Improving Strategies in Dealing with Water Supply Fulfilment and Groundwater Conservation:
Learning from Successful Policies and Practices

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ABSTRACT

The need of water inevitably keeps increasing in line with population growth. Meanwhile, the availability of water is relatively constant or even tends to decrease. This condition makes water become a crucial substance in the future. On the other hand, water can also be viewed as reused and recycled material. Therefore, managing water resource efficiently through good governance seems to be far more important than discussing its physical scarcity. In the case of Indonesia, the availability of water resources is abundant but the condition of service in water sector, especially drinking water, has not been able to suffice the demand. Obviously, there are many obstacles to overcome this problem such as geographical, financial, and technical constraints. To respond this circumstance, improvement strategies are needed.

Formulating strategies obviously requires many considerations. Both constraints and opportunities should be taken into account. Fortunately, various strategies have been practiced worldwide in dealing with drinking water provision. Those strategies are valuable examples to be learned. Furthermore, contingency theory views that there is no one best strategy in dealing with any problems since every problem is context-dependent. This premise can be used as a framework in formulating such strategies for improving drinking water service in Indonesia. In this research, this concept is applied by synthesising local potentials in Indonesia and foreign experiences. Data on potentials is gathered from secondary data published by government and other institutions, while foreign experiences are taken from structured literature study. Following the principles of contingency theory, strategies are selected based on their suitability to the context of Indonesia. Therefore, selected examples mostly come from countries which have similar climate, as well as financial and technological capacity.

Finally, this research would end with suitability assessment of selected examples to the context of Indonesia in order to formulate sort of improvement strategies. The assessment is based physical and non-physical aspects such as topography, climate, population, existing regulations, and so forth. From this stage, eight improvement strategies are promoted to be applied to certain circumstances in Indonesia.

Keywords: *contingency theory, drinking water provision, improvement strategies, lesson learning.*

GUIDELINE FOR USING THESIS

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ACKNOWLEDGEMENT

This master thesis is completed as a partial fulfilment of the requirement for Master Degree from Institut Teknologi Bandung and University of Groningen. I am interested with drinking water issues since water is a basic need of human that must be sufficiently fulfilled. However, recent condition of water service has not sufficed the requirement. This situation, then, triggers people exploits water resources, especially groundwater individually to fulfil their need. Therefore, improvement strategies in drinking water provision should be formulated to respond the situation. Through this research, some recommendations are achieved and are expected can contribute for improving the strategy of drinking water provision.

In this opportunity, my greatest gratitude to Allah Subhanahu Wata'ala, the God Almighty for all His blessings and gifts. I am also immensely grateful to my supervisor dr. ir. Terry van Dijk and Ibnu Syabri, B.Sc, M.Sc, Ph.D for the advice, comment, direction, and knowledge that make this work worthy. I also address my grateful to all lecturers in both ITB and RuG who give me valuable knowledge about environmental and infrastructure planning.

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ABBREVIATION

ADB	: Asian Development Bank
AWBV	: Algemeen Waterreglement Beheersverordening (*General Rules of Water Management*)
AWR	: Algemeen Water Reglement (*General Water Rules*)
BMG	: Badan Meteorologi dan Geofisika (*Meteorology and Geophysics Board*)
BOT	: Build Operation Transfer
BOW	: Burgerlijke Openbare Werken (*Public Works*)
BPPSPAM	: Badan Pendukung Pengembangan Sistem Pelayanan Air Minum (*Development Support Agency for Water Supply System*)
BPS	: Biro Pusat Statistik (*Central Bureau of Statistics*)
CBO	: Community Based Organisation
DAWASCO	: Dar es Salaam Water and Sanitation Company
FAO	: Food and Agriculture Organisation
KKPPI	: Komite Kebijakan Percepatan Pembangunan Infrastruktur (*Committee for the Acceleration of Infrastructure Development*)
km^2	: square kilometre
km^3	: cubic kilometre
L/day	: Litre per Day
m^3	: cubic metre
NGO	: Non Government Organisation
NOAA	: National Oceanic and Atmospheric Administration
OECF	: Overseas Economic Cooperation Fund
P3DT	: Program Pembangunan Prasarana Desa Tertinggal (*Rural Infrastructure Development Programme*)
PDAM	: Perusahaan Daerah Air Minum (*Regional Drinking Water Company*)
Permen	: Peraturan Menteri (*Ministerial Regulation*)
PERPAMSI	: Persatuan Perusahaan Air Minum Seluruh Indonesia (*Indonesian Association of Drinking Water Company*)
PP	: Peraturan Pemerintah (*Government Regulation*)
PPP	: Public-Private Partnership
REPELITA	: Rencana Pembangunan Lima Tahun (*Five-year Development Planning*)
SUSENAS	: Survey Sosial Ekonomi Nasional (*National Socioeconomic Survey*)
TOR	: Term of Reference
USGS	: United States Geological Survey
UUD	: Undang Undang Dasar (*constitution*)
VOC	: Vereenigde Oostindische Compagnie (*East India Company*)
WSSLIC	: Water Supply and Sanitation for Low Income Community

CHAPTER I
INTRODUCTION

1.1 Background

Water undoubtedly is an essential substance in human's daily life. There is no single aspect in this livelihood can simply exclude the importance of water. Therefore, people have been doing various efforts in fulfilling this need and unsurprisingly most of human's civilisations are started close to water resources. Historical evidences show that dealing with water resources has been conducting even from prehistoric age. Mays (2004) noted that the first successful attempt in managing water supply occurred about 6,000 to 7,000 years ago in Mesopotamia and Egypt, and this ancient historical evidence still can be seen recently.

Indeed, water requirement constantly increases as a consequence of the growth of human's population and civilisation. Efforts for fulfilling this need also shifted in line with technology improvement. Water has been being exploited in various methods, such as simply taking water from natural spring or river, digging conventional well, boring deep groundwater well, or even desalinating sea water into fresh water. These kinds of water exploitation methods can bring consequences to the nature since water consumption cannot be divorced from whole hydrologic system (Maimone, 2004).

Furthermore, water is not unlimited resource. Not only that, its distribution is also uneven. From hydrologic perspective, the availability of water in the earth (both underground and surface water) is basically constant. Maidment (1993), as cited by Leap (1999), calculated that the total amount of water in the earth is 1,385,984,610 km^3. It consists of 1,338,000,000 km^3 of sea water, and the rest is fresh water. However, not all of this fresh water can be used for human's consumption, only the 10,530,000 km^3 of groundwater, 91,000 km^3 of fresh water in lakes, and the 2,120 km^3 of water in rivers that essentially can be utilised to fulfil water requirement. Based on this figure, it can be clearly seen that groundwater has a significant portion. Nevertheless, exploiting groundwater excessively can decrease environmental condition. It affects to lowering water

table, and then it will be followed by land subsidence (Babel et al, 2006) and sea water intrusion (Putranto and Kusuma, 2009). In addition, groundwater overexploitation which is the major cause of declining water table implicates to economic disadvantages in terms of increasing pumping cost. (Al-Sakkaf et al, 1999; Bromley et al, 2001; Gupta, 2002).

Based on the reality that water is finite substance and the danger of overexploitation, the use of water is supposed to be well regulated. Besides, the awareness of utilising water efficiently has to be encouraged in order to sustaining this natural resource. Biswas and Tortajada (2010), for instance, argued that discussing water-related issues is not merely about physical scarcity. Different with oil and gas, water basically can be reused or recycled for several times. Therefore, regulating the use of water within good water governance is far more relevant than paying too much attention on its physical scarcity.

However, good governance cannot be generated easily but it has to be well planned. It also requires active participation of many stakeholders as well as normative and institutional framework for executing their roles (Tortajada, 2010b). Not only that, there are different problems faced by developed and developing countries. Developed countries have already established their water supply and sanitation services but management-related issues still need attention. Meanwhile, developing countries is still struggling in providing sufficient amount of water supply to all citizens, on the other hand they also have to protect environment (Tortajada, 2010a). Developing countries has to deal with water scarcity, especially for countries where the shortage of water became their geographical characteristics such as on desert (Bajard et al, 1981). It then is worsened by rapid population growth that happens in most developing countries. Consequently, competition among different interests in utilising waters cannot be evitable (Ruelas-Monjardin et al, 2009). Furthermore, scattered informal settlements that are many in developing countries make networked water supply become technically more difficult to be provided (Aiga and Umenai, 2002.,Akbar et al, 2007). From an institutional perspective, there is also such kind of

institutional failure in regulating and providing reliable water supply for all citizens (Bakker et al, 2008).

By contrast, Indonesia as one of countries that actually rich of water resources is also facing more or less similar problems in dealing with water supply fulfilment. According to Hartoyo (2010) cited in Samekto and Winata (2010), the potential of water that can be utilised annually in Indonesia reach around 6.94 x 10^{11} m^3.

Figure 1.1 Queueing for water
(source: www.antarafoto.com)

However, only 23 per cent of this amount of water has been exploited. From that percentage, a fifth is used to fulfil domestic use and the rest is for irrigation. Within this amount of water resource, scarcity of water is still frequently faced particularly in drought season. And ironically, in rainy season most regions in Indonesia have to deal with serious flood problems. Government is likely failed to manage water issues.

Unsurprisingly, people who are not reached by water supply service then try to seek solution for their need of water individually. Mostly they exploit groundwater on their own properties. They dug well within various depth and type of well in searching consumable water resources. At the glance, it likely does not bring a serious effects and the need of water is simply fulfilled. However, it will implicate on various problems in the long term. Based on this fact it is interesting to be investigated what kind of disadvantages of this trend. This thesis tries to elaborate this issue as well as seek possible solution for Indonesia in dealing with water supply fulfilment. It will be done by learning from several successful policies that have been implemented in several countries. Indeed, the possibility of knowledge transfer from those countries will also be suited with Indonesian contexts.

1.2 Research Objectives

This study is developed by a concern about water supply services in Indonesia that likely has not been satisfying although the amount of potential of water resources is abundant. Because of that, it is important to figure out recent condition of domestic water services in Indonesia. Furthermore, identifying factors which actually cause this circumstance is also essential. On the other hand, this research is also motivated by the awareness of environmental degradation caused by individual water exploitation especially groundwater resources. Therefore, exploring environmental effects of groundwater overexploitation is necessary to be discussed.

Many policies and strategies was successfully formulated and implemented by several countries. Obviously, it might be useful to learn from those success stories. As Biswas and Tortajada (2010) underlined that discussing water-related issues is not merely about physical scarcity but also regulation, it is expected that this research finally will contribute to improve water supply that is in line with environmental protection efforts. These strategies, technically or institutionally, expectantly can be achieved as a result of learning from various successful examples. Indeed, it will be suited with Indonesian contexts.

1.3 Research Problems

Based on those research objectives, exploration of theoretical and empirical aspect of water-related issues and environmental impacts of groundwater overexploitation are conducted through this study. To be more focus, research question are formulated as follows:

1. *What is the relation between water service reliability with individual groundwater exploitation in Indonesia?*

   Through this question, it is expected that the real condition of water supply fulfilment can be figured, the gap between supply and demand will also be identified as well as potential that can possibly be utilised to reduce or even eliminate that gap. And then, relation between the ability of government in

providing reliable water supply will be assessed against tendencies of people exploit groundwater individually. To support this research question, some sub-questions can be derived:

a. How fast the demand of water for domestic use in Indonesia increase in the last decades? And in what way did people fulfil this need?
b. How does the drinking water service in Indonesia enable to suffice the increasing demand?

2. *What are alternative options that can be utilised in order to improve the condition of water supply services in Indonesia?*

Through this research question, the possibility for improving water service in Indonesia will be explored. The discussion will focus on technical and institutional opportunities that probably can be exploited. To elaborate this item, it will be followed by some sub-questions:

a. What kind of water resources potentials and how much of them can be exploited to balance water fulfilment and environment protection?
b. How does recent institutional arrangement enable to regulate and accommodate water provision sufficiently?

3. *What are suitable strategies to be addressed to certain conditions in the context of Indonesia?*

Through this question some solutions that have been practiced to overcome water provision problems will be explored. And then, this list of solution will be assessed if they can possibly be implemented in specific circumstances in Indonesia. Critical factors determining the successfulness of the strategies will be elaborated. Strategies that are quite similar will be grouped into one category, and then the variety in the implantation as well as keys of success will be observed. This expectantly can widen the perspective and understanding in formulating more applicable strategies.

To support this research question, two sub questions will also be formulated:

a. What are the keys of success from those listed strategies to overcome water related issues?

b. What are the pitfalls that should be avoided if those listed strategies are possible to be implemented in Indonesia?

1.4 Research Systematic

In general, the main idea of this research can be seen schematically as picture 1.2. The research begins with a growing concern that individual groundwater exploitation in Indonesia tend to increase. There must be reasons as well as consequences for this trend. Therefore, it is necessary to investigate this issue. Technical and institutional problems in water provision are suspected as the causes. In this research, the discussion will be limited in these two aspects. Furthermore, there are also opportunities to overcome this dilemma. They may come from internal resources that have not been optimised yet, and also foreign experiences that can be taken as inspirations. Synthesising those potentials obviously is valuable in responding current problems. Finally, the result expected from this research is formulating strategies for improving water provision in Indonesia.

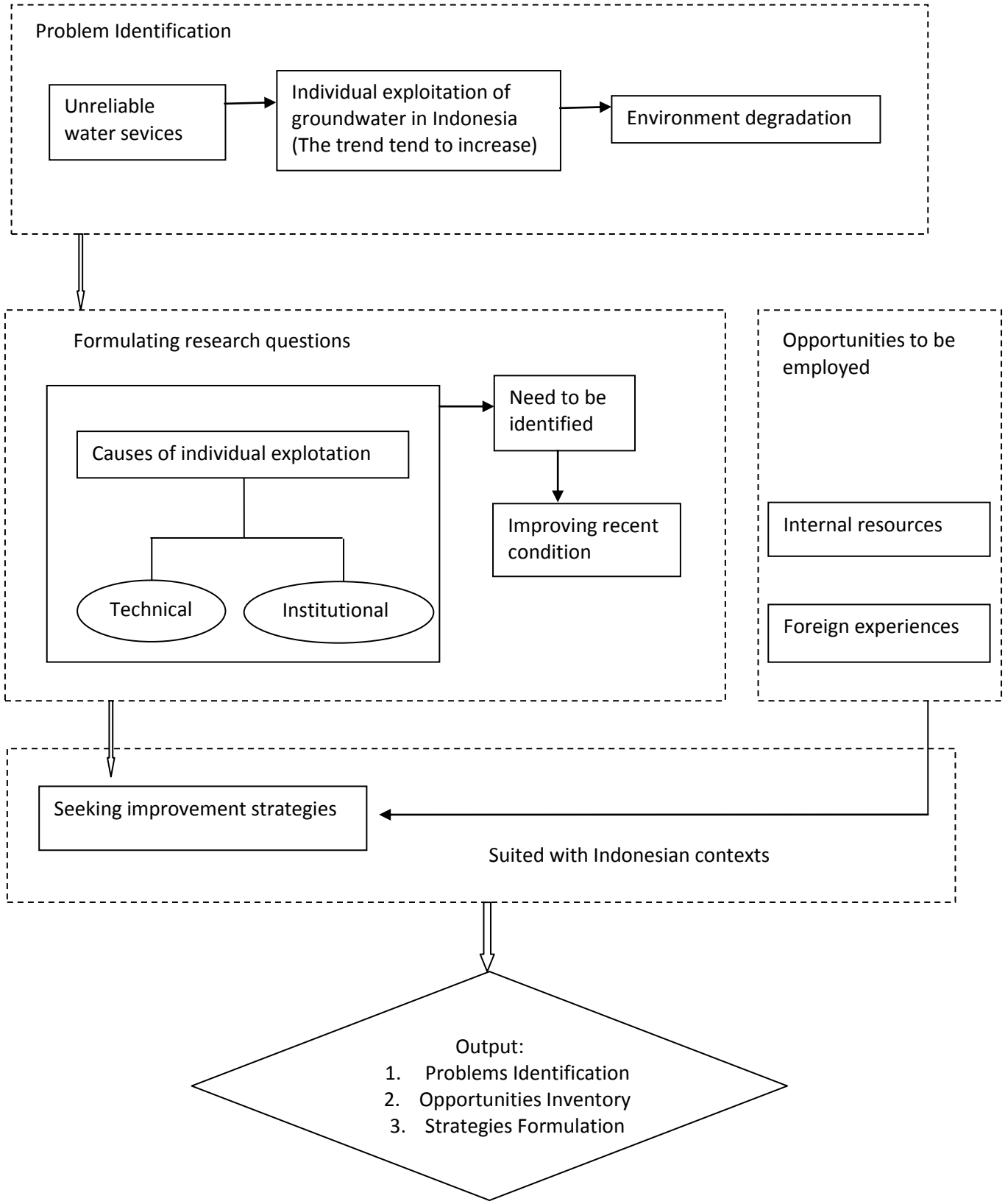


Figure 1.2 Research Framework

Furthermore, to operationalise this research, steps and time allocation is presented by the next section of this research proposal. In addition, intermediate objectives of each step are also inserted.

1.5 Research Methodology

To achieve the objectives of this research and answer the research questions, several steps will be taken. The research will start by identifying current water-related issue in Indonesia especially about water service and its implication to individual exploitation. Information about this issue is collected from various resources such as previous researches, reports, newspapers, and other media. It is expected that problem identification will be formulated based on this information. Furthermore, the stage will be continued by framing theoretical basis for this research. The concepts of water requirement and provision as well as various strategies that can be taken will be elaborated. From this step, water provision issues expectantly can be well understood and various strategies can be listed.

After understanding the most relevant and critical issues, the next stage are collecting the data. There are many possible methods can be undertaken for gathering the data. One alternative is direct observation within field study. Through this method the most recent condition of drinking water service can be understood more factually because information is gained directly. This method is likely more suitable to gain specific and detail data such as in the aspect of engineering, financial, management, and so forth. Direct observation is obviously very useful to describe something in detail and specific explanation, but to discuss the issue within wider perspective at macro level this method seems to be less relevant. There will be a lot of observation within various themes and places in long period if strategy formulation aimed in this research apply direct observation method.

Another option that can be undertaken to satisfy the purposes of this research is revealing people's aspiration through interview. Respondents may come from various groups such as government officers, politicians, private sectors, and communities. Of course, asking people's opinion can reveal their preference and

more suitable strategies can probably be well formulated. Nevertheless, people's preference does not entirely reflect the most appropriate strategies can be implemented to them. It sometimes merely shows their interest respectively instead of their objective opinion.

Based on those considerations, this research will not employ those two methods but it will be done through structured literature study. Data collection will be conducted by gathering secondary data published by government reports, academic journal papers, newspaper articles, and other related materials. Through this method, it is expected that wider figure of the recent condition of drinking water service can be achieved. Furthermore, previous researches that are published in academic journals expectantly can give more scientific perspective in viewing water-related issues. The limited time and budget as well as geographical constraints also become major reasons why this method is undertaken. Collecting primary data through direct observation or interview is very difficult considering how large Indonesia is and the diversity that belongs to this country. It would be impossible to be done in about four months that is given for finishing this research. Therefore, gathering available data that has already published is preferable.

Data on population growth will be useful to view the demand side of water provision. On the other hand, data on the service coverage of the water companies represent the supply side of water provision. And then the relationship between the quality of water provision services and individual water resource, such as groundwater, exploitation will be explored through literatures. By this method, the first research question expectantly can be answered. Therefore, the uses of available literature and other text materials, which are relevant to the research questions such as the books, journal articles, seminar proceedings, working papers and secondary data from official documents, unpublished materials, newspapers, and other sources from internet is very helpful.

To answer the second research question, the data of potential water resources, water policies, and social economics circumstances will be very useful. Through this information, possible opportunities will be listed in order to improve the

recent condition of water service. In this stage, the uses of materials such as academic journals, books, unpublished materials, seminar and workshop materials, law and regulation documents, newspapers, and other sources from internet will still be employed.

Eventually, the last research question will be elaborated through a systematic literature comparison. It will be conducted by selecting relevant articles discussing drinking water provision. By doing this step, it is expected that various strategies in dealing with this issue that has been practiced in several places can be listed. And then, critical factors that determine the success or even the failure of such strategies will be identified. To ensure the validity of information, the author(s) of relevant articles will be contacted through e-mail. Furthermore, the list of strategies within respectively keys of success as well as pitfalls will be assessed in Indonesian context. In this phase, in between result gained from the second and third research question will be synthesised to improve strategies dealing with water related issues.

After collecting relevant data and discussing the three research questions, the next stage is formulating conclusions and recommendation. It is expected that a wider perspective in understanding problems related to water provision in Indonesia will be gained. In addition, through learning process from various strategies implemented in various places recommended solutions for recent problems will also expectantly be formulated. To simplify, the steps of this research is presented schematically in the following figure. Research methodology and the structure of discussion are presented in figure 1.3.

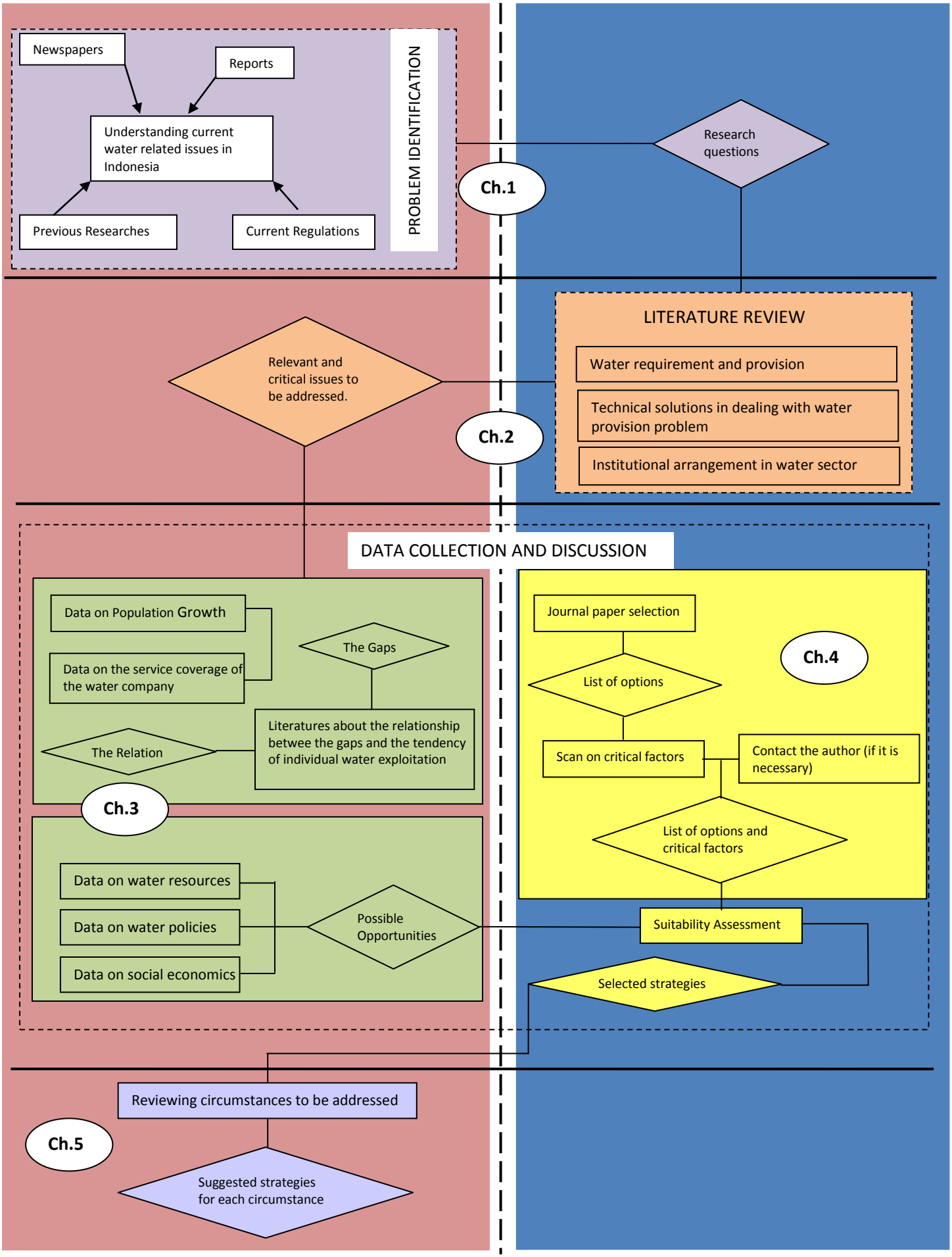


Figure 1.3 Research Methodology and the Structure of Discussion

From this picture, it can be seen that the discussion is distinguished into two main parts. There is dash that divide the area into two areas; red and blue areas. The former contains chapters discussing empiric part of water provision that occur in Indonesia and. The later will more focus on theoretical discussion and generic experiences undergone by several countries. Furthermore, the division of chapters is also illustrated by this picture. Each chapter is represented by different colours and consists of activities that will be done as well as expected outputs. The rectangular shape indicates the activities or data required as inputs while the rhombus shape illustrates the expected results from the activities.

CHAPTER II
THEORETICAL FRAMEWORK

2.1 Understanding Water Comprehensively

2.1.1 Hydrologic Cycle

Discussing water cannot be divorced from understanding hydrologic cycle. It is important to understand this process comprehensively in order to determine which stage of all process can be intervened through policies and strategies. Hydrologic cycle fundamentally can be defined as a cycle of water shifting process in terms of its formation and movement that occurs continuously in nature (Raghunath, 2006). In another word, hydrologic cycle can be described as the continuous movement of water on, above and below the surface of the earth. In this process, water also undergoes changes in its form of the vapour, liquid, and solid. To simplify, it will be illustrated by this following picture.

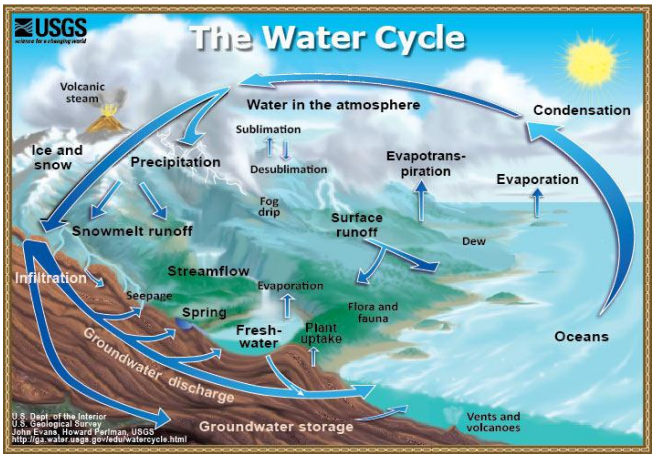


Figure 2.1 Hydrologic Cycle
(Source: http://ga.water.usgs. gov)

During the cycle, water on the surface of the earth i.e. rivers, lakes, polders, oceans, and even water particles in soils, evaporates to the air and shift its form into vapour. This process is called as evaporation. Besides from water, evaporation is also undergone by vegetation. In this case, it is commonly called as evapotranspiration. These vapour then rise to the atmosphere and are condensed. The result of this condensation stage is the shift of vapours into clouds. And then the clouds result in precipitation. Raghunath (2006) distinguish forms of precipitation based on the form and size of water particles as drizzle, rain, glaze, sleet, snow, snowflakes, hail, dew, frost, fog, and mist.

A portion of this precipitation streams over land surface called as runoff. Some of runoff fill water reservoirs such as rivers, lakes, polders, and so forth, while the rest flows to the sea and evaporate again. And another part of infiltrates into the ground which construct the ground water table. Some of this portion, like surface water, also flows to the sea while the rest still remain becoming groundwater storage. This process occurs within continuous cycle. Therefore, hydrologists strongly believe that the amount of water in the earth is constant.

Despite strong belief among hydrologists on constant amount of water, problem of water requirement still appears in daily human's life. There is likely something troubled in this issue. Therefore, water sector needs to be managed. In the view of planning, understanding hydrologic cycle is also helpful in order to choose in which stage policies and strategies can be developed through water management. Of course, evaporation, condensation and rainfall are extremely difficult to be intervened through policies. The most reasonable option is managing water in the phase of runoff and groundwater storage. This research tries to elaborate this stage in order to improve strategies in water supply fulfilment.

2.1.2 Groundwater-Surface Water Interaction

Groundwater and surface water, such as streams, lakes, polders, wetland, and so forth, cannot be viewed as two separated substances. They interact and are able to influence each other. Therefore, understanding the basic principle of this interaction is necessary for effective management of water resources (Sophocleous, 2002). In the case of interaction between groundwater and stream, for instance, there are three types of interaction (according to USGS[1]). They are: (1) Gaining Stream, (2) Losing Stream, and (3) Disconnected Stream.

In the first type, water table is usually higher that the stream surface. In this case, groundwater seeps into the stream through the streambed. Meanwhile, an opposite circumstance occurs in losing stream type. In this second type of interaction, water in the stream infiltrate into groundwater through the streambed.

[1] USGS: United States Geological Survey

Different from the two previous types, disconnected stream is characterised by the appearance of unsaturated zone between streambed and water table. To be more detail, the distinction among those three types of interaction can be figured as follows.

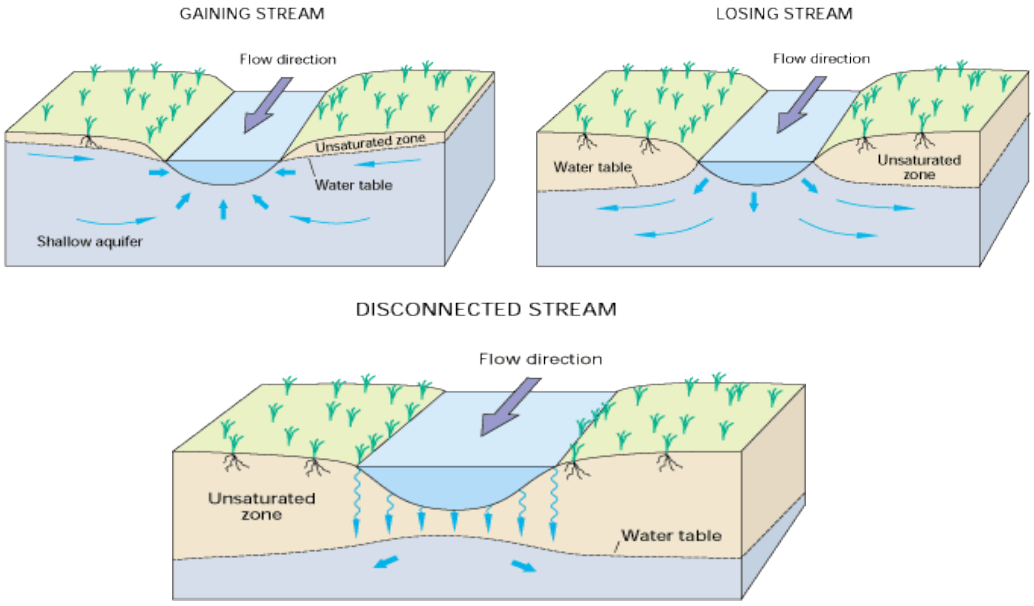


Figure 2.2. Types of groundwater-surface water interaction
(Source: http://pubs.usgs.gov)

2.2 The Use of Water and Its Environmental Effects

2.2.1 Defining the Need of Water

Defining the need of water is an important starting point in developing such kind of water management. It cannot be considered as a simply statistical calculation. It is very subjective depend on personal perception and cultural tradition of people who thought (Gleick, 1996; Akpabio, 2011). Furthermore, different kind of human's activities also affect to the amount of water that is supposed to be consumed. It then affects to the way society in valuing and treating water. Although it is not technical aspect of water provision, considering this aspect is essential in developing strategies of water provision or even improving existing ones.

Without ignoring the importance of cultural tradition in appreciating water-related issues, it is also necessary to consider technical aspect in defining the need of water. Glick (1996), for instance, defines a minimum daily water requirement for domestic uses including for drinking, sanitation, bathing, and food preparation. Furthermore, Bradley (2004) in his research observes the amount of water requirement from several countries. The data can be summarised as follows (data is calculated for water requirement per capita):

- Malaysia : 137 L/day
- Korea : 115 L/day
- Germany : 130 L/day
- UK : 128 L/day
- USA : 143 L/day

This data can also be a supporting evidence to strengthen the argument that lifestyle and cultural background cannot be simply ignored in defining what and how much water requirement is.

2.2.2 Water Exploitation and Its Consequences

As human's daily life highly depends on water, methods for exploiting this resource also develop in line with increasing demand and technology improvement. Undoubtedly, every action taken by human in abstracting water resource brings certain environmental impacts. The most significant impact of water exploitation, especially groundwater, is declining water level. It then remains voids in soil particles. It actually endangers human's life at least in two ways. First, voids in soil particles decrease bearing capacity of soil in holding building or any structures above. If it occurs continuously in the long term, those constructions will be slowly moving down. This phenomenon is called land subsidence. Second, these voids also allow saline water to infiltrate to fresh water zones. It often occurs particularly in coastal zones. It means that fresh water is polluted by saline water. And water that is consumed by human is no longer purely fresh water.

Besides harming human life, depletion of the water resource also affects to ecosystem. As groundwater and surface water interact, it consequently brings

influences in the availability of water on surface such as lakes and rivers where ecosystems exist. In another word, the depletion of groundwater also implicates to the depletion of surface water. And lack of water can harm ecosystems as well as humans (EEA[2] Report, 2009).

2.3 Water Provision: Constraints and Opportunities

Water is everybody's substantial need. Therefore, demand for this resource will obviously increase. By contrast, the supply is relatively constant or even decrease. To overcome this dilemma, it needs a kind of intervention in managing water resource and its distribution. The party who have this authority is government. In Indonesian context, water and other natural resources also belong to state's authority to be utilised for the prosperity of citizens (UUD 1945[3], article 33, verse 3). Moreover, in discussing water provision for the poor Akbar et al (2007) suggest the principles that should be applied (p.29):

1. Water should be maintained both in quantity and quality.
2. There should be strong political commitment to support water provision efforts.
3. Institutional rules and regulations should be maintained and enhanced.
4. Water supply should be managed as an economic good.
5. Water supply should be managed as a social good.
6. Water supply should be operated and maintained with appropriate technical knowledge and tools and standards.

However, government is likely failed in providing this basic need. Bakker et al (2008), for instance, have identified sources of government's failure in providing networked water supply especially for the poor as follows (the case study of research was taken in Jakarta):

- The culture of governance within urban government which does not prioritize the poor.
- Land use policies and related decision making processes at municipality level.

[2] EEA: European Environment Agency
[3] UUD 1945: Undang-Undang Dasar 1945 (Constitution of Indonesia)

- Low capacity of water Supplier Company which is owned and operated by local government.
- Water Provider Company concentrates on serviceable area that means geographically reachable and financially able to pay the cost. Extending the service to the poor is understood as unbeneficial expansion in terms of increasing installation cost decreasing potential revenue.

To overcome this kind of problem, there are several approaches actually can be done. Public-Private Partnership, for example, can be an alternative solution (Johnson and Moore, 2004). Another approach is involving community in managing water supply as it has been being conducted in Bangladesh (Akbar et al, 2007) and Afghanistan (Abdullaev and Shah, 2011). In technical measure, intensifying and expanding the recycling of wastewater like what has been being applied in Kuwait (Al-Damkhi et al, 2009) can be taken as one example of effort in overcoming water resource scarcity problems.

Besides those technical approaches, institutional approaches such as legislation and organisation reform are also important to be considered. For instance, China has issued a comprehensive framework for integrated water management trough the 2002 Water Law (Liu, 2009). On the other hand, coping with water-related issues is occasionally responded by organisation reform like what has been implemented in Brazil (Braga et al, 2009).

Furthermore, Rouse (2007) views local community groups as potentials to improve water services especially in remote area where water companies cannot provide the water service. He points out some keys of success in dealing with water service in rural areas that have been practiced in some developing countries regarding the importance of community involvement (Rouse, 2007; p.95-96):

1. Government support for local initiatives
2. Strong and effective community leadership.
3. Technical and financial assistance from NGO to improve community capacities.

4. The choice of proper technology in which community can run and maintain the facilities.
5. A proportional water tariff that is able to cover operational and maintenance cost.

In short, there are still opportunities to overcome the constraints of water provision. Therefore, it is interesting to investigate key success of those kinds of strategies and synthesise them in order to deal with water-related problems and improve water policies.

2.4 Contingency Theory

Considering water as human's basic need, problems regarding drinking water provision obviously have to be solved. There should be strategies to deal with this issue. From the perspective of contingency theory, problems are context-dependent and solutions cannot be replicated in the same manner when they will be implemented in the different places and time. Therefore, there could not be "one best way" to deal with a certain problem and the optimal alternative is contingent upon factors which are called as contingency factors (Donaldson, 1996). Moreover, Bradshaw (2009) states that contingency approach is advantageous for understanding what suits in one place and time, may not suit in another and efficiency is related to the ongoing alignment of various contingency (p.62).

The principle of contingency theory stated by those authors above can be taken as an inspiration in formulating strategies for drinking water provision that will be discussed in this research. Water-related problems such as water shortage, low level of water service, lack of financial and technical capacity, and so forth are generally faced by many countries in the world. It looks like similar problem, but in fact those problems are dependent to the context of respective country. Since this research will discuss several strategies in dealing with drinking water provision comparatively, it will be useful to follow the basic principle of contingency, strategy perform dependently upon their compatibility to the contingency factors; fitter strategy implicates to higher level of performance.

Donaldson (2001) discusses deeply contingency theory regarding organisational arrangement. He argues that contingency factors of organisational structure consist of task uncertainty, task interdependency, and the size of organisation. These three factors determine what kind of organisational structure that is needed to overcome the problem. Moreover, Bradshaw (2009) explores contingency approach to non-profit governance. She proposes four configurations of governance regarding the dimensions of external environment. The concept of the configurations is illustrated by the following figure.

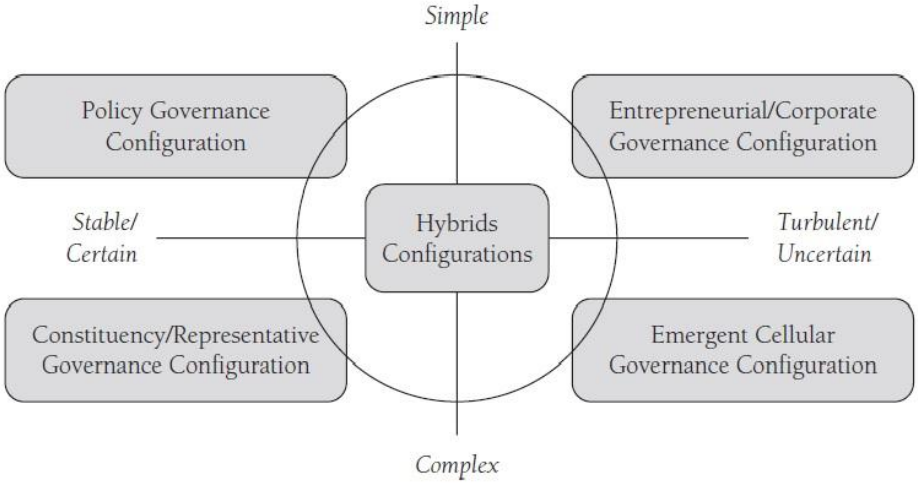


Figure 2.3 Governance Configuration and Dimensions of the External Environment (Source: Bradshaw, 2009)

In this model, two dimension of external environment are presented into two axes. The horizontal axis represents stability context of environment. Meanwhile, the vertical axis represents the dimension of complexity. Well-defined and homogeneous membership and a set of stakeholders who share similar expectation are categorised into simple situation. By contrast, complex is defined as the opposite of simple situation. And then, governance configurations are proposed based on the combination of situations. For instance, typical policy governance is recommended for stable and simple situation; other types of governance can be seen in the picture 2.3 in accordance with respective quadrant. Since water sector usually belongs to government which is non-profit organisation, this model can be an alternative to develop required institutional arrangement for improving the performance of water service.

2.5 Learning From Appropriate Examples

Following the principles of contingency theory which view every problem is context-dependent; it will be useful to explore various strategies and contexts embedded to them. Every nation has their own strategies to overcome water problems. Therefore, learning these various examples either their successfulness or failure can be very beneficial. In the policy perspective, Dolowitz and Marsh (1996) define this approach as policy transfer which means "*a process in which knowledge about policies, administrative arrangements etc. in one time and/or place is used in the development of policies, administrative arrangements and institutions in another time and/or place*" (p. 344).

Furthermore, Evans (2009) distinguishes policy transfer in the way it is studied into five approaches. The first is "*process-centred approaches".* These approaches emphasise on the process of policy transfer in order to explain whether it is voluntary or coercive. The second is called as "*practice-based approaches*". These approaches are closely related to organizational learning, evidence based policy making and comparative public policy. The third is named as "*ideational approaches*" which focus on the social learning approach, the epistemic community approach and discursive approaches. The fourth is "*comparative approaches*" that require widely qualitative description in explaining factors enabling policy transfer occurs. The last one is called as "*multi-level approaches*". In these approaches, outcomes of policy transfer through macro, meso, and micro levels are deliberately considered (p.248-255). Moreover, degrees of transfer were identified by Rose (as cited by Dolowitz and Marsh, 1996) into five categories; "*copying, emulation, hybridization, synthesis, and inspiration*" (p. 351). And generally there are four transfer mechanisms (Marsh and Sharman, 2009) namely *learning, competition, coercion, and mimicry* (p. 271-272). Borrowing a metaphor from medical science, transplantation is suggested for unhealthy patient that can take advantages from a healthy transplant from a donor (Pessali, 2011). However, a successful policy in a certain place and time cannot be simply implemented in another place and time. It is necessary to check its transferability that very much depends on the context of the country

where the policy come from as well as to the country it will be applied (Pessali, 2011; van Dijk, 2006).

Furthermore, van Dijk (2006) noticed four characteristics that make policy transfer is failed to be well implemented. The first pitfall is related to terminology that is sometimes misinterpreted viewed by different localities. The second is jumping directly to a conclusion while problem's core and instrument's target have not matched yet. The next pitfall is in tailoring the procedure. It has to be concerned that an instrument is not one-size-fits-all. The implementation should consider local contexts. Finally, the assumption that views something new means better than the old ones frequently also leads to pitfall.

2.6 Conceptual Model

This research will be conceptualised into one conceptual model as shown in picture 2.4. The blue box in this picture shows the scope of discussion in this research. The discussion will more focus on recent condition of drinking water service and strategies for improvement. The issue of insufficient supply to serve demand in water service will be explored as well as the tendency of individual exploitation. This situation obviously brings consequences especially for environment degradation and people's health. However, the issue of individual exploitation impacts will not elaborated and might be considered for further research.

Furthermore, discussing recent condition of drinking water service cannot be simply divorced from previous events as background. Insufficient drinking water service that appears nowadays may come from various dimensions such as political, technical, financial, and institutional. Nevertheless, this issue will only be discussed briefly because the focus of this research is more on strategy formulation instead of revealing the causes of recent condition.

Regarding strategies formulation, it will be conducted by structured literature study. Various strategies from several countries that have been published through journal papers and data from Indonesia will be synthesised in order to formulate

improvement strategies in drinking water sector in Indonesia. Therefore, assessing the suitability of selected examples to the context of Indonesia is crucial. In this stage, principles of contingency theory and policy transplantation is highly employed in order to formulate sort of recommendation regarding improvement strategies for drinking water service in Indonesia. Finally, if this research will be continued, topics on the impact of proposed strategies are highly suggested since this issue has not been covered in this research.

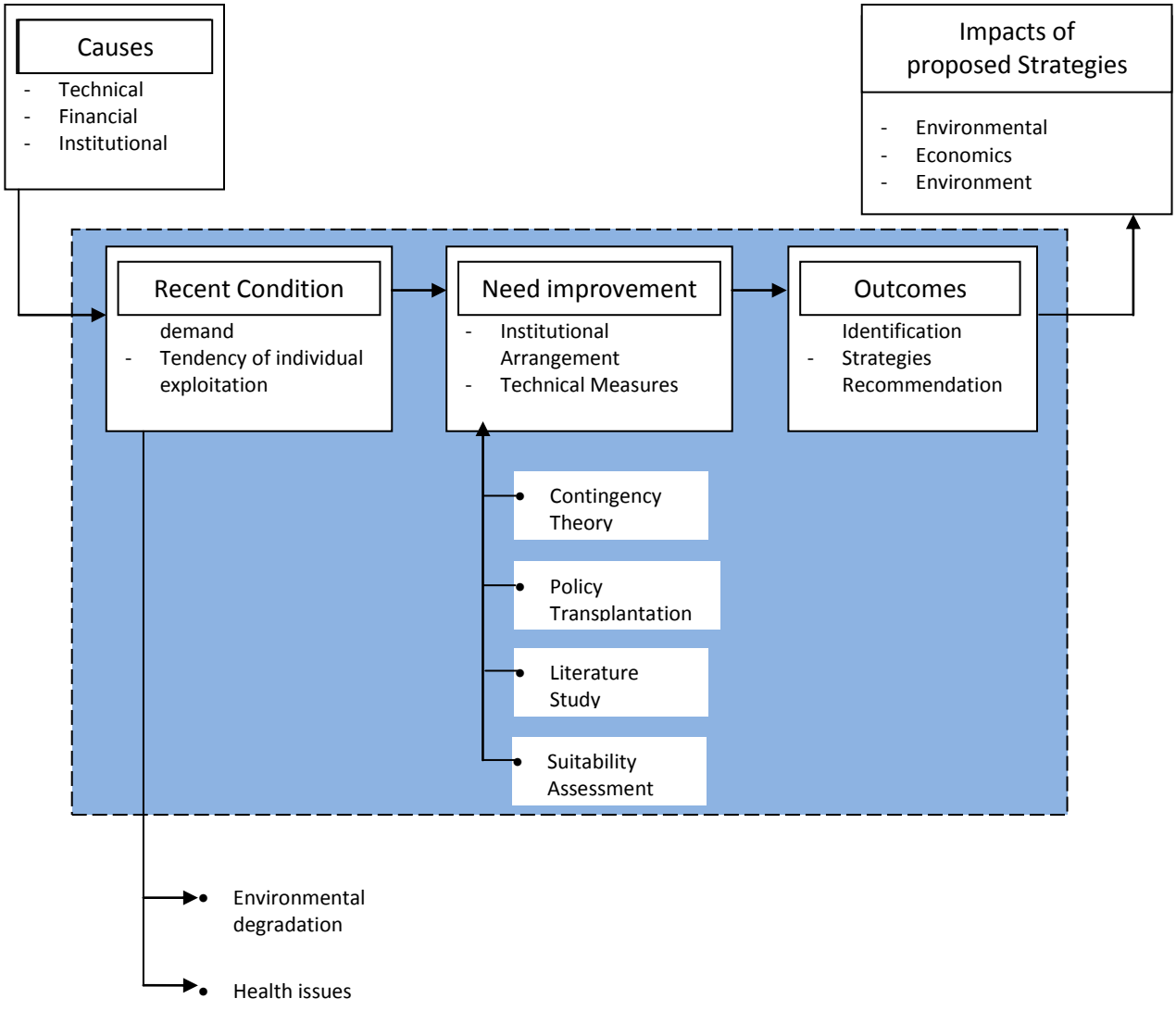


Figure 2.4 Conceptual model of the Research

CHAPTER III
WATER RESOURCES AND SERVICES IN INDONESIA

3.1 Geographical Condition

Indonesia is an archipelago country located between 11^{o} south and 6^{o} north latitudes and 95^{o} east to 141^{o} east longitude. There are 17,508 islands in this country where about 6,000 of them are inhabited. In addition, Indonesia lies between two continents, Asia and Australia as well as two oceans, Indonesian Ocean and Pacific Ocean. These geographical features obviously implicate to the climate condition in Indonesia. The existence of two continents and oceans influence the pattern of wind movement. This movement pattern is essential for rainfall potentials. The wind that blows from the oceans brings a high humidity that can potentially be rain. By contrast, the wind that blows from the continents brings less humid air and usually cause dry season (Tukidi, 2010).

Furthermore, being located in equatorial zone, Indonesia undergoes a tropical climate. This climate circumstance is characterised by high temperature, high humidity, and abundant rainfall. In general, the rainy season starts at November to March while the dry season occurs during April to October. However, Indonesian Meteorology and Geophysics Board divides the rainfall pattern into three categories based on the distribution of average monthly rainfall rate, they are:

1. *Monsoon type*

   This type is characterised by a clear difference between rainy and dry period which then is categorised in the season zone. This type is categorised by one extreme wet period (in December, January, or February). In normal climate condition, zones that have monsoon type will have maximum amount of rainfall in the one of those months. Meanwhile, the minimum amount of rainfall occurs in June, July, or August. The monsoon type mostly occurs in the southern part of Indonesia such as southern Sumatra, Java, Bali, Nusa Tenggara, southern Kalimantan, southern Maluku, and southern Papua.

2. *Equatorial type*

   Different with the monsoon type, the equatorial rainfall type has two peak points of rainfall rate. Zones with this type normally receive rainfall every month in different intensity, but the maximum amount of rainfall occurs in March or October. The northern part of Indonesia such as the northern and western part of Sumatra, northern part of Kalimantan, northern part of Sulawesi, northern part of Maluku, and northern part of Papua are the zones with the equatorial pattern.

3. *Local type*

   The pattern of local type is characterised by strong influence of local landscapes such as mountains and seas. Like the monsoon type, the local type also has one peak rainy season, but its period is different. This type is the opposite pattern of the monsoon type. While zones with monsoon type undergo extreme drought season, zones with local type have the maximum amount of rainfall and vice versa. Areas around north Papua, Maluku, and small part of Sulawesi are the zone with this type.

To be more detail, the area division of the rainfall patterns is presented by this following map.

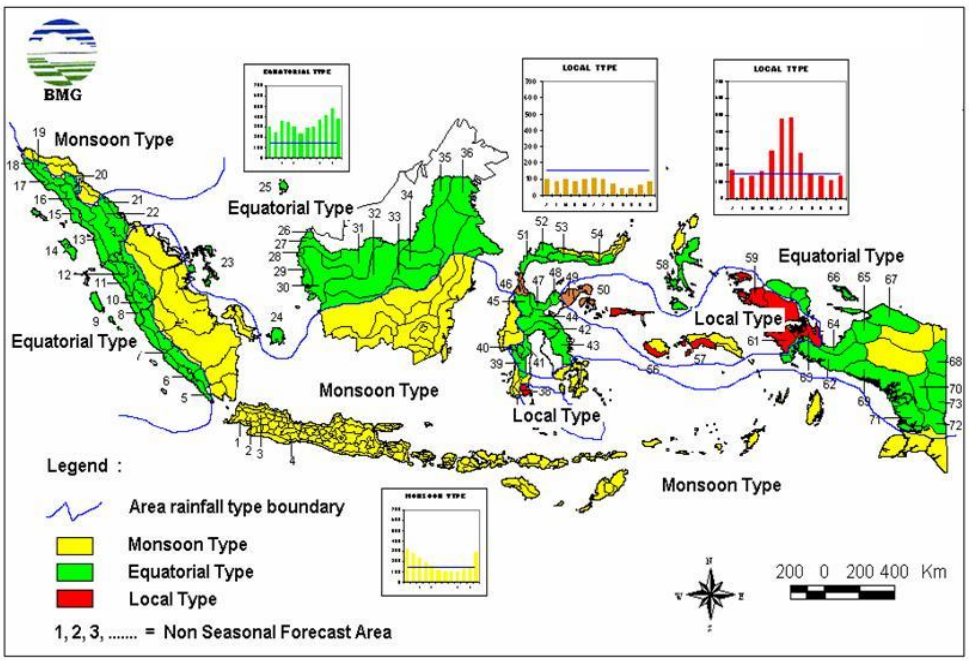


Figure 3.1 the zone division of rainfall pattern (source: www.bmg.go.id)

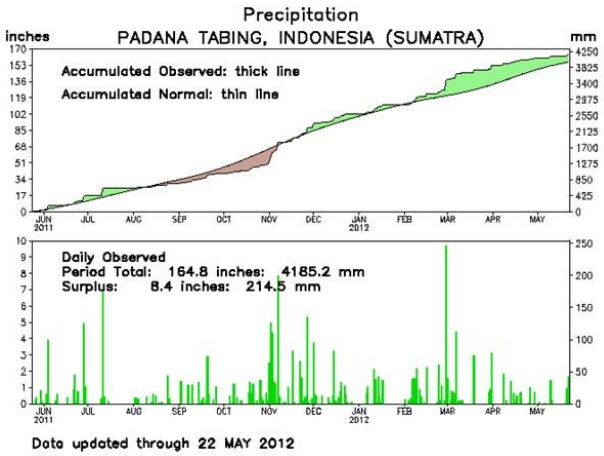
3.2 Water Resources in Indonesia

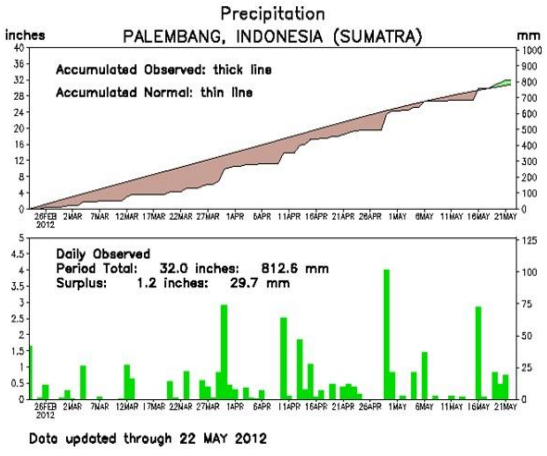
3.2.1 Rainfall

Indonesia is blessed with the richness of water resources. The availability of water in Indonesia reaches 15,000 metre cubic per capita per annum. However, the distribution of water is varied. For instance, Java Island where the total area is about seven per cent of the total land of Indonesia has only 4.5 per cent of total water potential in Indonesia. However, this island is inhabited by more than sixty percent of total population (Dikun, 2003).

Moreover, the average amount of annual rainfall in Indonesia is also different in every place. It varies from 500 to more than 5,000 millimetres (Tukidi, 2010). In the period of June 2011 until May 2012 NOAA (National Oceanic and Atmospheric Administration) recorded that the amount of rainfall in Indonesia varied from 856 mm to 4184.2 millimetres per year. Referring to the climate classification developed by Koppen, it can be categorised into climate type A (tropical moist climate) (www.physicalgeogrphy.net). This climate is characterised by precipitation occurs all year long within various intensity. The monthly temperature variation is 3^{o}C or less, while the average temperature is between 18^{o}C and 32^{o}C.

Data from NOAA also shows that in six observed rainfall gauge stations there are surplus of the amount of rainfall although in some places are also deficit. The surplus was recorded in Padang (West Sumatra), Palembang (South Sumatra), Banjarmasin (South Kalimantan), and Manado (North Sulawesi). Meanwhile, Jakarta and Makassar (South Sulawesi) underwent rainfall deficit in 2012. To be more detail, the data is presented in the following figures.





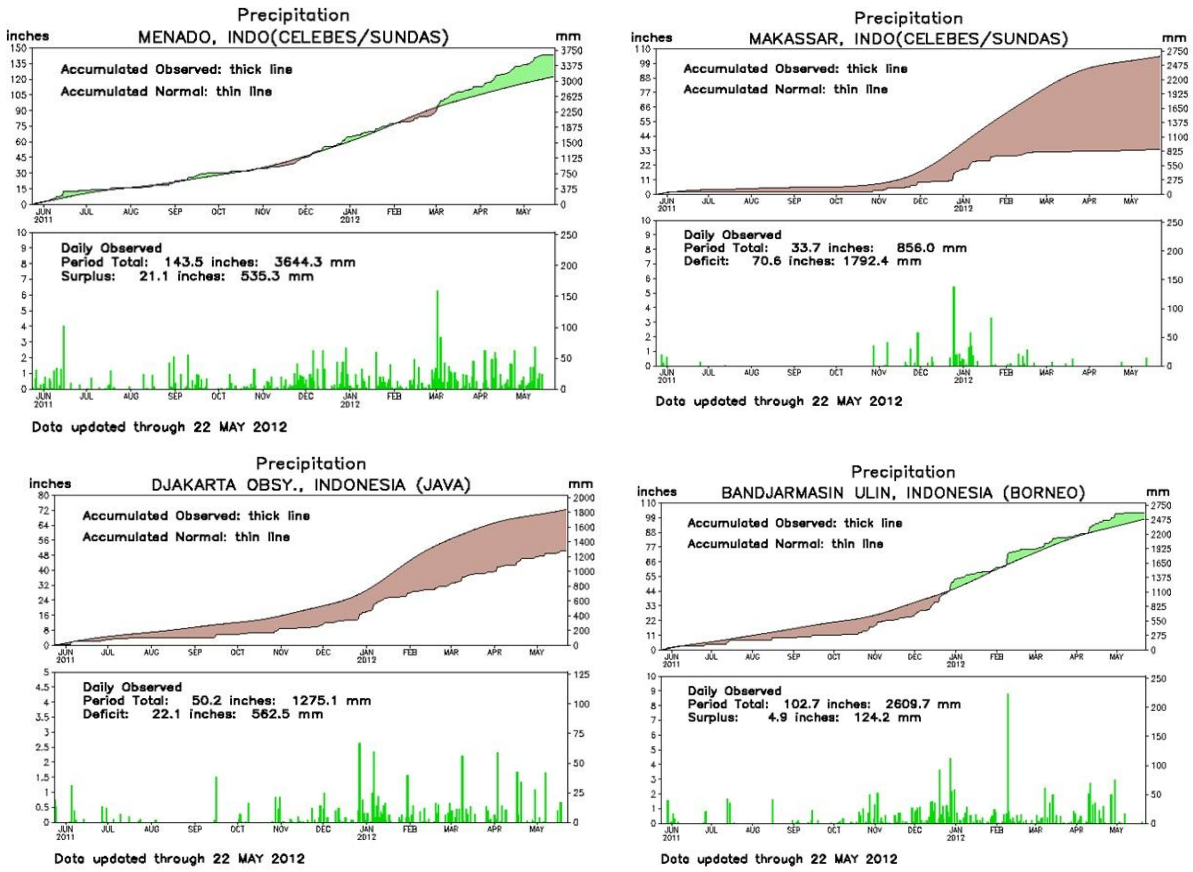


Figure 3.2 the rainfall rate in Indonesia recorded in six rainfall gauge stations (2011-2012) (Source: www.noaa.gov)

Based on the data above, it can be inferred that Indonesia basically has a huge potential of water resource from the rainfall. In the six rainfall gauge station it was recorded that the rainfall occurs throughout the year within various intensity. This water resource can actually be utilised directly through rainwater harvesting or in the form of surface water such as natural spring, rivers, or lakes. Furthermore, it can also be stored as groundwater through infiltration following hydrologic cycle. To conclude, there is abundant potential water resource that is available and can be exploited.

3.2.2 Surface Water

Rivers

Indonesia has more than 5,590 rivers; most of them were formed because of volcanic process. It implicated to the characteristics of the rivers which have a high difference in the slope of riverbed between upstream, middle stream, and

downstream. When rain comes with a high intensity and erosion from the upstream, it brings high sedimentation. Consequently, this occurrence reduces the capacity of the river in holding the water and cause flood especially at the downstream areas (Dikun, 2003).

This following table shows the list of major rivers in Indonesia and their hydrological condition. Ministry of Environment categorised the hydrological condition of the rivers into three categories; good, moderate, and bad. It referred to the characteristics of the rivers such as slope and cross-sectional area that implicate to the capacity of the river in holding the potential of sedimentation and flood.

Table 3.1 the list of rivers in Indonesia and their hydrologic condition

Province/ The Name of the River	Location	The Area of River Basin (km^2)	Volume (10^6 m^3)	Hydrological condition
North Sumatera				
Barimun	Seroja, Labuhan Batu	6,781.00	5,606.00	good
Bingei	Binjai, Langkat	1,621.30	789.30	good
Asahan	Asahan, Pulau Rakyat, Pulau Raja	4,669.40	2,355.00	good
West Sumatera				
Batang Kuantan	Lima Puluh Koto, Payahkumbuh	1,421.00	1,705.00	bad
Riau				
Rokan	Lubuk Bendahara, Kampar	4,848.00	4,383.00	moderate
Siak	Pantai Cermin, Siak Hulu, Kampar	1,716.00	1,966.00	good
Batang Kampar	Lipat Kain, Kampar	3,431.00	6,017.00	good
Batang Kuantan	Lubuk Ambacang, Kuantan	7,464.00	6,767.00	moderate
Jambi				
Batanghari	Batanghari, Jambi	8,704.00	51,091.00	good
South Sumatera				
Musi	Sungai Rotan, Gelumpang, Muara Enim	6,990.00	7,974.00	good
Lampung				
Way Seputih	Buyut Udik, Central Lampung	1,648.00	584.40	bad
Way Sekampung	Pujo Rahayu, Gedong Tataan, South	1,696.00	1,275.00	bad

	Lampung			
West Java				
Cimanuk	Kertasemaya, Indramayu	3,305.00	7,195.00	good
Central Java				
Pemali	Brebes	1,250.00	1,937.00	bad
Bengawan Solo	Jebres, Surakarta	3,206.70	2,510.00	bad
Serayu	Kedunguter, Banyumas	2,631.00	3,479.00	moderate
Yogyakarta				
Progo	Duwet, Kalibawang, Kulon Progo	1.712.30	1,205.20	bad
East Java				
Bengawan Solo	Lamongan	17,300.00	9,056.00	good
Banten				
Cisadane	Sukasari, Babakan, Tangerang	1,146.00	2,645.00	bad
Ciujung	Cidoro Lebak, Rangkasbitung, Lebak	1,363.90	1,646.00	bad
West Kalimantan				
Kapuas	Manggu, Ngabang, Pontianak	3,710.00	9,498.00	good
Central Kalimantan				
Barito	Dusun Tengah, South Barito	1,531.00	237.80	bad
Kapuas	Kapuas	4,741.00	14,766.00	moderate
Kahayan	Kurun, Guning Mas	5,591.00	11,535.00	good
Katingan	Kasongan, Barito	4,741.00	32,732.00	moderate
Mentaya	Mentaya, East Kotawaringin	4,765.00	8,019.00	good
Lamandau	Arut, Kotawaringin	1,968.00	3,676.00	bad
Central Sulawesi				
Palu	Palu	3,062.00	910.20	moderate
South Sulawesi				
Rongkong	Ampana, Sadang, Luwu	1,030.00	1,001.00	moderate
Cinranae	Madukeling, Sengkang, Wajo	6,437.00	3,583.00	bad
Walanae	Mong, Mario Riwano, Soppeng	2,680.00	2,095.00	bad
Sadang	Kabere, Cendana, Enrekang	5,760.00	2,756.00	moderate
Southeast Sulawesi				
Roraya	Lainea, Konawe Selatan	1,747.00	482.50	bad

(source: Ministry of Environment (2009) as cited in Samekto and Winata (2010))

Aside from by the natural characteristic, sedimentation and flood problems are also worsened by environmental degradation caused by human activities. Deforestation, for instance, has reduced absorption capacity particularly in catchment areas. It then increases the amount of runoff that potentially brings sedimentation and flood. Data from Ministry of Forestry states that deforestation rate has increased significantly from 1.6 million hectares per year to 2.1 million hectares per year during 1985 – 2001. It was caused by the conversion of forest to settlements, industries, mining sites, and illegal logging as well (Samekto and Winata, 2010).

Furthermore, problems that are faced in managing river basin are also related to coordination and sharing responsibility among institutions. It commonly occurs in managing rivers that lay inter-jurisdictions and are used for multiple needs such as agriculture, energy, and drinking water. The problem happens usually in defining which party that is supposed to be responsible in the water resource management and whose budget should be used (Dikun, 2003).

Lakes

Besides rivers, Indonesia has also surface water resources from lakes. From hydrologic view, the existence of lakes is essential. As a component of hydrologic cycle, lakes function as collection points for storage of surface water runoff and groundwater seepage. Besides, lakes also have a significant role in evaporation process (Cech, 2005). The number of lakes in Indonesia is roughly calculated that there are more than 500 lakes scattered across islands within various capacities. The following table shows 15 big lakes in Indonesia while there are many others that are not listed.

Table 3.2 the list of Lakes in Indonesia and Their Area

No	Province	The Name of the Lake	Area (Hectares)
1	Aceh	Laut Tawar Lake	5,965
2	North Sumatera	Toba Lake	110,260
3	West Sumatera	Maninjau Lake	9,950
4	Jambi	Kerinci Lake	4,000
5	Central Java	Rawa Pening Lake	2,660

6	Bali	Batur Lake	10,535
7	East Nusa Tenggara	Kalimutu Lake	105
8	West Kalimantan	Sentarum Lake	40,000
9	South Kalimantan	Bangkau Lake	535
10	East Kalimantan	Jempang Lake	15,000
11	North Sulawesi	Tondano Lake	4,638
12	South Sulawesi	Tempe Lake	14,200
13	Gorontalo	Limboto Lake	3,000
14	North Maluku	Laguna Lake	185
15	Papua	Sentani Lake	14,000

(Source: www.nationalgoegraphic.co.id)

3.2.3 Groundwater

Groundwater storage is another important component of hydrologic cycle besides surface water. Some portions of rainfall infiltrate into the ground and fill areas that are called as groundwater basin. In the Law Number 7 Year 2004 about Water Resource, groundwater basin is defined as a zone which is bordered by hydro geologic boundaries where all hydro geologic process such as recharge, flow, and discharge occur (article 1 point 12).

Ministry of Environment calculated groundwater potential in Indonesia. Data of these water resources can be seen in the following table.

Table 3.3 the Potential of Groundwater Basin in Indonesia

No.	The Name of Island	Groundwater Basin		
		The number of groundwater basin	Area (km^2)	Volume (million m^3)
1	Sumatera	65	270,656	109,926
2	Java	80	80,936	41,334
3	Kalimantan	22	209,971	68,473
4	Bali	8	4,381	1,598
5	Nusa Tenggara	47	41,425	10,139
6	Sulawesi	91	37,768	20,244
7	Maluku	68	25,830	13,174
8	Papua	16	52,662	43,400
	TOTAL	**397**	**723,629**	**308,288**

Source: The Environmental Status of Indonesia (2008) as cited in Samekto and Winata (2010)

Based on this table, it can be seen that groundwater is one of water resource potentials than can be possibly optimised. There are some benefits in exploiting groundwater resources. Firstly, groundwater resource is more hygienic compared to surface water because of natural filtration process that is undergone by this water resource. Secondly, the availability of this water resource is constant throughout the year. Thirdly, groundwater is relatively easy to be exploited and do not required an advanced technology. These benefits then lead people to be pragmatic and exploit water resource to satisfy the need of water. In Indonesia, this trend is even worsened by the absence of clear regulation in exploiting groundwater resource as well as unreliable water service.

3.3 Water Services in Indonesia

In this part, the development of drinking water service will be explored. The discussion will be started by exploring historical development of water sector. It aims to give a broader perspective in viewing water service development. From the history, it is expected that various strategies and aspects attached to them such as political regime, dominant actors, funding resource, and so forth can be well understood. By learning from the past, it then implicates to the consideration that should be taken into account when strategies to improve recent condition are promoted.

After elaborating historical aspects of drinking water service, the discussion will be continued by exploring the dynamics of supply and demand of drinking water. While historical development can give sort of insight to understand what factors make previous strategies were successful or failure, dynamics of supply and demand represent the condition that has to be dealt with recently and possible projection for the future as well.

3.3.1 The Historical Development of Water Sector

It is important to explore the history of water service in Indonesia since the recent circumstance cannot be simply separated from the past. By elaborating this history, a more complete figure about the water service and its evolution are expected to be well understood. In this following part, the history will be

presented. It is compiled from various authors such as Pasandaran (2005) Pasandaran (2008), Dikun (2003), and related internet sources such as www.pamjaya.co.id, www.pambdg.co.id, www.psda.jabarprov.go.id, www.wikipedia.org, and so forth.

The Dutch Colonisation Era

During the colonisation era Indonesia was governed by several kingdoms across the archipelago. Their political power could not be simply ignored although the political power of VOC (*Vereenigde Oostindische Compagnie*) was dominant. Considering this situation, the need for a more centralised form of government arose over year especially regarding public needs. In 1866 the Department of Public Works (*Burgerlijke Openbare Werken/ BOW*) was established with the obligation and authority in managing sanitation, irrigation and drainage.

In 1925 Ir. J. Blastone as the director of BOW initiated to arrange such regulation in managing water resources. He started regulating the distribution of water especially for farming and plantation uses. Five years later, formal regulation about water authorisation namely *Algemeen Water Reglement Voor Java en Madoera* was issued. This regulation was applied for the teritory of Java and Madura. Furthermore, in 1936 *Algemeen Water Reglement* (AWR) was approved by *Volksraad* (House of Representative) and was applied for larger territories besides Java and Madura. AWR can be viewed as the milestone of decentralisation of water management. In this regulation, the authority and obligation of main irrigation channel belonged to central (colonial) government while farmers were responsible for managing water through tertiary channel. Regarding to the sharing of this responsibility, colonial government issued *Algemeen Waterreglement Beheersverordening* (AWBV) in 1937. Through this regulation, the authority and responsibility of the institutions dealing with water resource management were clearly regulated. This regulation became a legal basis for the related institutions to play their roles in managing water resources.

The Soekarno's Old Order Era

After the independence proclamation in 1945, Soekarno took over political power in Indonesia. Because of financial and technical limitation, there was no significant improvement in the beginning of Soekarno's era. In 1959 the government of Indonesia formed an institution which was responsible to handle water supply namely *Djawatan Teknik Penjehatan* (Sanitation Engineering Department). This institution started to develop drinking water infrastructures in several cities. In this initial phase the projects were conducted in Jakarta, Bandung, Manado, Banjarmasin, Padang, and Pontianak. These projects were cooperation projects and supported financially by the government of France. It was not until 1962 the government of Indonesia issued Law Number 5 Year 1962 about local government owned company. This regulation became legal basis for the establishment of local water companies that were owned by local government called *Perusahaan Daerah Air Minum* (PDAM) in Indonesia.

The Soeharto's New Order Era

Soeharto's era was characterised by five-year development plan namely *Rencana Pembangunan Lima Tahun* (REPELITA). The development of water sector in this era was significant. Water projects that required huge investments were conducted. To overcome this financial problem, the government of Indonesia achieved the loan from OECF (Overseas Economic Cooperation Fund). The construction of *Saguling* Dam (1986) and *Cirata* Dam (1987) as well as continuing the construction of *Jatiluhur* Dam that was initiated in the Soekarno's era were evidences of significant improvement. The construction of those three dams could be said as the starting point of the integrated use of water since they were utilised for drinking water, irrigation, and power plants.

In the period of REPELITA I (1969-1973) the development of water sector focused on the rehabilitation and dissemination of water infrastructures as well as the increasing of the production capacity of existing water providers (PDAM). The result of this strategy was the addition of 127,000 new household pipe networks that could serve 2.7 million people in Jakarta and West Java Province, and the increasing of production capacity up to 6,220 Litres per second. It was

also characterised by the establishment of PDAMs in many provinces either inside or outside Java Island. In this era Term of Reference (TOR) for drinking water provision started to be promoted and the Indonesian Association of Water Companies called PERPAMSI (*Persatuan Perusahaan Air Minum Seluruh Indonesia*) was established in 7 April 1972.

The government of Indonesia started arranging the master plan for drinking water service in REPELITA II (1974-1978). This policy resulted in the production of master plan for 120 cities and detail engineering design for 110 cities regarding drinking water physical infrastructure. On the other hand, the government of Indonesia also enhanced institutional capacity by establishing more PDAM up to municipality level. Through this policy, there was such kind of cost sharing in managing water services. Central government was responsible to develop production plant while local government had to be responsible for improving the distribution pipe networks. This project was supported financially by Asian Development Bank (ADB).

The concept of Basic Need Approach was promoted in the period of REPLITA III (1979-1983). Through this concept, the daily amount of water for every individual was assumed around 60 Litres. Therefore, the production capacity of PDAMs could be simply calculated in serving the society. However, the lack of financial support could not be in line with this assumption. To respond this circumstances, the government of Indonesia encouraged PDAMs to achieve such financial condition that could possibly cover operation and maintenance cost. Through this policy, the government of Indonesia started promoting "full cost recovery" concepts in the development of water services.

In the period of REPELITA IV (1984-1988) there was a shift in the organisational nature of PDAMs. Previously PDAMs were sector organisation but now the organisational nature of PDAMs was more territorial. Therefore, the Ministry of Internal Affair also involved in drinking water issues since municipality governments in Indonesia were under authority of this ministry. In 1984, the ministry of Public Works incorporated with the Ministry of Internal Affairs signed the decree that regulated the development of drinking water services.

Furthermore, the Ministry of Internal Affair in 1985 also issued the instruction that obligate provincial governments to establish Provincial Monitoring Development Unit (PMDU). This organisation aimed to monitor and evaluate the performance of PDAMs which were belonged to municipality governments.

REPELITA V (1989-1993) expectantly became "take off phase" of the development in Indonesia. In this stage, the development of drinking water infrastructures was not merely aimed to serve domestic needs, but also commercial sectors such as industry, trading and tourism. The result of this phase was the addition of production capacity up to 14,000 Litre per second and increasing service coverage for six million people in 820 municipalities as well as 42 million people scattered in 3,000 villages.

In the REPELITA VI, there was a target to improve water supply infrastructure by increasing the service coverage up to 22 million people and reducing the leakage of piped water from 38% to 25%. In this period, the government of Indonesia launched a development programme for less developed rural area called P3DT (*Program Pembangunan Prasarana Desa Tertinggal/Village Infrastructure Development Programme)*. Moreover, in 1995 the government of Indonesia established WSSLIC I (Water Supply and Sanitation for Low Income Community); and the Ministry of Health became the executing agency in this programme. Both P3DT and WSSLIC brought significant influences in improving water service especially for remote rural areas that have been served by water companies (PDAMs). However, financial crisis that occurred in 1998 caused this development plan did not run well as it was desired and the goal to improve water service and infrastructure cannot fully achieved. It then was worsened by instable political circumstance that made Soeharto's regime had to be ended in 1998.

After Financial Crisis and Reform Era

After the termination of Soeharto's regime, decentralisation system was highly promoted in almost all sectors unexceptionally water provision. In this era, local governments had larger authorities while the role of central government for some

extent was reduced. PDAMs are no more fully supported financially by central government; the ownership of PDAMs and the revenue from water service go to the local governments. On the one side, this situation brings potentials for local governments to increase their revenue, but it also implicates to the increasing budget that has to be allocated to operate and maintain water infrastructure. Furthermore, the possibility of cooperation with private sectors in providing water service is also introduced in this era. In order to improve the performance of PDAMs, Coordinating Ministry of Economy, Finance, and Industry established the Sub Committee of PDAMs Improvement under the Committee of Infrastructure Development Acceleration Policy (*KKPPI/Komite Kebijakan Percepatan Pembangunan Infrastructure*). This Sub-Committee aimed to formulate policies and strategies for improving PDAMs and to explore the possibility of partnership with private sectors in developing water supply service.

Although the authority of central government is not as strong as in the Soeharto's era, the central government still have a political power in regulating water issues. There are some regulations issued regarding to water sectors in this era:

- In 2000 the Ministry of Regional Autonomy issued Ministerial Regulation Number 8 about Accounting System Guidance for PDAMs. This legal basis is still used until now.
- The Ministry of Health issued Ministerial Decree Number 907 in 2001. This decree regulates the terms and supervision of drinking water quality. This regulation is used as the guidelines in monitoring the quality of drinking water produced by PDAMs and is still applied until recent days.
- In 2004 the government of Indonesia issued the Law Number 7 about Water Resources. Through this law, there are some principles in managing natural resources that is accommodated. The principles are: good governance principle, subsidiary principle, equity principle, priority use principle, prior appropriation principle, sustainable development principle, good sustainable development governance, and the principle of participatory development.
- The government of Indonesia issued the Government Regulation Number 16 in 2005 about the Improvement of Drinking Water Provision System. This

regulation is the highest hierarchy of regulation that specifically regulates water provision issues. And then this regulation is followed by the ministerial regulation that is issued by the Ministry of Public Works (the Ministerial Regulation Number 294 year 2005). This regulation regulates the establishment of Development Support Agency for Water Supply System (*BPPSPAM/Badan Pendukung Pengembangan Sistem Penyediaan Air Minum*). This agency has tasks to give assistance for realising: (1) qualified water supply management and service within affordable price, (2) equal benefits gained either by consumers or water providers, and (3) efficient water supply service.

- In 2006 the Ministry of Public Works issued the Ministerial Regulation Number 20 about National Policies and Strategies for Improving Water Supply Provision System. This regulation is used as a reference in the implementation water supply provision system. In the same year, the Ministry of Internal Affair also launched the Ministerial Regulation Number 23 about the guideline in determining water tariff.

Points to Be Highlighted

By exploring the historical background of drinking water provision in Indonesia, there are some essential remarks can be highlighted:

- Water sectors have been critical issues to be concerned since a long time ago and government has taken various attempts, either through technical measure or institutional arrangement, to deal with water provision.
- The role of political power is so strong in determining selected strategies and directing policies in public services unexceptionally drinking water provision. Besides, the nature of political regime also determines the chosen strategies.
- Because of a weak financial capacity combined with a huge investment required for water infrastructure, the government of Indonesia relied very much on foreign donors in providing drinking water service. It then becomes a heavy burden especially when monetary crisis occurred in 1998.

- Strategies that were taken mainly focused on supply side using more technical approaches, and only a little attention on encouraging local potentials and environmental concern in dealing with water provision.

3.3.2 Supply Versus Demand in the Drinking Water Sector

Based on the explanation on the historical background of water service in Indonesia, it can be clearly seen that many efforts have already been taken to supply the need of water. However, the demand side of this need is not less dynamic. Rapid population growth and uneven distribution of population bring special challenges in overcoming the problem of water provision. Data from Central Bureau of Statistics shows that in 2010 there are almost quarter billion inhabitants living in separated islands and they are distributed unevenly. Java Island, for instance, has around seven per cent of total area of Indonesia but there are more than 50 per cent of total population living there. By contrast, Maluku and Papua are only inhabited by less than three per cent of population. This following table can be a figure to describe how big the challenges are.

Table 3.4 the Number of Population in Indonesia (1971-2010)

Province	Population					
	1971	1980	1990	1995	2000	2010
Aceh	2.008.595	2.611.271	3.416.156	3.847.583	3.930.905	4.494.410
Sumatera Utara	6.621.831	8.360.894	10.256.027	11.114.667	11.649.655	12.982.204
Sumatera Barat	2.793.196	3.406.816	4.000.207	4.323.170	4.248.931	4.846.909
R i a u	1.641.545	2.168.535	3.303.976	3.900.534	4.957.627	5.538.367
J a m b i	1.006.084	1.445.994	2.020.568	2.369.959	2.413.846	3.092.265
Sumatera Selatan	3.440.573	4.629.801	6.313.074	7.207.545	6.899.675	7.450.394
B e n g k u l u	519.316	768.064	1.179.122	1.409.117	1.567.432	1.715.518
L a m p u n g	2.777.008	4.624.785	6.017.573	6.657.759	6.741.439	7.608.405
Kep. Bangka Belitung	-	-	-	-	900.197	1.223.296
Kepulauan Riau	-	-	-	-	-	1.679.163
DKI Jakarta	4.579.303	6.503.449	8.259.266	9.112.652	8.389.443	9.607.787
Jawa Barat	21.623.529	27453525	35.384.352	39.206.787	35.729.537	43.053.732
Jawa Tengah	21.877.136	25372889	28.520.643	29.653.266	31.228.940	32.382.657
DI Yogyakarta	2.489.360	2.750.813	2.913.054	2.916.779	3.122.268	3.457.491
Jawa Timur	25.516.999	29188852	32.503.991	33.844.002	34.783.640	37.476.757
Banten	-	-	-	-	8.098.780	10.632.166

B a l i	2.120.322	2.469.930	2.777.811	2.895.649	3.151.162	3.890.757
Nusa Tenggara Barat	2.203.465	2.724.664	3.369.649	3.645.713	4.009.261	4.500.212
Nusa Tenggara Timur	2.295.287	2.737.166	3.268.644	3.577.472	3.952.279	4.683.827
Kalimantan Barat	2.019.936	2.486.068	3.229.153	3.635.730	4.034.198	4.395.983
Kalimantan Tengah	701.936	954.353	1.396.486	1.627.453	1.857.000	2.212.089
Kalimantan Selatan	1.699.105	2.064.649	2.597.572	2.893.477	2.985.240	3.626.616
Kalimantan Timur	733.797	1.218.016	1.876.663	2.314.183	2.455.120	3.553.143
Sulawesi Utara	1.718.543	2.115.384	2.478.119	2.649.093	2.012.098	2.270.596
Sulawesi Tengah	913.662	1.289.635	1.711.327	1.938.071	2.218.435	2.635.009
Sulawesi Selatan	5.180.576	6.062.212	6.981.646	7.558.368	8.059.627	8.034.776
Sulawesi Tenggara	714120	942.302	1.349.619	1.586.917	1.821.284	2.232.586
Gorontalo	-	-	-	-	835.044	1.040.164
Sulawesi Barat	-	-	-	-	-	1.158.651
M a l u k u	1.089.565	1.411.006	1.857.790	2.086.516	1.205.539	1.533.506
Maluku Utara	-	-	-	-	785.059	1.038.087
Papua Barat	-	-	-	-	-	760.422
Papua	923440	1.173.875	1.648.708	1.942.627	2.220.934	2.833.381
INDONESIA	119.208.229	147.490.298	179.378.946	194.754.808	206.264.595	237.641.326

(Source: Biro Pusat Statistik/Central Bureau of Statistics (2011))

Furthermore, a huge amount of demand has not been satisfied by drinking water service provided by water companies. BPS recorded that in 2009 PDAMs in all provinces on average could only cover around twenty per cent of their respective area. There are some limitations faced by PDAMs as the water service provider. Those limitations are related to technical, institutional, and financial (Asih, 2006). PDAMs are often technically constrained to provide water service because people live in the areas with geographical obstacles such as isolated islands, mountainous areas. On the other hand, PDAMs also have institutional limitation in terms of human resource quality as well as organisational professionalism. Finally, the lack of financial capacity of PDAMs also becomes major constraint to expand their service coverage. To view the service coverage of PDAMs in Indonesia, it can be clearly seen in figure 3.3.

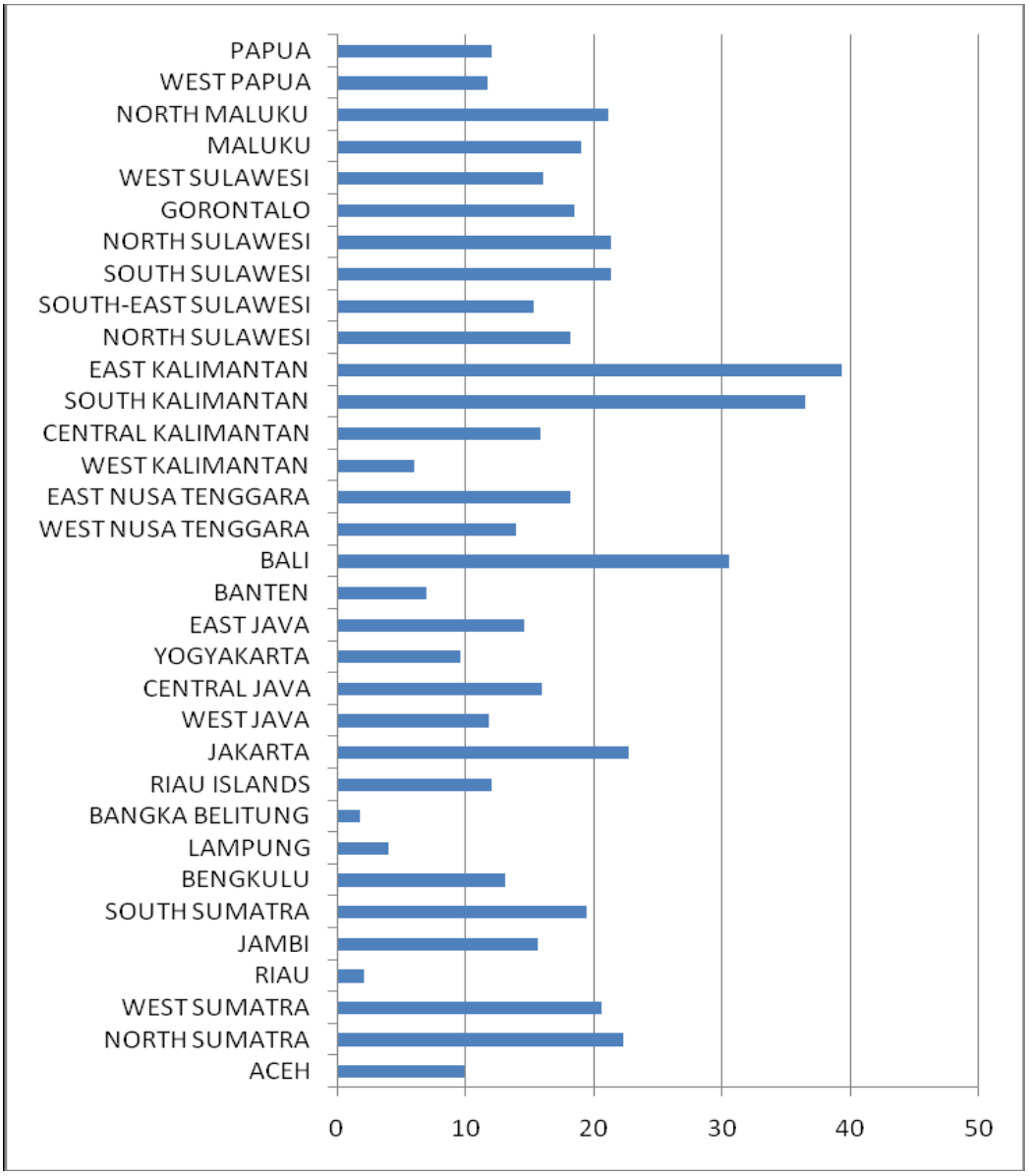


Figure 3.3 the Service Coverage of PDAMs in 2009 (Source BPS, 2009)

Comparing the dynamics of population growth and the ability of water providers to serve the need of water, it can be concluded that water providers disable to fully satisfy water requirement. As water is the basic need in human's daily live, unsurprisingly people search other options to fulfil their need instead of relying on the service provided by water companies. In the next section of this chapter, various efforts done by people to fulfil their need of water will be elaborated.

3.4 Various Efforts to Satisfy the Need of Water

In 2010 Central Bureau of Statistics conducted National Survey on Social and Economic namely SUSENAS (Survey Sosial Ekonomi Nasional). The survey was conducted in 497 cities in 33 provinces. On that survey, data related to the condition of drinking water provision is also gathered as well as various ways people fulfil their need of water. Data from the survey categorises people in fulfilling their water requirement by the water resource:

1. Piped water from PDAMs

   This category is a community group who has access to pipe water provided by water companies, either PDAMs or private companies.

2. Informal water vendors

   This category is a community group who does not have direct access to piped water, but they still consume water from Water Company by purchasing from informal vendors.

3. Bottled water

   This group consume drinking water that is produced by Water Company that sells bottled drinking water.

4. Individual exploitation

   This group does not consume water from any providers. They usually exploit groundwater in their own property. This survey distinguish this exploitation into two types; deep bored groundwater and shallow dug well. The former is usually using electricity in the abstraction while the latter is abstracted manually by human power.

5. Rainwater

   This group uses rainwater as the main water resource. They collect water from the rain, store it into storage tank, and then consume in as drinking water.

6. Surface water

   This group fulfil their water requirement by simply taking water from surface water such as natural spring, rivers, lakes, and so forth.

Furthermore, these various attempts in fulfilling the need of water are categorised into two main categories; a group who has an access to water and who does not.

In this case, people who purchase bottled water as their main water resource are categorised into a group who does not have access to water. By contrast, people who fulfil their need of water by individual exploitation are categorised into a group who has an access to water. To be more detail, the data are presented in this following figure.

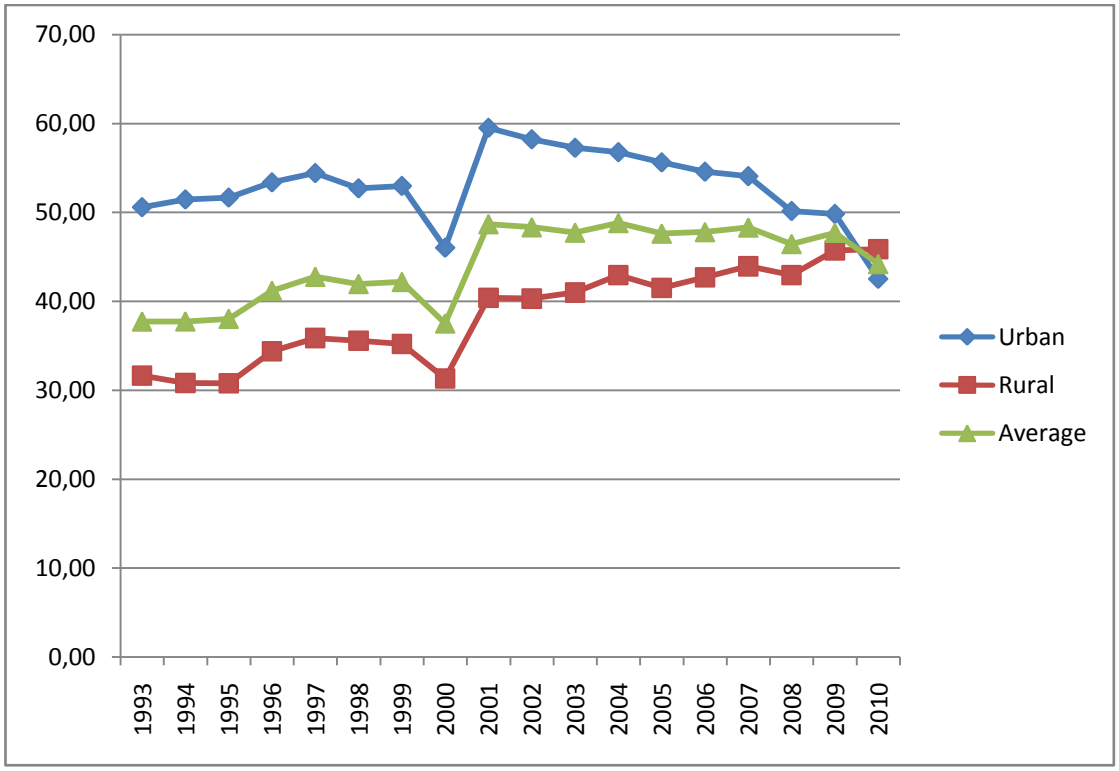


Figure 3.4 the percentage of household which have an access to drinking water (source: Hardjo, 2012)

The graph shows the percentage of household who have access to drinking water; data was recorded from 1993 to 2012 for urban and rural areas. In general, it can be clearly seen that there is an increasing trend for water accessibility while there is also downward trend in 2000. This result is gained because the survey that was conducted in that year did not include Aceh and Maluku. The households having access to drinking water is expressed in percentage, so the result that is expressed statistically looks like a downward trend.

Moreover, the survey previously defined that people who fulfil their need of water from either water companies or individual efforts, as long as the water is properly consumable, is categorised into the same category. If this data is confirmed with the data from PERPAMSI on picture 3.3, therefore, it can be interpreted that the

percentage of people who exploit water resource individually is quite significant. The data from PERPAMSI was that gathered in 2009 shows that on average service coverage of PDAMs is about twenty percent while East Kalimantan has the highest percentage of service coverage which is almost forty per cent. However, the percentage of household having access to properly consumable water in the same year according to SUSENAS is approximately fifty percent. To view the more detail figure of drinking water fulfilment in every province, the data can be seen in this following table.

Table 3.5 the percentage of household having properly consumable water based on the province in 2009 and 2010

No	The name of the province	The percentage of household			
		Urban areas		Rural areas	
		2009	2010	2009	2010
1	Aceh	34,19	24,74	29,20	30,68
2	Sumatera Utara	62,45	52,11	41,33	40,34
3	Sumatera Barat	58,14	47,94	40,53	38,17
4	R i a u	35,83	29,05	46,08	46,96
5	J a m b i	63,59	54,14	45,44	45,80
6	Sumatera Selatan	59,66	50,65	41,91	43,55
7	Bengkulu	43,15	37,02	27,60	24,37
8	Lampung	37,71	34,02	41,20	39,36
9	Bangka Belitung	34,31	36,13	39,18	40,22
10	Kepulauan Riau	36,22	21,69	39,46	34,72
11	DKI Jakarta	34,81	28,41	-	-
12	Jawa Barat	41,04	34,35	39,77	37,04
13	Jawa Tengah	61,54	58,63	55,28	56,49
14	D.I. Yogyakarta	57,61	54,50	65,85	73,12
15	Jawa Timur	54,06	47,95	57,25	57,26
16	Banten	27,54	22,19	27,35	22,61
17	B a l i	51,63	37,77	71,42	65,47
18	Nusa Tenggara Barat	49,76	50,44	41,51	43,15
19	Nusa Tenggara Timur	76,97	69,43	39,00	44,43
20	Kalimantan Barat	76,28	67,54	45,71	48,98
21	Kalimantan Tengah	53,03	48,71	28,56	36,40
22	Kalimantan Selatan	76,64	67,18	34,79	35,94
23	Kalimantan Timur	65,10	45,35	40,54	39,83
24	Sulawesi Utara	43,79	44,74	45,03	44,13
25	Sulawesi Tengah	49,01	38,30	43,13	34,07
26	Sulawesi Selatan	63,38	49,04	43,74	42,92
27	Sulawesi Tenggara	71,13	51,34	55,50	50,50
28	Gorontalo	61,47	47,10	37,18	36,40

29	Sulawesi Barat	65,01	55,96	32,28	32,12
30	Maluku	74,72	65,56	48,59	51,47
31	Maluku Utara	66,56	68,75	34,16	48,57
32	Papua Barat	55,20	38,49	45,12	48,24
33	Papua	53,56	43,63	30,29	28,59
Indonesia		**49,82**	**42,51**	**45,72**	**45,85**

(source: Hardjo, 2012)

There are some important points can be highlighted to describe the condition of drinking water fulfilment that occurs in almost all provinces:

1. The service coverage of the rural areas in general is less that in the urban areas. It indicates that the development of water service provision is influenced by geographic condition. The distant location of rural areas can be suspected as the geographical obstacle for water service improvement. In addition, rural areas are also characterised by sparse population that probably is not economically beneficial to be served by water companies.

2. In some provinces, there is a downward trend from 2009 to 2010. There are some possibilities to explain this trend. Firstly, the performance of water companies is getting worse so their service coverage also decline. Secondly, the population may increase rapidly while water companies cannot balance it with their performance improvement. Therefore, the percentage of service coverage automatically decreases. Thirdly, old consumers stop their contract with water companies and switch to other alternatives such as bottled water or individual groundwater exploitation. As this survey previously has defined people who rely on the bottled water as their main water resource are categorised as a group who does not have access to water source, the assumption of consumers switching their choice can be accepted. In addition, the data of bottled water consumption shows an upward trend. The data can be viewed by the following figure.

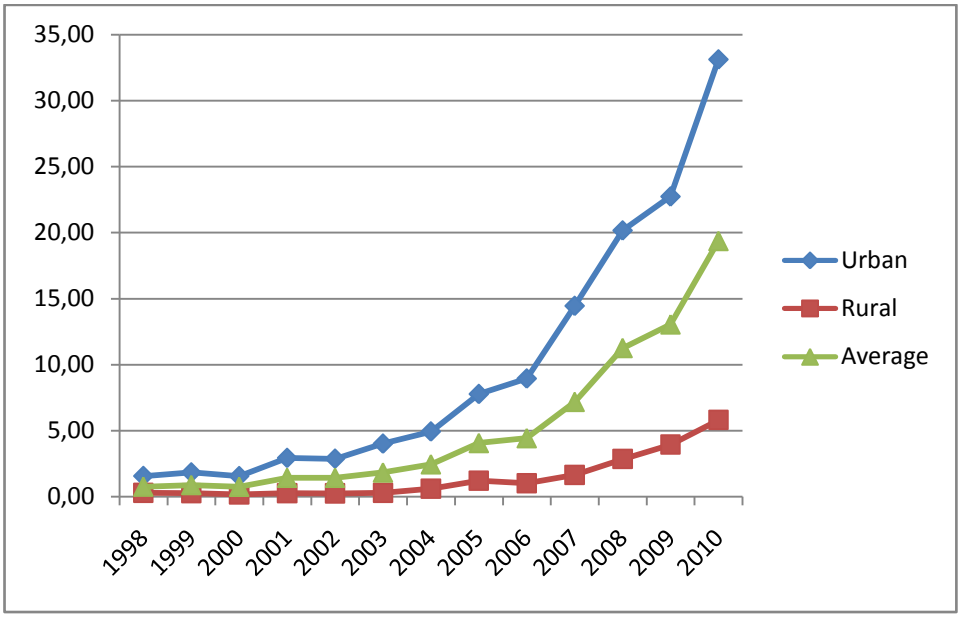


Figure 3.5 The percentage of household consuming bottled water as their drinking water (source: Hardjo, 2012)

To conclude, there is a strong relation between the performance of water service which likely improve in the slow pace and the water demand that increase more rapidly. PDAMs' inability in balancing the dynamic of water demand has implicated to the tendency of people to search another water source. Apart from this fact, there are also much potentials can be exploited in order to improve water services. As previously discussed, water resources in Indonesia are abundant either that come from rainfall, surface water, or groundwater. Furthermore, the tendency of people shifts their drinking water into bottled water or other resources should be considered as a challenge that is supposed to be responded by improving the recent condition. In the next section of this chapter, potentials that can be exploited to improve recent condition will be further discussed.

3.5 Brainstorming Possible Alternatives Based on Existing Potentials

3.5.1 Exploiting Water Resources within Suitable Technical and Financial Capacity

In discussing water supply provision, the dilemma between technical sophistication and cost required and the implication to the quality of the service seems to be inevitable. Basu and Main (2001) illustrate this tension into a schematic figure as it is presented in this following picture.

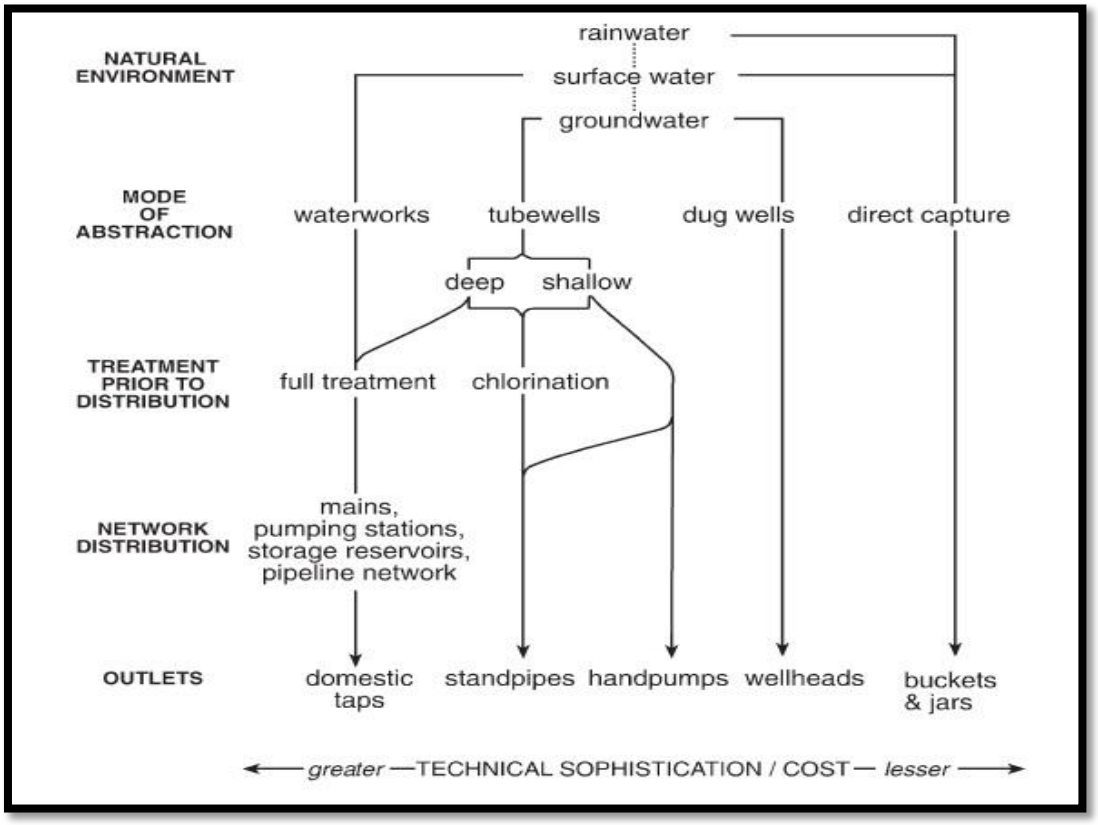


Figure 3.6 various modes of water abstraction (Source: Basu and Main, 2001)

The diagram shows that each water abstraction method brings its consequences in terms of technical sophistication and required cost. Obviously, technical sophistication and cost is not too necessary when people satisfy their need of water by simply direct capture from rainwater or surface water. However, it needs more efforts and time for people taking the water from the river by using buckets especially when the location of water resource is distant from their settlement. For rainwater harvesting, it depends very much on the season and cannot be done in all occasions. From these two illustrations, it can be inferred that water fulfilment through this way is time-space-dependant although it does not require a huge amount of investment and a sophisticated technology.

In the contrary, having potable water resource requires several treatment procedures that, of course, cost a lot of money and need advanced technology. In addition, it obviously cannot be done individually. Therefore, the existence of institutional arrangement is also needed besides sufficiently technical and financial support. Apart from these requirements, the output of this approach is

commonly desired by societies. Practically, they do not need to search water resource to satisfy their need of water except they just pay the bill while water can be simply consumed without depending very much on the time-space-dependant. In the context of Indonesia, where water sectors mainly belong to government's domain, the appearance of a good water service can be evidence that government successfully serve their citizens implicating to the political trust of the citizens.

In the middle of two poles (direct capture and provided service) lies groundwater abstraction. This method can likely be an alternative solution to overcome water fulfilment dilemma. While direct capture method is not reliable quantitatively and qualitatively, groundwater exploitation is relatively more reliable. On the other hand, the investment for groundwater exploitation is not as huge as piped water service. It can be done in smaller scales demanding on less advanced technical support. Nevertheless, it does not mean that groundwater exploitation is free from bad impacts. Environmental effects caused by groundwater over exploitation cannot be concerned as trivial issues. Excessive discharge of groundwater implicates to the depletion of water table and can lead to more severe water shortage. Moreover, the empty space in the soil particles caused by groundwater discharge can possibly allow saline water to infiltrate. This occurrence noticeably may affect to the quality of water that is consumed. In short, there are always consequences in taking such method in water fulfilment. The point is how to optimise existing potentials to maximise the benefits without ignoring possible bad consequences.

According to the diagram in figure 3.6, the authors list three types of water resource that can be exploited; rainwater, surface water, and groundwater. If they are confirmed with the existing water resources in Indonesia as it has been discussed in the section 3.2, there essentially are many opportunities can be taken. Abundant water resources that belong to this country are a huge potential to be exploited. There are many options can be conducted in order to improve the recent condition.

3.5.2 Reformulating Water Tariffs into More Reasonable Rates

Improving water services cannot also be divorced from developing institutional arrangement. In this case, PDAMs as the major water service providers have not been able to satisfy the expected condition. Dikun (2003) noticed that there is a misunderstanding in interpreting Law Number 5 Year 1962 about Local Government-Owned Company that is used as a legal basis of the establishment of PDAMs. In many cases, municipality governments often view the establishment of the PDAM in their territory as an economic opportunity to increase their revenue instead of as a public service. Consequently, PDAMs are often established without considering deliberately aspects that support the performance such as technological ability, sufficient water availability, and even potential cost recovery. It then implicates to the performance of PDAMs that is lower than expected level.

On the one hand, PDAMs function as a revenue source, but water is often viewed as common good for public interest. It can be seen in the process of determining water tariff. This process involves local representatives, and the decision is legalised in the form of regional regulation approved by both executives and legislative bodies. Obviously, there are always political tensions in this process. Unsurprisingly, the rate is not determined in accordance with economic calculation, but frequently political consideration. It results in the low price which merely covers production cost and is difficult to finance service improvement. As an illustration, here is the water tariff of PDAMs in Jakarta that is set in the Governor Regulation Number 11 Year 2007.

Table 3.6 the Water Tariff in Jakarta

No	Consumer Classification[4])	Consumption Block and the Tariff per m^3 (Rp.)		
		0 – 10 m^3	11 – 20 m^3	> 20 m^3
1	Group I	1,050.00	1,050.00	1,050.00
2	Group II	1,050.00	1,050.00	1,575.00
3	Group III A	3,550.00	4,700.00	5,500.00
4	Group III B	4,900.00	6,000.00	7,450.00
5	Group IV A	6,825.00	8,150.00	9,800.00
6	Group IV B	12,550.00	12,550.00	12,550.00
7	Group V	14,650.00	14,650.00	14,650.00

(Source: www.pamjaya.co.id)

Compared to bottled water this tariff scheme is far much cheaper. As a comparison, consumers have to pay about 10,000 Rupiahs for 20 litres of bottled water. Nevertheless, the trend show that bottled water consumer increase significantly as it is presented in the figure 3.4. It can be interpreted that consumers actually are able to pay up to the level set by bottled water companies as long as their need can be satisfied sufficiently. In addition, water is a basic need that undoubtedly cannot be substituted by other goods. This circumstance actually creates a room for PDAMs to reformulate their tariffs into more reasonable level. The tariff should be able to cover not only production cost, but also the costs for maintenance and expanding the network in order to improve the performance and service coverage of PDAMs.

3.5.3 Optimising existing institutions and regulations

In 2004 the Government of Indonesia issued Law Number 7 that regulates water resource issues. This regulation is used as the main legal basis in water resource management. There is significant improvement accommodated in this regulation.

[4]) According to Governor Regulation Number 11 Year 2007 , the consumers of PDAM are classified into seven group:

- Group I : social facilities such as orphan houses, mosques, churches, etc.
- Group II : low income housings and public facilities owned by government such as hospital, schools, etc.
- Group IIIA: middle income housing
- Group IIIB: small enterprises, grocery store, non-profit private organisation.
- Group IVA: high income housings, government office, commercial buildings.
- Group IVB: high rise buildings, luxury apartment, hotel and tourism facilities, large scale warehouses and factories.
- Group V : special area such as Tanjung Priok Port.

Water sectors that previously are strongly dominated by central government recently are more decentralised in line with the spirit of decentralisation era. The authorities and responsibilities of each level government (central, province, municipality, and even village) regarding water resource management is clearly stated in this law (article 14, 15, 16, and 17). Furthermore, the possibility of private sectors and community involvement in water provision is also covered in this regulation (article 40). In this article, private sectors and community groups are allowed to participate in the water supply provision that aim to (article 40 paragraph 5):

- Provide reliable water service within affordable tariff.
- Balance the interests of consumers and water service providers.
- Increase the efficiency and coverage of drinking water service.

The principles of water conservation are also accommodated in the Law Number 7 Year 2004. This issue is specifically stated in the third chapter of the law consisting of six articles (article 20, 21, 22, 23, 24, and 24). According to this law, water resources (both surface and groundwater) and environmental condition that is related to the quality of water resources such as catchment areas in the upstream, river banks, and so forth are supposed to be conserved in order to sustain the availability of water and prevent water-related disaster either caused by human or nature.

To implement the Law Number 7 Year 2004 specifically for the drinking water provision, in 2005 the Government of Indonesia issued Government Regulation Number 16 about Drinking Water Provision System Development. This regulation is an instrument to implement the Law Number 7 Year 2004. In this regulation the Drinking Water Provision System Development is defined as activities aimed to develop, expand, and/or increase physical system and non-physical (institutional, management, finance, community participation, and legal aspect) that is integrated in order to provide drinking water service to societies (article 1 paragraph 7). Furthermore, this government regulation also tries to cover wastewater and disposal issues. Those two problems are viewed as an integral part and cannot be seen partially from drinking water issues.

Water tariff formulation and what aspects are supposed to be included in calculating the tariff are also accommodated by Government Regulation Number 16 Year 2005 as well as financial resources that are allowed to finance drinking water development. Again, private sectors and communities are welcomed and even expected to participate in the development of drinking water sector (article 64 and 65). In formulating water tariff, this regulation also clearly mentions elements that should be included such as operational and maintenance cost, depreciation, interest rates, and reasonable benefits (article 60, paragraph 3).

In following up those two regulations, in 2006 the Ministry of Public Works formulates national policies and strategies which is outlined into the Ministerial Regulation Number 20/PRT/M/2006. This regulation is aimed as a guideline in formulating technical policies, planning, and programmes implementation that are related to the development of drinking water provision system either in urban or rural areas. There are five policy directives that are eager to be achieved:

1. Increasing the service coverage and quality of drinking water for every people in Indonesia.
2. Encouraging participation for financing drinking water provision.
3. Improving institutional capacity and regulation.
4. Increasing the availability of raw water in a sustainable manner.
5. Encouraging the partnership with private sectors and communities.

In conclusion, there are chances to improve recent water service condition in terms of institutional support. The existing institutions and regulations, decentralisation atmosphere in political system, and a room given for private sectors and communities to participate are the opportunities that can be optimised even though it is still hard in the implementation phase. On top of that, both natural resource and institutional circumstances are valuable capital that is supposed to be properly exploited in order to improve the recent condition of water service.

CHAPTER IV
SEEKING APPROPRIATE STRATEGIES TO THE CONTEXT OF INDONESIA

In this chapter, the discussion of seeking strategies that suit to the context of Indonesia will be elaborated. Findings from previous chapter will be useful to determine the improvement strategies. In addition, they will also be enriched with various examples that have been practiced worldwide through literature study. In the beginning of this chapter, concepts in contingency theory will be revisited in order to notify that there is no single best strategy but context-dependent. And then, it will be continued with discussing considerations in selecting the examples preceding literature study in choosing strategies; list of strategies will be gained from literature. Eventually, this chapter will end with the assessment of strategies in the context of Indonesia.

4.1 Revisiting Contingency Theory

In seeking appropriate examples to be learned, the concepts of contingency theory and policy transplantation is essential to be considered. In the perspective of contingency theory, strategies to improve organisational performance are always context-dependent. Therefore, in the process of selecting examples to be learned the context of respective country is crucial instead of merely viewing the successfulness.

After understanding the context of origin countries, another essential aspect is considering the context of Indonesia. It is important in order to assess the suitability of listed strategies. This is because there is close relation between fit to contingency factors and increasing performance (Donaldson, 2001). This author, then, conceptualise fit as congruence combining the level of contingency and structure that produce higher performance. In short, it can be stated that the degree of suitability determines the success of such strategies if they are intentionally to be adopted.

4.2 Considerations in Selecting Strategies to Be Learned

There are so many strategies have been applied in order to fulfil the need of drinking water. On one hand, it makes more options to be chosen as good

examples. On the other hand, not all of them are suitable to be implemented in another place. Some of strategies very much embed to the local characteristics which are difficult to be applied when the context does not match. However, some strategies are also generic and relatively easy to be applied in other places. By considering this situation, some principles are taken into account when selecting examples to be referred. Selected examples are taken if they are technically applicable and financially feasible. On top on that, they should be in line with the legal framework of Indonesia.

In selecting the cases as examples, there are some considerations to be taken. The first is geographical condition. The examples mostly come from tropical countries that approximately have similar climate with Indonesia. This factor is essential for avoiding physical obstacles that possibly constrain such strategies to be imitated. Besides this physical feature, economic condition and technical ability of selected countries are also important to be considered. Therefore, examples mostly come from developing countries where their economic and technological capacity is not too different with Indonesia's.

Furthermore, findings about potentials that are possible to be exploited are also important consideration is selecting the strategies. As it has already discussed in chapter 3, there are opportunities to improve the recent condition of drinking water provision. The existence of natural resources which are abundant is a priceless potential. In addition, recent legislations that are used as legal basis to operate and manage water sector has accommodated principles that allow different approaches for water provision such as community involvement and public private partnership.

Based on considerations above, several strategies from various countries have been selected through journal papers. And then the background of water problems is listed as well as the critical factors of each strategy. In general, the list of strategies can be categorised into three main groups (the complete list of articles can be seen in appendix 1):

1. institutional arrangement
2. community-based water management

3. public-private partnership

The common purpose of those strategies is to improve drinking water service and to deal with obstacles of accessing drinking water. However, they are different in terms of dominant actors who play the role. In the institutional arrangement, for instance, government plays major role. Meanwhile, in the community-based water supply dominant actors belong to local community although they are still supported by government or NGOs. In the third strategy, both government and private sectors have essential roles in determining the success of the strategy. This strategy is mainly conducted to overcome financial limitation faced by government to provide public services.

4.3 Various Examples from Literature Study

4.3.1 Institutional Arrangements

Several examples of institutional arrangement are taken from selected journal papers (Appendix 1). The list of those examples and respective background and critical factors, which can be categorised as institutional arrangement, can be seen in the following table.

Table 4.1 Strategies of Institutional Arrangement from Several Countries and Their Critical Factors

No	Strategies	Background	Critical Factors	Location
1	Integrating urban and rural water management function	Rapid population growth and economic development implicates to high demand of water and leads to the potential of water shortage.	Inter-region coordination	China
	Implementing planned water use and water saving system		Connecting resource allocation planning and the abstraction permit system	
	Water quota management		Shifting form supply-side to demand-side management and implementing the new approach gradually	

	Strengthening coordination among institutions dealing with water management, urban planning, and environment protection	Overlapping among institutions in water sectors	Formally hierarchical connection	
2	Establishing what so called as Technical Secretariat to conduct necessary reform measures	Over-centralised of water service cannot afford expected level of service	The ability of Technical Secretariat to conduct reform measure and cooperate with foreign donors	Yemen
	Promoting decentralised water service and testify the idea into pilot projects		Political will for reform and decentralisation	
	Promoting public-private partnership and gaining financial support from foreign donors	The lack of financial ability to cover water service	The role of Technical Secretariat succeeding the strategy.	
3	Implementing decentralisation through *budgeting by objectives*	The lack of technical and financial capacity	Move from supply-side approach to demand-side approach with local capacities	Benin
4	Cost sharing between central government and local authorities to invest for project in the water sectors	The lack of technical and financial capacity	The approach seems to be failed to finance high-cost water supply system	Mali
5	• Delegating water provision to local authorities • Cooperating with private sectors and foreign donors	The lack of technical and financial capacity	This strategy implicates to management skill of government in dealing with water tend to be stagnant or even decrease because government tends to give the responsibility to other parties	Senegal
6	Establishing national policy through 10-year plan for water and wastewater management	Gaps and overlaps among ministries, authorities, and agencies regarding the functions and responsibilities	The improvement of institutional capacity has not been sufficiently conducted since the government still pay more attention to physical infrastructure to meet the desired supply	Lebanon

7	Pipeline rehabilitation to increase efficiency	Water service coverage is not adequately satisfying the need because of inefficiency such as leakage	Greater emphasis on demand-side management	Calcutta
	Involving NGOs and scholars to test communities' water resources	The use of groundwater become more intensive that is suspected as major cause of arsenic contamination	Increasing environmental awareness is supposed to be supported by water service improvement	
8	Changing the work culture radically by enforcing strict discipline	Centralised and top down management resulted of former regime implicate to inefficiency and poor performance of staffs	The use of incentive and sanction for staffs with transparent policies	Phnom Penh
	Reducing unaccounted water by treating staffs as ordinary consumers	Unaccounted water because former regime gave water service free for staffs	Equity and transparency	
	Reformulating water tariff	Low water tariff cannot afford cost recovery	Considering the principles of financial viability and social sensitivity in proposing new tariff	
9	Enacting a cabinet resolution on remedial measures for the mitigation of the groundwater crisis and land subsidence	High urbanisation with large population implicate to more intensively use of both surface and groundwater	Political will to reduce the use of groundwater	Bangkok
	Establishing the Metropolitan Waterworks Authority (WMA) which is intentionally aimed to formulate water policy		Treating WMA as business organisation which committed to be a good corporate governance	
	Revising former master plan		The implementation of demand management measures	
10	Diversifying water resources such as imported water (from Johor, Malaysia), local catchment, recycled water, and desalinated water	The absence of natural water resource	Strong political will to suffice the need of water	Singapore

	Integrating land use planning and water management	Limited land implicates to the competition for development and environment protection	Effective legal and regulatory framework as well as its strong enforcement	

From the listed strategies, it can be noticed that institutional arrangement play important roles in improving drinking water service. Various strategies have been taken in order to overcome constraints faced by countries respectively. Water scarcity, for instance, is responded by various approaches. In China, this problem is handled by the implementation of water quota for industries that consume water excessively. Meanwhile, Singapore undertake integrated land use planning and water management, besides diversifying water resources, to overcome water scarcity problem because it is also combined with limited land for development.

Moreover, the lack of technical and financial capacity resulted from previous political regime is also handled differently even though decentralisation is the most favourable. However, Phnom Penh took a different action to deal with this issue by changing the work culture radically. In implementing this strategy, facilities and privileges previously achieved by government staffs are stopped because of efficiency consideration. Besides that, involving non-governmental parties such as NGOs, private sectors, foreign donors in improving technical and financial capacity is also commonly practiced by several countries to overcome technical and financial constraints.

Viewing institutional arrangement strategies and their successfulness, generally there are some critical factors can be highlighted. Firstly, the scale of service is essential to be considered. Although institutional arrangement mostly belong to the domain of government at national level, dealing with water provision problems is likely difficult to be taken in this level. Centralisation, for instance, has led the water service become less efficient (Gerhager and Sahooly, 2009; Biswas and Tortajada, 2010b). It increase financial burden of central government to finance the development of water projects. However, some countries like Benin, Mali, and Senegal are also suffered when decentralisation was initially introduced. The gaps in technical and financial capacity between central

government and local authority makes the process of decentralisation does not run smoothly. Juglin et al (2011), notice that the difference in understanding centralisation caused the different type of service models implicating to the difficulty in developing standardised water service at local levels.

Secondly, coordination is also a keyword of success. As water issues are characterised by multiple interests within cross boundaries, coordination both inter-regions and inter-sectors, becomes an essential thing. Empirical evidences from listed strategies, such as Lebanon, show that institutional gaps and overlaps formerly existing have led water services become inefficient (El-Faddel et al, 2001). This country has set a general policy for water resource management and conducted several water projects but the results have not reached the desired level because of ineffective institutions and regulations.

Furthermore, the success of strategies above is highly influenced by strong political will to provide satisfying water services. Let us take the case of Singapore. This small country has no significant water resource to be relied on, but Singapore has already been successful to suffice the need of water adequately. The commitment of government to fulfil citizen's need is articulated in the national policy implemented into five strategies: physical infrastructure, legislation and enforcement, water pricing, public education, research and technology (Luan, 2010). Through this strategy, Singapore basically has involved essential factors that are required to manage issues comprehensively. However, a strong political will should be supported by effective legal framework and its enforcement. Otherwise, strategies will be difficult to be implemented and expected results will be hard to be achieved. Phnom Penh, for example, has been successfully improved the performance of water service because of strong law enforcement within the principle of equity and transparency. Former regime privileging government staffs has made the performance of the staffs degrade. This work culture eventually can be changed through a strict enforcement implicating on the increasing of service performance.

Finally, the shift of approach from supply-side to demand-side management also becomes a critical factor determining the success of strategies. Supply-side

management that more focus on physical development, in fact, could not fully cover the dynamics of water issues such as environmental changes. Strategies based on this approach are usually costly and requires advanced technology. On the other hand, managing demand-side might be much cheaper and could adapt with environmental dynamics (Brandes and Maas, 2004).

4.3.2 Community-based Water Management

Besides strategies related to institutional arrangement that is highly dominated by the role of government, community-based water management can be an alternative option. This approach is strongly relied on the role of community even though the role cannot be simply ignored. Several examples of community based water management are listed in this following table.

Table 4.2 Strategies of Community-based Water Management from Several Countries and Their Critical Factors

No	Strategies	Background	Critical Factors	Location
1	Instalment of water point to be managed by community	Large concentration of informal settlements inhabited by low income people have no access to potable water	The involvement of foreign donors, NGOs, local government, and informal leaders	Dhaka, Bangladesh
2	Encouraging local participation through public-private-community joint action	Informal fringe settlements which are not provided by water supply service	Horizontal and vertical linkage among relevant stakeholders	Dar Es Salaam, Tanzania
3	Introducing community management where communities contribute to the drinking water facilities development and management	Water sectors was handled by central government but the service cannot reach remote rural areas	Relevant actors involved, regular training and meeting, financial arrangement	Rural areas in Ghana
	Promoting rainwater harvesting		This strategy is not successful because of the lack of technical support	
4	Establishing a new policy which emphasis on increased stakeholder participation and water resource management	Highly centralised system of water provision	The policy seems to be less successful because of limited consultation and is still implemented in traditional command and control approach	Kenya

5	Proposing water policy and institutional reform that accommodated communities' participation through fair water tariffs	There was no official water policy	Proposed policy was unsuccessful because of less political commitment from government to improve water service	Zanzibar
6	Formulating the new water policy that accommodates the principles of comprehensive water resource management	Insufficient institutional arrangement	International supports from ADB, FAO, and IWMI	Sri Lanka
7	Establishing the new water act that cover the principles of decentralisation, market-based water allocation, full cost recovery and has more linkage to other sectors of society	Outdated water regulations	The involvement of all stakeholders in the process of formulating the policy	South Africa
8	Introducing a water project that involves government, private sectors, and communities	Water supply had been unreliable and existing scheme likely needs to be reformed	In the beginning the project ran well, but it became less successful because of unequal political power among stakeholders	Rajasthan, India
9	Government incorporating with private contractors and NGO provide public hand pump while operation and management of hand pump belong to communities	Water service cannot reach rural communities	The projects look like unsustainable because of the lack of payment for operational and maintenance cost; rural communities still view that water is free	Rural areas in Mali

Community-based management in water provision that is listed in the table 4.2, and perhaps in other places, is commonly practiced for areas where are located distantly from city centre. These areas are usually not covered by water service companies because of geographic obstacles and economic consideration. From listed examples, it shows that community-based management can be an option to overcome those constraints. Although the implementation of this approach is different in many countries, the core of this strategy looks like similar; community involvement.

Moreover, from various strategies that have been practiced there are some critical issues can be noticed; one of them is support from external parties. Community based management strategies in the list above are mostly conducted for communities in rural areas located far from water service coverage. The communities are characterised by the lack of capacity in dealing with water provision. Therefore, the assistance from external parties in the form of financial and technical support is important to succeed the programmes. The experience of rainwater harvesting programme in Ghana can be taken as an example how important the support is. The great opportunity to exploit rainwater as water resource was not successfully achieved because of the lack of technical support (Opare, 2011a). By contrast, at another rural area in Ghana, community based management program was successfully done because of a good collaboration between government and community followed by regular training to increase community capacity (Opare, 2011b). This evidence, once again, shows that the role of community in determining the successfulness of the programme is very essential. And the influence of community in succeeding the programme will be much stronger if their capacity is continuously enhanced.

Moreover, the issue of equity in the relation among different stakeholders is also essential to be taken into account. In most cases, community frequently becomes the weakest party in the system. Tripartite water project in Rajasthan, India called "Our Water Project" which involves government, private contractors and civil society can be taken as an example. In the beginning of the project, everything seems to be good. As time goes by, the performance of water service tends to decrease. When community complain about it, there is no response either from government or private contractors (O'Reilly and Dhanju, 2012).

Apart from those external factors, intrinsic characteristics of community are also a crucial element. Local culture in viewing water issue plays an important role for sustaining such kind of community-based water management. The experience of public hand pump instalment in rural areas in Mali confirms that local culture determine the sustainability of the projects. In those areas, most local people still view that water is a free substance without any payment. This situation makes

existing facilities be less maintained because of the absence of operation and maintenance cost. Therefore, the form of participation is also supposed to be well defined before introducing such kind of community based water management programmes. Jones (2011) proposes that participation should be articulated not only in the form of citizenship but also in the form of payment for public service.

4.3.3 Public-Private Partnership

Another approach to overcome water service provision problems besides two approaches above is Public-Private Partnership (PPP). The PPPs basically are conducted to overcome financial constraints faced by government. From this point of view, the role of private companies is crucial to support government financially. However, they also need political and legal certainty that belongs to government authority. Through this mutual relation, both government and private sectors presumably can achieve benefits respectively as well as share potential risks.

Several strategies regarding PPPs in water provision are listed in table 4.3. Fully privatisation, however, will not be mentioned for some reasons. Firstly, fully privatisation in drinking water service is likely too difficult to be applied in Indonesia because of regulation constraints. In the constitution of Indonesia, article 33, it is stated that water belongs to state's authority to be utilised for the prosperity of citizens. It then is followed by the Law Number 7 year 2004 stating that water resources are under state's authority (article 6, paragraph 1), and the state recognises the right to water for indigenous communities (article 6, paragraph 2 and 3). In addition, there is also the right to use water that can be given to individuals or enterprises (article 9, paragraph 1), but the role of government in giving the permit is still dominant. Secondly, privatisation was actually practiced in some area such as Jakarta, but it seems to be failed and far from expectation (Bakker, 2007). This author even notices that the existence of private company in Jakarta as 'anti-poor' (p.866) since private water company merely serve community with high income and geographically can be reached easily. Based on these considerations, fully privatisation is not preferable to be taken as an example.

Table 4.3 Strategies of Public Private Partnership
from Several Countries and Their Critical Factors

No	Strategies	Background	Critical Factors	Location
1	Promoting PPP through the scheme of Build-Operation-Transfer (BOT) aiming to provide reliable water service	Inadequate infrastructure combined with the absence of government budget to deliver reliable water service	Clear statement of benefit and risk sharing	Beirut, Lebanon
2	Involving private sector in order to overcome financial constraints in the service provision	Low level of coverage in water and sanitation due to limited government budget	The approach seems to be failed because it conducts not out of sense of opportunity but desperation. Besides, it also failed because it was strongly determined by political power instead of standard procedure of PPPs	Ghana
3	Introducing public-public partnership between publicly owned company called DAWASCO with Community Based Organisation (CBOs)	Private consortium failed to provide reliable water service within affordable price	The existence of CBOs to expand water service up to remote areas where former system could not reach	Dar Es Salaam, Tanzania
4	Involving private sectors in water provision to increase service coverage and reduce unaccounted for water	Rapid population growth and poor water service	The programme is significantly successful because of trust and commitment among involved parties: government, private operators, and consumers	Casablanca, Morocco
5	Promoting PPP involving state owned company and local enterprises	Former state monopoly system could not deliver water service sufficiently	The result is not satisfying because of the absence of clear statement on benefit and risk sharing	Congo-Brazzaville
6	Delegating the management and operation of water supply through lease or concession contract with private companies	Low level of water service	Both government and private companies stated clearly what their aims and convinced everyone of their intentions	Mozambique

From this table, there are some determinant factors can be identified. Firstly, the initiative to promote PPPs is supposed to be based on the opportunities to gain potential benefits rather than desperation of government to provide public service

because of limited funding. It will make PPPs project more interesting and can attract private to involve. The experience of Ghana can be taken as one example when government offered PPPs but in the sense of its desperation. And the result of the approach has not obtained maximally as it was expected. Secondly, agreement between involved parties has to be clearly stated accommodating the aims and intentions of each party. The obligations and authorities of respective party should be well defined considering potential benefits and risk can be gained by each party. Otherwise, mistrust issues will potentially appear and decrease the performance of the projects.

Apart from public-private partnership, there is another scheme of cooperation between government and non government bodies. The experience of privatisation in Dar Es Salaam, Tanzania, shows that private consortium has failed to provide sufficient level of water service. As a result, government initiated the establishment of public-public partnership. The cooperation involved publicly owned company and community based organisation. In this case CBOs can act as middlemen and direct producers. For those who live relatively close to pipe network, they can be middlemen to deliver water for people who cannot be reached by pipe network. And for those who live distant from pipe network they can be direct producers that can exploit the most possible water resource such as groundwater and distribute the water to the communities (Dill, 2010).

4.4 Assessing the Suitability of Strategies to the Context of Indonesia

Departing from listed strategies above combined with opportunities that was discussed in chapter 3, there are some critical points can be assessed. This following table illustrate the key of success that is obtained from the discussion in section 4.2 and the possibility to be applied in the context of Indonesia. However, only strategies that are possible to be implemented are listed. The degree of possibility is illustrated with the number of plus symbols. More symbols indicates more possible such strategy to be applied. Strategies which do not fit with the context of Indonesia will not be discussed although they are highly successful in the origin countries. Imported water, for example, will not be listed in this

following table since Indonesia actually has abundant water resources and is not necessary to import water.

Table 4.4 the Suitability Assessment of the Strategies

Strategies	Required elements	Possibility to be implemented	Notification
1. Decentralising drinking water service	Political system	+++	Since the termination of Suharto's era decentralisation is highly promoted through the enactment of a set of regulation regarding decentralisation (Law Number 22/1999 that was revised by Law Number 32/2004. In addition, drinking water provision now belongs to local government through PDAMs. (For further discussion see section 3.3.1)
2. Regulation reform and organisation arrangement	- Political will - Inter-regions and inter-agencies coordination - Effective law enforcement	++	Indonesia actually has already had a set of regulation dealing with water issues. However, the implementation is still weak and far from what is mandated by the regulations. In addition, water sector is still managed partially by several institutions such as the ministry of public works, the ministry of environment, the ministry of agriculture, and so forth. (for further discussion, see section 3.5.3).
3. Expanding pipe network	- Funding - Political will - Technological support - Raw water sources	+++	The government of Indonesia actually has already set targets to expand water service through pipe network expansion in the development plan. The government set a target of 60% population should be served in 2015 (Regulation of the Ministry of Public Works Number 20/PRT/M/2006). This is a kind of political will that support this strategy. The main obstacle is financial and technological support but it can be tackled by cooperation with other parties such as foreign donors, NGOs, private sectors, etc.
4. Reformulating water tariff	- fair and transparent process - better performance of service - purchasing power of society	+	From legal aspect, the mechanism of tariff formulation has already set (Regulation of the Ministry of Internal Affair Number 23/2006). However, political

	- Legal basis		reform to develop clean governance is still ongoing process and the implication of increasing water tariff to the improvement of service performance is still questionable. (for further discussion see section 3.5.2)
5. Collective well	- Community involvement and awareness - Natural resources - Technical and financial support	+++	The existence of natural resource makes this strategy is possibly workable (supporting data can be seen in section 3.2.3). Community involvement is also accommodated in the Law Number 7/2004 article 35). In addition, the spirit of togetherness and mutual help embedded in the culture of communities, especially rural people, is a strong point that makes this strategy applicable.
6. Rainwater harvesting	- Natural resources - Technical support	++	The high rainfall rate of Indonesia is a huge potential to be exploited and some people still rely on this water resource (supporting data can be seen in section 3.2.1). from regulation perspective this strategy is also possible (Law Number 7/2004, article 35). However, there is still lack of technical support to apply this approach.
7. Joint funding	- Conducive economic circumstance - Equity and transparency	+	This approach seems to be difficult to be applied although there is still a chance. The possibility of this approach can be gained in line with the Law Number 7/2004, article 40 and 78. However, this strategy rarely occurs in Indonesia and mistrust issue often appear when this kind of scheme is implemented. One of possibility is government build the facilities and communities are responsible to maintain.
8. Public-Private Partnership	- Legal certainty - Fair sharing on benefits and risks	+	Although PPP has been practiced in Indonesia but for water sector the partnership is still in the phase of design and construction while in the phase of operation and management this scheme is very rare. Privatisation has been conducted in big cities

			such as Jakarta, but this system is highly criticised since the nature of private company there is very much profit-oriented (Bakker, 2007).

CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Recommendation for Selected Strategies

Indonesia is a big country with high diversity in terms of geographical features, population density, economic condition, cultural characteristics, etc. These varied characteristics obviously bring consequences, or at least, should be considered while such strategies will be applied. Strategies regarding institutional arrangement, for instance, probably can be implemented generally without having significant obstacle related to those diverse characteristics. However, other strategies, especially which include technical measures, have to consider local characteristics in the implementation. Geographical, economic, and cultural characteristics are taken into account when such strategies will be promoted. This idea is inspired by the concept of sustainable development that considers environment, economy, and social aspects in proposing the any kind of development.

From the table 4.4, decentralising water service and establishing regulation are likely applicable in every place in Indonesia. They have been conducted in national level even though the implementation still needs to be improved significantly. In addition, regulation reform and other institutional arrangement are also required in the local level. And this effort should consider characteristics that inherently embed to respective locality. This following table elaborates characteristics that are suitable to be addressed by respective strategy that will make the strategy workable.

Table 5.1 Selected Strategies and the Characteristics to Be Addressed

Strategies	Characteristics to be addressed	Possible Location for Implementation
1. Decentralising drinking water service	In general, no specific requirement	Generally, it can be applied in all parts of Indonesia
2. Regulation reform and organisation arrangement	In general, no specific requirement	Generally, it can be applied in all parts of Indonesia
3. Expanding pipe network	a. Geographical features: - Areas with no extreme geographical constraints such	Java, Bali, Kalimantan

	as: steep mountainous areas, remote small islands, etc. - Raw water sources are available b. Socio-economic aspects: - Population density is moderate to high - Financial and technical support are available to expand the service - Communities with low to high income c. Socio-cultural aspects: - Communities who have willingness to pay	
4. Reformulating water tariff	a. geographical features: - in general, no specific requirement b. Socio-economic aspects: - Communities with middle to high income c. Socio-cultural aspects: - Communities who have willingness to pay	Java, Bali, Kalimantan.
5. Collective well	a. Geographical features: - Water resources are available - Rural or remote areas where pipe network cannot reach - Preferably flat topography b. Socio-economic aspects: - Population density from low to moderate - Preferably for communities with low income c. Socio-cultural aspect: - Preferably rural communities that still have a culture of mutual aid	Sumatere, Sulawesi
6. Rainwater harvesting	a. Geographical features: - Adequate rainfall rates - No significant water resource either surface or groundwater - Remote or isolated areas such as small island where pipe network cannot reach b. Socio-economic aspects: - Preferably for low income community - Population density from low to moderate c. Socio-cultural aspects: - Local government or other parties can give technical assistance	Maluku, Papua, Nusa Tenggara.

7. Joint funding	a. Geographical features: - There is no extreme geographical constraints to make the projects technically applicable b. Socio-economic aspects: - Preferably for middle income communities c. Socio-cultural aspects: - Mutual trust between government and societies	Sumatera, Sulawesi
8. Public-Private Partnership	a. Geographical features: - In general, no specific requirement b. Socio-economic aspects: - Conducive entrepreneurship atmosphere - Stable economic situation - Preferably for middle to high income communities c. Socio-cultural aspects: - Mutual trust between government and public sector	Java, Bali, Kalimantan

Obviously, to justify in which part of Indonesia such strategies can be well implemented is not an easy task due to high diversity that belongs to this country. However, some characteristics that are inherently embedded in respective region can be guidance in determining favourable locations for certain strategies. The first two strategies (decentralisation and regulation reform) seem do not require specific requirements and can be widely conducted. This is also supported by political atmosphere in Indonesia nowadays that tend to strongly promote decentralisation though the role of central government cannot be simply ignored.

Furthermore, expanding pipe network is recommended for Java, Bali, and Kalimantan. High population density in Java and Bali as shown on table 3.4 become major consideration this strategy is preferred. Letting individual (or even communal) groundwater abstraction could cause huge environmental degradation since the demand for water is very high in line with the number of population. Therefore, intensifying pipe water that takes surface water as major raw water is more reasonable to prevent such environmental degradation. In the case of Kalimantan, this strategy is chosen because of the existence of many rivers (table 3.1) as abundant raw water potentials instead of population consideration and its

topographical feature that is relatively flat. This circumstance brings benefits in technical aspects of pipe network development. In addition, the service coverage of Water Company in provinces located in this island is more than average (picture 3.3). It shows that those water companies are more advanced in covering the service and potentially can be more improved. Expanding pipe network, then, can involve private sectors through public private partnership (PPP) especially in Java and Bali, where potential consumers is promising great benefits. This situation, of course, will attract private sectors to invest. In line with service improvement, moreover, reformulating water tariff can be possibly done without rejection from consumers.

On the other hand, collective well can be promoted for regions that have significant constraints such as topographical feature and financial support to expand pipe water service. Sumatra and Sulawesi can be preferably selected to apply this strategy. Various topographical features, from low land to mountainous areas, to some extent make pipe network is very difficult to be developed. Another consideration to choose these islands is because of the existence of groundwater potential. As shown in table 3.3, Sumatra and Sulawesi have a huge amount of groundwater potential that can be exploited wisely to fulfil the need of drinking water. To finance collective well, joint funding scheme can be utilised. For instance, government finance the construction of wells and communities are responsible for operation and maintenance. This scheme can reduce financial burden of government. It also can build sense of belonging among societies because the facilities are operated and maintained by themselves; and they are responsible to contribute.

Moreover, rainwater harvesting is highly proposed for regions that consist of a lot of remote islands as well as spread population. Maluku, Papua, Nusa Tenggara are preferable for this strategy. The existence of remote small islands that makes these regions are difficult to be served by pipe network. Therefore, rainwater harvesting can be an alternative. This choice is also supported by abundant rainwater potential that exist in those regions (picture. 3.1). However, this strategy should be supported with sort of technical support to assist communities to collect, use, and

waste the water efficiently since rainwater harvesting relies very much on seasonal water resource. In this case, joint funding scheme can also be utilised as an instrument to finance the facilities.

5.2 Reflection to the Theory

After elaborating various strategies that have been practiced in several countries, there are some points can be expressed to confront what are stated theoretically and what happen in reality:

1. Contingency theory states that there is no "one best" strategy to deal with such problems, to organise corporation, or to make decisions. The most possible way is seeking the most suitable one by considering internal and external factors where the problems are dependent. As a consequence, there will be many alternatives to solve one problem; and the most suitable to the context is the recommended one. In the case of drinking water provision, a similar phenomenon also appears. Selected examples basically have the same core problem in dealing with drinking water issue, but every place have its own unique strategies and cannot be generalised as one generic approach. This phenomenon essentially is the explanation of contingency concepts that problems are context-dependent and requires specific approach to deal with.

2. In discussing structural contingency, Donaldson (1996) states that centralised and formalised institution is the most suitable approach for small size organisations within less complexity and do not need specialisation. However, decentralisation is highly promoted for the opposite circumstances. This argument is likely in line with the condition of water service in several countries. Drinking water provision can be said as a complex problem involving many interests and requiring special capability. Because of that, centralisation approach has been failed to handle this issue. However, organisational structure is not the only factor that determines the successfulness in the case of drinking water service. The broad public participation within informal organisation such as in Dhaka and Dar es Salaam show that informal institutions also play important roles. Besides,

this is also strengthened by the awareness of limited source and critical needs besides responsibility to existing facilities.

3. From policy transplantation perspective, lesson learning process may come from either outside or inside through the past that belonged to the country. This research tries to use both learning source to improve drinking water service in Indonesia. Internal sources are gained from the historical development of drinking water service that was conducted by previous regimes. Meanwhile, external sources come from synthesising journal papers discussing drinking water issues. From those two valuable resources, the list of proposed strategies is formulated. As Dolowitz and Marsh (1996) categorised five categories of the degree of policy transfer (copying, emulation, hybridization, synthesis, and inspiration), the process and the result of this research can also be grouped into one of those categories.

5.3 Points to Be Remarked for the Process and Outcomes of the Research

There are some points can be highlighted from this research and the process within that is probably useful for self-evaluation as well as for further research:

1. This research focuses on the issue of recent condition of drinking water service and pays little attention on the previous events causing this condition. In addition, strategies formulation is highly inspired by foreign experiences. Dolowitz and Marsh (1996) underline that lesson learning may come from either internal or external source. Following this statement, there will be valuable to conduct research on such strategy formulation but use previous events in the drinking water service as main inspiration since this issue has not been widely discussed in this research.

2. The negative impacts of excessive groundwater exploitation has been widely discussed by experts but it still needs more research involving various disciplines such as hydrology, geology, environmental science, and so forth. On top of that, effect that can possibly be received by human is also essential. The studies on thin issue will be valuable as consideration in managing water

resources since discussing how to manage water resource within good governance is far more important than paying too much attention on its physical scarcity (Biswas and Tortajada, 2010).

3. This research has not covered the impacts of proposed strategies if they are implemented. Since there is no "one best" strategy to solve problems (Donaldson, 2001), proposed strategies can also bring consequences positively or vice versa. Therefore, continuing this research by exploring possible consequences of each strategy in the field of environment, economics, social, etc. can widen the perspective in understanding drinking water issue.

REFERENCES

Abdullaev, Iskandar and Usman Shah, (2011), 'Community Water Management in Northern Afganistan: Social Fabrics and Management Performance', *International Journal of Environmental Studies*, Vol. 68(3) pp. 333-341.

Aiga, Hirotsugu and Takusei Umenai (2002), 'Impact of Improvement of Water Supply on Household Economy in A Squatter Area of Manila', *Social Science & Medicine*, Vol. 55, pp. 627 – 641

Akbar, H.M. Delwar, John R. Mennery, Basil van Horen, Phil Smith (2007), 'Community Water Supply for the Urban Poor in Developing Countries: The Case of Dhaka, Bangladesh', *Habitat International*, Vol. 31, pp. 24 – 35.

Akpabio, Emmanuel M. (2011), 'Water and People: Perception and Management Practices in Akwa Ibom State, Nigeria', *Society and Natural Resources*, Vol. 24, pp. 584 – 596.

Al-Damkhi, Ali Mohamed; R.A. Al-Fares; K.A. Al-Khalifa; S.A. Abdul-Wahab, (2009), 'Water Issue in Kuwait: A Future Sustainable Vision', *International Journal of Environmental Studies*, Vol. 66 (5), pp. 619-636.

Al-Sakkaf, Rafik A., Yangxiaou Zhou, Michael J. Hall (1999), 'A Strategy for Controlling Groundwater Depletion in the Sa'adah Plain, Yemen', *Water Resource Development*, Vol. 15, (3), pp. 349 – 365.

Babel, Mukand S., Ashim Das Gupta, Nina Donna Sto Domingo (2006), 'Land Subsidence: A Consequence of Groundwater Over-Expolitation in Bangkok, Thailand', *International Review for Environmental Strategies*, Vol. 6, (2), pp. 307 – 328.

Babel, Mukand S., Rivas, Aldrin A., Kallidaikurichi, Seetharam., (2010), 'Municipal Water Supply Management in Bangkok: Acheivement and Lessons', *Water Resource Development*, Vol. 26 (2), pp. 193 – 217.

Bajard, Y., M. Draper., P. Viens (1986), 'Rural Water Supply and Related Services in Developing Countries: Comparative Analysis of Several Approach', *Journal of Hydrology*, Vol. 51, pp. 75 – 88.

Bakker, Karen., (2007), 'Trickle Down? Private Sector Participation and the Pro-poor Water Supply Debate in Jakarta, Indonesia', *Geoforum*, Vol. 38, pp. 855 - 868.

Bakker, Karen., Michelle Kooy, Nur Endah Shofiani, Ernst-Jan Martijn (2008), 'Governance Failure: Rethinking the Institutional Dimensions of Urban Water Supply to Poor Household', *World Development*, Vol. 6, (2), pp. 307 – 328.

Basu, S.R., and Main, H.A.C., (2001), 'Calcutta's Water Supply: Demand, Governance, and Environmental Change', *Applied Geography*, Vol. 21, pp. 23-44.

Biswas, Asit K. & Cecilia Tortajada (2010a), 'Future Water Governance: Problems and Perspectives', *Water Resource Development*, Vol. 26, (2), pp. 129 - 139.

Biswas, Asit K., Tortajada, Cecilia., (2010b), 'Water Supply of Phnom Penh: An Example of Good Governance', *Water Resource Development*, Vol. 26 (2), pp. 157 – 172.

BPS, (2009), 'Survey Sosial Ekonomi Nasional ', Jakarta, Biro Pusat Statistik.

Bradley, Robert M. (2004) Forecasting Domestic Water Use in Rapidly Urbanizing Areas in Asia ', *Journal of Environmental Engineering*, Vol. 130(4), pp. 465 - 471.

Bradshaw, Patricia., (2009), 'A Contingency Approach to Nonprofit Governance', *Nonprofit Management & Leadership*, Vol. 20 (1), pp. 61 – 80.

Braga, B.P.F; R. Flechea; P. Thomas; W. Cardoso; A.C. Coelho; (2009), 'Integrated Water Resources Management in A Federative Country: The Case of Brazil', Water Resources Developmet, Vol 25 (4), pp. 611 – 628.

Bromley, J., J. Cruces, M. Acreman, L. Martinez, M.R. Llamas (2010), 'Problems of Sustainable Groundwater Management in An Area of Over-Exploitation: The Upper Guadiana Catchment, Central Spain', *Water Resource Development*, Vol. 17, (3), pp. 379 - 396.

Cech, Thomas V., (2005), 'Principles of Water Resources: History, Development, Management, and Policy (2nd Edition)' John Wiley & Sons, Inc. New Jersey.

Coppel, Gabriel P., Schwartz, Klaas., (2011), 'Water Operator Partnership As A Model to Achieve the Millenium Development Goals for Water Supply? Lesson from Four Cities in Mozambique', *Water SA*, Vol. 37 (4), pp. 575 – 582.

Cosier, Martin., Shen, Dajun., (2009), 'Urban Water Management in China', *Water Resource Development*, Vol 25 (2), pp. 249 – 268.

Dikun, Suyono. (2010), 'Infrastruktur Indonesia Sebelum, Selama, dan Pasca Krisis., Badan Perencanaan Pembangunan Nasional (BAPPENAS), Jakarta.

Dill, Brian., (2010), 'Public-Public Partnership in Urban Water Provision: the Case of Dar Es Salaam', *Journal of International Development*, Vol. 22, pp. 611 – 624.

Dolowitz, David and David Marsh, (1996), 'Who Learns What from Whom: a Review of the Policy Transfer Literature', *Political Studies*, Vol. 54 pp. 343-357.

Donaldson, Lex., (1996), 'The Normal Science of Structural Contingency Theory' in Clegg, Stewart R. & Hardy, Cynthia., (eds.), (1999), *Studying Organization: Theory and Method*, SAGE Publication Inc., London.

Donaldson, Lex., (2001), 'The Contingency Theory of Organization', SAGE Publication Inc., London.

El-Faddel, M., Zeinati, M., Jamali, D., (2001), 'Water Resource in Lebanon: Institutional Capacity and Policy Options', *Water Policy*, Vol. 3, pp. 425 – 448.

European Environmental Agency (2009), 'Water Resources Across Europe-Confronting Water Scarcity and Drought', *EEA Report No.2/2009.* Copenhagen.

Evans, Mark (2009), 'Policy Transfer in Critical Perspective', Policy Studies, Vol. 30(3), pp. 243-268.

Gerhager, Barbara., Sahooly, Anwer., (2009), 'Reforming the Urban Water Supply and Sanitation (UWSS) Sector in Yemen', *Water Resource Development,* Vol. 25(1), pp. 29 – 46.

Gleick, Peter H. (1996), 'Basic Water Requirement for Human Activities: Meeting Basic Needs', *Water International,* Vol. 21, pp. 83 - 92.

Gupta, Rajiv K. (2002), 'Water and Energy Linkage for Groundwater Exploitation: A Case of Gujarat State, India', *Water Resource Development,* Vol. 18, (1), pp. 25 - 45.

Hadadin, Nidal., Qaqish, Maher., Akawwi, Emad., Bdour, Ahmed., (2010), 'Water Shortage in Jordan – Sustainable Solution' *Desalination,* Vol. 250, pp. 197 – 202.

Hardjo, S.H., (2012), 'Data Air Minum dan Sanitasi Hasil Susenas', material presented in the coordinating meeting of BAPPENAS, Jakarta, 1 February 2012.

Higa Eda, Laura E., Chen, Weiqi., (2010), 'Integrated Water Resource Management in Peru', *Procedia Environmental Science,* Vol 2, pp. 340 – 348.

Jaglin, Sylvy., Repussard, Clement., Beloec'h., Anne., (2011), 'Decentralisation and Governance of Drinking Water Service in Small Wast African Towns and Villages (Benin, Mali, Senegal): the Aduous Process of Building Local Governments', *Canadian Journal of Development Studies*, Vol. 32 (2), pp. 119 – 138.

Jamati, Claude., (2003), 'Casablanca (Morocco): An Example of Public-Private Partnership', *Water Resource Development*, Vol. 19 (2), pp. 153 – 158.

Jiang, Y., Chen, Y., Younos, T., Huang H., He, J., (2010), 'Urban Water Resource Quota Management: the Core Strategy for Water Management in China', *AMBIO*, Vol. 39, pp. 467 – 475.

Johnson, Robin A. & Adrian T. Moore (2004), 'Improving Urban Water Infrastructure Through Public-Private Parterships', in Larry W. Mays (ed). *Urban Water Supply Handbook*, Mc Graw-Hill.

Jones, Stephen., (2011), 'Participation As Citizenship or Payment? A Case Study of Rural Drinking Water Governance in Mali', *Water Alternatives*, Vol. 4, pp. 54 – 71.

Kyessi, Alphonce G., (2005), 'Community-based Urban Water Management in Fringe Neighbouhoods: the Case of Dar es Salaam, Tanzania, *Habitat International*, Vol. 29, pp. 1 – 25.

Leap, Darrell I. (1999), 'Geological Occurrence of Groundwater', in Jacques Delleur (ed). *The Handbook of Groundwater Engineering*, CRC Press LLC, Florida.

Luan, Ivy O.B., (2010), 'Singapore Water Management Policies and Practices', *Water Resource Development*, Vol. 26 (1), pp. 65 - 80.

Maimone, Mark. (2004), 'Defining and Managing Sustainable Yield', *Ground Water*, Vol. 42, (6), pp. 809 - 814.

Mays, Larry W. (2004), 'Urban Water Infrastructure: A Historical Perspective', in Larry W. Mays (ed). *Urban Water Supply Handbook*, Mc Graw-Hill.

O'Reilly, Kathleen., Dhanju, Richa., (2012), 'Hybrid Drinking Water Governance: Community Participation and Ongoing Neoliberal Reforms in Rural Rajasthan, India', *Geoforum*, Vol. 43, pp. 623 – 633.

Opare, Service., (2011), 'Rainwater Harvesting: An Option for Sustainable Rural Water Supply in Ghana, *GeoJournal*, pp. 1 – 10.

Opare, Service., (2011), 'Sustaining Water Supply trough A Phased Community Management Approach: Lesson from Ghana's "oats" Water Supply Scheme', *Environment Development Sustainability*, Vol. 13, pp. 1021 – 1042.

Osumanu, Issaka K., (2008), 'Private Sector Participation in Urban Water and Sanitation Provision in Ghana: Experiences from the Tamale Metropolitan Area (TMA)', *Environmental Management*, Vol 42. Pp. 102 – 110.

Pasandaran, Effendi., (2003), 'Reformasi Irigasi Dalam Kerangka Pengelolaan Terpadu Sumberdaya Air', *Analisis Kebijakan Pertanian*, Vol 3 (3), pp. 217-235.

Pasandaran, Effendi., (2008), 'Membangun Kerangka Pengelolaan Terpadu Sumberdaya Lahan dan Air: Perspektif Sejarah dan Politik', Scientific Speech delivered in Social Economics Analysis and Agriculture Policy Centre, Bogor, 5 September 2008.

Pessali, Huascar (2011), 'Public Policy Design in Developing Societies Beyond Transplantation', *Journal of Developing Societies*, Vol. 27 (1), pp. 11 - 28.Putranto, Thomas T. & Kristi I. Kusuma. (2009), 'Permasalahan Air Tanah Pada Daerah Urban', *Teknik*, Vol. 30 (1), pp. 48 - 56.

Raghunath, H.M. 2006, *Hydrology: Principles, Analysis, and Design*, New Delhi, New Age International Limited Publisher

Rouse, Michael. (2007), 'Institutional Governance and Regulation of Water Service: The Essential Elements', IWA Publishing, London.Ruelas-Monjardin, Laura C., J.M. Chavez-Cortez., D.P. Shaw (2009), 'Scarcity and Conflict, Key problems in Water Management: A Mexican Case Study', *Local Environment*, Vol. 14 (8), pp. 765 – 782.

Samekto, Candra and Erwin S. Winata (2010) 'Potensi Sumber Daya Air di Indonesia' (papers presented in the seminar Application of Water Supply Provision Technology for Regencies/Municipalities in Indonesia) organised by Pusat Teknologi Lingkungan-Badan Pengkajian dan Penerapan Technology, Jakarta, 16 June 2010.

Seppala, Osmo T., (2002), 'Effective Water and Sanitation Policy Reform Implementation: Need for Systemic Approach and Stakeholder Participation', *Water Policy*, Vol. 4, pp. 367 – 388.

Sophocleous, Marios (2002), 'Interaction between Groundwater and Surface Water: the State of the Science', *Hydrology Journal*, Vol 10, pp. 52 – 67.

Tati, Gabriel., (2005), 'Public-Private Partnership (PPP) and Water Supply Provision in Urban Africa: the Experience of Congo-Brazzaville', *Development in Practice*, Vol. 15 (3), pp. 316 – 324.

Tortajada, Cecilia (2010a), 'Water Governance: A Research Agenda', *Water Resource Development*, Vol. 26, (2), pp. 309 - 316.

Tortajada, Cecilia (2010b), 'Water Governance: Some Critical Issues', *Water Resource Development*, Vol. 26, (2), pp. 297 - 307.

Tukidi, (2010), 'Karakter Curah Hujan di Indonesia', *Jurnal Geografi*, Vol 7 (2) pp. 136-145.

Van Dijk, Terry (2006), Transplanting Instruments that Work: Four Practical Lesson on Eliminating Assumptions, *Planning Theory and Practice*, Vol 7 (4), pp. 421 - 442.

Yamout, Ghina., Jamali, Dima., (2007), 'A Critical Assessment of A Proposed Public Private Partnership (PPP) for the Management of Water Services in Lebanon', *Water Resource Management*, Vol. 21. Pp. 611 – 634.

Yue, Derek P.T. and Tang, S.L., (2011), 'Sustainable Strategies on Water Supply Management in Hong Kong', *Water and Environment Journal*, Vol 25. pp. 192-199.

Laws and Regulations:

Peraturan Menteri Pekerjaan Umum Nomor 20/PRT/M/2006 Tentang Kebijakan dan Strategi Nasional Pengembengan Sistem Penyediaan Air Minum

Peraturan Pemerintah Nomor 16 Tahun 2005 Tentang Pengembangan Sistem Penyediaan Air Minum

Undang-Undang Dasar 1945.

Undang-Undang Nomor 7 Tahun 2004 Tentang Sumber Daya Air

Internet Sources:

http://ga.water.usgs.gov/edu/watercycle.html

http://pubs.usgs.gov/circ/circ1139/htdocs/natural_processes_of_ground.htm

http://www.antarafoto.com/peristiwa/v1218003981/antri-air

http://www.cpc.ncep.noaa.gov/products/global_monitoring/precipitation/indo_1yrprec.shtml

http://www.physicalgeography.net/fundamentals/7v.html

http://www.pamjaya.co.id/Informasi-Tarif.html

www.pambdg.co.id,

www.psda.jabarprov.go.id,

www.wikipedia.org

Appendix 1 List of articles discussing strategies in dealing with water provision problems

No	The Title of the Article Author(s) (Year)	Location of case study	Problem(s)	Solution(s)	Critical factor(s)
1	Community Water Supply for the Urban Poor in Developing Countries: The Case of Dhaka, Bangladesh H.M. Delwar Akbar; John R. Minnery; Basil van Horen; Phil Smith. (2007)	Dhaka, Bangladesh.	1. Low income population (around US $327 per capita per annum) (p.25). 2. Large concentration of the informal settlements which do not have access to potable water (p.25). 3. Water availability is not the principal reason why potable water is not available to informal settlements; the main reasons are political, institutional, and economics (p.26).	1. Instalment of water point (reservoir and hand pump) to collect water from both groundwater resource and public water provider initiated by NGO namely *Dushtha Shasthya Kendra* (DSK). 2. A water point is initially proposed and invested by DSK after dialogue with community, and then the community owned and managed the water point. The community paid for the amount of water they took from public water point. This payment aimed to finance operation and maintenance costs.	1. Important actors are international donor agencies, national NGOs, public water providers, local government, and informal communities (p.26). 2. Demand for water indicated by the community's willingness to pay (p.27). 3. Community is responsible for daily operation and revenue collection, repayment of the loan to NGO and the use of surplus revenue collected from the site. Meanwhile, NGO's responsibilities include monitoring revenue collected by field workers, payment of the public water provider's bill, monitoring social disputes, and transfer of the water point to the community after cost recovery (p.27). 4. Problems arise from illegal water business that lost their business (p.28), therefore, there should be a clear institutional regulations for multi-provider involvement (31-32).
2	Sustainable Strategies on Water Supply Management in Hong	Hong Kong	1. No natural lakes or substantial groundwater resources (p.192). 2. The main supply come from	1. The use of seawater for toilet flushing (p.192) 2. Metering and tiered water tariff	1. Huge investment in developing and rehabilitating the infrastructures as well as to

	Kong Derek P.T. Yue; S.L. Tang (2009)		Dongjiang River in Mainland China required high investment. On the other hand, the increase of pollutant recharge may cause an unacceptable deterioration in the raw water quality (p.192).	(p.193). 3. Large-scale replacement and rehabilitation of aged pipelined and leakage reduction (p.194). 4. Valve-type toilet flushing apparatus (p.195). 5. Education and publicity programme (p.195).	advance the technology. 2. Measures to encourage the community to change their behaviour regarding water consumption.
3	Community-based Urban Water Management in Fringe Neighbourhoods: the Case of Dar es Salaam, Tanzania Alphonce G. Kyessi (2005)	Dar es Salaam, Tanzania.	1. Informal fringe settlements are not provided by water supply service through municipal system (p.2). 2. Inadequate water and sanitation services caused water-borne diseases (p.2-3).	1. Encouraging local participation and partnership (the public, the private, and the community) through joint action (p. 7-9). 2. Cooperating with donor organisations and gaining assistance from them either in the construction or management of water infrastructure (p.9). 3. Establishing the WMC (Water Management Committee) which is mainly aimed to supervise water supply in the settlement (p.10).	1. The important role of private vendors as one of elements in water provision (p.9). 2. The use of revenue from water saes for operation and maintenance cost (p.12). 3. Following a demand-oriented service delivery and community-based approach. It could be viewed as a low-cost system that considers poor community within their varying income and expenditure could accept the service based on their demand (p.13). 4. Horizontal and vertical linkages among relevant stakeholders (p.18).
4	Rainwater Harvesting: An Option for Sustainable Rural Water Supply in Ghana Service Opare	Rural communities in Ghana namely Dupong and Djogbe.	1. Low water supply coverage (especially for rural areas) and water shortage problems (p.1). 2. Local people depended on the river or lake (although it is polluted) in spite of the availability of rainfall is	1. Seeking the possibility of rainwater harvesting for rural community (p.8).	1. Although rainwater harvesting is a big opportunity to overcome water supply problems in rural areas, it has not been optimised yet because of the lack of technical supports (p.10).

	(2011)		abundant in the rainy season (p.3). 3. Lack of suitable harvesting facilities (p.4). 4. Unclear land demarcation that indicated the ownership of that land caused difficulties when rainfall harvesting facilities would be built (p.5). 5. Roofing materials in rural areas is less suitable for rainwater harvesting (p.6).		
5	Water Shortage in Jordan- Sustainable Solution Nidal Hadadin; Maher Qaqish; Emad Akawwi; Ahmed Bdour. (2010)	Jordan	1. Due to the arid and semi-arid climate, available water resources are limited; and the gap between water supply and demand threatens to widen significantly because of population growth and economic development (p.197-198). 2. Jordan relies very much on three water resources (the Jordan, the Zarqa, and the Yarmuk river) which are polluted caused either by saline water from the sea or industrial activities (p.198). 3. The potential of regional conflict over water resource with neighbour countries (Syiria and Israel) (p.198).	1. Seeking the possibility of rainwater harvesting through intensive research related this issue (p.200). 2. Desalinating seawater (p.200-201). 3. Reduction of demand on water through irrigation technologies, reuse domestic applications, and educating people to encourage the awareness (P.201)	1. The main reason of water shortage in Jordan is the lack of water resources. It can be tackled by appropriate water technology. However, other strategies such as encouraging public awareness and participation, constructing comprehensive legal framework cannot be simply ignored (p.201).
6	Sustaining Water Supply through a Phased Community Management	Oyarifa, Abokobi, Teiman, Sesemi (OATS), Ghana	1. Water sector in Ghana was dominantly handled by central government through Ghana	1. Introducing community management approaches in providing water service, like in OATS communities where the	1.There are key management actors determining the success of project implementation: Local water

	Approach: Lessons from Ghana's "Oats" Water Supply Scheme Service Opare (2011)		Water and Sewerage Corporation which was limited in the service coverage especially rural areas like OATS (P.1027). 2. Private agencies was less attracted to participation approaches since these imply holding regular meetings with communities, and soliciting their inputs in critical management decisions which lengthen implementation and management procedure (p.1028-1029).	communities were making a formal request for water and sanitation assistance to local government called District Assemblies (DA). In addition, communities contributed 2.5% of the total cost of the project (p.1030). 2. Technically water system was built through a fill and draw system where water is pumped from a mechanised borehole into a reservoir, and then distributed through distribution mains and lines to standpipe where it is fetched by individuals (p.1030). 3. In day-to-day operation, communities manage water service from the distribution, maintenance, to fee collection (p.1030).	management institutions, the district assembly, community water and sanitation agency, private sector agency, and local operating staff (p.1030-1033). 2.Regular training and review meeting to improve the capacity of local actors and disseminate information (P.1033-1034). 3.Financial arrangement to operate and maintain the infrastructure (p.1035).
7	Calcutta's Water Supply: Demand, Governance and Environmental Change S.R. Basu H.A.C. Main (2001)	Calcutta, India.	1. Low- income people receive no water from the municipal network and have to provide for their own needs (p.28). 2. Some people are difficult to be covered by piped water because of living in the edge of the city and far from pipe network (p.29). 3. People who lived within supply area in fact unable to access piped water at any given time because of intermittent supply and low pressure of pipelines (p.30). 4. Calcutta stands and rely its water resource on the River	1. Improving distribution of existing supply through effective pipeline rehabilitation and extension (p.38). It mainly aimed to reduce demand for groundwater. 2. The net recharge of aquifers under central and southern part of the city (p.28). 3. Involving several local organisations such as NGOs and scholars to test community sources for arsenic and other contaminants (p.40).	1. Increasing the volume of abstraction is not too necessary at present since it would be costly and continue to impact damagingly on water resources, particularly through the leaching and drying-out of aquifers, thus exacerbating groundwater contamination. 2. A greater emphasis on integrated demand-side management in dealing with water supply problems of efficiency, equity, and environmental degradation (p.39).

			Hugli. However, there is a decline in the mean level of Hugely and an increase salinity because of upriver extraction and environmental change (p.31-32). 5. The leakage of pipeline networks lead to inefficient distribution and affect negatively to water quality.		
8	Urban Water Management in China Martin Cosier; Dajun Shen. (2009)	Beijing; Shanghai; Shaoxing, China	1. A large number of population (in the end of 2005 it was estimated that population of Beijing = 14.2 million, Shanghai = 17.8 million, Shaoxing = 4.36 million) required a huge amount of water resource (p.254 – 261). 2. Water affairs belong to municipality government, many institutions are involved but lack of coordination among their related function or even their responsibilities are somehow overlap (p.263-264). 3. Some of objectives and methods for implementing particular parts of the management framework are not well defined cause ambiguities at the local level in terms of what the national requirement are trying to achieve (p.264).	1. More integrating urban and rural water management function, enabling stronger internal coordination between the resource management, urban planning and environmental protection aspects of urban water supply and management (p. 265). 2. Implementing the planned water use and water saving system as a respond to the limited availability of water (p.265). 3. Approach to ensure reliable water supply more focused on constructing new infrastructure than on consideration of the overall water availability and demand at a catchment level (p.266).	1. A formal connection between resource allocation planning and the abstraction system is highly required to ensure urban area receives the reliability of supplies that is expected (p.266). 2. Urban development and expansion in China is continuing at a great pace. Therefore, water resource management will be much more complex and require a comprehensive urban water management and coordination among related institutions.

9	Reforming the Urban Water Supply and Sanitation (UWSS) Sector in Yemen Barbara Gerhager; Anwer Sahooly. (2009)	Yemen	1. Over-centralized water service suffered from low coverage and inadequate level of service; the tariffs were too low to cover public expenditure (p.29). 2. High population growth (nationally 3.5% and up to 7% in urban areas) requires higher coverage of water service (p.42).	1. Institutional reform was initiated by the formation of Steering Committee by Prime Minister and the setting up of a Technical Secretariat to conduct reform measures (p.30). 2. Promoting decentralised water service and testify this idea through pilot project (p.31). 3. Regulation reform regarding to water services (p.31-32). 4. Establishing Public Private Partnership (PPP) (p.33-34).	1. Cooperation with foreign donors to gain financial and technical support (p.30). 2. The important role of Technical Secretariat in conducting awareness campaigns, facilitating consensus-building, giving support advice regarding to water-related issues, securing a combination of technical and institutional development to realise the decentralisation process (p.32) 3. The sustained political will for reform and decentralisation, demand at a local level, and the commitment of everyone involved in the sector reform were the keys of success (p.40).
10	A critical Assessment of A Proposed Public Private Partnership (PPP) for the Management of Water Service in Lebanon Ghina Yamout; Dima Jamali. (2006)	Beirut, Lebanon	1. Civil war (1975-1990) brought an adverse effect on fiscal condition such as high debt (p.613-614). 2. Lebanon has adequate total water resource, but lacks the conveyance systems for delivery of water to where it is most needed (p.615). 3. Inadequate infrastructure and poor costumer management has fostered a culture of non-payment for services and a resistance to tariff increase (p.616). 4. Poor service delivery has	1. Revitalising previous project (Awali-Beirut Project) that is neglected because of war (p.622-624). 2. Promoting PPP through the scheme of Build-Operation-Transfer (BOT) that essentially aimed to ensure a steady supply of water to Beirut within limited government budget (p.624). 3. Dispersing the responsibility such as water resource management, infrastructure construction, costumer management, to stakeholders involved (p.624-626).	1. Through BOT contract private firms are fully responsible for investment, management, and debt for the duration of the contract. Therefore, this is beneficial for limited government budget. Nevertheless, benefit and risk sharing has to be taken into account clearly (p.628-630). 2. The mobilisation of private sector participation for provision of water service will likely result in operating efficiencies and the release of government fund for other purposes (p.632).

			endangered uncontrolled well digging and the tapping of groundwater in many region of Beirut (p.616). 5. Operation and maintenance cost are not recovered and revenues are constrained by political decision on tariff increase (p.617).		
11	Decentralisation and Governance of Drinking Water Services in Small West African Towns (Benin, Mali Senegal): the Arduous Process of Building Local Governance Sylvy Jaglin; Clement Repussard; Anne Belbeoc'h. (2011)	Benin; Mali; Senegal.	The three countries faced more or less similar problems: 1. Lack of technical and financial capacity, therefore they very much depends on foreign donors to improve water sectors (p.125). 2. Insufficient coordination between various components involved in water sector policy reform (126).	1. Benin: Implementing decentralisation principles through budgeting by objectives where local public services have been given greater responsibility for setting objectives and scheduling and budgeting for action programmes (p.124). 2. Mali: encouraging the mobilisation of local resources; central government demand a local contribution of 3 per cent of investment for projects in the water sectors (p.125). 3. Senegal: delegating public provision of drinking water to local authorities where local authorities are possibly allowed taking benefits from the projects (p.125).	1. The difference in understanding decentralisation and the lack of coordination among localities caused the different types of service models in terms of management practices. It then makes difficulties in developing a shared and standardised model of water services at the local level (p.132) 2. Most of the cases in the three countries show that donors and international agencies tend to transform community-based management into PPPs arrangement involving local small-scale providers because of mistrust to local governments (p.133).
12	Private Sector Participation in Urban Water and Sanitation Provision in Ghana: Experiences from the Tamale Metropolitan	Ghana	1. Urban growth and expansion has occurred without planning intervention which led to urban sprawl (p.105). 2. Low level of coverage in water and sanitation services (p.105).	1. Privatisation of water and sanitation management in order to provide the services more efficiently (p.107).	1. Privatisation in Ghana seems to be failed because it has been adopted not out of sense of opportunity, but rather out of desperation (p.107). 2. Another cause of failure is that the

	Area (TMA) Issaka Kanton Osumanu (2008)		3. Limited government budget to cover water service for whole area (p.106)		privatisation did no follow the conventional procedure such as a formal and open bidding process. It was strongly determined by political power instead of procedure that should be (p.107).
13	Water Resources Management in Lebanon: Institutional Capacity and Policy Options M. El-Fadel; M. Zeinati; D. Jamali. (2001)	Lebanon	1. Temporal and spatial variations in precipitation and limited groundwater resources (p.425). 2. Inadequate supporting data (such as hydrological and meteorological) is an obstacle in formulating proper water management (p.426). 3. There are several gaps and overlaps among ministries, authorities, and agencies regarding the functions and responsibilities (p.432-436).	1. Conducting rehabilitation and maintenance water-related projects through the assistance of grants and loans from major donor organisations (p.438). 2. Setting a general policy for the management of water resources through the formulation of the 10-year plan for water and wastewater management (p.438).	1. The government of Lebanon concentrated to expand water service development through policies and projects than mainly focused on technical measures. On the other hand, gaps and overlapping on the legal and institutional arrangement seemed to be ignored. In addition, the improvement of institutional capacity and public awareness regarding water-related issues has not been sufficiently conducted yet (p.444).
14	Integrated Water Resources Management in Peru Laura E. Higa Eda; Weiqi Chen. (2010)	Peru	1. in 1990s Peru intensively encouraged private investment in order to accelerate economic growth. It triggered more investment in Peru, especially in mining sector. However, it was not balanced with environmental protection efforts causing environmental degradation unexceptionally the quality of water (p.343).	1. Improving Integrated water resource management (IWRM) with regards to balancing water demand and supply (p.344). 2. Promoting technologies for environmental informatics to find indicators for more precise and realistic monitoring and assessment (p.344).	1.Technology is obviously needed for ensuring water availability and control, but institutional and regulatory arrangement is also important to guide this process (p.345). 2.For the purpose of improving governance and avoiding disturbance, disagreement and protests about the water management policies, relevant stakeholders should be involved within various level (local, municipal,

					provincial, regional, and national) (p.346).
15	Effective Water and Policy Reform Implementation: Need for Systemic Approach and Stakeholder Participation Osmo T. Seppala (2002)	Kenya; Zanzibar; Sri Lanka; South Africa.	The four countries have more or less similar problem regarding water-related issues (p.368): 1. Water scarcity; 2. Deterioration of water quality; 3. Inter-sectors and inter-regions water allocation conflict; 4. Inappropriate pricing of water; 5. Excessive government involvement and bureaucratic control; 6. Outdated institutional arrangement; 7. Fragmented and poorly coordinated water administration.	1. Kenya: establishing autonomous water and sanitation companies and launching the new national water policy which emphasised on increased stakeholder participation and integrated water resource management (p.374-376). 2. Zanzibar: in 1981, the Zanzibar government decided to provide water supply to domestic household costumers free of charge. However, the policy was reformed and water pricing was introduced (p.376-377). 3. Sri Lanka: Formulating the new water policy with support from international organisation (ADB, FAO, WHO, and IWMI) (p.377-378). 4. South Africa: Issuing the new water act that adopted the principles of management decentralisation, market-based water allocation, full cost recovery, and integrated water resource management and that more related to other sectors of society (p.378).	1. Water policy development and reform is primarily politically driven although high-level technical skill is required to succeed the process. Evidence, for instance in Zanzibar, showed that such reform was less successful because of the lack of political will (p.379). 2. Institutional changes can trigger a successful policy reform. Fundamental institutional change to reform the water sector may be achieved through an integrated approach through inter-dimensional synergy (p.380). 3. A water policy cannot function in vacuum, but in continuum with other sectors of society. Therefore, a systemic approach which includes acknowledging hygiene, sanitation and water as a human right, and relating it to human development, the elimination of poverty, environmental sustainability and integrated water resource management is obviously required (p.380). 4. The roles and responsibilities of various stakeholders need to be given adequate attention in the reform process (p.381). 5. It is important to build the capacity

					of sector professional, civil society, and communities to understand and commit to the new policies (p.382).
16	Hybrid Drinking Water Governance: Community Participation and Ongoing Neoliberal Reform in Rural Rajasthan, India Kathleen O'Reilly; Richa Dhanju. (2012)	Rajasthan, India	1. Water supply had been unreliable and contaminated but it was supplied to villagers for free (p.624). 2. Dysfunctional Government of Rajasthan drinking water supply scheme need to be reformed (p.624).	1. Reform drinking water supply through a mixture of decentralisation and marketisation within a project called "Our Water Project". This project is an example of a hybrid (tripartite) model for water supply management wherein the state regulates and monitors the supply, but also relies on private contractors and civil society for the system's efficient functioning (p.624).	1. In the beginning the project run well, but it tends to decrease in term of the quantity and quality of water because of the lack of maintenance (p.626-627). 2. There is unequal political power among stakeholders. In this case, societies are the weakest since their complaints frequently are ignored and have no response from competent institutions (629-631).
17	Public-Public Partnerships in Urban Water Provision: The Case of Dar Es Salaam Brian Dill (2010)	Dar Es Salaam, Tanzania	1. Lack of sufficient water supply; about 2.5 million residents struggle to meet their basic daily needs for water (p.613). 2. Private consortium that previously served water provision failed to deliver water either commensurate with demand or at a cost that most citizen can bear (p.612).	1. Residents undertake a variety of individual actions to acquire water such as purchasing from vendors, building tank for rain harvesting, and drill their own wells (p.614). 2. As private sector has failed to meet citizens' need. It was replaced by Dar Es Salaam Water and Sanitation Company (DAWASCO), publicly-owned company which cooperate with Community Based Organisation (CBOs) in providing water service, especially outside service coverage areas (p.612-613).	1. The existence of CBOs as partners in water provision is crucial. They play important roles as middlemen and direct producers. The former is usually performed by CBOs who live relatively close to pipe network; they played a key role in constructing and controlling secondary pipes that pass through neighbourhood. The latter group of CBOs operates in areas distant from main water line. In this area they are permitted to drill deep well in order to fulfil water requirement (p.615-620).
18	Participation As Citizenship or Payment? A Case Study of Rural Drinking Water	Three villages in Maly namely: Fansiracoro, Guily, and Yelekebougou.	1. Many citizens, especially who live in rural areas, do not have access to safe drinking water (p.57). 2. Mali is changing its political	1. Government incorporating with private contractors and NGOs provide public hand pump for rural communities. Communities are given	1. In this case, rural communities often viewed water is free. This perspective is supposed to be changed through education until

	Governance in Mali Stephe Jones (2011)		nature into more decentralised, but financial and technical resources transfer is very slow (p.58). 3. When public hand pumps were promoted, they were well-operated in the beginning. But this situation was not sustainable since there was insufficient organisation or financing to pay for maintenance and repairs (p.64)	obligation and authority to manage, operate, and maintain public hand pumps (p.59-62).	users accept the need to contribute to cost recovery (p.67). 2. The development of public hand pumps is likely less successful since lack of payment for operation and maintenance cost (p.68). 3. Participation should not be merely viewed as a kind of citizenship, but also in the form of payment for such services (p.68)
19	Water Operator Partnership As A Model to Achieve the Millennium Development Goals for Water Supply? Lessons from Four Cities in Mozambique Gabriel Patron Coppel; Klass Schwartz (2011)	Four cities in Mozmbique namely: Chowke, Inhambane, Maxixe, Xai Xai.	1. The level of access to water services in Mozambique is one of the lowest in the world (p.576).	1. Enacting the Water Law (Law 16/91) as general legal framework for the management, protection, conservation, use, and control and monitoring of the water resources. And then this law was followed by National Water Policy (Resolution 7/ 95) that covers the principles of privatisation of urban water supply (p.577). 2. Delegating the management and operation of public water supply services through the establishment of management, lease or concession contracts with private companies (p.577). 3. Inviting foreign donors to involve and invest in the development of water sectors (p.578).	1. Cooperation with foreign donors is not only in gaining investment but also in the development of human resource and capacity building of staffs working in the water sectors (p.578-580). 2. The issue of trust when the partnership was established is crucial. Both government and private sectors stated clearly what their aims respectively as well as convince everyone of their intentions (p.581)
20	Water Supply of Phnom Penh: An Example of	Phnom Penh, Cambodia	1. Years of centralised and top down management under Khmer	1. Cambodia government requested help from the various multinational and	1. Reformulate water tariff which consider financial viability and social

	Good Governance Asit K. Biswas; Cecilia Tortajada. (2010)		Rouge regime had contribute to a culture of inefficiency, bureaucracy, corruption and conformity unexceptionally in water sectors (p.157-158). 2. Population which is dominated by low income people cannot pay reasonable cost for water service(p.160). 3. Unaccounted water because staffs do not pay for water resulted of former policy (p.160).	bilateral aid institutions to rehabilitate its battered urban water system and to formulate a future long term plan (p.158). 2. Changing the work culture radically by enforcing strict discipline in a sensitive, fair and transparent manner (p.161). 3. Reducing unaccounted water by treating staffs within the same treatment with ordinary consumers (p.163).	sensitivity (p.163). 2. Bureaucratic reform and radical change of work culture has increase staffs' performance (p.161). 3. Giving subsidy for the absolute poor (p.167-168). 4. The use of incentives and sanctions for staffs with transparent policies that were consistently implemented (p.171).
21	Municipal Water Supply Management in Bangkok: Achievements and Lessons Mukand S. Babel; Aldrin A. Rivas; Seetharam Kallidaikurichi. (2010)	Bangkok, Thailand	1. Bangkok is highly urbanised with a large population implicating to increasing demand of drinking water. It then brings a consequence to use both surface and groundwater (p.193-194).	1. Establishing the Metropolitan Waterworks Authority (WMA) as state enterprise which has autonomy to formulate water policies (P.195-196). 2. Issuing a Cabinet Resolution on Remedial Measures for the Mitigation of the Groundwater Crisis and Land Subsidence (p.198). 3. Revising the master plan of WMA which previously focused very much on supply oriented approach into more balance combination between supply and demand management (p.198-199). 4. Reducing water loss (unaccounted water) caused by leakage to increase supply efficiency (p.201). 5. Promoting progressive water tariff structure (p.206-207)	1. Treating WMA as business organisation which committed to be good corporate governance in providing public service (p.197). 2. Implementing demand management measures that is complemented with measures to increase revenue and reduce operational and maintenance cost (p.208). 3. The implementation of measures to increase the efficiency of staff, and subsequently higher efficiency in the delivery of services (p.211). 4. Meeting future water demand with aggressive implementation of demand management measures (p.215).
22	Singapore Water Management Policies	Singapore	1. Singapore is small city with limited natural water resources	1. Diversifying water resources to meet the needs such as imported water	1. Strong political will from government in providing citizens'

	and Practices Ivy Ong Bee Luan (2010)		and high population (p.66). 2. Limited land area to catch rainfall and the absence of natural aquifers (p.66)	from Johor (Malaysia), local catchment, recycled water, and desalinated water (p.66). 2. Implementing what so called as a multi-pronged approach in water supply and water management policy namely: physical infrastructure, legislation and enforcement, water pricing, public education, and research and technology (p.66). 3. Integrating land use planning and water management because of limited space for development (p.69)	basic needs (p.67-68). 2. A good institutional framework where relevant government affectively coordinate with one another for any application by both the private and the public sectors in development works (p.69). 3. Effective legal and regulatory framework as well as its strong enforcement (p.71-74). 4. Large-scale water recycling and technological innovations to produce clean water from used water (p.75). 5. Intensive campaigns to encourage people's awareness on water issues (p.75-76).
23	Urban Water Resource Quota Management: The Core Strategy for Water Demand Management in China Yan Ling Jian; Yuan Sheng Chen; Tamim Younos; He Qing Huang; Jian Ping He. (2010)	China	1. A large population in China combined with rapid economic development increase water requirement that leads to water shortage (p.467). 2. Poor water supply management, low water us efficiency, and inadequate sewage treatment and discharge have further exacerbated water shortage in urban areas (p.467).	1. Implementing urban water quota management on a nationwide scale in order to change the ineffective and traditional water-management techniques (467-468). 2. Water quota firstly was applied for five industries that consumed the most significant portion of water resource (thermal power, textiles, petrochemicals, metallurgy, and paper). And then the policy is widened for general industries, commercial enterprises, as well as public services (p.469). It resulted in the significant decrease of water use year by year (p.473).	1. Water quota management is conducted in an integrated way which is led by the central government and local governments with the participation of the public and industrial sectors (p.468). 2. Water quota policy is implemented gradually in sequential phases (469-470).

24	Casablanca (Marocco): An Example of Public-Private Partnership Claude Jamati (2003)	Casablanca	1. rapid growth of population and poor customer service regarding water (p.153)	1. Involving private sectors in providing drinking water service to increase service coverage and reduce unaccounted for water. After five years contract, service coverage increase significantly	1. Trust and commitment between parties: the Moroccan authorities, customers, and private operator
25	Public-Private Partnership and Water Provision in Urban Africa: the Experience of Congo-Brazzaville Gabriel Tati (2005)	Congo-Brazzaville	1. Previously public service were state monopoly, but this approach failed to deliver public service such as drinking water (p.317)	1. Promoting PPP through cooperation between SNDE (National Company for Water Distribution) and local companies (p.317).	1. The PPP approach is not significantly successful because there was no clear benefit and risk sharing (p.323)