high rate of rainfall, limited water provision, and flooding problem. First, based on information from Bandung government website, in 1998 Bandung average rate of rainfall 200.4 mm and the average number of rainy days is 21.3 days per month. This rate is higher than the Indonesian average rate of rainfall, which is only 146 mm. Bandung average rainfall in every month is illustrated in table 2.1.

Figure 2.3 Bandung Map



Source: google map

Table 2.1 Bandung average rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mm	240.3	207.4	223.9	241.4	174.4	73.2	63.5	64.6	78.1	144.6	258.6	253.9	2020.2
inches	9.5	8.2	8.8	9.5	6.9	2.9	2.5	2.5	3.1	5.7	10.2	10	79.5

Bandung data derived from GHCN 1. 309 months between 1921 and 1975
Source: www.worldclimate.com

Moreover, government has a limited ability to provide water supply in Bandung as explained in chapter 1, PDAM only serves 65% households in Bandung municipality and 14% households in Bandung regency. The other households fulfill their water needs from other resources, such as river, groundwater, and springs. Due to the rapid development, water quality and quantity is decreasing. It is because waste water from industry and domestic activity that directly

discharged into the rivers polluting the water and causing sedimentation. Consequently, there is degradation in groundwater for almost 2 meter per year (Pikiran Rakyat newspaper, 2006). In addition, according to Ir. Soepardiyono Sobirin, member of Dewan Pemerhati Kehutanan dan Lingkungan Tatar Sunda (DPKLTS), water resources in Bandung in the dry season is only 10% from total water demands or 28.750.000 m3/year with a bad quality. It is not enough to fulfill water demands that reach 182.500.000 m3 (Pikiran Rakyat, 2007).

Finally, rapid urbanization and population growth also causes flooding in Bandung. Seasonal floods usually happen in certain parts of the city, especially in the south part of Bandung, both of Bandung Regency area such as Bale Endah and Dayeuhkolot and Bandung Municipality area such as Gede Bage. However, flooding worsen since the north part of Bandung also attacked by flood, especially in the areas surrounding Cileuncang River (Location of floods can be seen on Figure 2.3). A lack of proper sewage system of the city caused the inability to absorb such high levels of runoff water, resulting in flooding. This situation can be a huge problem in the future if we are not dealt seriously.

Figure 2.4 Bandung flood location

In order to solve this water problem, both of Bandung municipality and Bandung Regency government have already issued several policies, such as Bandung Municipality spatial planning 2004, Bandung Regency strategy for flood prevention, and Bandung Municipality Regulation about development of building

or housing requirements. Bandung Municipality Spatial Planning 2004, article 14, states that programs to develop water supply infrastructure and to provide clean water can be done by building retention ponds, developing artificial lake and water discharge, and also enhancing water services. This regulation is implemented by developing artificial lakes in Saguling and Gedebage, establishing conservation area in the north part of Bandung, and developing water supply system in Cimenteng.

Bandung Regency also has several strategies to cope with water problem. According to Bandung Regency official website, Drs. Asep Syahdiana, one of Bandung regency officer, says that Bandung regency has several big strategies for flood prevention implemented in area around Citarum River, Rancaekek, Baleendah-Dayeuhkolot, Majalaya, and Banjaran areas. He said that the strategies divided into three periods:

- Period 1 (2011-2015): Curug Jompong technical engineering, Tegalluar dam development, polder development, river normalization, forest village community institution empowerment, land rehabilitation and reforestation, and environmental pollution control
- Period 2 (2016-2020): settlement ordering along Citarum river, natural conservation in north Bandung catchment area, and land use change supervision
- Period 3 (2021-2025): land rehabilitation and reforestation. The government also tries to change the livelihoods of farmers into cattleman or fisherman

Moreover, Bandung municipality also appeal the citizens to built rainwater disposal system in every house by release Bandung Municipality Regulation number 14 Year 1998 about water resources in building or housing. It states that every house should provide water 60 liter per person per day. Moreover, it also regulate that every house or building should have rainwater disposal system to anticipate the five-year intensity rainfall. Therefore, houses with the groundwater more than 10 meter have to build retention ponds. This regulation actually opens the opportunity to implement rainwater harvesting in urban area.

However, the rainwater harvesting in the Bandung haven't been implemented yet. The implementation require several influence factors to consider, for instance physical condition, technical factor, economic situation, politic situation, regulation, and social factor. This research will focus on the social factor within the community. It is because rainwater harvesting should be implemented on the community level. Hence, it is important to understand the capacity of community to implement this method, as discussed in the next section.

2.3. Community Capacity

As Few (2003) states that in the policy making process it is not physical and financial resources important to identify, but also human and social resources. In reality, this is necessary since the awareness of the community in the environment and policy making process is increasing. Nowadays, "working with communities", "bottom up approach" "collaboration" has become new phenomenon of policy making. The program fostering social inclusion and engendering a sense of community is believed to enhance the policies, which helps in the reduction of social conflict (Centre of Urban and Community Research, 2005).

Moreover, the successful of working with communities depends on community capacity. There are numbers of definitions about community capacity, including definitions from Healy (2001), Gittel and Vidal (2002), and Chaskin (2001). Healy (2001) defined community capacity as the capabilities that exist within communities and within the networks with outside communities in the civil society. Community capabilities to act base on their own values and priorities may strengthen individual and community itself. In short, community has the capacity to act on their own capability. Gittell and Vidal (2002) define capacity as the "potential for community residents to act on collective commitments, interests, and objectives." Chaskin (2001) give further explanation about community capacity as the interaction of human capital, organizational resources, and social capital existing within a given community that can be leveraged to solve

collective problems and improve or maintain the well-being of that community. It may operate through informal social processes and/or organized efforts by individuals, organizations, and social networks that exist among and between them and the larger system of which the community is a part (Chaskin, 2001:7). In short, community capacity presents the capabilities that come from interaction within and between communities based on sets of resources to solve their collective problems and set their own agendas. Moreover, it may strengthen the well-being of communities.

Moreover, there are several resources that support community capacity, such as financial, physics, human, and social resources. In fact, it is hard to find a community with all of these resources. Local communities sometimes face situation with a limited financial, human and physical resources. In that situation social become the only resource in the community that could be used to deal with common problem. Consequently, social capital becomes the key characteristic of communities.

2.4. Social capital

There are many terminologies about the social capital. The literature about social capital is growing fast and has been highlighted in many discussions about community. Social capital is about the value of social networks, bonding similar people and bridging between diverse people, with norms of reciprocity, that enable people to resolve problems and achieve common goals.

Several approaches have used the term "social capital". For instance, social capital was built on the earlier work of Jacobs (1961). He uses the term of social capital to quantify aspects of community life to makes some communities safer and more enjoyable places to live (in Healy, 2001). Bourdieu (1986) explored social capital as "*the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition*" (Bourdieu 1986, p. 248).

Innes (1994) argues that social capital is an interactive governance assets constituting intellectual capital (knowledge resources), social capital (stock of trust and relationship), and political capital (capacity to act collectively). Fukuyama (1997) saw social capital as the existence of a certain set of informal values or norms shared among members of a group that permit cooperation among them' (Fukuyama 1997). Woolcock (1998) defined social capital as *'the information, trust, and norms of reciprocity inhering in one's social networks*' (p. 153). Putnam (2000) defines social capital as the key characteristics of communities where a sense of belonging, cooperation, and trust is the power that should be treated more than resources. This several definition brings to the understanding that social capital is assets in communities that connect each member, based on sense of belonging, trust, and norms, to make the community safer and enjoyable.

Dimensions of social capital could be categorized as bonding and bridging capital (Putnam and Woolcock in Healy, 2001). Putnam divided the dimensions of social capital into bonding capital that links the same people and bridging capital that links different people while Woolcock differentiated the forms of social capital into bonding capital as the people need to “get by” and bridging capital that people need to “get ahead” (Healy, 2001). Dimension of social capital can be different, depends on the aims of community relationship.

Based on Woolcock and Narayan (2000), there are four approaches in social capital theory: communitarian, networks, institutional, and synergy, based on the levels and dimensions of social capital and its recognition of the outcomes that social capital can generate. The differences between these approaches are drawn in table 2.2.

Table 2.2 Four view of social capital

Perspective	Actors	Policy prescription
Communitarian view		
Local associations	Community groups Voluntary organizations	Small is beautiful Recognize social assets of the poor
Network views		
Bonding and bridging community ties	Entrepreneurs Business groups Information brokers	Decentralize Create enterprise zones Bridging social divides
Institutional view		
Political and legal institutions	Private and public sectors	Grant civil and political liberties Institute transparency, accountability
Synergy view		
Community networks and state-society relations	Community groups, civil society, firms, states	Coproduction, complementarily Participation, linkages Enhance capacity and scale of local organizations

Source: Woolcock and Narayan, 2000 in www.socialcapitalresearch.org accessed on July 26, 2011

Communitarian approach

Woolcock and Narayan (2000) identifiy the communitarian perspective equates social capital with such local organizations as clubs, associations, and civic groups. Communitarians, who look at the number and density of these groups in a given community, hold that social capital is inherently good, that more is better, and that its presence always has a positive effect on a community's welfare. This approach assumes that communities are homogenous entities that automatically include and benefit all members and it has the same meaning with productive social capital and perverse social capital. However, it is found in the developing world that demonstrates that a high level of social solidarity or informal groups does not necessarily lead to economic prosperity (Woolcock, 2000).

Networks

Woolcock and Narayan (2000) identify network approach takes into account both advantages and disadvantages of social capitals. This approach focuses on the importance of vertical as well as horizontal associations between people and of relations within and among such organizational entities as community groups and firms (Woolcock and Narayan 2000, p. 230). This approach believes that social capital is built by network in which people connects with other, even with the "disconnect" segments. It supports the "bonding and bridging social capital" dimensions in recent literature from Putnam and Woolcock. However, this approach gives us more understanding about social capital.

Institutional

Woolcock and Narayan (2000) identified that proponents of the institutional view argue that the vitality of community networks and civil society is largely the product of the political, legal and institutional environment. The approach views social capital as a dependent variable where as the communitarian and networks perspectives largely treat social capital as an independent variable giving rise to various outcomes (Woolcock and Narayan 2000).

Synergy

This view attempts to integrate the compelling work emerging from the networks and institutional approaches (Woolcock and Narayan 2000). Three central key tasks for synergy view theoreticians, researchers and policymakers is to 'identify the nature and extent of a community's social relationships and formal institutions, and the interaction between them; develop institutional strategies based on these social relations, particularly the extent of bonding and bridging social capital; and determine how the positive manifestations of social capital cooperation, trust and institutional efficiency can offset sectarianism, isolationism and corruption'.

Based on these approaches, synergy approach is the most comprehensive approach for the subject of this research, because it brings some aspect from communitarian approach, and also recognizes the complementarities of links to the institutions of civil society (Healy, 2001). Healy (2001) argues that different institution can brings into different social capital. It depends on:

- Resources these institutions have.
- The kinds of relationships they have, and potentially have, with communities.
- Other competing agendas and imperatives upon them.

Healey also stated that institutional resources are embodied in social relations and interactions (in Khakee, 2006). It can change continually as interactive processes that shape the opportunity of social learning process. Moreover, Khakee (2006) identifies three capitals that influence the community institution capacity: intellectual, social, and political capital.

- Intellectual capital

  Intellectual capital in this research means the ability of community to transform knowledge and intangible assets into wealth-creating resources. It starts with the knowledge base, and then follows with the mechanism in the community to transform the knowledge into capability to enhance the community capacity. This capital is important component for the institutions. Therefore the intellectual capital should be recognized and mobilized for the benefit of the institutions.

  Healey (2006) argued that intellectual capital is useful for community to develop an understanding about "what's going on" and "how our bits of experience" may be related to what is going on elsewhere. In this research, the range of knowledge about how various way of thinking about the problem existing in the community is the basic knowledge. Moreover, the frame of knowledge including different ways for justifying ideas, making distinctions and observing limitations could alter the knowledge into action that prosper for the community. Finally, the openness and learning sense of new ideas and new sources of information will enhance the community knowledge.

- Social Network capital

  The interaction between actors within community is the important factor that will help community to build institutions, to commit themselves to each other, and to knit social fabric. Hayek (1992) states that human institutions will serve human purposes only if they have been deliberately designed for these purposes, often also that the fact that an institution exists is evidence of its having been created for a purpose, and always that we should so re-design society and its institutions that all our actions will be wholly guided by known purposes.

  The criteria to identify and evaluate social capital in this research are:

  - The range of social relations: extent of stakeholder involvement, nature and functioning of various network
  - The Linkages between networks, including density of interconnections, relation between core and peripheral network, integration between networks (Khakee, 2006)
  - The power relations holding networks together.

- Political capital

  Competing agendas or imperatives upon the community that may influence community institution works is political capital. Political capital related with the capacity to act collectively base on common goals to change the established ways and find new opportunities within the established power (Khakee, 2006). Through learning and developing trust and generating a capacity to act collectively, it will enhance the capacity of community as well as individual capacity. Moreover, effective mobilization methods may help community to act collectively within the power structures. Change agents also important to initiate community action and trigger the change the perception in the community and brings to the community action.

The criteria to assess political capital include:

- Opportunity structures: decision making process within the community, stakeholders' access in decision making process
- Mobilization methods: range of techniques, adaptation, consensus building, and organizing collective action
- Change agents: key person who has the ability to change community perception and encourage collective action

These three indicators are believed shape the institution capacity in civil society. It is important input for policy making to formulate institutional strategies, especially to promote positive manifestations in the civil society. Furthermore, Healey (1997, in Khakee, 2006) promoted some criteria in social capital assessment to ensure social capital as "moral commitment to places" rather than only short-term returns. These criteria include:

- Rational perspective or achievements of substantive objective
- Learning perspective or behavioral change
- Institutional perspective or forging and maintaining links and relations
- Democratic perspective or involvement of stakeholders

Accordingly, the indicators that used to identify social capital in this research is illustrated in Table 2.3.

Table 2.3 Social capital and its assessment indicators

Type of social capital	Criteria	Indicator
Intellectual capital	Range of knowledge, frame of knowledge, learning sense	Degree of understanding, sharing knowledge, action based on knowledge and mutual learning
Social-network capital	Range of social relation, linkages between networks, power relations	Extent of actors involvement, characters of networks, frequent of networks, forces linking networks
Political capital	Opportunity structure, mobilization method, change agents	Decision making process, stakeholder's access, techniques of development new action, key persons

Source: researcher interpretation based on Khakee (2006)

CHAPTER 3. BANDUNG COMMUNITY CAPACITY FOR RAINWATER HARVESTING

The discussion about water management in chapter 2 emphasized the influence of community capacity in water management, especially in the implementation of rainwater harvesting. This chapter explores/ investigates the community capacity, particularly in Bandung. The of community capacity in this research will focus on social capital. The aim of this analysis is to identify the successful of community participation on social program, such as rainwater harvesting. This chapter will be divided by four parts. First part of the chapter will explore Bandung community capacity by outlining the context. Second part is about the measurement of social capital based on three criteria: intellectual, social network, and political capital. Finally it will be linked with the possibilities of rainwater harvesting implementation in Bandung.

3.1. Water problem in Bandung community

This research is held in Bandung, through three case studies in three different areas that represent different type of community. These are settlement area in Dayeuhkolot, Panghegar housing complex and in Lombok Street. It also represents Bandung communities that face water problem, especially flood. The location of these settlements can be seen on Figure 4.1. Then, it follows with the explanation of geographic condition, socio-economy background, and water problem in each location.

Figure 3.1 Case study location

(1) Dayeuhkolot

(2) Panghegar

(3) Lombok

3.1.1. Dayeuhkolot community

Dayeuhkolot is a suburb area in the south Bandung that lies on Bandung regency administrative area. This area is near Baleendah. Both of these areas are located in lower sea level compare with other areas in Bandung. It makes this area is a gathering place of water. Consequently, Dayeuhkolot is known as potential flood area. Furthermore, land use is keep changing from rice field into industrial area. It leads to the declining of water catchment areas. It causes flood when the rain falls.

Dayeuhkolot is an old settlement which was inhabited by native people. However, rapid development in this area causes many immigrants who worked as a labor come and live in this area. They buy or rent a home near their work place. Most of them are work in the lower level jobs based on their education level, senior high school. Therefore, their socio-economic is potential by low to medium income.

Based on interviews with respondents from this area, this community gets the water from the well, although the quality and quantity is decreasing lately. Rapid development of the industrial sector surrounding this area causes the degradation of water supply. Many factories take the ground water up with stronger pump equipment. Moreover, the factories throw their waste to the river without appropriate treatment. It contaminates water resources, including water resources in the well. However, some residents, especially those who cannot afford to buy

drinking water, forced to drink water from the well; even it is not good for their health.

The geographic condition, which Dayeuhkolot is lower than other area in Bandung, makes this area always become submerged of water when the rain comes. Flood happens in certain settlements, mostly residence that placed lower than the road surface. It paralyzed the main access to the city center. Road users must seek the alternative route. However, according to the interview this community representative, in 2005 and 2010, all of the settlement area also experienced with flood. According to the local newspaper[5], in 2010 more than 1.000 houses in Dayeuhkolot were attached by floods. In the worst area, floods is almost 2,5 meter height. Recently, more severe flooding will happen caused by more development in higher land, like in the north of Bandung, and as well as factories built surrounding this region.

3.1.2. Panghegar housing complex community

Panghegar housing complex located in the suburbs area in the south-east part of Bandung. This settlement is located near Gedebage, the primary center for the eastern part of Bandung. The location can be seen on figure 4.1. Therefore, this housing complex is surrounded by both industrial and commercial area. According to Bandung municipality spatial planning (2004), Gedebage was planned as an activity center for the east area of Bandung, including an integration between commercial activity and transportation system. Bandung municipality plans to develop an integrated station that includes road transport terminal, container terminal, and the railway station. However, this plan will make this area growth with more building and less water catchment area.

Located in suburb area, Panghegar housing complex is the middle level of housing that dominated by medium income people. Based on the interview with

[5] _____. 2010. *Banjir di Baleendah dan Dayeuhkolot Meluas.* Pikiran Rakyat on 3 December, 2010. Retrieved from http://www.bandungkab.go.id/index.php?option=com_content&task=view&id=2873&Itemid=22

public figure in Panghegar housing complex, most of residents are migrants from various backgrounds: ethnic, race, religion, and education. However, they can live together without conflict due to these differences.

Related with water supply, the Panghegar community representatives said that:

> "*We are still not served by PDAM (public water utilities). We have to find the other water resources, such as from the well or water vendor. It is estimated that around 40% residents built a well in their house. The other, 60% of residents, who cannot afford to build a well, have to buy the water from water vendor. Water vendor sells water with the price Rp 1,200 per 20 liter. One household usually needs 200 liter per day, so they have to buy 6,000 liter or Rp 360,000 per month (around $ 40). This is equivalent to 10% of our income*".

Furthermore, residents who have a well face water quality and quantity problems. Once, the community took the water sample to the laboratory. The result stated that the water contains high level of iron and other organic substance which are not good to consume. Moreover, the quantity of water is decreasing because industries and factories surrounding their settlements also use the ground water taken with strong pump equipment. In the future this situation will be worse if the development of this area continued, as planned by Bandung municipality.

Rapid development in Gedebage area also causes another water problem, such as flood. When heavy rain comes, the main street and the houses that lower than the road surface are most likely attacked by flood. According to experience the interviewee, sometimes the flood reached 1 meter height. It affects the transportation mobility, although didn't get into the settlement area. The flood affects the access to the city center. Moreover, flood may cause the damage of vehicle that pass through the flooded area.

Actually the government had anticipated this situation by planning the construction of artificial lakes in Gedebage in 2015 (Bandung Spatial Planning, 2004). However, according to the rapid development plan of this area, it is feared

that this artificial lake could not accommodate the runoff when the rain falls. Flood is still threat this area if there are no other solutions to cope with water problem.

3.1.3. Community in Lombok Street

This community is on the center of Bandung, administratively in Bandung Wetan sub-district. This area altitude is higher than the other areas in Bandung, especially in the southerly area. Likewise, the settlement is near commercial center in Bandung. Due to this strategic location, this settlement gets complete basic service from government, such as water supply, electricity, telephone, and so on.

This strategic location also makes the land prices expensive. Therefore, this settlement is dominated by high-level incomes who afford to buy house in this area. Most of them have a big house with the security guard. Moreover, this settlement is surrounded by commercial building, such as shops, offices, hotels, and the other commercial functions.

Even though this settlement in the center of Bandung and government provide complete infrastructure, but the drainage system is bad. Moreover, rapid developments of commercial activities have decreased the water catchment area. As a result, this area sometimes flooded during the heavy rain. According to Detik Bandung news, in April 16, 2011, flood attacked some location in the center of Bandung, including Lombok Street. The rain has only dropped for 40 minutes, but the 5- 25 cm height flood occurred for 30 minutes in this location (Detik Bandung news, 2011). It is a bad sign, because this area is higher than the other areas. Therefore, if this area has already threat by flood, the lower areas must be attached by the worse flood.

According to the respondents in Lombok Street, most of the residents in this settlement get water supply from PDAM services. In addition, some residents still use the water from the well. According to the interviewee, the quality of well

water is better than the water from PDAM. Besides, the quantity of well water is still abundant, even in the dry season. It is because this area is on the water catchment area for Bandung.

The characteristics of these three locations are summarized in this table.

Table 3.1 Characteristics of representative community in Bandung

Characteristic	Dayeuhkolot	Panghegar	Lombok
Physics	Lowland, surrounding by factories	Lowland, surrounding by factories, plans as a an activity center	Highland, center of commercial and business activities
Socio-economics	Low-medium income, different social background	Medium income, different social background	High income, different social background
Water supply problems	No government water supply, degradation of water quality and quantity,		Government water service, individual well with good quality and quantity
Flood problems	Every five years, flood attacked settlement, Flood in the main road causes transportation system disturbance,	flood attach main road during the rain	

Source: researcher interpretation

The research is done in these three locations. This section would involve a synthesis based on interviewees, literatures (journal, articles, newspapers, government reports), and the researcher experience.

3.2. Social Capital

As explained in the previous chapter, community capacity can be assessed by social capital. In this research, social capital will be examined from intellectual, networks, and political capital in Bandung community, especially in the three representative communities.

3.2.1. Intellectual capital

Intellectual capital in this research means the sharing knowledge in the community. It is important because by learning each other, the community will socially construct their understanding of the same even and then share their understanding with others (Brown in O'Donnel at al, 2002). Based on the sharing knowledge, the community may follow with action that gives benefit for their community and individual itself. There are three indicators used to assess intellectual capital: range of knowledge, frame of knowledge, and openness and learning sense. Accordingly, intellectual capital of Bandung community is assessed by these three indicators.

Range of knowledge

Rainwater harvesting will be implemented if the community know about the method and its benefit for them. There is a range of knowledge among communities resulted to the different perception and consideration of rainwater harvesting in the community.

Based on the interview, all of these representative communities have not implemented the rainwater harvesting yet. Therefore, the rainwater harvesting concept is only limited to the understanding about rainwater harvesting concept. According to the interview, all communities understand rainwater harvesting is an activity to collect rainwater as an alternative water resource. There are two perception about rainwater harvesting methods, ground and roof catchment. First, ground catchment is understood as an activity to built retention ponds in the yards or an open area in community. In their perception, this technique of rainwater harvesting requires more space, money, and complicated equipment. Therefore, rainwater harvesting is still not their priority to implement. Second, some communities recognize rainwater harvesting as an activity to collect rainwater from the rooftop. It could be implemented in their house, for example in Panghegar community is found a few household that implement it individually. However, there are many households are still not implemented because they do not feel it is necessary to implement since they already has adequate other water resources from the well or PDAM (especially in Lombok community).

Moreover, there are different perceptions according to the implementation of rainwater harvesting in these representative of Bandung community:

1. Community Dayeuhkolot considers rainwater harvesting as an activity to built common retention ponds. They argue that they don't have enough money and space to built the retention ponds
2. Community Panghegar also argue that common retention pond require space that is limited in their area. However, the rooftop method is also known and implemented in some houses individually.
3. Community Lombok argue that they don't see the importance of rainwater harvesting implementation in their community because their community has already have adequate water resources, both from the well and PDAM services.

Frame of knowledge

People have their own frame of knowledge, but on the other hand their knowledge also framed by social background. As Healey (2006) argued that social life is socially embedded, we are all active agents in the construction of our own lives but also "socially constructed". Accordingly, community perception about rainwater harvesting is framed by their perception but on the same time an interaction among the community member will form the common perception.

Communication among the community member is one of the ways to share their knowledge and shape the common knowledge. Related with the implementation of rainwater harvesting, there is different communication type among the community member in these three locations. First, Dayeuhkolot community has discussed about rainwater harvesting implementation. Once in the community meeting, RT leader have talked about government appealing to collect rainwater in every house. Unfortunately, this topic has never been followed up by government, community, and actors. As discussed above, it is because community feels that they cannot afford to do this. Moreover, the community representative stated that there is no support from government to follow it up. Second, based on interview with respondents from Panghegar community, they never discussed the rainwater harvesting application among community member. Thirdly, Lombok

community also never discussed this method. Based on socio-economic condition in this community, they already have sufficient resources, such as water, financial, and so on. Therefore, they don't feel the rainwater harvesting is necessary to discuss and implement.

The openness and learning sense

Sharing information and knowledge among the community member will succeed if there is the openness and learning sense in the community. By accepting other knowledge and discussed it together, community may build community knowledge and act based on the same perception.

Related with rainwater harvesting implementation, there is still limited application of rainwater harvesting in Bandung communities. It is because there is still limited discussion about rainwater harvesting. From all of the community representatives, only Dayeuhkolot community that has been discussed the rainwater harvesting. Moreover, other source on information that frequently accessed by community, for example television, newspaper, internet, is still underutilized as information source for rainwater harvesting implementation. Most of respondents said that they ever heard about rainwater harvesting from television, newspaper, and internet source. But it never discussed with other community member, so there is no consideration to implement it collectively.

3.2.2. Network capital

A network of social relation is the core dimensions of social capital. It shows the structure of the community based on norms of trust and reciprocity within the community members (Stone, 2001). The structure of community is important to understand how the community works. In this research, network capital is assessed by exploring the range of social relations, the linkages between networks, and the power relations.

The range of social relations

The range of social relations can be seen on how often the community interact and involve in community action. This is a basic requirement for community capacity building. Therefore, it is important to recognize the relations among the community member before implement social program in the community.

Based on dimensions of social capital, there are two types of social relations, bonding and bridging capital. Both of bonding and bridging capital are found in Bandung community. Bonding capital can be found in Dayeuhkolot and Panghegar community. All respondents in these locations agreed that there is still an interaction between the community members, community meeting and other social gathering is still regularly held, and some public figures are identified and respected by all community members. The community members know each other and they often talk with each other. Even though respondents from Panghegar stated that in the recent days, the social network in this community is decreasing. Based on respondent's opinions, it is because the community members busy with their work and don't have much time to socialize with their neighborhood. Putnam (2000) argued work pattern may influence the community engagement. Financial demands in the family caused people work harder and some housewives are forced to work in order to increase family income. Respondent in Panghegar also found that there is a change in community participation type. People prefer to donate money rather than their time and energy. For example, when there was a theft, the community agreed to hire the security guard while in the past the community was still willing to take turns in watch their environment at night.

Moreover, different social capital dimension is found at Lombok community. This community has a bridging capital since less interaction is found in this community. Local institution, such as RT organization, is only functioned for government affairs, such as issuance of identity cards, election, and distribution of government announcement. Respondents in Lombok community said that there is no social relation among the community member. As Moser (in Few, 2003) stated that "the more assets people have, the less vulnerable they are, and the greater the erosion of people's assets, the greater insecurity" (Few, 2003:52). Based on physics and social-economic condition of this community, they already have

adequate resources, such as financial, adequate government services, good quality of water resources that make them secure. Therefore, the community institution, such as RT, is only a bridge that links community with government, especially for government affairs.

In conclusion, there are different dimensions of social network in community, bonding and bridging capitals. Bonding capital is found in less income community, such as Dayeuhkolot. In medium level income, like Panghegar, bonding dimension is also found; even the social relation is decreasing. Bridging capital is found in Lombok community, which dominated with rich people. Based on social economy condition of each community, it is found that the richer they are the less they interact with each other. It is because the more assets people have, the more people can cope with their problem so they do not need others help.

The linkages between networks

Most of community in Indonesia stresses the role of Rukun Tetangga (RT)[6] as a linkage for social network. RT organization becomes the center of the community network since it is the lowest level of community institution. Social problems are first discussed in RT organization. Therefore this research focuses on RT organization as a medium linkage between community members.

In bonding community, such as in Dayeuhkolot and Panghegar, community meeting is a media to sit together discussing common problems that occur in their community. According to the respondents' information, RT caretaker usually invites public figures and other community members if there are some information from government or crucial issues that important to discuss.

Moreover, there are several regular social gathering, such as "arisan"[7] or religious meeting, which held by housewives. Housewives usually meet and share information informally. In fact, this is important media to share information among the community member. Housewives has a central role in family, therefore

[6] Rukun Tetangga (RT) is a local community organization in Indonesia. It is built by local community, but acknowledged by government. RT leader is voted by the community member. RT consists of 30-50 households based on spatial location.

[7] Arisan is an Indonesian social gathering in which is popular among housewives and relatives to meet monthly for a private lottery similar to a betting pool.

the community capacity depends on housewives role as well. When they share information with other housewives, it is equally the same with knowledge sharing in the community.

In bridging community, like Lombok community, any community meeting is never found. They never held a social meeting in RT organization. RT leader in Lombok community said that he has to distribute the announcement letter to each community member if there are some information from government that should be announced to the residents.

In conclusion, bonding community still has media to link with each other while in bridging community there is no linkages between community members.

The power relations that holding networks together and the allocation structure of linking networks

In formal organization, the caretaker usually has power to run the organization, including in holding the community member together and develop the structure. RT caretaker also has the power to keep the organization run and holding networks between the community members. However, RT also an informal organization that based on kinship. RT caretaker cannot ignore the public figures that are respected by the community member. Based on the interview in Panghegar and Dayeuhkolot community, elder and religious leaders are still respected by the community. Consequently, public figures also have power to bond the community members.

Furthermore, housewives also have a role in keeping the social network within the community in informal ways. As explained above, housewives held regular social gathering. This gathering is more frequent than the formal community meeting. Therefore, the relation between housewives is found closer than householders. In sum, the power of housewives connection cannot be ignore in the structure of linking network in the community.

Lombok community is different from the other community representatives. As they have a weak relationship and no medium to communicate, they don’t recognize the structure of community institution except the RT caretaker. Hence,

based on observations, there are no actors that have power to bond the community.

To sum up, there are two dimensions of social capital in Bandung: bonding and bridging capital. Bonding capital is more visible in Dayeuhkolot and Panghegar community rather than in Lombok community. Lombok community has more bridging capital characteristics with government affairs as a bridging factor.

Bonding community can be seen on the tight relationship among the community members. The community members know each other. However, in some communities found that the social networks are getting less because of the work pattern. For example, the type of participation has changed from directly involvement into financial support.

Bonding community also can be seen on community meetings that usually held to discuss community problems. In the community meeting, public figures influence is needed to maintain the bonding between community members. Moreover, we cannot ignore housewives role in bonding community. They usually held regular social gathering or religious meeting. This regular meeting is important for information sharing.

3.2.3. Political capital

Rainwater harvesting is not only seen as the action to cope with water supply problem, but also as a community action to participate in urban water management. It comes from consideration to involve in water management that not only aims for the community itself, but also for the urban scale as well. The capacity of community to act collectively as a participation in urban water management may brings to “the opportunity of community to change the established way of doing things” (Khakee, 2006). It is not only about the invention of new working method, but also how it works in the established power relation, such as in Rukun Tetangga (RT) institution. In this research, political capital will be identified in the RT institution based on the opportunity structure, mobilization methods, and key agent indicator.

Opportunity structure

The opportunity structure is an indicator to identify how the community selects their issues, identifies the priorities of agenda, and finds a way that the actors in community can access and approach to collective activities (Khakee, 2006). All of these criteria reflected in community meeting agenda. Therefore, this identification focuses on community meeting process.

According to the respondents, community meeting usually discusses about two topics, government appeal and common problem in the community. Government appeal is one of the main roles of RT institution based on regulation about RT organization[8]. Moreover, common problem that related with water resources is explored to identify the opportunity structure of rainwater harvesting implementation.

Problems in water quality and quantity are the main issues of water problems in community. According to respondents, they ever talked about these issues in community meeting, especially in Panghegar and Dayeuhkolot community. It is a crucial issue when they find the quality of water is getting worse and the water quantity become less during dry season. It affected their daily lives because water is an important aspect in human life. Based on discussion in community meeting, they set several agenda. One of the main agenda is report it to the government. Both Dayeuhkolot and Panghegar community have ever set the action to report it to the government because they believe these problems are government responsibility. Then, community representative report it to the local government. However, according to the respondents, the local government never responds it appropriately. They still found quality and quantity degradation in the water resources.

As conclusion, community meeting is an effective medium for community discussion. They can discuss issues in their daily life and set an agenda. However, there are still difficult to actualize the agenda because some community members

[8] Ministry of Public Affairs Regulation number 7 of 1983 stated RT as a community organization that is recognized and fostered by the government to maintain and preserve the values of Indonesia community life based on mutual cooperation and kinship as well as to help improve fluency task of governance, development, and community in the village

are still not sure. Finally, even the action is implemented; it still cannot influence the other stakeholders, especially local government.

Mobilization methods

The community report seems to be ignored by government. It is because water problems are complex, so the solution cannot handle by government itself. It requires participation from other actors, including community. Indonesian Law Number 7 of 2004 implies that community participation is important in water management.

Based on this law, community participation could be organized by government or local government support or by community initiatives. Related with rainwater harvesting, government support is on the form of regulation and guidelines. In chapter 2, regulation and guidelines about rainwater harvesting are already explained. However, the regulation is not enough to mobilize the community in implementing rainwater harvesting. It requires adequate support to encourage the community willingness to act. Unfortunately, most of respondents in this research stated that government never comes to their community for socializing the rainwater harvesting. There is only Dayeuhkolot community claimed that local government has appealed the community to collect rainwater even the socialization never been followed up with the implementation. According to respondents, it requires stronger government support to initiate the implementation of rainwater harvesting in their community.

Moreover, there are several seminars, studies, discussions about the importance of rainwater harvesting in Bandung. For example, Chay Asdak, researcher in Water Resource and Environment research center (PPSDAL)[9], stated that Bandung municipality should support rainwater harvesting activities as an anticipation for degradation of water supply in Bandung (Pikiran Rakyat newspaper on 22 May, 2009). Furthermore, some individuals have been initiated to harvest rainwater in their own house, as it found in some houses in Panghegar community. But all of

[9] Pusat Penelitian Sumber Daya Air dan Lingkungan (PPSDAL) – Water and environment resource research center

these efforts are insufficient to encourage other community member to encourage the implementation of rainwater harvesting.

In sum, government regulations, guidelines, studies, experts' opinion, and individual initiatives are not sufficient to mobilize the implementation of rainwater harvesting in communities. It needs other mobilize methods to encourage people implemented rainwater harvesting, beside the other factors that influence the willingness of community to act, such as key person or change agent that discussed below.

Change agents or key person who triggers the collective action

Change agent is a person or institution who knows how to encourage community members involved in problem solving action. Change agent could be government, donor, volunteer, public figure, RT leader, or even one of the community members. According to rainwater harvesting implementation, all respondents said that there is no one who encourages them implemented rainwater harvesting in community. Therefore, rainwater harvesting has not been implemented yet in their community.

As a conclusion, political capital in some community has an opportunity structure, which community meeting has ever encourage people did something for solving the problem. They went to government reporting their water problem; even this action cannot change the situation. It is because government itself cannot handle these complex water problems. Therefore, rainwater harvesting becomes alternative solution where community itself solves their problem. Unfortunately, the mobilization methods that initiated by government and community itself could not encourage the whole community to implement rainwater harvesting. Moreover, person or institution, that know how to involved people in rainwater harvesting activity, is also not found. Consequently, the political capital is still insufficient to encourage people implemented rainwater harvesting.

To sum up, the social capital in Bandung communities can be seen on table 3.2

Table 3.2 Social capital identification in Bandung community

Social capital	Indicator	Community representatives			Conclusion
		Dayeuhkolot	Panghegar	Lombok	
Intellectual capital	Range of knowledge	Retention ponds techniques, limited source of fund and space	Infiltration ponds and collect rainwater from the roof, limited space	Rooftop rainwater harvesting, no consideration about the rainwater harvesting	Different perception and consideration of the importance of RH
	Frame of knowledge	There's a discussion but no implementation because of limited resources	No discussion and no collective implementation. But a few households are implemented individually	No discussion, no implementation	Even there is discussion, but it is still not enough to encourage the implementation of rainwater harvesting collectivelly
	Learning sense	Limited discussion and lack of desire to use other information source			
Social network capital	Range of social relation	Bonding community	Bonding community with several signs about social network degradation	Bridging community with government affairs as a bridge	Different type of social capital dimensions

Social capital	Indicator	Community representatives			Conclusion
		Dayeuhkolot	Panghegar	Lombok	
	Linkage between networks	Community meeting is a formal communication medium and "arisan" or religious meeting is an informal linkages between housewives		No communication between community member	Linkage between networks only found in bonding community
	Power relation	RT caretaker and public figures as the main actors while housewives could influence the decision making process informally		No power relations	There is a relation between formal and informal power
Political capital	Opportunity structure	Based on community agreement, they ever tried to report their problem to the government. but there is no respond from the government			
	Mobilize methods	Government appeal to collect rainwater	Regulation, guidelines, studies, seminars, individual pilot project about rainwater harvesting are not sufficient		
	Change agent	Change agents is still not found			

Source: writer's interpretation based on interview with communities' representative, 2011

Based on the assessment above, social capital in Bandung community can be divided into two different social capital related with physical and social-economic condition:

1. Communities in the sub-urban area, such as Panghegar and Dayeuhkolot, that have limited government services and mostly have a lower income, have different social capital compare with communities in central urban area, such as Lombok street, that have sufficient government services and higher income.
2. Communities like Panghegar and Dayeuhkolot consider the importance of rainwater harvesting as an alternative method for water supply, even they are still see more obstacles rather than the benefit of rainwater harvesting implementation. Different perception is found in communities like Lombok Street community. They have less consideration about the importance of rainwater harvesting because they already have sufficient water supply.
3. Communities with limited services and lower income are found more bounded rather than communities with sufficient services and high income. Communities with bounded relationship are maintaining their network through community meeting and taking the time to socialize with their neighbors. This bounded relationship is an opportunity to make the mobilization easier. However, there is a tendency that participation method is changed into less directly involve due to the other occupation in their work.
4. Housewives regular meetings, such as "*arisan*" and religious meeting, are potential for community enhancement through knowledge sharing and encourage collective action. It is because women have strategic position in running a household activity.
5. Related with rainwater harvesting, there is no key agent within the community that can influence the community member's perception to act collectively. But it is also found that public figures are still respected with community member. It is an opportunity to encourage collective action through public figure's appeal.
6. In short, since the rainwater harvesting has not implemented in Bandung community, social capital has not proved contribute to the rainwater harvesting implementation. However, the assessment above shows some

opportunities of social capital to support collective action such as rainwater harvesting. Moreover, it also shows that bounded communities have more opportunity to encourage collective action rather than bridging community.

3.3. Community capacity contribution to the rainwater harvesting implementation

As rainwater harvesting has not implemented in Bandung community, it is still not proved that community capacity can support the rainwater harvesting implementation. But some criteria in social capital is expected give contribution to the rainwater harvesting implementation.

Intellectual capital

Community knowledge about some rainwater harvesting technique is the basic resource of rainwater harvesting implementation. If community has adequate knowledge about the importance of rainwater harvesting and techniques to implement it, it is easier to encourage collective action in community to implement it. Moreover, the contribution of media as a source of information also helps to enhance community understanding about rainwater harvesting.

Social network capital

Social network also contribute to encourage community action. Based on this research, it is showed that bonding community has more opportunity to support social activity rather than bridging community. In bonding community, it is easier to share knowledge because they know each other. Moreover, they have a medium to share knowledge, such as community meeting and other social gathering. Bonding community also has public figure who respected by the other community members. Finally, the role of housewives cannot be ignored because they have an important position in the family and they have more bonding with other housewives through regular social gathering.

Moreover, rainwater harvesting may still be implemented in bridging community with different approach. Even though their social network is weak, they are still

has other capital that can be utilized, such as financial capital, political capital, and so on.

Political capital

Political capital is important factors to mobilize the community in implementing rainwater harvesting. Unfortunately, it is found that political capital in Bandung community is still weak to mobilize the implementation of rainwater harvesting. The mobilization methods and change agent is still not found support community to change their perception about rainwater harvesting. However, there is still an opportunity to enhance political capital by using community meeting and the role of public figure to mobilize the collective action.

3.4. Factors influencing future rainwater harvesting implementation

According to the social capital assessment, it is found that community capacity in Bandung is varied according to physics, social, economic community background. However, there are several general factors that influence future rainwater harvesting implementation in Bandung:

- Appropriate knowledge about rainwater harvesting methods and its benefit influence community perception and desire to implement it
- Sharing knowledge among the community members enhance community knowledge
- Source of information, such as media and government announcement, may affect the community knowledge about rainwater harvesting
- Dimensions of social capital affect the approach to encourage people in rainwater harvesting implementation.
- Community meeting is an important medium to share knowledge, shape the common perception, and encourage the collective action
- Women have an important role to support the action since they are responsible for household activity.

- Community member active participation determines the success of rainwater harvesting implementation
- Mobilization methods based on social economic condition is important to encourage community action
- Key agent is essential to encourage community action

These influence factors are important to consider when rainwater harvesting wants to be implemented in community. In the next chapter, these factors are used to formulate recommendation in rainwater harvesting in Bandung community.

CHAPTER 4 CONCLUSION AND RECOMMENDATION

Based on international agreements and several water problems in Indonesia, alternative solution based on participatory approach, efficiency consideration, and integrated management concept is important to find. The alternative solution comes to the rainwater harvesting method. Rainwater harvesting is a process to collect rainwater and use it for human activity. It can be implemented in households or community level because the method is easy and cheap. This method utilizes rainwater, which was previously not considered as a resource, and often considered as a source of disaster like floods, tsunami, and so on. In fact, rainwater harvesting can provide significant benefits, such as reducing floods and supplying the water in area that experience shortage in water supply.

However, most of community in Bandung is not accustomed with rainwater harvesting method although they face water problems. Based on theory of community capacity and social capital explained in Chapter 2, the possibility of rainwater harvesting is related with community capacity. It also explained how community capacity can be measured through the concept of social capital, including intellectual, social-network, and political capital. These capitals are regarded important to support community capacity when they want to implement rainwater harvesting. Therefore, this research aimed to identify Bandung community capacity which influencing the implementation of rainwater harvesting, through identifying intellectual, social network, and political capital. Moreover, the assessment of community capacities is used to identify factors that could influence future rainwater harvesting implementation, and guide policymaker regarding rainwater harvesting or other social programs in Bandung community.

After synthesizing data from government documents, newspaper, interview results, and researcher experience, it is found that social capital in Bandung community is varied base on physics, social, and economic condition. Moreover, even though rainwater harvesting has not implemented yet in Bandung, there are

several factors in social capital that potential to support the future rainwater harvesting implementation. Next paragraph explains detailed research findings based on research questions order.

Based on social capital measurements, the capacity of Bandung community is varied base on the background of the community. In general, there are two main differences: bonding and bridging community. Bonding community can be found mostly in sub-urban area where the households are low until medium level income and the public services are limited. This bonding is born from the consideration of communal problems that cannot be solved individually. It encourages the sense of mutual needs and awareness to act collectively, as described in part of Chapter 2 about the community capacity theory.

At the same time, bridging community is found in the central part of urban where public services are more complete and the community member is in high level income. Based on community capacity theory in Chapter 2, this community doesn't have enough reasons to act collectively since they can cope with their own problems.

These differences bring to the different approach when rainwater harvesting wants to implement in each community. Therefore, the approach of rainwater harvesting implementation in Bandung should consider several general factors discussed in Chapter 3.

Moreover, it is found that Bandung community capacity is still insufficient to encourage the implementation of rainwater harvesting. it is because several factors are still not achieve, such as:

- Most of Bandung communities still have limited knowledge about rainwater harvesting. Consequently, their desire to discuss and implement rainwater harvesting is still weak.
- Even though government has already formulated some regulations and guidelines for rainwater harvesting implementation, there is no sufficient government encouragement in community level.

- There is no key agent or change agent who encourages the community to implement rainwater harvesting.

Moreover, Bandung community also has several potential factors to implement rainwater harvesting:

- With appropriate knowledge of rainwater harvesting, community perception may change and affected to the desire to implement it
- Distribution of knowledge could use media mass source that often accessed by community
- Sharing with others could affect community perception about rainwater harvesting implementation
- Access to media information, such as television and newspaper could enhance community knowledge
- Bonding community help the distribution of knowledge and the collective action through community meeting
- Women has a main role in the family that could influence the desire to implement rainwater harvesting
- Appropriate mobilization methods supports the collective action to implement it
- Public figures and religious figure could help to influence community perception
- The right change agent could make community want to implement rainwater harvesting

Based on those influence factors, recommendations are built to guide the future implementation of rainwater harvesting in Bandung community. According to the research significance in Chapter 1, the guidelines in this research aim to give recommendations for Bandung local government, both of municipality and regency, as the policy maker in rainwater harvesting implementation. The detail of the guidelines draws in this explanation:

a. First of all, the consideration of community to implement rainwater harvesting is important. With appropriate knowledge about benefit of this method rather than the difficulty of the implementation, community may change their perception about this method. It is hoped to come up the awareness of community to implement this method.
b. To give appropriate information about rainwater harvesting in community, several works can be done.
    - Communication media such as television, newspaper, and so on can be used to share the information of this method.
    - Government appeal can be the other information sources. Based on experience on Dayeuhkolot community, government appeal should be follow up with other support, such as guidelines socialization, mentoring, or action program.
    - Public figure or religious leader who respect by community may give appealing. Their word can be heard by community
c. If community is willing to do this method, it is important to find the suitable rainwater harvesting technique in this community. Based on experience in India (see chapter 2 about the implementation of rainwater harvesting in India), the appropriate techniques depend on geographical and geological condition. Since Bandung has several hills and valley, it is important to consider the geographical of community location.
d. Moreover, the strategy to implement rainwater harvesting depends on dimensions of social capital.
    - Bridging community, such as Lombok community, requires individual encouragement or external coordination. Strategy to encourage individual implementation, such as collect rainwater from each rooftop, built retention ponds in backyards, and the other techniques that can do individually is suitable for this community. Moreover, government or developer initiatives, as implemented in Singapore, could be an alternative strategy. Other actors outside community can initiate the implementation of rainwater harvesting, and then community will contribute with other sources, such as financial

support or provision of land, to develop the rainwater harvesting techniques.

- Another strategy is implemented in bonding community. The encouragement to implement this method collectively will be more succeed in this dimensions of community. Therefore, the strategy in this community is by enhancing communication among community member. Community itself that decide which techniques to implement the communal action such as build a communal retention ponds, collect rainwater from public area, and so on.

e. Change agent is an important factor to initiate the community desire and capability to implement this method. Therefore, change agent should be available. It can be a public figure that community respects. Public figure can appeal to ask community implement this method. The other change agent could be a government with program that initiates people to collect people. Non-government organization, like UNICEF or World Bank, also could be the change agent to support community implement the rainwater harvesting.

f. Women also could have a center role in this action. Women are the actors in community that most understand with community daily life. They have responsible to provide their family with adequate supply, including water supply. Moreover, in some community they usually held regular social meeting. It is a media to share information with others. Therefore, it is important to consider the role of women in this program. With the approach to women, give them adequate information, encourage them, it is an opportunity to implement this method successfully.

In conclusion, rainwater harvesting is an innovative way that in line with integrated water management concept. This method base on participatory approach, considers water as an economic goods that should be used efficiently, considers rainwater as a resources rather than waste, and places women role in the implementation. Moreover, rainwater harvesting also suitable with Bandung

condition that has a high amount of rainfall and limited water supply. Therefore, rainwater harvesting should be implemented in Bandung. However, according to social capital condition in Bandung community, some efforts are needed to encourage people change their perception and mobilize collective action achieving common goals. If it succeeds, it can enhance community capacity as well.

However, this research only focus on social capital as factors influenced rainwater harvesting. In fact, there are several factors that influence the implementation of rainwater harvesting as well, such as technical factors, other actors support, financial support, and so on. Following research to identify other factors that influence rainwater harvesting is needed until this method ready to implement. Based on comprehensive research with several factors, it is will help policy maker to formulate strategy for rainwater harvesting implementation. Thus, it supports water management policy as well.

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APPENDIX 1– LIST OF QUESTIONS

Subject	Questions
1. Community background	- Where is the location of community? - What kind of water problem that faces the community? for example flooding or lack of water
2. Social capital	
a. Intellectual capital	- What does the community know about rainwater harvesting? - Is there any discussion about rainwater harvesting in the community? - Is there any plan to implement it in your community? - From where the community know the rainwater harvesting and its application?
b. Social-networks capital	- Describe the relationship between neighbors? - How do you communicate with others? - What kind of meeting that usually held in the community? - Who usually come to the community meeting?
c. Political capital	- What is the priority that usually discuss in the community meeting? - How is the discussion process in the institution? - Who is the key person who influences the institution decision? - Do all members accept the decision in institution discussion? - Is there any key person or institution that encourages the rainwater harvesting implementation?