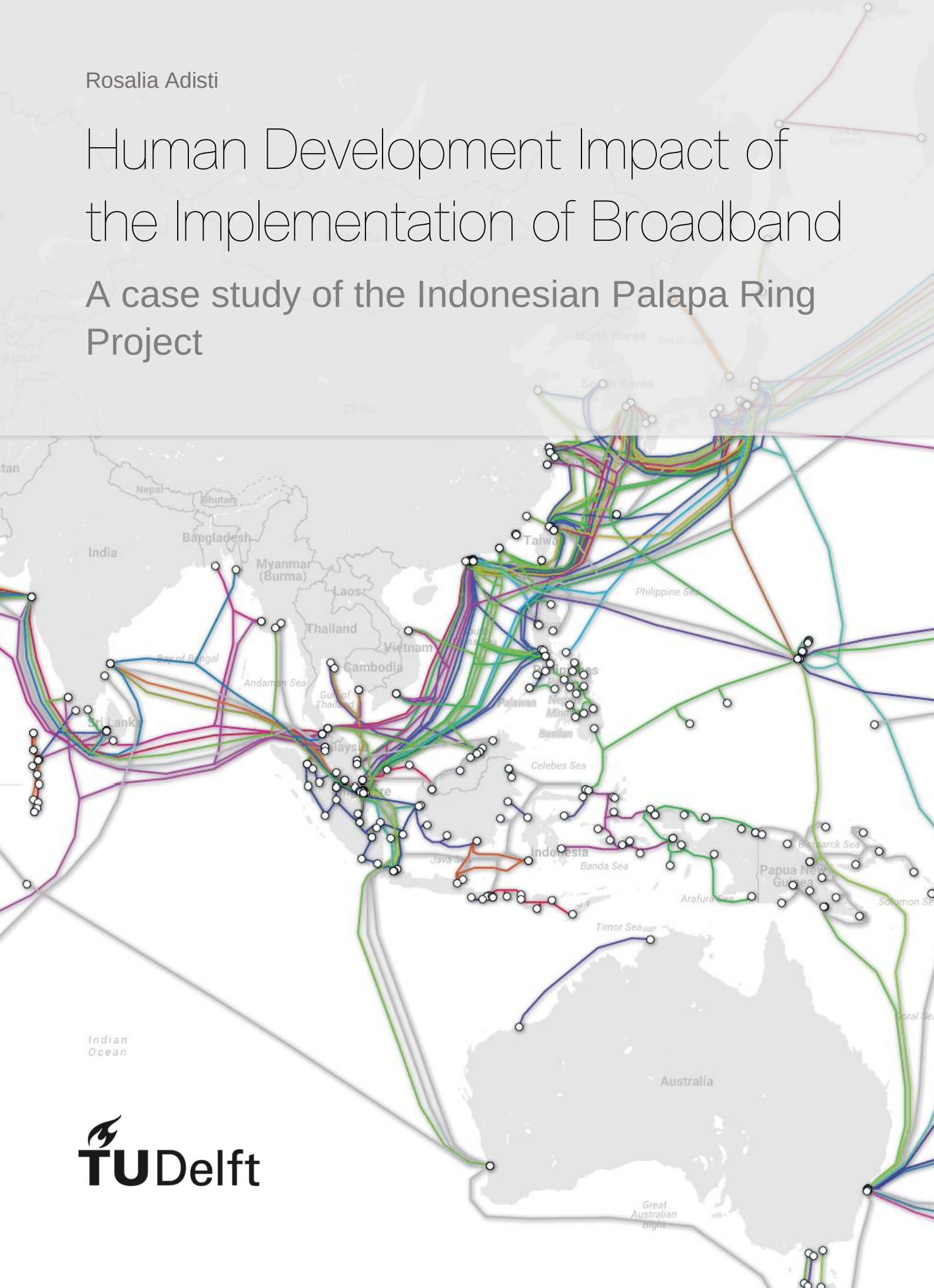
Rosalia Adisti

Human Development Impact of the Implementation of Broadband

A case study of the Indonesian Palapa Ring Project



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Cover picture: Submarine Cable Map (source: TeleGeography - submarinecablemap.com)

Human Development Impact of the Implementation of Broadband

A case study of the Indonesian Palapa Ring Project

By

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Preface

The last one and a half years, which I have dedicated for my thesis research, have been a curiosity journey for me. Being the first generation who grew up with internet, I always wanted other people to experience the same: enjoying what (high speed) internet can offer. It was my childhood dream to connect remote areas to the internet. However, at one point, I started to question, do people actually receive the benefits from the internet? What benefits are they? What if it is actually harmful?

When my friend Fauzi told me about the upcoming implementation of Palapa Ring project, I was excited. I used to live in Papua and I know how disconnected it was; in 1999, I had the newspapers delivered every three days. Of course, the situation is different now, but back in 2014, I still read Facebook posts whining about 64kbps internet and the lack of 3G network in Jayapura, which are the consequences of not being connected to fiber optic backbone network. I thought, what a wonderful project, this Palapa Ring! It would surely address some digital divides. However, it reminds me about my questioning. A curiosity on how broadband would impact the society, that extends beyond economic benefits, has led me to write this thesis. It challenged me to learn new subjects that are different from my background. Despite all the struggles, I am happy to finally finish this thesis research.

This thesis research would not be possible without the supports of a lot of people whom I want to acknowledge. I would express my gratitude to Nuffic Neso Indonesia who have given me the opportunity to study in TU Delft through StuNed scholarship. I would also like to say thank you to my parents who have supported me both morally and financially during my stay here. Special thanks go to Dr. Wim Ravesteijn for all his supervisions and his belief in me that I can bring this thesis to a good end. Furthermore, I would like to thank Prof.dr.ir Ibo van de Poel and Dr. Laurens Rook for the valuable insights.

I would also like to thank the people who have helped me in conducting the research. To Revi, Fauzan, and Mas Agung, thank you for helping me in the interviews. To Lusi and Naomi, thank you for providing evaluations for my thesis. To Fauzi, Reni, Fitri, CY, and Riska, thank you for all the discussions. To Fabri and Pim, thank you for the full moral support!

Rosalia Adisti

Den Haag, September 2017

List of Abbreviations

AQ	Additional question
BP3TI	The Center of Telecommunication Financing & Provision
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
HDI	Human Development Index
RHDIA	Resulting HDIA
HDIA	Human Development Impact Assessment
IAIA	International Association for Impact Assessment
IBP	Indonesian Broadband Plan
ICT	Information and Communication Technology
ICT4D	Information and Communication Technology for Development
IIGF	Indonesia Infrastructure Guarantee Fund
ISP	Internet Service Provider
kbps	Kilobits per second
Kominfo	Ministry of Communication and Information Technology
Mastel	Masyarakat Telematika (Telematics Society)
Mbps	Megabits per second
MDG	Millennium Development Goals
MKCS	Mataram-Kupang Cable System
NGO	Non-Governmental Organization
OECD	Organization for Economic Co-operation and Development
PR	Palapa Ring
RQ	Research Question
SDG	Sustainable Development Goals
SIA	Social Impact Assessment
SME	Small and Medium Enterprises
SMPCS	Sulawesi-Maluku-Papua Cable System
SRQ	Sub-Research Questions
TOR	Terms of Reference
UN	United Nations
UNDP	United Nations Development Programme
USO fund	Universal Service Obligation fund
Wantiknas	Dewan TIK Nasional (National ICT Council)
WTO	World Trade Organization

Executive Summary

To understand the full impact of broadband implementation, more than its relationship with economic growth is required to be investigated. Its impact on other aspects of development, such as its impact on human development, is needed. This study aims to generate insight into impact assessment in the field of human development and broadband using the case of the Indonesian Palapa Ring project. The Palapa Ring project was chosen as the case study as it is a backbone network deployment to all the municipalities in Indonesia. This project posed the question: "*What does a human development impact assessment of the Palapa Ring project look like, and what can be learned from its application?*"

The literature review revealed that ICT contributes positively to some elements in human development, while in other aspects of human development it presents disadvantages. By doing literature research, a framework to assess the impact was also developed, consisting of the criteria and the methods. The four pillars and sub-themes of human development used as criteria for assessing impact are: productivity (health, education, income, individual well-being), equality (by gender, by ethnicity, by social class, and among geographical areas), sustainability (community well-being, environmental sustainability), and empowerment (political freedom and engagement, government accountability). Furthermore, the research investigates three stages of impact assessment. In the pre-assessment, the broadband project and its related effects are identified, stakeholders are identified and analyzed, and linkages between broadband implementation and human development are mapped. In the impact assessment, consultation process and participatory approaches are identified, indicators are developed, impact assessment tools and techniques are identified and implemented, and the impact assessment results are analyzed. In the post-assessment, post-assessment measures are identified.

This study took place during mid-2016 to mid-2017. It involved desk research and interviews of actors and stakeholders. The interviews with participants in Jakarta were conducted face-to-face, while for those living outside of Jakarta it was conducted via telephone or video calls. As a result, mostly positive impacts are expected in productivity and empowerment pillars, while equality and sustainability pillar expects both positive and negative impacts. The main receivers of the positive impact would be the technologically literate people, broadband adopters, residents of municipality level, and privileged groups. Meanwhile, main receivers of the negative impacts would be people with low technology literacy and underprivileged groups.

Productivity

In the productivity area, it was found that the positive impacts come from health (from uses of e-health, broadband use for disease prevention and health campaigns), education (e-education, access to online materials), and income (support for businesses and individuals/household), and the negative impact comes from health (potential health misinformation) and individual well-being (e.g. internet-related addictions, cyberbullying).

Equality

While the Palapa Ring might fulfill its task to bring equality across municipalities, there are possibilities of more inequalities geographically beyond municipalities (e.g. rural areas) and across

social groups, which is based on ethnic groups (e.g. between natives and non-natives) and based economic groups (i.e. rich vs poor). In addition, age and educational background matters in the adoption of broadband.

Sustainability

Concerning environmental sustainability, several positive and negative impacts that are discussed by the literature (e.g. less carbon consumption by the means of dematerialization, increased e-waste) will not be expected in this case; instead, broadband will play a role in in spreading awareness about environmental issues, since environmental issues are not yet viewed as important by Indonesian society. Moreover, through the utilization of broadband, carbon consumption is likely to be increased. Negative impact is likely in community well-being (radicalism, frauds, scams, and fake news).

Empowerment

The people who use broadband are likely to be empowered; in this case, broadband is expected to give positive impacts on political freedom and engagement, freedom of information, and freedom of opinion. In the field of government accountability, while it makes the government look more transparent, whether or not it would stimulate transparency or reduce corruption is doubted.

Based on the findings, it is recommended for the government to do several things: addressing implementation issues related to broadband utilization, promoting technology and media literacy, engaging less privileged groups, extending the broadband implementation to rural areas, promoting environmentally sustainable use of broadband, ensuring a free and safe online sphere, paying attention to local context, engaging local stakeholders, promoting healthy competition, and ensuring meta-infrastructure readiness. These actions are important in enhancing the positive impacts and mitigating the negative impacts of broadband to human development. From this assessment, we also learned that different scopes of broadband implementation would lead to different impacts. In this case, Palapa Ring is a backbone network, which would enable further broadband and narrowband connection. In evaluating the application of the framework to the case, we also found that the sub-themes set before are not enough to express the concept of the pillars. In upcoming assessments, we call for a constant reinterpretation of the sub-themes and the assessment of the relationship between pillars of human development, in order to fully represent the concept of human development. Moreover, a disconnect to the concept of capability is felt in this study; in further assessment, especially in a smaller scale, capability approach could be integrated to the framework to make it more people-centered.

Ultimately, this study has tried to make a connection between the field of broadband, human development, and impact assessment by developing a framework to assess human development impact assessment of broadband implementation and its application to the Indonesian Palapa Ring project. The proposed framework can be used to assess other broadband projects and can be a model of human development impact assessment that can be applied in other areas. The findings of the case study also give feedback to the literatures on the impacts of broadband to human development by supporting previous findings, foreseeing impacts that would not materialize in the Palapa Ring case, and adding newfound possible impacts.

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Chapter 1 Introduction

This chapter presents the overview of the research, including background, problem definition, research objectives, research questions, and research methodology.

1.1 Background

The role of ICT in development has been researched extensively in the field ICT for development (ICT4D). One of the components of ICT is an internet connection, which connects the people in a certain location with every other part of the world. From this starting point, we can look to broadband technology, which is one of the options to connect people to the internet.

As a component in ICT, broadband is seen as an important enabler in socio-economic development (Rohman & Bohlin, 2013). Based on a study done in 12 countries between 1980 and 2006, every ten percent of increase in broadband service penetration would lead to 1,3% of economic growth (Qiang, Rossotto, & Kimura, 2009). This economic impact can be further broken down to GDP growth, job creation, and consumer surplus (R. L. Katz, 2014). Furthermore, the social impact of broadband penetration can be linked to many spectra: it links to poverty reduction (from infrastructure construction, improved labor productivity, skill signaling, to reduced job search costs), quality of life (welfare index), social inequality, and access to basic services (human development index) (R. L. Katz, 2014). In general, ICT can trigger development or in another way a means for development because ICT can rapidly disseminate ideas, values, and process, as well as supplement education, science, healthcare, culture, economic interaction, and markets (Rooksby & Weckert, 2006).

This relation between ICT and development is derived from a large set of data from many countries. It can be seen from a macro level. If applied to a specific country, we can expect either the same set of effects or possibly a different set of effects. For example, from an economic point of view, one possible difference is in the GDP growth mentioned earlier. It is found that the growth effect from broadband is stronger in developing countries than in developed countries (Qiang et al., 2009). In social impact, a literature review combined with qualitative research in a specific region of Australia found that there are several key factors from education, health, and community development that are affected by the deployment of high-speed broadband (Rampersad & Troshani, 2012).

1.2 Problem Definition

To know the full overview of impacts of broadband to development, studies should go beyond broadband's economic impacts. In this case, human development could be the starting point of the investigation. This is illustrated in the practical and scientific problem below.

Practical Problem

Since 2005, there has been inequality of telecommunication infrastructure across Indonesia. Therefore, the government of Indonesia proposed Palapa Ring Project, which aims to connect all regions in Indonesia and bridging gaps between regions. However, the project did not run smoothly; an initial attempt to implement it by a consortium in 2007 failed due to lack of funds and commitment

from member companies. Despite this, in 2009, a part of the original plan was implemented by Telkom, a state telecommunication company; it was called the Mataram-Kupang Cable System (MKCS). In 2013, Telkom decided to continue implementing parts of the plan in Sulawesi, Maluku, and Papua, dubbed the Sulawesi-Maluku-Papua Cable System (SMPCS). In 2014, the government came up with Indonesian Broadband Plan (IBP), which included Palapa Ring as one of its flagship projects. The rebranded Palapa Ring project aims to deploy a fiber optic backbone network that will connect all the municipalities both in the commercial and non-commercial area (Bappenas, 2014; Rohman, 2014). As we can see in the map below, Telkom's SMPCS is included in this plan (red line in Figure 1), while the rest would be implemented by the Ministry of Communication and Information Technology or Kominfo (yellow line in Figure 1).

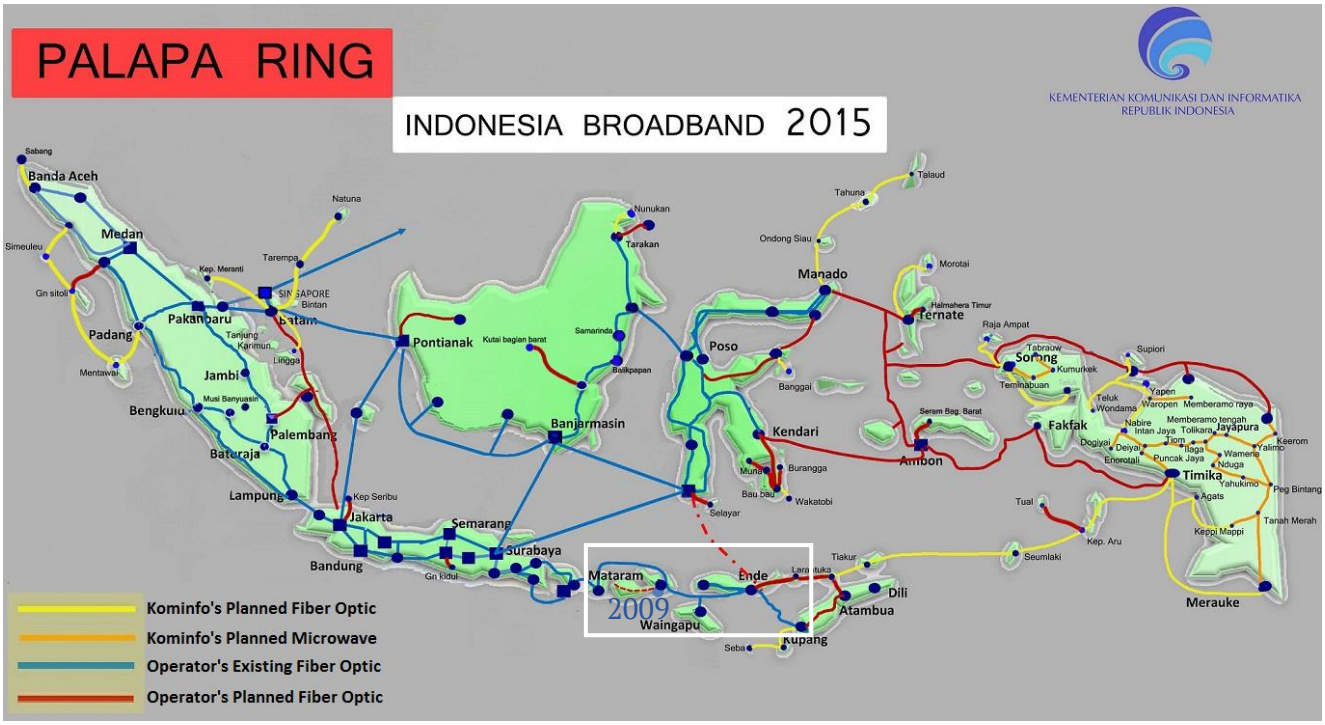

Figure 1 Indonesia Palapa Ring Project Plan as of 2014 (Rohman, 2014)

In IBP, it is stated that Indonesian broadband would be developed to achieve three development aims: (1) boosting economic growth and improving the nation's competitiveness, (2) supporting the improvement of the quality of Indonesian human development, and (3) maintain the sovereignty of the nation (Bappenas, 2014). If we look at these aims, assessing the human development impact of the Palapa Ring Project will be relevant to the first and the second aim. Putting this into context, the deployment of this backbone network can possibly stimulate further development in eastern Indonesia, which is seen as the less-developed region (Panggabean, 2014).

How Palapa Ring will impact the people in the region is further complicated by several problems. For example, the choice of technology has been criticized as not being a feasible option for the Indonesian archipelago (Gunaratne, Ilavarasan, Rohman, & Fernando, 2014) and that the difference of interests among implementers (i.e. Telkom and the government) might hamper the achievement of social benefit as planned by the government, since Telkom's key performance indicator might be only calculated from the financial aspect (Rohman, 2014).

In the end, the human development impact assessment of this Palapa Ring project will shed light on how broadband penetration will impact the human development of people residing in the corresponding regions. The result might not be generalizable due to the unique condition of the case. What can be done in the research includes evaluating the human development impact of the already implemented broadband network or assess the future impact of the to-be-implemented Palapa Ring network, mainly in the eastern part.

Scientific Problem

In knowing the development impact of a broadband implementation, assessment is needed. However, an approach to perform a comprehensive assessment of human development is not yet mature. An effort has been made by the United Nations Development Programme (UNDP) in the area of trade policy (Yamamoto & Oh, 2012), but it only served as a toolkit in trade policy impact and not as a complete framework on how to perform human development impact assessment in other areas. This is problematic because there is a need to assess the impact on human development in various areas, including broadband.

In assessing the impact of broadband implementation to human development, this thesis aims to build a framework for human development impact assessment. It will be derived primarily from the UNDP human development impact assessment toolkit, while also looking at the theory of impact assessment, particularly social impact assessment (IFC, 2012; Vanclay, 2015) and the concept of human development. Furthermore, the framework will be applied to broadband implementation.

1.3 Research Objective

From previous literature study, it is known that several knowledge gaps are present. First of all, there is a gap in the relationship between human development and ICT, especially involving broadband implementation. Literatures have described the relationship between ICT and human development, but a more specific context relating to broadband implementation is still lacking. This gap creates an opportunity to research a human development impact of broadband implementation. However, there is also a lack of a specific framework for human development impact assessment. This is a second knowledge gap. This thesis aims to contribute to both knowledge gaps.

The research objective of this study is to build knowledge and insight into impact assessment in the field of human development and broadband on the basis of the Palapa Ring Project, by developing a methodology of human development impact assessment and applying it to Palapa Ring Project. Here, the problem owner is the Indonesian Bappenas (Ministry of National Development Planning) as the planner of Indonesian development. The main deliverables of this research will include three things. The first is a methodological approach to assessing broadband implementation's impacts on human development, the second is a first human development impact assessment result of the Palapa Ring project, and the third is recommendations for a government body on how to enhance the positive impact and mitigate the negative impact of the broadband implementation.

1.4 Research Questions

The central research question here is *What does a human development impact assessment of the Palapa Ring project look like, and what can be learned from its application*?

To answer the research question, we have several sub-research questions.

SRQ 1 *What is the relation between ICT in general and human development?*

In this sub research question, ICT in general as well as broadband is being examined to see what are the possible relationship between ICT/broadband and human development in theory. A number of topics in the field of ICT and human development will be explored to give a better understanding of the issue.

SRQ 2 *What criteria are relevant for assessing the human development impact of broadband implementation?*

In this research question, the underlying concept in human development, impact assessment, and broadband implementation itself is reviewed. This will result in a set of criteria that is relevant to assess broadband implementation's impacts on human development.

SRQ 3 *What methods are relevant for assessing the human development impact of broadband implementation?*

This research question deals with the methods and phases of conducting the human development impact assessment. A method will be developed based on impact assessment method, particularly social impact assessment, previous human development impact assessment tools, and other relevant assessment methods.

SRQ 4 *Can we apply the methods and criteria of human development impact assessment of broadband to Indonesian Palapa Ring project and what is the result if we apply it?*

After the methods and criteria of HDIA for broadband implementation have been developed, its appropriateness for Palapa Ring project will be investigated. If it is, the framework will be implemented to Palapa Ring project. Here, analysis would be made on the expectations of the project (the goals), other positive impacts, the negative impacts, how to enhance the positive impacts, and how to mitigate the negative impacts.

In addition, we are interested in the recommendations and the lessons to be learned, which gives rise to the following additional questions. These questions will be addressed in the concluding chapter.

AQ 1 *What can we learn by assessing Palapa Ring project in order to make a recommendation on how to enhance human development positive impact & prevent and mitigate human development negative impact?*

Based on the assessment result, the favorable condition by which the broadband implementation would make the desired impact should be known. A recommendation is given to enhance the positive impact and to prevent and mitigate the negative impact of broadband implementation.

AQ 2 *What can we learn from the Palapa Ring project in relation to stimulating and assessing human development impact of broadband?*

This additional question corresponds to the sub-research questions that relate to the theory for assessing human development impact (SRQ 2, SRQ 3). The lesson learned will contribute to the impact assessment of human development in broadband in general.

1.5 Methodology

In this chapter, the research framework, an overview of the case, and the research methodology will be presented.

1.5.1 Research framework

The research framework of this thesis is provided below.

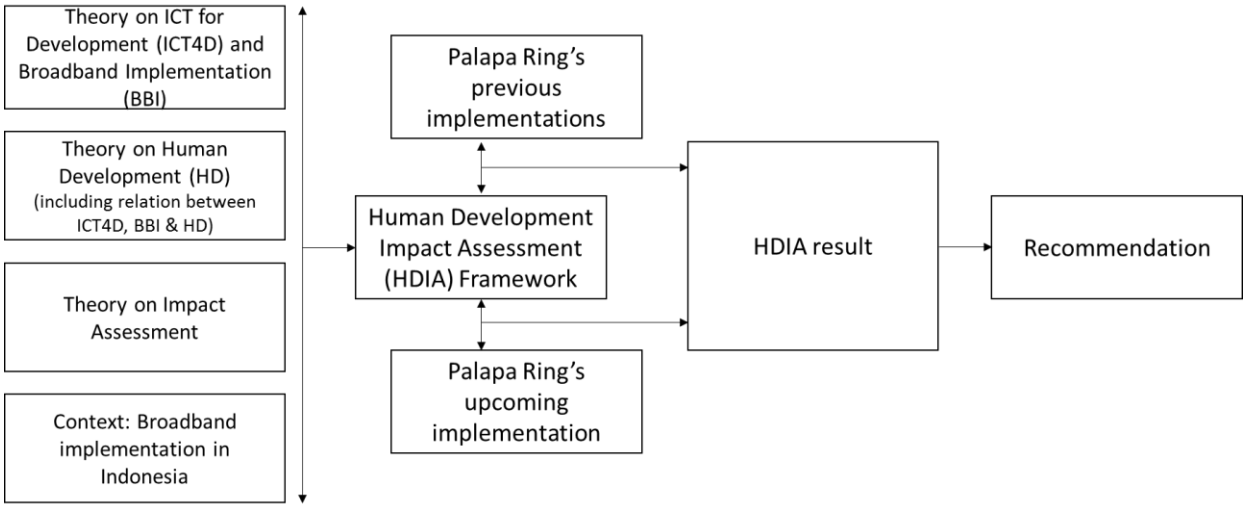

Figure 2 Research Framework

This research framework shows the theories that are used to construct the Human Development Impact Assessment Framework. Based on the theories, a human development impact assessment framework for broadband implementation is developed, which consists of the methods and the criteria to assess the human development impacts of broadband implementation. This framework is then used for assessing the case of Palapa Ring. By doing the evaluation of the previous implementations, reviewing the literatures about broadband benefits and disadvantages, and conduct assessment on the upcoming implementations, the impacts of upcoming implementation is then predicted.

After the assessment is done, the expected result leads to a recommendation to the problem owner of this project, which is Bappenas. The recommendation would be based on how to enhance the positive impacts and how to prevent and mitigate the negative impacts of broadband.

1.5.2 Defining the unit of analysis: the cases

This research is based on a single case study, Indonesia Palapa Ring project as the part of Indonesian Broadband Plan 2014-2019. Single case study is used because the implementation of broadband in Indonesia is different from other implementations in the developing world (Gunaratne et al., 2014) and the scope of Palapa Ring is large enough to provide insights about the impact of broadband implementation on human development.

For this research, a case study protocol is also developed. The case study protocol will serve as a guideline for the case study, to enhance the reliability of the research, and to ensure that the case study obtains its goal. It is developed according to the structure of case study protocol proposed by Yin (Yin, 2014). It includes the data collection procedure, expected preparation prior to interviews,

and interview questions. The case study protocol is a separate document and not included in this thesis report since some of its parts overlaps with the appendices (e.g. interview questions, list of interviews).

Within the case of Palapa Ring, the assessment is focused in two regions. The first region is Nusa Tenggara, where broadband (MKCS) has been implemented in 2009-2010. The impact of broadband implementation after 5-6 years would be seen in this region. The second region is Papua. In Papua, fiber optic broadband has entered the region in the beginning of 2016 after SMPCS was implemented by Telkom. However, it was only implemented in the bigger cities; the smaller and more remote municipalities would be covered by Kominfo's implementation that is expected to be ready in 2019. In this region, the impact assessment will foresee the impact of both implementations, as the impact of the newly-implemented fiber optic broadband (after a few months) might not be visible yet. These two regions are part of eastern Indonesia, which is seen as less developed regions of Indonesia.

1.5.3 Research methodology

In the table below, the research methodology will be presented.

Table 1 Research Methodology

Sub Research Questions	Research Methodology
1. What is the relation between ICT in general and human development?	Literature review on ICT and Development, Broadband Implementation, and Human Development
2. What criteria are relevant for assessing the human development impact of broadband implementation?	Literature review on ICT and Development, Broadband Implementation, Impact Assessment, and Human Development. The criteria are grouped into four main themes which are derived from four pillars of human development: productivity, equality, sustainability, and empowerment.
3. What methods are relevant for assessing the human development impact of broadband implementation?	Literature review on impact assessment: social impact assessment, human development impact assessment, and other relevant sources. The assessment is divided into three phases according to HDIA tools proposed by UN (pre-assessment, impact assessment, post assessment) to ensure compatibility with the previous tools.
4. Can we apply the methods and criteria of human development impact assessment of broadband to Indonesian Palapa Ring project and what is the result if we apply it?	Single case study. The assessment is based on the HDIA framework developed from the previous research question. The type of the research will be exploratory qualitative research. Several semi-structured interviews with the stakeholders of the project are conducted. An analysis of the relevant documents and other sources (books, media) are also conducted.

In addition, to answer the additional questions, analyses based on the findings of the sub research questions are performed. For additional question 1 (recommendation), the analysis is based on the findings of SRQ 4. For additional question 2 (lessons learned), the analysis linked back the assessment result (SRQ 4) to the previously developed framework (SRQ 2 and 3).

To summarize, the research methodology includes a literature review and an exploratory qualitative case study that involves a semi-structured interview. In the semi-structured interview, a set of topic

and questions will be prepared, but there will be open questions and further discussions with the interviewee to explore the impacts of the broadband implementation. This approach is selected due to the fact that there has been no previous similar research which will enable a replication of the assessment.

1.6 Report Structure

After this introduction chapter, chapter 2 will give perspectives of the various concepts, mainly on broadband implementation, human development, and impact assessment. Following chapter 2, chapter 3 will discuss the framework of human development impact assessment. In chapter 4, the result of the assessment will be presented. Next, chapter five will present discussion of the result. Finally, chapter 6 will present the conclusion. Figure 3 below provides the mapping to which research and sub research questions are answered in the report chapters.

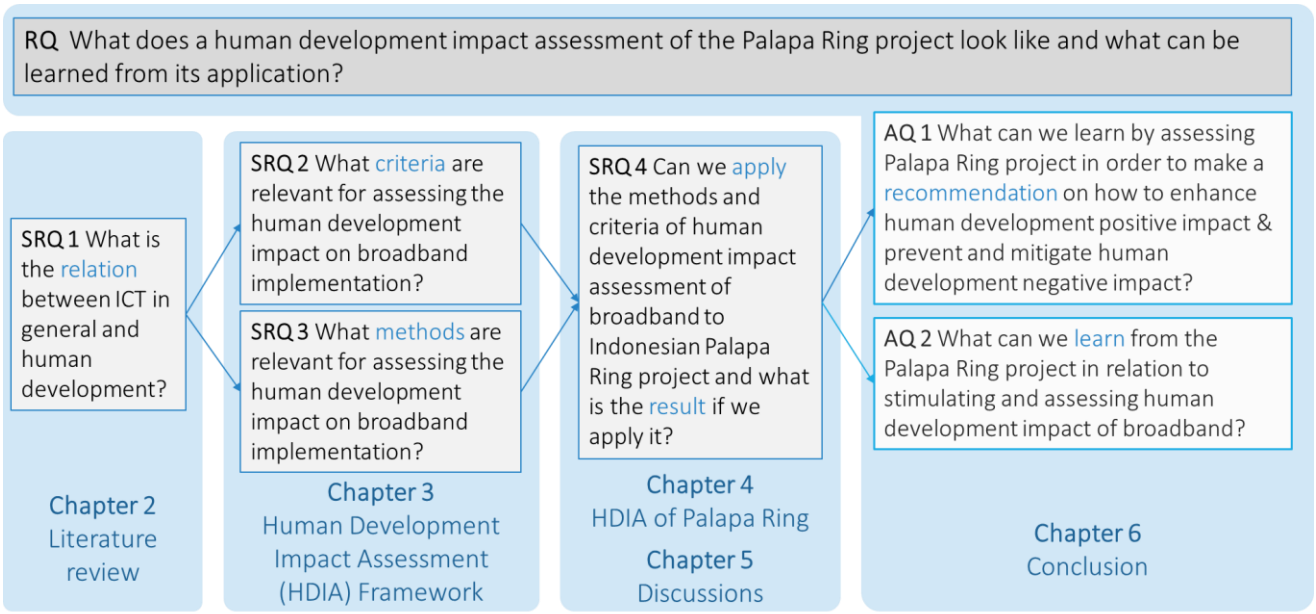

Figure 3 Mapping of research questions and additional questions to report chapters

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Chapter 2 Broadband, Human Development, and Impact Assessment: A Literature Review

This chapter will discuss sub research question 1: **"What is the relation between ICT in general and human development?"**

In this chapter, we aim to introduce various concepts that become the basis of this thesis research. As the background, in subchapter 2.1, the relationship between technology, ICT, and development is explored. After that, we will review literatures about broadband implementation (subchapter 2.2), human development (subchapter 2.3), and impact assessment (subchapter 2.4) and try to find a link between the three of them (subchapter 2.5). In addition, the context of Indonesian broadband implementation and Palapa Ring project would also be presented (subchapter 2.6).

2.1 Technology, ICT, and Development

2.1.1 Development and the Role of Technology in Development

Development studies had been an established academic discipline since the end of the 1980s. One of the first lines of research is development economics. Over time, it expanded to a multi-disciplinary subject, taking into account social change. Even though there is no universally accepted definition of development, the field continues to grow. The first concept of development includes economic growth, with the growth of gross national product (GNP) and employment rate as indicators. More than that, it is concerned with the achievement of a better life (Sen, 1988). Later, the concept of human development (will be explained in subchapter 2.3) was also founded. In general, it is used to measure the progress of a particular country or region. In a recent trend, the concept of sustainability also plays a role, with the most prominent example being the newly-launched Sustainable Development Goals by UN ("Sustainable Development Goals," 2016).

In the field of development, technology can play a role. Loo and Soete have mentioned extensive literature during the last fifty years that shows technology and economic growth is related (Loo & Soete, 1999). Ranis and Zhao (2013) has also discussed the relationship of technology and development: technology, when combined with human development, contributes critically to economic growth, which further increases human development. Moreover, technology also plays a key role to achieve sustainable development. The technology itself can include, among others, health technology (mobile health), education (distance learning), or energy (solar, wind, and hydropower) (Hostettler, 2015). In this research, information and communication technology are the main focuses.

2.1.2 ICT and Development

The field of ICT for development (ICT4D) first emerged in 1990, when the internet started to become widely available and UN's Millennium Development Goals (MDGs) was introduced. Here, the digital

technology provided a tool in search of a purpose, while the development goals were in search of a mechanism of delivery (Heeks, 2008). This early ICT4D was what Heeks called "ICT4D 1.0", while he proposed ICT4D 2.0, which emphasized on making the poor the central actor of ICT4D.

Since then, the impact of ICT in development has been extensively researched. In general, it is agreed that investment in ICT will drive macroeconomic growth. A finding suggested that it reduces poverty (Grace, Kenny, & Qiang, 2004), while another suggested that there is little evidence on how it is linked to pro-poor growth (Batchelor & Scott, 2005).

In the theory about ICTs contribution to pro-poor economic growth, the key drivers of growth include rural livelihoods, private sector development, infrastructure, financial infrastructure, and service delivery support structure. ICT can also be used to improve a specific sector. In agriculture, ICT is used by farmers and fishermen to access information on weather, soil and crops, and up-to-date market and commodity prices (Batchelor & Scott, 2005) or to increase efficiency in the agricultural supply chain (Steinfeld & Wyche, 2013). ICT can also create opportunities such as digital entrepreneurship and provides a digital business ecosystem (Moore, Palfrey, & Gasser, 2003).

It is also suggested that ICT can bring about participation of people in the society, empowerment, better health, and better education (Kuyoro, Awodele, & Okolie, 2012), all of which are linked to human development. People's access to ICT brings about the sense of empowerment and active participation both socially and politically. In general, it is viewed as enabling, promoting, or having a critical role in socio-economic development (Dabla, 2004; Hameed, 2006; H. Rahman, 2007).

Despite all this, there are also the challenges and disadvantages of ICT4D. One of the challenges is the inclusion of underprivileged social groups in ICT4D initiatives. In a research in the state of Andra Pradesh, India, ICT4D cannot give equal benefit for diverse social groups with different levels of skill, access, and education (Dabla, 2004). About the disadvantages, as mentioned by Heeks, they may revolve around the themes of security, privacy, protection, inequality in labor market, the loss of work/life balance and ICT-induced stress, as well as children's health, learning, and cognitive development (Heeks, 2014). Moreover, it is important to note that with the increasing use of ICT, the environmental sustainability becomes a challenge (Hamel, 2010).

2.2 Broadband Implementation

The term "broadband" has different meanings depending on the context in which it is discussed. It is viewed as "relative" rather than "fixed" (Fijnvandraat, 2008), since it refers to the actual availability of bandwidth at a certain place at a certain time, which changes over time. It refers to multiple aspects of the network and services: the infrastructure to deliver services to users, high-speed access to the internet, or the services and applications available via broadband networks (Kelly & Rossotto, 2012). Technically, the term broadband refers to a specific amount of bandwidth transmitted over a network to end-user (Fijnvandraat, 2008). Every country can have their own specific definition of what they define as broadband; it can be based on the speed (Mbps or kbps) or the functionality of the broadband network in question. For example, the government of Indonesia defines broadband as an always-connected internet access which guarantees information resilience and security, as well as having the ability of triple-play with the speed minimum 2 Mbps for fixed access and 1 Mbps for mobile access (Peraturan Presiden 96/2014). In this case, broadband is not only defined by its speed and its ability

(triple-play of voice, video, and data), but also with other properties like always-connected and the information security.

The broadband network in a country can be deployed by the private sector and the government. In many countries, it is a mix of them; the government supplied the areas that are not commercially viable for private telecommunication company to build there. It is usually a part of the strategy of implementing the broadband by the government; implementing broadband is one of international agenda of development. In implementing broadband, the government usually have a specific broadband development plan. In implementing broadband, there are several aspects that should be considered, which may include its technical aspect, coverage, supplementing programs/initiatives, policy approaches, financing aspect, law and regulation, and plans to create demands for broadband (Kelly & Rossotto, 2012).

2.3 Human Development

Human development is used as one of the indicators of development in regions and countries. It is first developed by the economist Mahbub ul Haq in the early 1990s and it is also related to the idea of Sen's human capabilities (UNDP, 2017). It is usually used as the measure of human well-being, together with GDP.

In the concept of human development, people are the center of human development analysis. There are two perspectives or dimensions of human development. The first is the formation of human capabilities or directly enhancing human abilities, which reflects the combination of functioning (being and doing), in which one sees the value and has reasons to value (e.g. improved health, knowledge, and skill). The second is the real opportunity to accomplish what one values (economic, political, social, cultural) by using these required capabilities, or how conditions for human development can be created (UNDP, 2017; Yamamoto & Oh, 2012).

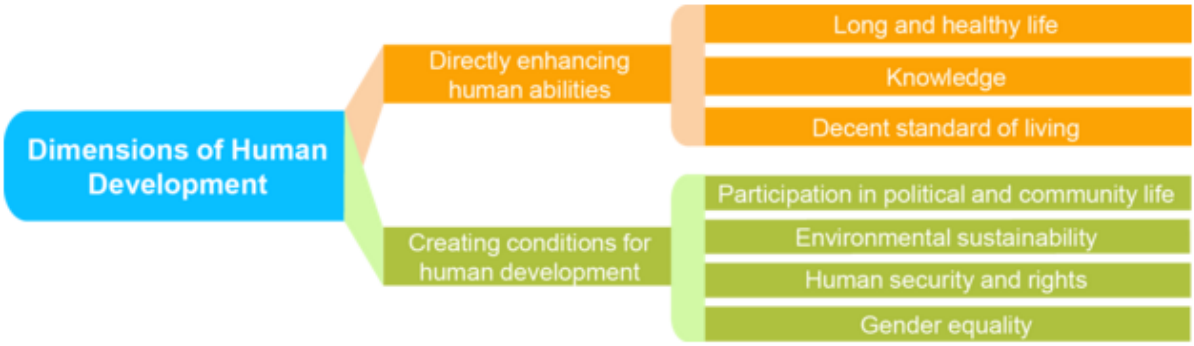


Figure 4 Dimensions of Human Development (UNDP, 2017)

2.3.1 Indicators of Human Development

The Human Development Report[1] uses composite-based index in measuring basic dimensions of human development. There are three basic aspects of human development: a long and healthy life,

[1] The Human Development Report is an annual report commissioned by the UNDP, which presents topics related to human development across countries.

knowledge, and decent standard of living (Yamamoto & Oh, 2012). The indicators used are life expectancy at birth, education index (expectancy of the length of primary/secondary/tertiary education in year and average of the length of education in year), and adjusted GDP per capita. Those indicators are used to measure the human development index (HDI), which is accepted as the universal indicator of human development across countries. However, the concept of human development itself goes beyond the three indicators. Ranis, Stewart, and Samman (2006) proposed sixty potential set of measurable indicators over eleven categories: mental well-being, empowerment, political freedom, social relations, community well-being, inequality, work conditions, leisure conditions, economic stability, political security, and environmental conditions.

2.3.2 Four Pillars of Human Development

In explaining the human development paradigm, Haq (1995) introduced four essential components that is also known as the four pillars of human development: productivity, equality, sustainability, and empowerment. Productivity can be linked to improvement of human capabilities as an end and as a means for people to participate and benefit from economic growth. It includes people's advances in health, education, and labor force capabilities. Equality refers to the equal access to opportunity for all members of society. Sustainability refers to governing of physical, human, financial, and environmental resources in a manner that does not compromise the ability of future generations from improving their welfare. Empowerment refers to people's capability to shape process and events affecting their lives regarding economic and socio-political-cultural aspects, e.g. to be able to participate actively in decision-making processes that have an impact on one's livelihood (Yamamoto & Oh, 2012).

To measure the full impact on human development of a specific initiative, an impact assessment is needed. The following subchapter explains the concept of impact assessment.

2.4 Impact Assessment

The field of impact assessment is closely related to technology assessment, which provides factual and normative input into technology choices or decision-making process. Technology assessment itself deals with three orders of effect: the first order being the foreseen effect which is mostly positive, the second order effect dealing with the unplanned and sometimes undesired effect, and the third order effect concerning effects of effect. Meanwhile, impact assessment can be defined as "the process of identifying the future consequences of a current or proposed action" (Becker, 2001).

Impact assessment finds it roots from Environmental Impact Assessment, which originated in the 1960s after the publication of Rachel Carson's environmental science book the Silent Spring. Over time, it has been adapted into legally-based decision support instrument to assess the environmental impact of a specific development project (IAIA, 2009). It also evolved to other types of impact assessment, including social impact assessment (Becker, 2001; Vanclay, 2015), human rights impact assessment (Abrahams & Wyss, 2010), health impact assessment (WHO, 2016), poverty impact assessment (World Bank, 2015), and privacy impact assessment (Wright & Hert, 2012). In 1980, International Association for Impact Assessment (IAIA) was established as a professional and technical organization for impact assessment (IAIA, 2009).

In these fields of impact assessment, a number of guidelines have been developed. For example, in social impact assessment, a guideline has been developed by International Association for Impact Assessment, which comprises of the relevance of social impact assessment, the phases and tasks, and the review criteria (Vanclay, 2015). From sustainability point of view, a document on performance standards on environmental and social sustainability was developed by International Finance Corporation, a subsidiary of World Bank (IFC, 2012). It includes the assessment and management of environmental and social risks.

The steps of impact assessment, for example, can be seen on how social impact assessment is performed. It comprises on 26 tasks of SIA which are grouped into four phases, based on the guidelines of IAIA.

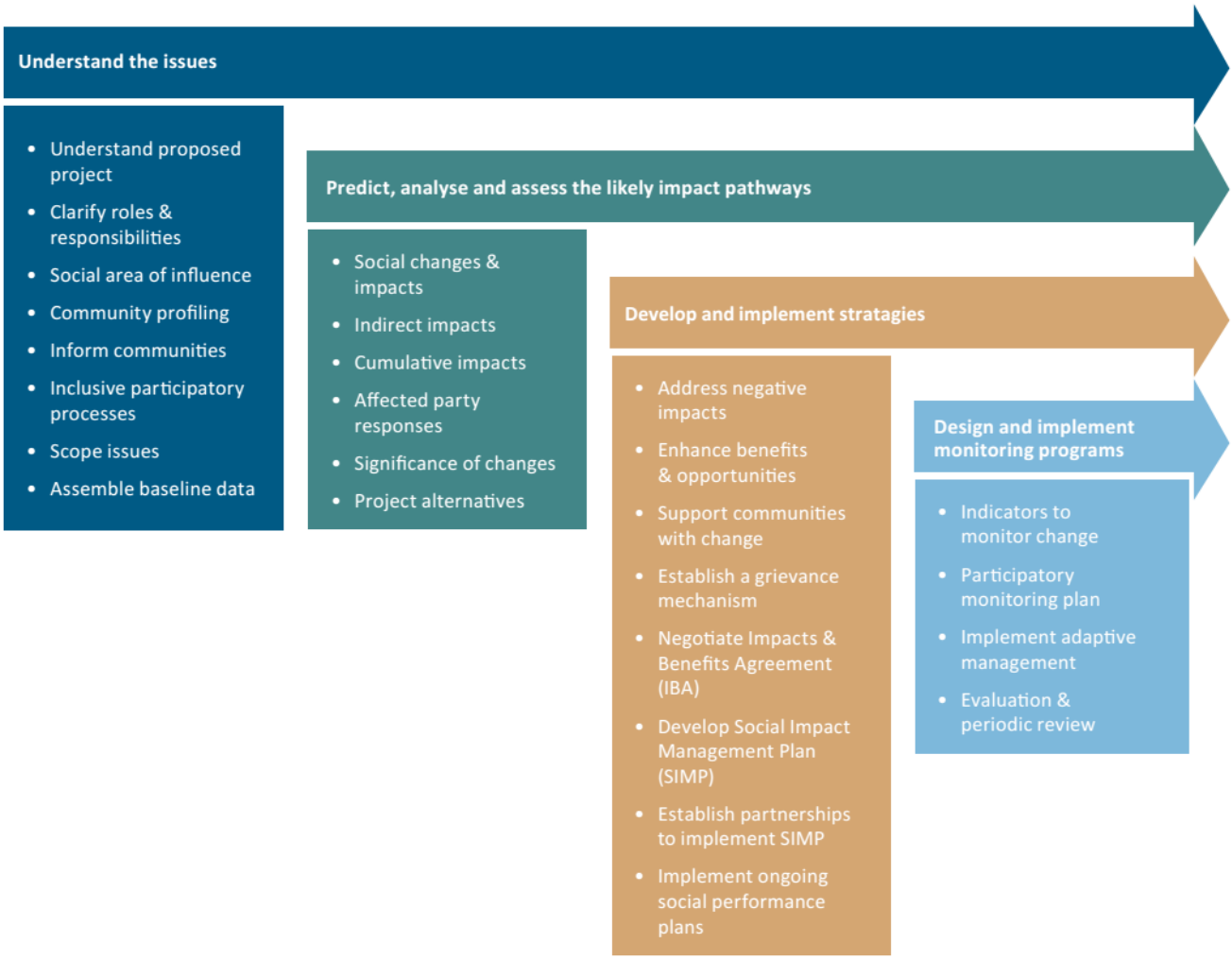


Figure 5 Phases of SIA (Vanclay, 2015)

Impact assessment also poses challenges. In SIA, the challenge can be whether the impact assessment will actually predict the effects, the management of the social impact after the assessment, the understanding of the social and cultural context, and practical concern challenges. Practical concern challenges include conflict of interests, timing, biased assumptions and methodologies, and professional ethics (Joyce & MacFarlane, 2001). Furthermore, if SIA is done by using qualitative research, there are more specific challenges. It can be about deciding on research participants or the focus of the interviews, or the possibility of the research idiosyncratic or divergent views, dishonesty,

and exaggeration or underestimation of likely impacts. It can also be about handling the data that are collected, analyzing and interpreting the data, or ensuring the validity, reliability, and rigor throughout (Fitzgerald, 2003).

2.4.1 Human Development Impact Assessment (HDIA)

While social impact assessment has a framework, there has been a less complete framework on how to do a human development impact assessment. One effort has been made in using a human development approach to measure social impact (Burd-Sharps, Guyer, & Lewis, 2011). In measuring human development impact of a specific policy implementation, the United Nations Development Programme (UNDP) has created a toolkit for human development impact assessment, but in the case of trade policy (Yamamoto & Oh, 2012). It was developed based on unpublished UNDP guidance notes of human development impact assessment and also based on several World Bank, UN, and OECD sources of poverty, social, and sustainability impact assessment (Yamamoto & Oh, 2012). The toolkit outlines the conceptual framework for assessing the human development impact of trade policy, including the concepts of human development.

UNDP's HDIA toolkit also explained several basic concepts of (their version of) human development impact assessment. First, the object of the assessment is the corresponding policy or equal to it: comprehensive or specific, depending on the dimension and impact of the prospected policy change. Second, the timeframe of the HDIA, which could be before, during, or after the completion of corresponding policy. Third, the party responsible to undertake the HDIA: while the government leads the HDIA, it will include policy makers from relevant ministries and parliament, private sector, academia, CSOs, media, and (vulnerable) groups that would be affected by policy change. Fourth, how HDIA should be undertaken: it involves identifying aspects of human development that are likely to be affected by the policy change; the indicator can be selected in a systematic manner by examining the linkages and transmission channel. Furthermore, stages and steps are also discussed. The diagram below sums the process of the assessment.

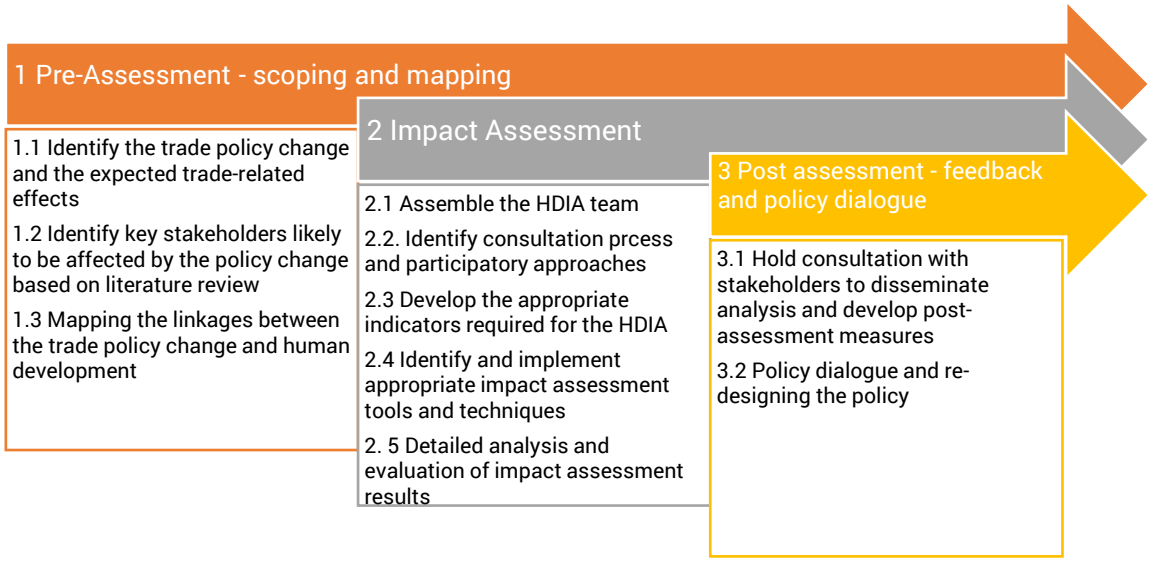


Figure 6 Stages and steps for Human Development Impact Assessment for Trade Policy (Yamamoto & Oh, 2012)

This HDIA toolkit developed by UNDP emphasizes the participatory decision-making process in which all of the relevant stakeholders and representatives of the affected groups are required to be engaged in the discussion of the topic and its impacts. The stages and steps reflect the whole process of human development impact assessment as an integral part of policy implementation, while the very process of the impact assessment itself is addressed in *2.4 Identify and implement appropriate impact assessment tools and techniques* and *2.5 Detailed analysis and evaluation of impact analysis result*. In the appendix, the toolkit provides examples of assessment tools, both qualitative (e.g. focus group with stakeholders) and quantitative analysis (social accounting matrix, computable general equilibrium models, partial equilibrium analysis, and factor analysis).

This human development impact assessment toolkit provided by UNDP gives a general idea and the concepts of the human development impact assessment. However, it is not a complete framework or guidelines for human development impact assessment in general. It is specific to the case of trade policy, even though it does provide the examples of the cases of previously conducted HDIA in 2005 (Agreement of Textiles and Clothing/ATC expiry) in Cambodia, Lao PDR, and Nepal. The framework is not readily implemented in this broadband case since it provides a different point of view. This poses a challenge for HDIA: that no ready-to-use guideline is available.

2.5 Linking Broadband Implementation, Human Development, and Impact Assessment

The effort to specifically link broadband implementation to human development has not been explicitly made. One of the possible link is from digitization concept, which is defined by R. L. Katz (2014) as the capacity to use broadband and other digital technologies to generate, process, share and transact information. In the figure below, we can see digitization index vs human development index.

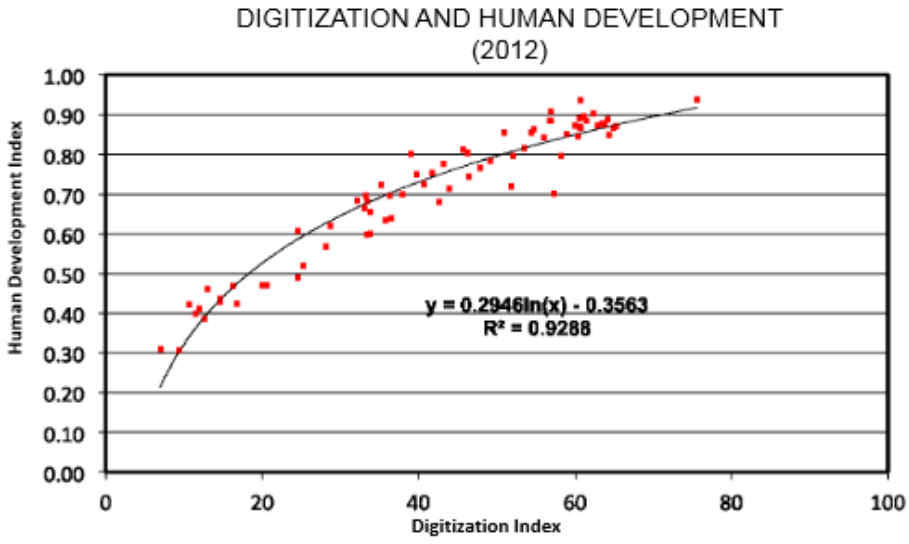


Figure 7 Digitization and Human Development Index (R. L. Katz, 2014)

Since a thorough study relating human development and broadband implementation has not been made, possible links between them can be derived from two themes. The first is the relation between ICT and human development, and the second is the socioeconomics impact of broadband. From these two themes, we can find overlapping links between broadband implementation and human

development. One of the challenges is to make it specific to broadband, because, in the field of ICT, the area covered is quite large; ICT includes tools or techniques that allow recording, storing, using, diffusing, and accessing electronic information (Hamel, 2010). As for the impact of broadband, the concept of human development could be broken down further (e.g. to the four pillars or the categories/indicators as mentioned in subchapter 2.3) to determine the overlapping points.

From ICT point of view as mentioned earlier in subchapter 2.2, there has been a clear link between ICT and empowerment of civil society: in this particular area, the presence of internet can increase opportunities for online political activism and governmental process transparency, despite the issue of censorship and monitoring (Hamel, 2010). Hamel also mentioned that online information benefits in filling learning resource gap in developing countries (Hamel, 2010).

Broadband has a positive impact on raising rural income, based on research done in rural India, as well as economically empowering female agricultural producers in Burkina Faso (Qiang et al., 2009). Broadband was also successful in enabling a more advanced medical technology in several case studies, one of them being Tamil Nadu video conferencing system for minor eye problems (Qiang et al., 2009). In the developed country, in Cornwall, UK, broadband also has a positive impact. The image of Cornwall was changed from a rural laggard to an area worth living and working. For three years since the broadband was implemented, about 4300 broadband-related jobs have been created, including through technology start-ups. It also contributes to the increase of annual GDP of Cornwall and contributes to productivity, which is the first pillar of human development (Fornefeld, Delaunay, & Elixmann, 2008).

Besides increasing network penetration, increasing the speed of broadband can also make an impact on human development. In a study of the impact of increased broadband speed by Ericsson (2013), it is found that faster broadband can increase productivity (productivity pillar), giving better access to services and improved healthcare (productivity pillar and the concept of long and healthy life). The report also found that increasing broadband speed could lead to positive and negative environmental impacts. In the picture below, a schematic of potential impacts stemming from increased broadband penetration and speed is shown.

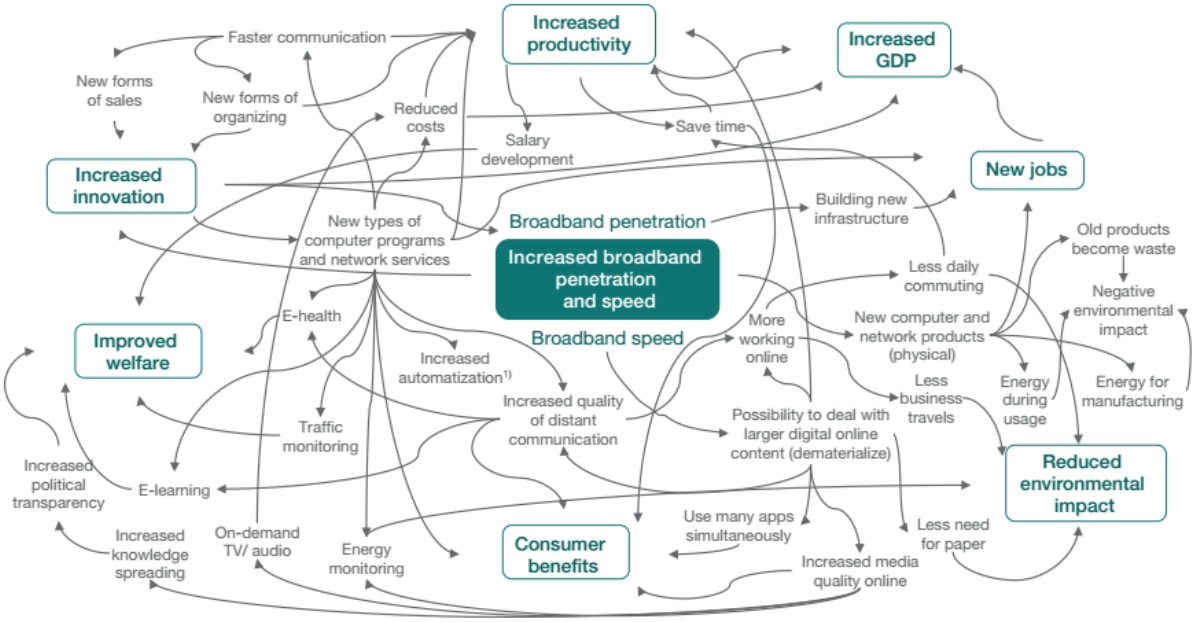


Figure 8 Schematic of effects from increased broadband penetration and speed (Ericsson, 2013)

However, there has not been a framework that specifically discuss how to assess the human development impacts of broadband implementation. This is the research gap and will be addressed in this thesis research, specifically in Chapter 3.

2.6 Palapa Ring Project and Indonesia Broadband Implementation

2.6.1 The current condition of ICT in Indonesia

Currently, the connectivity rate of broadband in Indonesia is considered laggard compared to other countries, according to a study by The Economist Intelligence Unit. Furthermore, the fixed broadband prices are still above the affordability criteria of less than 5% of average monthly income; in Indonesia it is 9.1% (Andreasson, 2014). In ITU's ICT Development Index 2015, which measure the readiness, use, and capability of ICT in a particular country, Indonesia is ranked 108th from 167 countries measured, with the index of 3.9 (ITU, 2015). The index measures eleven indicators, which will be given in the table below. From the table, we can see several very low numbers: there is only 1.19 fixed broadband subscription per 100 inhabitants, 17.14% of individuals using the internet, and 29.08% households are connected to the internet.

Table 2 Indonesia ICT Development Index (ITU, 2015)

INDONESIA ICT Development Index	
IDI 2015 Rank	**108**
IDI 2015 Value	**3.94233**
IDI Access Sub-Index	**4.6**
Fixed-telephone subscriptions per 100 inhabitants	11.72
Mobile-cellular telephone subscriptions per 100	126.18
International internet bandwidth per Internet user(Bit/s)	6,225
Percentage of households with computer	17.75
Percentage of households with Internet access	29.08
IDI Use Sub-Index	**1.79**
Percentage of individuals using the Internet	17.14
Fixed (wired)-broadband subscriptions per 100 inhabitants	1.19
Active mobile-broadband subscriptions per 100 inhabitants	34.72
IDI Skills Sub-Index	**6.93**
Adult literacy rate	93.88
Secondary gross enrolment ratio	82.54
Tertiary gross enrolment ratio	31.51

Besides ICT Development Index, Indonesia is ranked in the middle in Network Readiness Index study conducted by World Economic Forum. It ranks 79th out of 143 countries studied, which includes environment (political and regulatory environment & business and innovation environment), readiness (infrastructure, affordability, and skills), usage (individual usage, business usage, and government usage), and impact sub-index (economic and social impacts) (Dutta, Geiger, & Lanvin, 2015).

Other than the said indicators, studies conducted in Indonesia also found that it is difficult to access the internet in remote areas. In mountainous area, where telephone signal is not present, internet could only be accessed to the nearest city (A. Rahman & Quaddus, 2012). However, there is great

potential use for internet in Indonesia: stimulating democracy, shaping collective identity, online election, use by civil society organizations, use in educational institutions, and e-government, among others (Lim & Nugroho, 2011).

2.6.2 Palapa Ring

In the 1990s, Indonesia ratified international agreements (GATT, WTO) that leads to liberalization of telecommunication sector. While other countries deregulate their telecommunication sector when the fixed access density is 10-20%, Indonesia deregulated it at a fixed access density of 4% (Bappenas, 2014). This leads to an inequality of telecommunication infrastructure across Indonesia, where the more economically developed regions receive better telecommunication access. The same applies to broadband. While broadband in the western parts of Indonesia is developed by private sector, the ones in eastern Indonesia are lagging since it is not financially interesting.

In 2005, Kominfo introduced Palapa Ring as a ring network of undersea fiber optic cable. By approaching several telecommunication company, in 2007 Kominfo was able to form a consortium of six companies to commit the infrastructure development. At that time, the project's main objective was to connect the eastern Islands in Indonesia. However, in the span of two years, the consortium disbanded. Despite that, Telkom, a state telecommunication company and the biggest contributor to the consortium decided to develop a part of Palapa Ring in Nusa Tenggara; they deployed fiber optic cables from Mataram in West Nusa Tenggara to Kupang in East Nusa Tenggara (Mataram-Kupang Cable System). The project was implemented between 2009 and 2011 (Huawei, 2011).

Since the project's scope is the implementation of broadband in less developed regions, companies were unsure of the financial return. Coupled with the financial crisis in 2008, it was reasonable for the companies to withdraw themselves from the consortium. Realizing this, Kominfo negotiated a different way to fund the project to Bappenas and the Ministry of Finance. Meanwhile, Telkom continued to build parts of Palapa Ring: this will lead to the Sulawesi-Maluku-Papua cable system, dubbed SMPCS (2013-2015).

Supported by the 2011 Masterplan for Acceleration and Expansion of Indonesia's Economic Development (MP3EI) and the success of Kominfo's negotiation, the government launched Indonesian Broadband Plan in 2014 with Palapa Ring as one of its flagship project. By 2014, the project transformed; it aims to connect 497 municipalities across Indonesia by deploying a fiber optic backbone networks (Bappenas, 2014). Telkom committed to build access to 145 municipalities through SMPCS, and the rest, 51 municipalities, would be conducted by the government. The government used the term "commercial area' and "non-commercial area", where Telkom implements in commercial areas and the government in non-commercial areas. The government then divided their part into three: western, central, and eastern Indonesian packages. As of 2017, all the government packages are in the process of being implemented.

This whole process leads to a long delay in the project. Palapa Ring was initially launched in 2005, but it is (to be) implemented partially over time between 2009 and 2019. The full timeline and implementations of Palapa Ring can be found below.

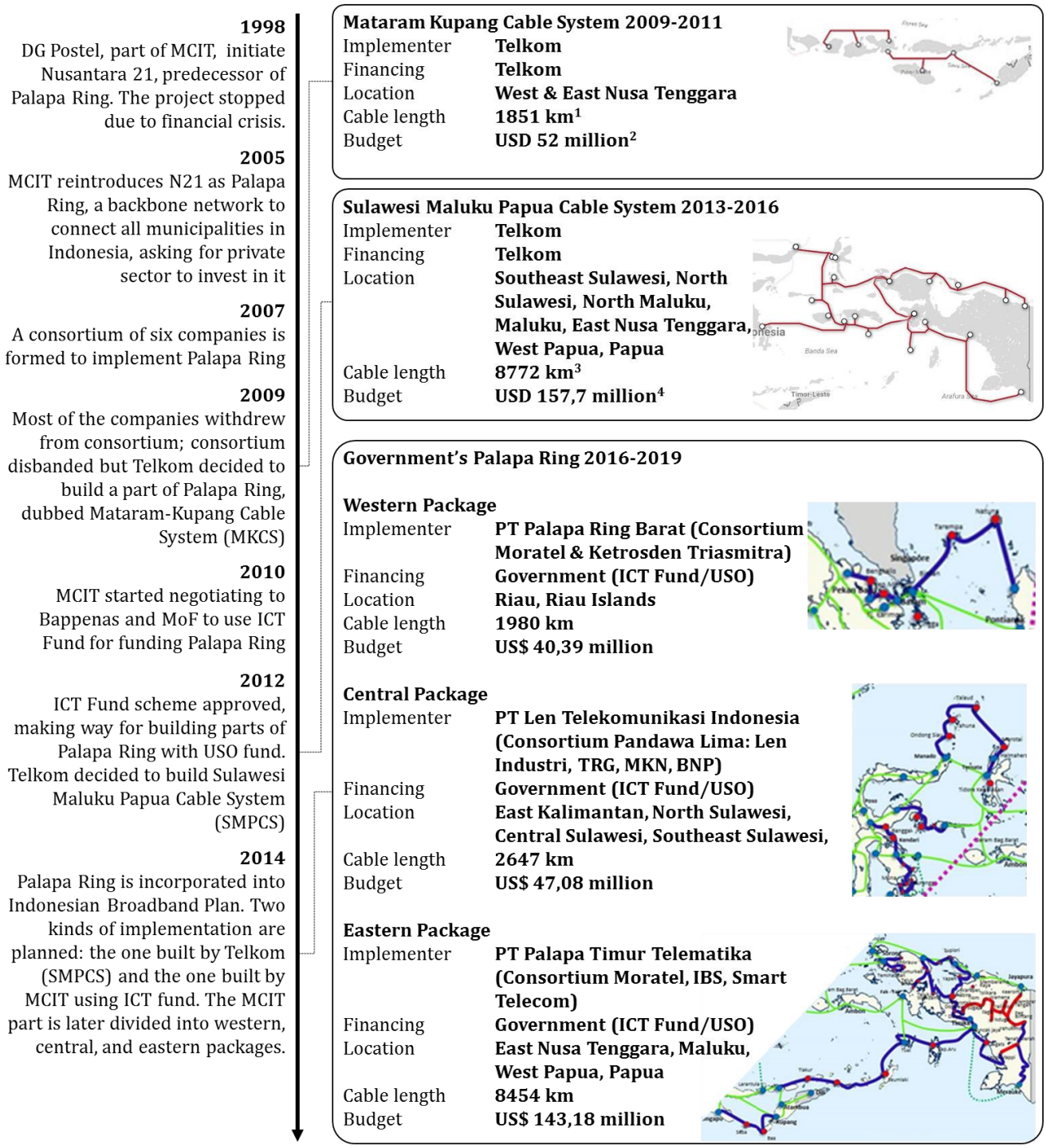


Figure 9 Timeline and Implementations of Palapa Ring until 2014

2.6.3 Indonesian Broadband Context

In Indonesian Broadband Plan 2014-2019, the government explained its plan to develop broadband in Indonesia. The broadband plan includes critical projects such as Palapa Ring and shared duct from the infrastructure side, USO reformation for accommodating broadband ecosystem, and developing government networks. It also includes main policies in infrastructure, utilization, regulation

framework, and financing aspects. Moreover, it has five priority sectors in utilizing broadband, which are e-government, e-health, e-education, e-logistic, and e-procurement.

Outside of the plan itself, the government of Indonesia is also trying to maximize the socio-economic impact of national broadband plan, by using ICT to develop vibrant ICT ecosystem, foster accelerated economic growth, and enable sustainable social development. This is summarized in a strategic map proposed by the Indonesian government, as seen below.

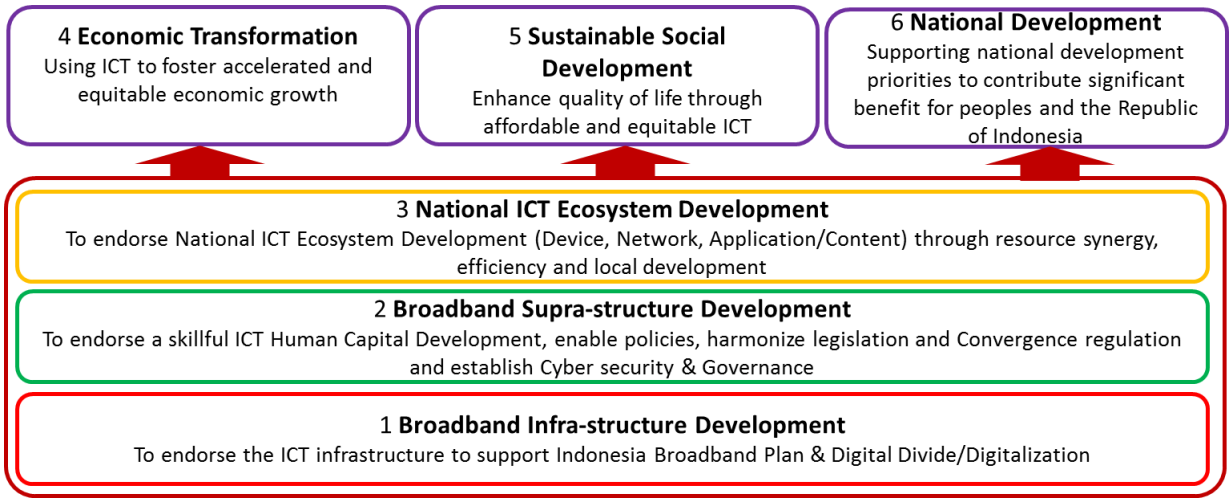


Figure 10 Proposed Strategic Map for Indonesian Broadband Implementation to Maximize Socio-Economic Impact (Nashiruddin, 2015)

Chapter 3 Creating Human Development Impact Assessment Framework for Broadband Implementation

This chapter will discuss sub research question 2, **"What criteria are relevant for assessing the human development impact of broadband implementation?"** *and sub research question 3,* **"What methods are relevant for assessing the human development impact of broadband implementation?"**

To create Human Development Impact Assessment Framework for assessing broadband, two considerations are applied. **First** of all, there are two main points here, the method and criteria, which corresponds to the second and third sub research questions. The method consists of how will the human development impact assessment (HDIA) be undertaken: stages, steps, and all corresponding methods to perform the steps. The criteria answer the question of the human development criteria for the HDIA. **Second** of all, this framework is built upon existing ones. Since UNDP has released human development impact assessment toolkit, it is used as the basis of the framework. However, the toolkit specifically applies to trade policy change, therefore a broader impact assessment framework is also considered as a reference in order to complement the toolkit, including assessment impact to ICT4D and broadband projects.

The chapter will review relevant methods (subchapter 3.1) and criteria (subchapter 3.2). In the subchapters, the structure from UNDP's human development impact assessment on trade policy toolkit would be presented first (subchapters 3.1.1 and 3.2.1), then other possible sources are explored to complement the method (subchapters 3.1.2 and 3.2.2). After that, reviews of impact assessments on ICT4D and broadband are presented (subchapter 3.3). The resulting framework will be presented in subchapter 3.4. Here, the resulting methods (subchapter 3.4.1) answer sub research question 3 and the resulting criteria (subchapter 3.4.2) answer sub research question 2.

3.1 Review of Relevant Methods

This subchapter discusses the process of human development impact assessment. As a continuation from subchapter 2.4, stages and steps of impact assessment are discussed here. First, UNDP's human development impact assessment method would be reviewed. Following that, other source of impact assessment methods would be explored.

3.1.1 UNDP's Human Development Impact Assessment process

As mentioned before in subchapter 2.4.1, the process of human development impact assessment is done in three steps: pre-assessment, impact assessment, and post-assessment. This subchapter reviews the three stages.

3.1.1.1 Pre-Assessment—scoping and mapping

The pre-assessment stage of UNDP's human development impact assessment (Yamamoto & Oh, 2012) deals with identifying the policy change and determining the scope of the assessment. This is done by ascertaining the interlinkages between the policy change and the human development aspects to be assessed. This involves three steps, which are explained below.

HDIA1.1 Identify the policy change and the expected related effects

In this step, the relevant policy is identified and the scope of the assessment is determined. Since the context here is trade policy, this step aims to identify the specific trade agreement. Moreover, it also mentions that the trade policy changes can affect human development through three channels: price, transaction volume and output structure, and budgetary distribution. Here, there are three main focuses: the trade policy being assessed, whether the policy has been implemented, and the expected effects of the policy changes.

HDIA1.2 Identify key stakeholders likely to be affected by the policy change based on literature review

In this step, all the people and institutions affected by the changes will be identified. The institutions here involve the government and private institutions that would be responsible in managing the policy change and are able to provide information and opinions about the impacts of the policy. Moreover, per the stakeholder identified, their human development concern should be identified. In this step, there are two main points: the people, groups, and institutions most likely to be affected and how they will be affected by the trade policy change.

HDIA 1.3 Mapping the linkages between the trade policy change and human development

In this step, the linkages between the policy change and the relevant aspects of human development could be generated. Here, the main question is whether the trade policy change and human development linkages have become clearer.

3.1.1.2 Impact Assessment

This stage deals with determining the appropriate tools and techniques that will be used to assess the policy change and to implement the tools and techniques. This stage also involves data collection and analysis to produce the preliminary result of the assessment. This involves five steps, as mentioned below.

HDIA2.1 Assemble the HDIA team

In this step, a team of researchers and analysts who will carry out the human development impact assessment process is identified and assembled. The considerations of forming the team include the institutions where the team members come from (universities, government, research institute, CSOs), mix of the skillset, the needs of the country, and the availability of financial and human resources.

The main points here include whether the Terms of Reference (TOR) has been developed, whether the consultants for the HDIA been identified, and whether the TOR has been verified by the consultants.

HDIA2.2. Identify consultation process and participatory approaches

In human development impact assessment, consultation to and participation of the stakeholders is a key part. Here, the HDIA team should establish a process where stakeholders may participate in HDIA process. This approach is important in understanding complex human development impacts that can arise from a policy changes. It is also advisable to set up a national steering committee of the HDIA which consists of representations of the stakeholders involved. The main questions here include whether the key stakeholders and representatives of the group affected by the policy change have been identified, whether the TOR of the national steering committee of the HDIA has been prepared, and whether the national steering committee has been established in a way that ensures a fair representation of all interested/affected parties.

HDIA2.3 Develop the appropriate indicators required for the HDIA

In this phase, the HDIA team would list required information based on the outcome of the mapping from previous stage. Moreover, it assesses the availability of relevant data. An inventory of the data will also be made, which could include public data, data from institutions, or information from interviews, surveys, and participatory meetings. Crucial gaps in the data should also be identified. The main questions here include what data are needed, which data is available, what the data and the knowledge constraint are, and how the gap can be filled if data gap exists.

HDIA2.4 Identify and implement appropriate impact assessment tools and techniques

While there are different tools and techniques to perform the impact assessment tools, the choice of which tools and techniques to use depends on several things, including the scope, data available, technical skills, and time available for analysis. The analysis could be done qualitatively or quantitatively. In a complete impact assessment, several tools could be used before and after policy implementation. In the UNDP's HIDA for Trade Policy toolkit, there are several tools mentioned: In qualitative analysis, surveys and interviews could be conducted; in qualitative analysis, social accounting matrix, computable general equilibrium models, partial equilibrium analysis, and factor analysis could be conducted. The assessment will also cover both short and long-term effects and address dimensions of human development. The main question here include what impact assessment tools and techniques will be used.

HDIA2.5 Detailed analysis and evaluation of impact assessment results

In this step, analysis and evaluation of the result of the assessment is done. Moreover, positive and negative impacts of the policy change is identified. The main question here includes whether the draft study has been finalized.

3.1.1.3 Post-Assessment—feedback and policy dialogue

In this stage, feedback to the policymakers about the findings of the HDIA is done. Where necessary, measures to improve human development impacts and mitigation measures are proposed.

HDIA3.1 Hold consultation with stakeholders to disseminate analysis and develop post-assessment measures

In this step, there are three major things. The first is to identify the impact on policy space. Here, a policy space refers to "the ability of governments to make policies without being constrained by political or international legal forces" (Yamamoto & Oh, 2012). If the trade policy limits policy space, the ability of government to achieve developmental goals may be affected (due to restriction on subsidies, reduction in tariff levels, etc.). The second is to identify monitoring mechanisms, particularly for ex-ante assessment. In this mechanism, data is collected to track the effects of the policy. The third is to identify mitigation measures to achieve human development, especially for ex-post assessment. The main questions here include what the impact on policy space is, how it will affect human development outcomes, what the mitigation measures are, and what the monitoring mechanism will be.

HDIA3.2 Policy dialogue and re-designing the policy

Based on the findings and the recommendations, a policy dialogue should take place. The main question here includes what the follow up activities are, to implement the monitoring mechanism and policy suggestions.

3.1.2 Other Sources of Impact Assessment Methods

The stages and steps from UNDP HDIA toolkit has the same essentials as other impact assessment methods; in this case, it is being compared to SIA to find out gaps and possible detailed activities to one step in HDIA. In the table below, comparison between HDIA steps and SIA steps is being made. The full diagram of HDIA and SIA steps can be found in Figure 6 and Figure 5.

Table 3 HDIA and SIA steps mapping

HDIA Steps	**SIA steps**
HDIA1 Pre-Assessment - scoping and mapping	
HDIA1.1 Identify the policy change and the expected related effects	SIA1 Understand proposed project SIA2 Clarify roles and responsibilities SIA7 Scope issues
HDIA1.2 Identify key stakeholders likely to be affected by the policy change based on literature review	SIA3 Social area of influence SIA4 Community Profiling
HDIA1.3 Mapping the linkages between the trade policy change and human development	SIA7 Scope issues
HDIA2 Impact Assessment	
HDIA2.1 Assemble the HDIA team	SIA2 Clarify roles and responsibilities
HDIA2.2. Identify consultation process and participatory approaches	SIA5 Inform communities SIA6 Inclusive participatory process
HDIA2.3 Develop the appropriate indicators required for the HDIA	SIA8 Assemble baseline data
HDIA2.4 Identify and implement appropriate impact assessment tools and techniques	SIA9 Social changes and impact SIA10 Indirect impact SIA11 Cumulative impacts

HDIA Steps	SIA steps
HDIA2.5 Detailed analysis and evaluation of impact assessment results	SIA12 Affected party responses SIA13 Significance of changes SIA14 Project Alternatives SIA15 Address negative impacts SIA16 Enhance benefits & opportunities SIA17 Support communities with change
HDIA3 Post assessment - feedback and policy dialogue	SIA22 Implement ongoing social performance plan SIA23 Participatory monitoring plan SIA24 Implement adaptive management SIA25 Evaluation and periodic review
HDIA3.1 Hold consultation with stakeholders to disseminate analysis and develop post-assessment measures	SIA18 Establish a grievance mechanism SIA19 Negotiate Impact and benefits agreement SIA23 Indicators to monitor change
HDIA3.2 Policy dialogue and re-designing the policy	SIA20 Develop Social Impact Management Plan/SIMP SIA21 Establish partnerships to implement SIMP

If we look closely into SIA, it is found that the nature of SIA is project-based, and HDIA is policy-based (since it is meant for trade policy). However, broadband implementation in underdeveloped area encompasses both project and policy. Overall, the comparison provides insights on the cross-reference of HDIA and SIA; this is useful later when there is a need to complement the processes.

3.2 Review of Relevant Criteria

In exploring the criteria, the concept of human development is revisited. As a continuation from 2.3, four pillars of human development and other relevant criteria is discussed here.

3.2.1 Four Pillars of Human Development

In HDIA toolkit, four pillars of human development are used to group the indicators: productivity, equality (or equity), sustainability, and empowerment (Yamamoto & Oh, 2012), and used as the backbone of the assessment. While the concept of human development is developed over time since 1990, these four themes was briefly mentioned in Human Development Report 1995 (UNDP, 1995) and more extensively explained by Haq (1995) as four essential components of the human development. The usage of these four pillars in structuring elements of human development have been made in several UNDP documents, including Montes and Memis (2005). In the table below, adapted from Yamamoto and Oh (2012), the link between each pillars and the concept of capability and achievements is presented.

Table 4 Pillars of human development, capability, and achievements (Yamamoto & Oh, 2012)

	Productivity	**Equality**	**Sustainability**	**Empowerment**
Capability	Enabling people to participate in the growth process	Progressive equalization of access to opportunity	Governing of physical, human, financial, and environmental resources in a manner that does not compromise the ability of future generations from improving their welfare.	To shape the processes and events that affect one's life for those who have been denied it

	Productivity	Equality	Sustainability	Empowerment
Achievement	Ability to benefit from trade opportunities	Reduction of inequalities and disparities	Preservation of developmental achievements	Power to control or change one's life

3.2.1.1 Productivity

In terms of capability, productivity is meant to enable people to participate and benefit in growth process. The term itself has been defined as that related to improvement of human capabilities, both as an end and as a means for people to participate in and benefit from economic growth (Yamamoto & Oh, 2012). In productivity, investments in people are required and macroeconomic environment should be enabled for the people to achieve their maximum potential (Haq, 1995). Haq also argued that the view of productivity which views people only as a means to development obscures the centrality of people as the ultimate end of development. This puts productivity as only one part of human development paradigm and gives equal importance to equality, sustainability, and empowerment.

Yamamoto and Oh (2012) also suggested that productivity includes advances in health, education, and labour force capabilities to the groups that are most likely to be the corresponding policy, in this case broadband implementation. In its example to trade policy, linked indicators include enhanced access to healthcare, education, relevant and appropriate technologies, training and skill building. In a general term, they refer it to "those related to physical and mental well-being of the people".

3.2.1.2 Equality

In human development, the concept of equality refers to equitable access to opportunities (Haq, 1995) and not necessarily in results. Based on Montes and Memis (2005), the HDIA toolkit suggested that equality involves the "progressive equalization of access to opportunity for all members of society" (Yamamoto & Oh, 2012). Several concerns that have been linked with equality includes distribution of productive access, distribution of income, credit systems and allocation of bank credit, equal political opportunities, and social and legal barriers that limit the access of women, certain minorities, or ethnic groups (Haq, 1995). In a broader context, the issue of equality is also addressed in nearly all of Human Development Reports and became the main focus of 11 national reports between 1995-2010 (Alkire, 2010). The main forms of inequality addressed in the reports were the growth of income inequality and its implication for the poor, gender inequality, inequality between groups of countries and between regions within a country, and inequality between groups with the focus on marginalized groups and indigenous groups (Alkire, 2010). This is in line with what is addressed in Yamamoto and Oh (2012) where employment, income, and access disparities between and among social groups (by gender, ethnicity, and social class) and disparities between and among geographical areas and region become examples of indicator category. In relation to the corresponding policy, HDIA could be used to assess whether there has been changes in inequality as a result of policy implementation by looking at disparities among social groups and among geographical areas/regions.

3.2.1.3 Sustainability

The concept of sustainability revolves around the idea that the future generation deserve the opportunity of enjoying the same well-being as the current generation enjoy (Haq, 1995). Here, what is sustained is human opportunities, which is reflected in sustaining all forms of capital: physical,

human, financial, and environmental. Haq (1995) also argued that what must be preserved is the capacity to produce a similar level of human well-being, despite the potential difference of physical, human, and natural capital between current and future generation. It also stated that it does not mean to sustain present levels of poverty and human deprivation. In recent development work, the concept of sustainable development also receives attention, with the UN establishing Sustainable Development Goals in 2016 (United Nations, n.d.).

In context of trade policy, Yamamoto and Oh (2012) discussed potential relationship between sustainability and higher income. While there might be higher income—which leads to helping the society achieve their goals and improve the quality of life—as a result of a policy implementation, it should not be at the expense of future generation. Here, the negative effects could be in the form of degraded environment, less security, food insecurity, and depletion of human resources. The indicators they offer include community well-being, environmental sustainability, distribution of trade-related revenue to social expenditures on education, health, and social welfare programs, a well-balanced lifestyle between paid and non-paid work, and leisure activities.

3.2.1.4 Empowerment

While empowerment has been interpreted differently depending on specific socio-cultural and political contexts, most definition suggest that empowerment is the process of gaining power over decisions and resources (Jupp, Ali, & Barahona, 2010). In empowerment, people are in a position to exercise choices based on their free will (Haq, 1995) where it could be expanded to, among others, a government system or economic system where people can influence decisions about their lives. Empowerment addresses people's capability to shape processes and effects that affect their lives in terms of economic and socio-political/cultural aspects (Yamamoto & Oh, 2012). In HDIA toolkit which focuses in trade context, the relevant indicators include participation in decision making at various levels, the ability to hold property and have property rights, and the right to seek employment on an equal basis. However, other sources suggest more dimension to empowerment. For example, in their sourcebook, the World Bank suggested four elements of empowerment: access to information, inclusion and participation, accountability, and local organizational capacity (Narayan-Parker, 2002).

3.2.2 Other Sources of Human Development Indicators

In assessing what other themes could be appropriate for the indicators, UNDP's human development reports could be referred. From Figure 4, we can see the current concept of human development used by UNDP: the ones directly enhancing human capabilities (long and health life, knowledge, and decent standard of living) and creating conditions for human development (participation in political and community life, environmental sustainability, human security and rights, and promoting equality and social justice) (UNDP, 2017). From UNDP, the dimensions that are mentioned evolved over time and vary throughout human development reports. In addition to long and healthy life (health), knowledge (education), and resources for decent standard of life (living standard), a lot of other dimensions mentioned in human development reports 1990-2009 include political, social, and economic freedom, guaranteed human rights, self-respect, good physical environment, freedom of action and expression, participation, human security, being creative, being productive, democracy, dignity and respect to others, empowerment, a sense of belonging to a community, security, sustainability, cultural liberty, social and political participation, and civil and political rights (Alkire, 2010). In its analysis of what

dimensions constitute human development, Alkire (2010) noted that there is no fixed list of dimensions of human development. Therefore, she proposed several possible dimensions: health and life, education, decent standard of living, political freedom and process freedoms, creativity and productivity, environment, social and relational, and culture and arts.

In academic literature, the focus is on capability approach instead of UNDP's human development definition, where there is only a few conceptual treatment of human development (Alkire, 2010). However, there has been efforts to focus on the subject of human development. Ranis et al. (2006) suggested that the concept of human development went beyond the human development index that is now used by UNDP to measure human development; instead they examine requirements for human flourishing from several sources and proposed eleven broad categories outside HDI (that already includes bodily well-being, material well-being, and mental development): mental well-being, empowerment, political freedom, social relations, community well-being, inequalities, work conditions, leisure conditions, political security, economic security, and environmental conditions. In the table below, we can see the sub-themes/indicators of the eleven categories.

Table 5 Sub-themes/indicators of human development categories (Ranis et al., 2006)

Categories	Sub-themes/indicators included
Mental well-being	Measures of unhappiness: suicides, life satisfaction, prisoners
Empowerment	Ability of relatively weak groups in society to be autonomous and take control of their lives: gender empowerment, labor unions, married teenage girls, secondary school enrolment by gender
Political freedom	Political/civil liberties, political terror, political freedom, judicial independence
Social relations	Value of family, neighbor tolerance, divorce rates
Community well-being	Crimes, rule of law, alcohol use, trust in others, neighbor tolerance, AIDS deaths, natural disasters, corruption
Inequalities	Health inequality, horizontal inequality
Work conditions	Unemployment, minimum wage
Leisure conditions	Internet use, telephone availability, entertainment
Economic stability	GDP cycle, social security policies
Political stability	Political stability, political violence
Environment	Environmental sustainability

3.3 Putting into Context: ICT4D and Broadband

3.3.1 Impact Assessment on ICT for Development

In ICT4D, Heeks and Molla (2009) made a compendium of frameworks that can be used for assessing the impact of ICT4D projects. For the principles of assessing ICT4D projects, Heeks and Molla also provided the value chain of ICT4D as a basis for understanding ICT4D project, which is divided to four main targets of assessment: readiness, availability, uptake, and impact. Below we can see the value chain.

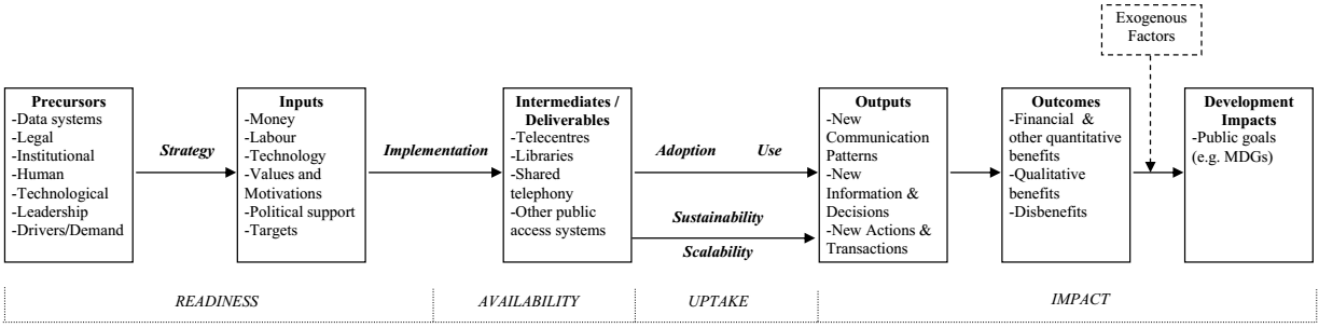


Figure 11 The ICT4D Value Chain (Heeks & Molla, 2009)

The ICT4D value chain is explained below.

- Readiness
  Readiness discusses the systemic prerequisites of ICT4D, such as the meta-infrastructure, ICT skills, policies, and so on.

- Availability
  Originally, availability refers to what services are available after an ICT4D project is implemented. In our context of broadband impact assessment, both broadband and other services that run on top of broadband could be interpreted as the intermediaries/deliverable, such as health platforms.

- Uptake
  In ICT4D value chain, uptake covers the extent to which ICT deliverables are used by its target population, the sustainability of this use over time, and the potential for scaling-up. In broadband impact assessment, uptake would measure the the uses of broadband across users.
- Impact
  This has three sub elements: outputs, outcomes, and development impact.
    - Outputs refer to the micro-level behavioral changes associated with the use of broadband.
    - Outcomes refer to the specific benefits or disadvantages associated with the use of broadband.
    - Development impacts refer to the contribution of the broadband project to broader development goals.

While Heeks and Molla summarized several frameworks to assess the impact of ICT4D, several of the frameworks overlaps with human development. The overlapping frameworks and principles could be seen in the Table 6. The principles that accompany each framework could help in analyzing the impact.

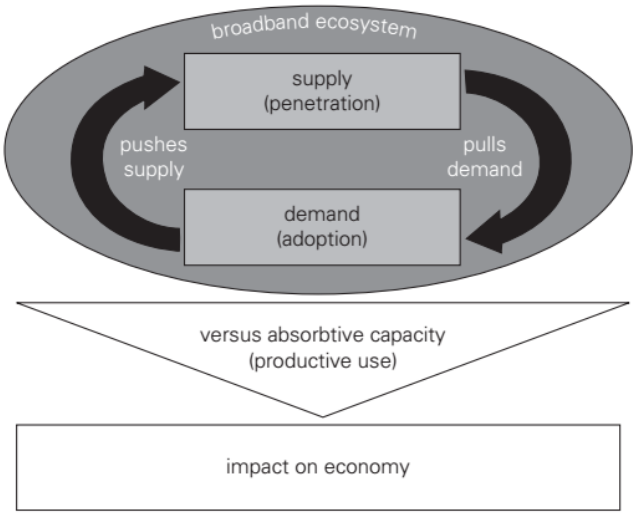
Table 6 A selection of ICT4D Impact Assessment Frameworks (Heeks & Molla, 2009)

Framework	**Principles**
Capabilities	The link of actual achievements of ICT is mediated at two stages: • Conversion of the characteristics of ICT into capabilities for an individual is shaped by personal factor (disability, age, gender), social factor (infrastructure [health,

Framework	Principles
	education], formal and informal institutions, and relationship of social capital and power), and environmental (climate, disease, pollution, topography) Conversion of ICT-based capabilities into actual functions is shaped by individual choice, which is a mix of personal preferences, specific needs, and social norms.
Livelihoods framework	Elements of livelihoods framework: • Vulnerability context: the external environment that shapes people's lives via shocks (conflict, disaster), trends (demographics, changing global prices), and seasonality • Assets: human capital (skills, knowledge, health, ability to work), natural (land, forests, water), financial (income, financial savings, non-financial savings), physical (infrastructure: transport, housing, water, energy, information/communications), producers goods (tools, equipment), social (networks, connectedness, group/organization membership, relationships) • Structures: public, private, NGO • Processes: the forces shaping how organizations and individuals behave • Strategies: the range and combinations of activities and choices that people make in order to achieve the livelihoods goals • Outcomes: what strategies achieve through use of assets via structures and processes within a context Application of information-handling technologies for livelihood strategies: • Type A: ICT applications that can be used directly by microentrepreneurs to serve their immediate information needs and their day-to-day decision-making requirements • Type B: ICT application that serve immediate information needs and day-to-day decision making requirements but are mediated on behalf of microentrepreneurs • Type C: ICT applications that strengthen longer-term social capital assets
Enterprise	The precursors that could impact the performance of an enterprise are demand, supply, entrepreneur, enterprise, and environment. In enterprise performance, the example being ICT availability, ownership, use, and usage. ICT can also impact enterprise value chain.
Gender	Gender evaluation methodology: identify interests in assessing impact on precursors (cultural norms, societal structures of cultural norms, societal structures of ownership and power, censorship), inputs (skills and access to training, information content and language, ability to adapt information and technology), implementation (power and control over ICT resources and projects), availability (access to information and ICTs), use (e.g. nature and organization of work, gender roles, privacy, security and pornography)

3.3.2 Impact Assessment on Broadband

The process in which broadband would attain impact is also proposed in broadband domain. Kelly and Rossotto (2012) proposed broadband ecosystem, where supply & demand support each other to create an ecosystem, where together with productive use, economic impacts can be achieved. The model can be found in the figure below.



Source: World Bank.

Figure 12 Broadband ecosystem (Kelly & Rossotto, 2012)

Several studies to find out the impact of broadband had been conducted. In Table 7, we can see a brief summary of what has been done.

From the table, we could see that most of them links with economic impact, while some links to social impact. The scope they have range from international/multiple countries, regional, single country, and areas within a single country. The studies employ various methods: qualitative, quantitative, case study, literature review, and cross sectional. While they offer a multitude of findings, they could be used to predict the impacts. In this study, the findings of these previous studies are used to map the impact of broadband, which is later done in the assessment (Appendix 1 Initial Expected Impacts).

Out of the studies that are done, one that is the most similar in context to human development impact assessment in broadband implementation is the social impact assessment of high speed broadband done by Rampersad and Troshani (2012) in a town in Australia. Since it assesses the social impact, it covers several human development themes such as education, health, and community development. It is done by interviewing several subjects and then analyze the data by reducing the data, displaying the data, then drawing conclusions.

Moreover, in assessing benefits and disadvantages/problems, there are several concerns that need to be taken into account from Firth and Mellor (2005) about the complexities to understand the benefit of broadband. Firstly, in the industry literature, benefits are sometimes confused with applications, attributes, or activities that are enabled. Secondly, gross outcome would count instead of marginal outcome if activities are confused with benefits. Thirdly, there are winners and losers and their respective valuation. Fourth of all, there is no clarity over the unambiguousness of benefits, costs, winners, and losers.

Table 7 Previous studies on the impact of broadband

Author (year)	Scope	Focus	Methodology	Findings
(Firth & Mellor, 2005)	General	General benefits and problems	Literature review	• Several benefits and problems in health, education, social relation, and jobs and prosperity
Fornefeld et al. (2008)	Europe	Growth and productivity	Quantitative analysis	• The use of efficient, broadband-based technologies to exchange information between companies and public services could lighten the administrative burden by € 44 bn/year in Europe. • The most important savings to be expected from the use of broadband by public services, though, is the improvement of efficiency in back-office processes involving information interchange between public services. Savings up to € 176 bn/year could be expected.
Qiang et al. (2009)	Multiple (120) Countries	Economic Impact (growth)	Quantitative analysis on economic growth data	• Broadband has a significant impact on economic growth
Rampersad and Troshani (2012)	Australia	Social Impact	Case study of Australia NBN	• Key sectors, including education, health and community development, should be critically assessed across pertinent dimensions in evaluating the social impact of HSB
Scott (2012)	Multiple countries	Economic impact (growth)	Quantitative analysis on economic growth data	• Confirming Qiang et al 2009 with more recent dataset
Ericsson (2013)	World	Socioeconomics	Input-output method, literature review	• Broadband speed is an important factor for regulators, policymakers and operators to consider. • Economic effects of broadband speed upgrades are spread through the economy via direct, indirect and induced effects. • Direct effects are changes in employment, economic production and behavior generated in the short term during the course of deployment of new infrastructure. • Indirect effects are medium-term effects which occur due to increases in productivity. • Induced effects are long-term transformative impacts on the economy with new industries/clusters, new ways of working, etc.
Mack-Smith (2013)	UK	Economic, Social, Environmental Impact	Quantitative analysis, projection on economic, social, &	• Economic: faster broadband speed will ad 17b p to UK annual Gross Value Added (GVA), 20p of economic impact every 1p of public investment

Author (year)	Scope	Focus	Methodology	Findings
			environmental impact 2008-2024	Social: concern over digital divide, teleworking Environmental: 1,5 ton CO2 equivalent saving per annum in UK
R. L. Katz (2014)	Various countries	Economic, Social, Political impact	Literature review	• The development of broadband and digitization is linked to economic progress, welfare, and political development
Whitacre, Gallardo, and Strover (2014)	US	Economic impact (growth)	Quantitative analysis on adoption of broadband vs economic/demographic data	• High levels of broadband adoption in rural areas positively (and potentially causally) impacted income growth between 2001 and 2010, and negatively influenced unemployment growth. Similarly, low levels of broadband adoption in rural areas lead to declines in the number of firms and total employment numbers in the county. Broadband availability measures (as opposed to adoption) demonstrate only limited impacts, suggesting that future broadband policies should be more demand-oriented.
Oomens and Munisteri (2015)	Europe	Socioeconomic Impact	Literature review	• Broadband has positive effects on GDP, employment, and other economic parameters Socioeconomic benefits may not appear in linear way Broadband brings network & scale effects to public interest programs, enables private sector innovation, necessary element of disruptive offers
Minges (2015)	China, Germany, US, Ecuador, Panama, Philippines, Senegal	Economic impacts	Cross sectional analysis, time series analysis	• Positive economic impact from fixed broadband inconclusive about whether there are diminishing returns inconclusive about whether fixed broadband has a bigger impact on the eeconomy compared to other ICTs

3.4 Resulting Framework

As the outcome of the previous exploration of relevant methods and criteria, the resulting framework is presented. This framework should be suitable to a specific broadband implementation within a country. With varying degree of complexity, it could suit assessing small implementation in a specific community/town and also a bigger level. It suits broadband implementation by any parties (the government, private companies, or other organizations/communities). In micro level, it could focus on individuals or a specific group. In macro level, it could focus on a characteristic of the area where it is being implemented (e.g. the economic level, whether it's a conflict zone).

3.4.1 Resulting Methods

In the process of arriving to the resulting methods, there are several things to be noted. First, while the stages and most of the steps are derived from UNDP's HDIA for trade policy, the concepts from social impact assessment are also taken. For example, mind-mapping concept from IAIA's SIA task 7 (scoping) and the process of analysing impact from phase 2 could be used (Vanclay, 2015, pp. 42-45). Moreover, IAIA's SIA reminds us to enhance positive impacts (task 16: develop and implement ways of enhancing benefits and project-related opportunities). In UNDP's HDIA, this is absent; in trade policies, the assumption is that the government's policy space (or room for manoeuvre) to achieve human development is limited by the implementation of a trade policy. This is why enhancing positive impacts is not found in the toolkit. At most, it is discussing normatively how HDIA could "lead the debate over how to maximize the development benefits of new trade policies" (Yamamoto & Oh, 2012, p. 13). However, in broadband implementation, this is not the case. Generally, in broadband implementation, positive impacts to communities are expected. Even then, in IAIA's SIA, the projects that become the subject of assessment (at least in the examples of the guideline) are usually projects that is not directly benefiting the local community, such as infrastructure projects or mining. In the broadband implementation assessment, the one assessed is not the undersea or underground fiber optic cable itself; it is the utilization of such network. This is where the context of ICT4D and broadband comes into play, which brings us to the second point. There should be identification of success factors of the broadband implementation itself, that is achieved through analysing the process in which broadband gives human development impact (through Heeks & Molla, 2009; Kelly & Rossotto, 2012). That is why in my proposed methods there is an analysis on the broadband implementation itself to make sure expected positive impacts could be achieved (part of HDIA3.1), which in turn also helps mitigate negative impacts. Third, concerning the impact assessments of broadbands, even though process-wise there is no specific thing to take into account, the results from previous impact assessments are crucial in foreseeing broadband impacts and the lessons learned should be noted in the analysis.

The assessment flow of the resulting methods consists of 3 stages: pre-assessment, assessment, and post-assessment. Generally, it is sequential, but the previous steps could be revisited later. It could be conducted in any phase of the project: before, during, and after the implementation of broadband, both in a longitudinal and cross-sectional way. To differentiate the steps ID from the UNDP's HDIA, the steps in the resulting methods is written with prefix R-, which stands for resulting-. The summary of the pillars and sub themes assessed is presented in Table 8.

Table 8 Assessment Flow

STEPS		
1	**Pre-Assessment: Scoping and Mapping**	
	1.1	Identify the broadband project/policy and expected related effects
	1.2	Identify key stakeholders likely to be affected
	1.3	Mapping the linkages between broadband implementation and human development
	1.4	Assessment of differing needs or interest
2	**Impact Assessment**	
	2.1	Technically prepare the assessment
	2.2	Identify consultation process and participatory approaches
	2.3	Develop the appropriate indicators
	2.4	Identify and implement appropriate impact assessment tools and techniques
	2.5	Detailed analysis and evaluation of impact assessment results
3	**Post-Assessment: Feedback and Policy Dialogue**	
	3.1	Hold consultation with stakeholders to disseminate analysis and develop post-assessment measures
	3.2	Policy dialogue and re-designing the policy

The details of this resulting methods can be found in the subchapters below.

3.4.1.1 Pre-Assessment

In pre-assessment, there are four tasks. The first to third tasks correspond to HDIA, where the fourth is added to conclude the phase.

RHDIA1.1 Identify the broadband project/policy and expected related effects

This step deals with identifying the scope of broadband project (e.g. a fiber optic backbone implementation, a fiber-to-the-home deployment in a specific area, or a national broadband policy) and explore related effects related to the scope of the broadband project or policy. Here, the expected effects relate to the scope itself (not to human development impacts); for example, a backbone implementation would affect broadband connection in a specific area and a national broadband policy might affect not only the infrastructure but also the utilization of a broadband implementation. The deliverable from this step is the identification of the broadband project/policy and its expected effects.

RHDIA1.2 Identify key stakeholders likely to be affected

This step deals with identifying stakeholders, both the ones that are directly involved with the project and the ones that aren't directly involved with the project but will receive benefits or disadvantages. Moreover, the institutions that are responsible in managing or implementing the broadband or are able to provide information and opinions about the impacts of the policy should also be identified. Moreover, their concerns should be identified. The deliverable from this step is the identification of the stakeholders and their concerns.

RHDIA 1.3 Mapping the linkages between broadband implementation and human development

In this step, the linkage between broadband implementation and human development is mapped. The mapping itself could be an impact pathways diagram (broadband project/policy → expected effects → human development concerns) or a mind-map (listing potential broadband impact per human

development concerns). The deliverable of this step is map of the linkages between broadband implementation and human development.

RHDIA 1.4 Assessment of differing needs or interest

In this step, the assessment of the differing needs and interests of stakeholder is conducted. To do this, actor or stakeholder analysis might be conducted. The deliverable of this step is an actor/stakeholder analysis.

3.4.1.2 Impact Assessment

In impact assessment, there are five steps.

RHDIA2.1 Technically prepare the assessment

In this step, assessment preparation is done, such as assembling assessment team and preparing other technical things for the impact assessment, e.g. developing the protocol or terms of reference. The deliverable of this step is an assessment protocol or terms of reference.

RHDIA2.2. Identify consultation process and participatory approaches

The consultation process is based on the stakeholders that is likely to be affected. Ideally, the assessment would involve relevant stakeholders and representatives of the groups that would be affected by the broadband implementation. The deliverable of this step is the identification of the stakeholders or stakeholder groups that will be involved in the assessment.

RHDIA2.3 Develop the appropriate indicators

In this step, what data and information required from data gathering is listed. They are derived from the four pillars of human development and the previous mapping from RHDIA 1.3. The deliverable of this step includes the list of required information and data, identification of available data and information, and ways to fill the data gap.

RHDIA2.4 Identify and implement appropriate impact assessment tools and techniques

In conducting impact assessment to broadband impact, the appropriate tools and techniques depends on several factors, including the scope, available data, technical skills, and time availability. The analysis could be qualitative or quantitative, and it can use primary or secondary data. A combination of tools can be used to conduct a complete impact assessment, where primary effects, nature, and magnitude of the effects are determined. The deliverable of this step includes the choice of tools/techniques (if qualitative, which method, and if quantitative, which method, or both) and the implementation said tools/techniques.

RHDIA2.5 Detailed analysis and evaluation of impact assessment results

In this step, analysis and evaluation of impact assessment result as well as identification of positive and negative implication of the broadband implementation is done. The deliverable of this step is the draft of human development impacts report.

3.4.1.3 Post-Assessment

In post-assessment, there are two steps.

RHDIA 3.1 Hold consultation with stakeholders to disseminate analysis and develop post-assessment measures

In this step, the primary task is to identify the measures to address negative impacts and enhance benefits and opportunities. This task is done by consultation with stakeholders. Moreover, there is identification on how the measures affect other policy area based on the expected positive and negative impacts. The mitigation could be done in several forms (e.g. avoid, reduce repair, compensate) (Vanclay, 2015) and the enhancing benefits could be done by ensuring successful broadband implementation, e.g. from assessing its value chain (ensuring readiness, ensuring its use/adoption) (see ICT4D value chain from Heeks & Molla, 2009). Moreover, especially in the case of ex-ante assessment, monitoring mechanism should be identified. The deliverable of this step is the list of measures to be taken and the monitoring mechanism.

RHDIA 3.2 Policy dialogue and re-designing the policy

In this step, a policy dialogue should take place as a result of the assessment. The deliverable includes the list of follow-up activities to implement the measures to be taken and the monitoring mechanism from RHDIA 3.1.

3.4.2 Resulting Criteria

After reviewing the dimensions of human development, criteria for the framework are selected. It is derived from HDIA toolkit, which means that it keeps the structure of the four pillars. Other indicators in human development outside of what is specifically mentioned in the toolkit is also considered. However, the criteria used in this assessment is meant to be non-exhaustive.

In *productivity,* the sub themes included are health, education, income, and individual well-being. Productivity is linked to physical and mental well-being of people. While health, education, and income make a big domain by itself, individual well-being covers those outside of the domain, for example mental well-being of people and leisure conditions. In the context of productivity, skill-building also plays a big role, but it is not a focus in this assessment; it becomes part of income (if the ones obtaining skills are workers) or education (if the ones obtaining it are students). Moreover, work conditions such as jobs and unemployment falls under income category.

In *equality,* the sub themes would be inequality by gender, ethnicity, social class, and inequality among geographical area. While equality can be interpreted of the equalization of access to opportunity for all members of society, equality in this case will be interpreted to two things. The first is whether the broadband itself will provide equal access for all members of society, while the second is whether it gives positive/negative effects to specific groups; in other word, whether it increase or decrease inequalities among social groups. This is because broadband could bring different impact to different social groups. While social groups (by gender, ethnicity, social class, and geographical area) is specifically assessed, affected groups from other pillars (productivity, sustainability, empowerment) should also be recognized to obtain fuller picture of equality dimension.

In *sustainability,* the sub themes include community well-being and environmental sustainability. While environmental sustainability refers to the environment, community well-being refers to issues in community such as crime and social relations.

In *empowerment*, the sub themes include political freedom and engagement and accountability of government. While empowerment encompasses a lot of things, other elements have been addressed in other pillars, which includes gender/specific social group issue and economic-related themes, which are explored more in productivity. Because of this, specific sub-themes in empowerment are the ones related to political freedom and engagement and government accountability.

The summary of the pillars and sub themes assessed is presented in the table below.

Table 9 Pillars and Sub Themes assessed

Pillars	**Sub-themes**
Productivity	Health Education Income Individual well-being
Equality	Inequality by gender Inequality by ethnicity Inequality by social class Inequality among geographical areas
Sustainability	Community well-being Environmental sustainability
Empowerment	Political freedom and engagement Accountability of government

Chapter 4 Human Development Impact Assessment of the Palapa Ring Project

This chapter will discuss sub research question 4: **"Can we apply the methods and criteria of human development impact assessment of broadband to Indonesian Palapa Ring project and what is the result if we apply it?"**

To answer sub research question 4, first, we need to examine whether the methods and criteria that have been developed in the previous chapter is applicable to Palapa Ring project. After that, if it could be applied, assessment is done to know the result of the impact assessment of Palapa Ring project. In the thesis project, human development impact assessment has been done. This chapter discusses the said assessment, where subchapter 4.1 discusses how methods and criteria of human development impact assessment is applied to Palapa Ring case and subchapter 4.2 presents the assessment result.

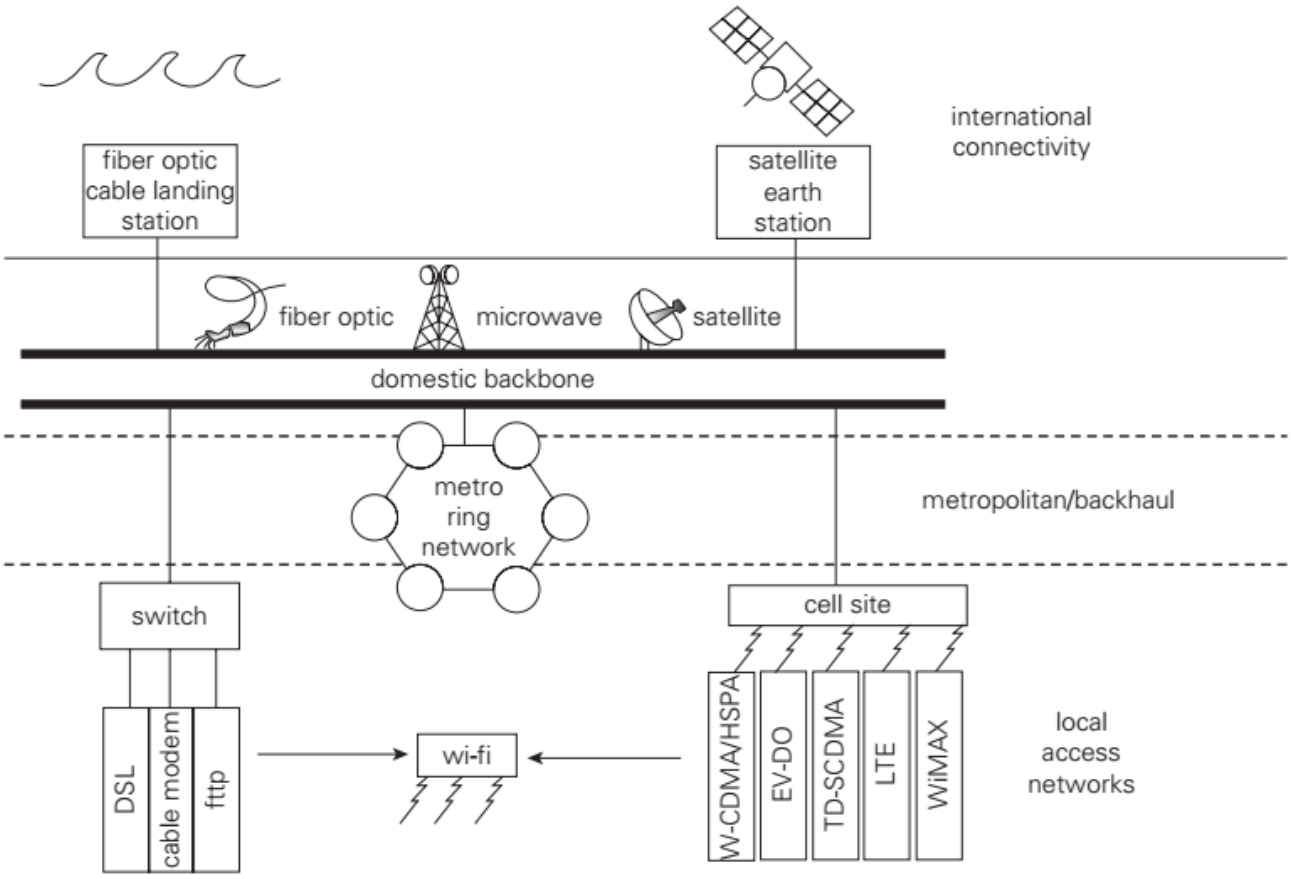
4.1 Assessment Process: Using the Framework to Assess the Indonesian Palapa Ring Implementation

In this subchapter, the methods and criteria of HDIA of broadband implementation that are developed in the previous chapter are applied to Palapa Ring project. The following sections illustrate how it is applied, structured by the stages.

4.1.1 Pre-assessment

RHDIA1.1 Identify the broadband project/policy and expected related effects

In this step, Palapa Ring project scope is assessed. Palapa Ring itself is a fiber optic backbone network that aim to connect all municipalities in Indonesia. These municipalities will then connect the network further to end user via backhaul network (Bappenas, 2014). Figure 13 below will present the overview of broadband supply chain, where Palapa Ring position here is in the "domestic backbone" and will enable backhaul as well as the fixed broadband and mobile broadband.



Source: Telecommunications Management Group, Inc.

Note: Generalized typical infrastructure implementation and topology, excluding technologies not widely used. DSL = digital subscriber line; EV-DO = CDMA2000 Evolution Data Optimized (mobile communication standard); fttp = fiber to the premises; LTE = Long-Term Evolution (mobile communication standard); TD-SCDMA = Time Division–Synchronous Code Division Multiple Access (mobile communication standard); W-CDMA/HSPA = Wideband Code Division Multiple Access (family of mobile communication standards)/High-Speed Packet Access; Wi-Fi = Wireless Fidelity, a wireless local area network standard based on the IEEE 802.11 standards; WiMAX = Worldwide Interoperability for Microwave Access (fixed and mobile communications standard).

Figure 13 Broadband supply chain (Kelly & Rossotto, 2012)

This Palapa Ring backbone network will enable high speed internet access to municipalities that do not yet have internet as well as municipalities with existing connectivity (Antara, 2017). The broadband quality depends on backbone and backhaul capacity. In other words, Palapa Ring would be enabler of broadband connectivity in the regions and municipalities it connects. As an expected effect, Palapa Ring would support internet connection in the regions, be it fixed broadband, mobile broadband, or narrowband. The full scale and history of Palapa Ring was presented in subchapter 2.6.2. The focus of assessment is ex-ante assessment for government's Palapa Ring 2016-2019, especially the Eastern Package.

RHDIA1.2 Identify key stakeholders likely to be affected

The pre-assessment identified a list of stakeholders and their interest, which can be seen in Appendix 2 Actors & Stakeholder Analysis. The identified stakeholders range from the project stakeholders (planners, companies who implement the project) to the ones who is likely to be affected (users).

RHDIA 1.3 Mapping the linkages between broadband implementation and human development

This study uses the sub-themes from table 9 to group expected impacts. After that, related expected effects are mapped. The result for this process can be seen in Appendix 1 Initial Expected Impacts. In the table, types of impacts are compiled from a number of resources and classified based on whether it is an ICT impact, internet impact, or broadband impact. The reason why ICT and internet impact is also investigated is twofold. First, broadband is a subset of ICT and internet. Second, not only enabling broadband, Palapa Ring as a fiber optic backbone network will also enable internet connection and the utilization will be achieved via ICT use. However, limitation is set to internet-related uses. A simple mind map of the linkages between broadband implementation and human development is provided below. It is derived from Appendix 1 Initial Expected Impacts.

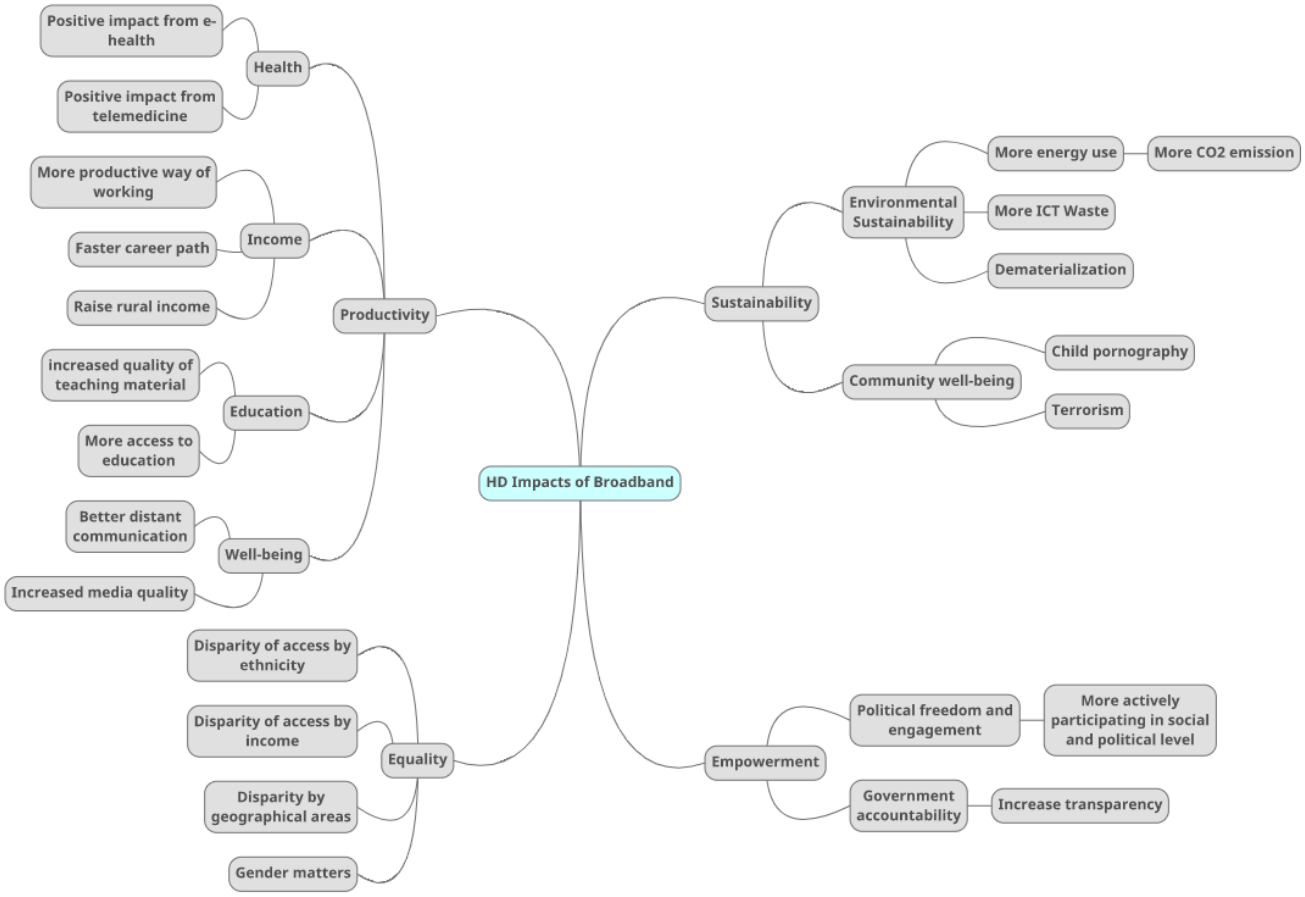


Figure 14 Mind map of human development impacts of broadband

RHDIA 1.4 Assessment of differing needs or interest

In identifying the differing needs/interests of the stakeholders, stakeholder/actor analysis is done. At first, they are classified. Furthermore, their involvement in the project, their objectives, their perception to the problem, and their resources are determined. Lastly, their criticality, dedicated, and whether their objectives are similar or not to the project objectives are determined. The full table can be seen in Appendix 2 Actors & Stakeholder Analysis.

Based on the actor analysis, groupings of stakeholder based on their needs/interest/power is done. This is presented in the diagrams below. The bold fonts indicate the stakeholder interviewed.

Dedicated		Non-Dedicated	
Critical	**Non-Critical**	**Critical**	**Non-Critical**
Bappenas **Kominfo** **Telkom**	BP3TI **National ICT Council** Consortiums: Moratel Ketrosden, Pandawa, Smarfren Local/other operators/ISPs **Mastel**, Chamber of Commerce **Other ICT-related NGOs** **Local University** Local public service offices	Ministry of Finance Ministry of Public Works Other ministries utilizing the broadband (Ministry of Health, Ministry of Education, etc.) **Local governments**	Coordinating Ministry of Economic Affair IIGF and other financiers
		Local Businesses **Local Residents & Organizations**	

Figure 15 Classification of Stakeholder

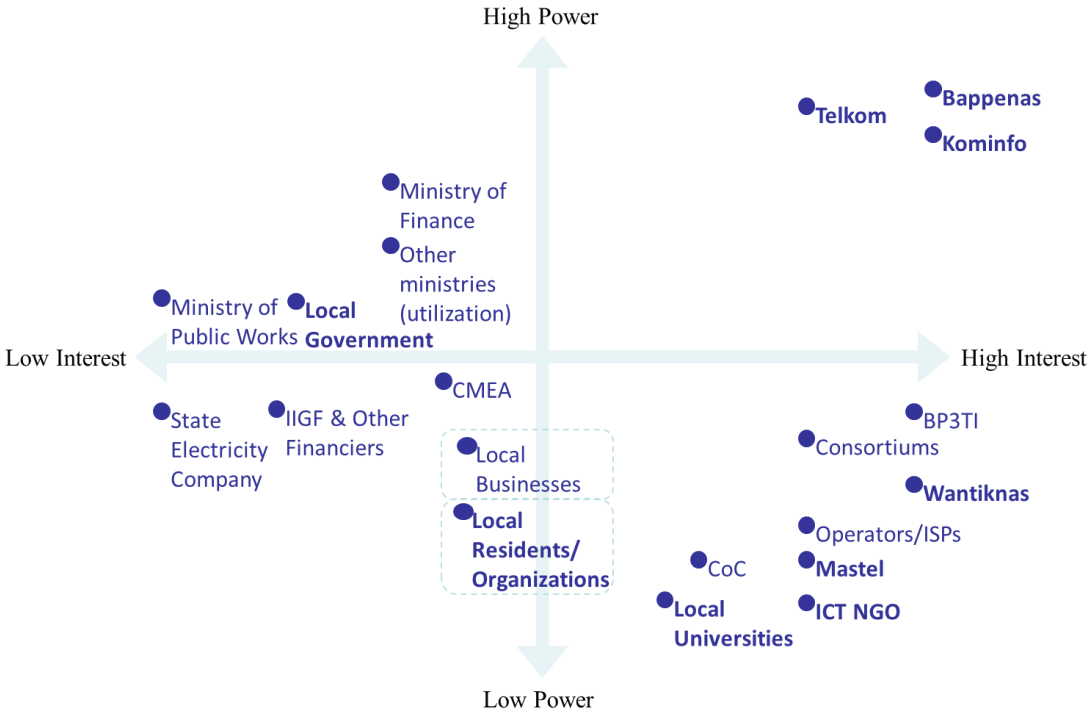


Figure 16 Power vs Interest matrix in stakeholder analysis

From figure 16, we can see which actors/stakeholders have high stakes. Furthermore, groupings based on their power/interest and their involvement in the project is also done. As a result, the distinction between actors, direct stakeholders, and indirect stakeholders are made. Actors are the ones with high power and high interest in the project, namely Bappenas, Kominfo, and Telkom. Direct stakeholders are the ones with high interest/low power or high power/low interest with high degree of involvement in the project (e.g. ministries, local government, Mastel, Wantiknas, consortiums) and indirect stakeholders are the ones with high interest/low power or high power/low interest with low degree of involvement in the project (e.g. ICT NGOs, local organizations, local universities). This distinction will matter later in presenting the expected impacts (subchapter 4.2) and the analysis.

4.1.2 Impact assessment

RHDIA2.1 Technically prepare the assessment

The assessment is done by one researcher (myself). A case study protocol is developed, which contains case description, interview protocol, interview questions (as a deliverable from RHDIA2.3 & 2.4), stakeholders list, target interviews, and description of assessment process. For every interview, a letter of interview request is sent, along with recommendation letter from TU Delft. A recording device or software is also prepared for the interviews.

RHDIA2.2 Identify consultation process and participatory approaches

The consultation process/participatory approach is done to the actors and relevant stakeholders that is able to give information to the expected impacts of the project. The identified parties are all the actors (Kominfo, Bappenas, Telkom), Mastel, Wantiknas, local governments (one in Nusa Tenggara region as evaluation and one in Papua region for the ex-ante assessment), ICT NGO, local university/ school/hospital/business, and local NGO on ICT or on human development area. Different stakeholder groups are expected to be represented and the views of stakeholders is expected to be balanced (from national government side, local government side, business, and civil society organization).

RHDIA2.3 Develop the appropriate indicators

The needed information for this assessment is the expected impacts of Palapa Ring project from all the four pillars of human development including their sub-themes. Further indicators are derived from the mapping of Human Development/Broadband that could be found in Appendix 1 Initial Expected Impacts. These expected impacts are derived from the evaluation as well as the expectations of actors/stakeholders. These evaluations and expectations could be gathered from government documents and interview to the stakeholders. Set of interview questions are also developed (Appendix 3 Interview Questions).

RHDIA2.4 Identify and implement appropriate impact assessment tools and techniques

Due to data availability (no previous assessment has been conducted), time availability (researcher will be in Indonesia only for three months and there is a master thesis time constraint), and scope of the assessment, impact assessment is done qualitatively with documents review and interviews to relevant actors/stakeholder as per task 2.2 (consultation process and participatory approach).

In the documents review, the needed information corresponds to the pillars and sub-themes set before. The purpose of document analysis is finding out the human development impact of previous implementation of broadband. However, during the assessment, documents that specifically discuss the impact of previous implementation are not available. Therefore, the primary document that is analyzed is Indonesia Broadband Plan 2014-2019. Other documents that are explored include other policy documents and regulations, including Presidential Decree No. 96/2014 about Indonesian Broadband Plan 2014-2019, Telecommunication Law (Law No. 36/1999), and other articles from government websites.

The interviews are conducted in July-October 2016 to 12 respondents across organizations, as shown in Appendix 4 Interview List. Interviews are held face to face in Jakarta (Interview 1, 2, 3, 5, 9, 10), over phone call (Interview 6, 7, 8, 11) and video call (Interview 4, 12). The variation of stakeholder

interviewed is shown in Figure 15 and Figure 16 in the previous subsection, which show their different needs/interests. The purpose of the interview is to know the general expectations/evaluation of Palapa Ring project (especially for interviews for national level institutions), to know the evaluation of Palapa Ring project, especially in Nusa Tenggara region (for interviewees from Nusa Tenggara), and to know the expected impacts of Palapa Ring project, especially in Papua Region (for interviewees from Papua). Organizations selected correspond to the institutions listed in RHDIA 2.2. All of the main organizations are willing to be interviewed. In the case of Telkom, interview in national level is unable to be obtained, but interview of Nusa Tenggara branch of Telkom is conducted. Therefore, the focus to Telkom interview is to know the evaluation from Nusa Tenggara. In the case of NGO, several initially planned local NGOs did not respond and therefore other NGOs are selected. Moreover, interviewees are selected based on their expertise, involvement in the project, and position in the organization.

The interview is done semi-structured, with interview questions based on expected impacts/linkage of human development and broadband (RHDIA 2.3). Therefore, it is open to new insights based on specific local conditions, specific project context, or Indonesian context in general. The examples of interview questions can be found in Appendix 3 Interview Questions. In the interview questions, several other questions groups that are relevant to Palapa Ring implementations are also asked, such as policy, technology, infrastructure/society readiness, and the specific conditions in the regions in which broadband would be implemented, to further assist RHDIA 3.1 in achieving positive impacts. All the interviews are conducted in Indonesian language. All the interviewees agreed to be recorded and the transcripts of the interviews are available upon request.

RHDIA2.5 Detailed analysis and evaluation of impact assessment results

Following the previous step, analysis and evaluation of the result are done. To structure the analysis and evaluation, first, recorded interviews are written down to transcripts. Then, it is summarized and classified based on the sub-themes (RHDIA 2.3). After that, they are presented in a table of summary, also available upon request. These steps correspond to data reduction and data display, which are steps in qualitative data analysis (Sekaran & Bougie, 2009). Second, the interview results are grouped to three stakeholders group and one for evaluation purpose. The three stakeholders group are the actors, direct stakeholders, and indirect stakeholders, which refers to the stakeholder groups from step 1.4. The evaluation are the interviews from Nusa Tenggara region. Moreover, since all the documents are sourced from the government, they fall under the actors group. The summary of the stakeholder groups/interviews can be found below.

Table 10 Presenting the results: stakeholder groupings v interviews and documents

Groupings		**Interviews & Documents**
Actors		Interview 2 (Bappenas), Interview 5 (Kominfo), Government Documents
Direct stakeholders		Interview 1 (Mastel), Interview 7 (West Papua local government), Interview 10 (Wantiknas)
Indirect stakeholders		Interview 3 (local NGO-education), Interview 4 (local NGO-ICT), Interview 9 (national NGO-ICT), Interview 11 (local university)
Evaluations	Actor	Interview 12 (Telkom)
	Direct stakeholder	Interview 6 (West Nusa Tenggara local government)
	Indirect stakeholder	Interview 8 (local NGO - citizen journalism)

The result of the interviews and documents analysis is presented in subchapter 4.2 of this thesis report.

Third, the expectations of the actors and stakeholders from the groupings is further analyzed. The positive and negative impacts are identified, as well as the open issues. A separate human development impacts report is not written for this assessment; however, if it is, it would mostly contain sub-chapter 2.6 (background and case description), chapter 4, and chapter 5 of this thesis report.

4.1.3 Post-assessment

RHDIA 3.1 Hold consultation with stakeholders to disseminate analysis and develop post-assessment measures

In this step, there are constraints (time constraint, scope of the assessment as a research case study, and human resource limitation) that prevent consultation with stakeholders after analysis part of the assessment is done. Therefore, during the interviews, information that are needed for this step from the stakeholder are also asked, i.e. mitigation strategy (address negative impacts and enhance benefits and opportunities). This is integrated in the interview, where they are asked about their thoughts on how to enhance positive impacts and mitigate negative impacts towards the end of the interview. Moreover, in several cases, interviewees were also asked about mitigation strategy if they mentioned a certain impact. Concerning ensuring successful broadband implementation, a set of questions on readiness, policy, technology, and stakeholders are also asked to interviewees. The answer to these questions are included in the analysis in order to make recommendations. The final recommendations part can be found in subchapter 6.2 in this document, which consists of measures to mitigate the negative impacts and enhance the positive impacts. Planned monitoring measures are not included in this document.

RHDIA 3.2 Policy dialogue and re-designing the policy

Due to the scope of the assessment as a research case study (not commissioned by the governments) and time/human resource constraints, this step is not done in this assessment.

4.2 Assessment Results: Expected Impacts

In this subchapter, expected impacts are laid out. As the background, there is a discussion about the potential impact of broadband based on the literature. Following that, expectations of the actors, direct and indirect stakeholders, and evaluation of previous impacts are laid out. The structure of this chapter is explained in previous subchapter (4.1.2) part *RHDIA2.5 Detailed analysis and evaluation of impact assessment result*. At first, further literature review is conducted to know the link of broadband or internet/ICT to specific area of human development. Then, the expectations of actors, direct and indirect stakeholders, and evaluations from previous implementation is laid out.

4.2.1 Productivity

4.2.1.1 Health

The link between health and ICT/broadband in general is well-documented in various publications. Hamel (2010) mentioned that ICT has the potential of making a positive contribution to health outcomes when it is a part of a nationally tailored intervention. Concerning the role of broadband,

Rampersad and Troshani (2012) mentioned that (high-speed) broadband assists healthcare providers in diagnosing diseases and monitoring them and provides quality care to patients remotely, which will save lives, time, and travel costs to rural communities. Meanwhile, Firth and Mellor (2005) mentioned that the link between health and the (broadband) internet is not limited to telemedicine; home internet users are also accessing health sites. According to them, there are at least three ways in which broadband could enhance health services: providing information to patients, enabling online medical applications, and providing training and support to professionals.

Concerning the potential negative impacts, Firth and Mellor (2005) also mentioned that the increasing reliance of passive leisure (virtual games, downloaded or streaming movies) of young males may affect their long-term health. Moreover, health misinformation may persist.

4.2.1.1.1 Expected Impacts – Main Actors

The policy documents and government websites mentioned positive impacts for health by the means of consolidated data/networks and the application of telemedicine (Bappenas, 2014; BP3TI, 2016b; Kemkominfo, 2016a; Tuwo, 2013). The interviews to Bappenas also resulted in expectation for health, which is to deliver health facility to the society: a healthier society. The actors also agreed that the broadband would be utilized in the form of telemedicine in the community health centers and government hospitals. However, they also raised concerns about the implementation of the service itself: the availability of fund to conduct the program, the medical facilities in the health centers, and the interconnectedness of the health centers.

4.2.1.1.2 Expected Impacts – Direct and Indirect Stakeholders

For direct stakeholders, the expectation for health is that broadband would be utilized to attain health goals such as more maternal health, lower mortality rate, and better public health. Meanwhile, for indirect stakeholders, the expectation is generally neutral or positive. The stakeholders also offer a broader view to this issue, where there is more perspective on how broadband is utilized. Other than e-health, the interviewees also discuss how broadband could disperse information for a specific disease (AIDS, malaria). However, there has been several criticisms of how the positive impact could be attained. First, the funding problem comes up again. Second, that health information system takes time to introduce to health workers. Third, that Indonesia does not have any regulation concerning medical record sharing yet, which is crucial in health information system. Fourth, the current utilization is scattered and incidental, and the policy should not only be looking good in paper while not actually being implemented. Fifth, the quality of health workers in Papua varies; while some said it is good, some said it is of low quality.

4.2.1.1.3 Evaluations from previous impacts

In health sector, the evaluation from Nusa Tenggara has been mixed, consisting of positive impact, positive but not yet maximized, and negative impact. The positive evaluation comes from Telkom, which is the one implementing the broadband. The interviewee from Telkom said that people look up for health-related information from the internet; however, other interviewee (NGO) pointed out that the people trust health-related information that is not credible. Moreover, fund issue and that the implementation is incidental/dispersed comes up again.

4.2.1.2 Education

Education is one of the recurring themes when it comes to the impact of ICT. As mentioned in Hamel (2010), online courses and distance education allow students to be enrolled in programs that are not available in their community. Moreover, it can be used in to reform education system, increase access to educational resources, improve education management, and enhance pedagogical technics. However, many researchers are still skeptical about the benefits of ICTs for education due to the lack of impact measurement to both the quality of education and its outcomes; Cuban (2009) and (Angrist & Lavy, 2002) supported the argument that the use of ICT doesn't translate to a positive contribution to student's learning outcome. Negative impact is also found in students who use ICT outside of learning environment and insignificant learning impact from ICT in school (Woessmann & Fuchs, 2004). Hamel (2010) also argued about appropriateness of using ICT in education, where the low electrification ratio and high cost of internet may make building library more appropriate than connecting to the internet. Here, language can also be a barrier where the impact of ICT is not received in education.

Referring to Bauer, Gai, Kim, Muth, and Wildman (2002), broadband is needed for synchronous and collaborative e-learning. Firth and Mellor (2005) mentioned that internet and broadband in education could improve student performance, including in national examination, and preparedness for the innovativeness. However, it depends on the quality of the material accessed and whether internet sourced information is complementary to face to face instruction (instead of being a replacement). In a negative side, broadband is also mentioned as a potential distraction level (Firth & Mellor, 2005).

In Rampersad and Troshani (2012), there are three things that are key: whether the training is synchronous and asynchronous, teaching material quality, and whether it is complimentary or substitution for other important modes of delivery of tacit knowledge.

4.2.1.2.1 Expected Impacts – Main Actors

From the policy documents and government sources, broadband is generally viewed as positively impacting education. They cite that the internet access availability highly correlates with education quality; moreover, it is utilized from administration perspective and also distance learning (Bappenas, 2014; BP3TI, 2016b; Kemkominfo, 2016a). In Indonesian Broadband Plan, e-education is one of the priority sector. It aims for a more equal quality of education by distribution and exchange of teaching material and improvement of learning process quality by the means of where teaching material virtualization and consolidated data and network. Concerning the expected impacts from the actors' interview, mainly positive impacts and negative impacts are recognized. Several utilization plans (teacher certification, e-learning, computer-aided test) and potential problem (ICT literacy, which could delay the impact) are also mentioned.

4.2.1.2.2 Expected Impacts – Direct and Indirect Stakeholders

The direct stakeholders give mixed expectations to education: mostly positive, but negative impact in student is also recognized. Meanwhile, the indirect stakeholders' interviews implied that the positive expectation can only be achieved is a long list of problems can be solved—the indirect stakeholder had discussed a lot of potential problems that could hamper the achievement of positive impacts. Most of the direct stakeholders mentioned government's program in utilizing broadband (national education

network, learning via government source, teacher education and certification, distance learning). Other than that, the utilization perspective comes from the use of YouTube tutorials in class and more learning sources (articles, journals, and textbooks). Concerning the negative impacts, the problem comes from students who use their time in the internet unproductively.

In education, the stakeholders also brought several concerns. First, there should be a change in how to conduct the pedagogical activity (student-centered learning, blended learning). Second, the lack of English skill in students make it more difficult to make sense of contents from the internet. Third, low technology literacy. Fourth, quality of teachers and schools. Fifth, that parents don't understand technology. Sixth, that there should be an implementation framework and ensuring last mile implementation.

4.2.1.2.3 Evaluations from previous impacts

The evaluations from Nusa Tenggara implementation has been mixed. The positive uses had been for school administration, services, and learning activities, while the negative impacts are mainly from students' perspective, in which unproductive and negative uses is recognized in bigger cities and more developed area in Nusa Tenggara region. Currently, in tackling the negative uses, access limitations are implemented by schools and operators. In a separate note, an example from other implementation (a case in Jakarta) could also be taken into account, where internet-based exam is implemented but students need to pay for their internet access in school. This could lead to exclusion of students who cannot afford the internet fee.

4.2.1.3 Income

The relation between broadband and the economy is one of the most-discussed topic in broadband literature. Generally, it is viewed positively to the economy and becomes one of the key reasons of broadband implementation. Qiang et al. (2009) mentioned that for every 10% broadband penetration in developing countries, there will be 1,38% per capita GDP growth. Other studies also concluded positive economic impact from broadband across countries (R. L. Katz, 2014; Mack-Smith, 2013; Minges, 2015; Oomens & Munisteri, 2015; Scott, 2012; Whitacre et al., 2014). However, closer look should be made to other aspects. While there is a link between broadband and employments and private sector innovation (Firth & Mellor, 2005; Oomens & Munisteri, 2015; Whitacre et al., 2014), there could be concern over the context, where large businesses might be benefiting more from broadband than SMEs (Firth & Mellor, 2005).

We can also take a closer look in how the broadband would affect the firms or household. In firms, there is a productivity gain of 11,1% after broadband is used (Ericsson, 2013). It saves time (e.g. for downloading large files), which allows greater productivity. There are also new creative and commercial opportunities, e.g. to reach customer worldwide. It can also save commuting time as more people could work from home more often. On top of that, there could be new types of computer programs and network services, which can reduce firms' hardware and software costs. Based on OECD and country studies from Brazil, India, and China, broadband access has a positive impact on household income (Ericsson, 2013). In households, broadband could increase productivity from decreased time taken for non-work obligations. It can also make people more informed, leading to faster career path. Moreover, there are more side jobs that could be done from home.

4.2.1.3.1 Expected Impacts – Main Actors

Concerning income, there are positive expectations from the government, especially from SMEs and e-commerce businesses (BP3TI, 2016c; Iskandar, 2016) via innovation, new goods and services, new processes, new business models, and the increase of economic competitiveness and flexibility (Kemkominfo, 2016b). The interviews also indicate positive expectation in income, with the emphasis of local businesses, new business potentials (partially as a secondary impact of e-commerce), and technology startups. However, there is a concern over lost jobs due to the disruptive nature of technology. On a side note, broadband is viewed as something that will change the society's lifestyle, one of which could be a consumptive culture.

4.2.1.3.2 Expected Impacts – Direct and Indirect Stakeholders

Both direct and indirect stakeholders have mostly positive expectations in income domain. The interviewee generally agree that broadband could help local business (e.g. in marketing), boost tourism, and create business opportunities. Moreover, there are potentials in e-businesses and technology startups. The interviewees also expect more livelihood opportunity in the form of side jobs. Concerning local business, several local products have also been mentioned, such as coffee and *buah merah* (*Pandanus conoideus*). However, broadband is also viewed as a disruptive technology. There is a possibility of transformed jobs (lost jobs and creation of new jobs). It should also be noted that the use of broadband in SME isn't automatically expected; there is a concern whether local businesses have enough literacy to utilize broadband and whether they can (and willing to) scale up.

4.2.1.3.3 Evaluations from previous impacts

There has been mixed evaluation from previous impacts: positive and negative. While broadband is used extensively in tourism, it is also used by other local SMEs. Moreover, it is used to promote local businesses and as a medium of creative economy, e-commerce, and other online business. Moreover, it is used in job vacancy and job searching. On the negative side, there has been cases of online business scams and frauds.

4.2.1.4 Individual well-being

In individual well-being, the relation between broadband or internet and mental well-being, social relations, and entertainment is explored.

In their review about the customer benefits of broadband, Ericsson (2013) mentioned that broadband facilitates distant communication. Since the media quality is increased, there is more opportunity to do video calling. Firth and Mellor (2005) noted that broadband leads to more contact with friends and family, but on the premise that the offline relationship is good. Therefore, if an individual is already marginalized, there is a possibility that the marginalization continues. Cotten, Ford, Ford, and Hale (2012) also presented the contradiction: while using the internet for communication could help reduce social isolation, loneliness, and depression, researchers also suggest that internet usage may have negative effects on mental well-being of people. Several suggested cases have been related to addiction to the technology to young people, exposure to violent material with increase aggression, cyber-bullying due to the anonymity of the internet, and increased levels of stress (Willson, Marshall, & McCann, 2009).

Other than facilitating distant communication, Ericsson (2013) also suggests other customer benefits of broadband, which are increased media quality and time savings. These are highly related with entertainment, since higher quality online media content such as movies, music, and image become available after broadband. Moreover, broadband also allows for directly streaming videos and audio without having to download it before. Other than that, there are enhanced access to other sources of entertainment such as interactive gaming (Firth & Mellor, 2005).

4.2.1.4.1 Expected Impacts – Main Actors

While not explicitly mentioned in the government documents, the interviews to actors give idea to individual well-being. The expectations have been mixed, where positive impacts as well as negative impacts are recognized. Some of the impacts mentioned include more knowledge to people (deemed positive) and online bullying, consumerism/consumptive behavior (negative). Here, the interviewees also mention the government's efforts to mitigate the negative effects, which are internet censorship and improving people's e-literacy.

4.2.1.4.2 Expected Impacts – Direct and Indirect Stakeholders

The reviews are mixed, but the stakeholders mainly give examples of negative impacts. Some of the impacts mentioned revolves around facilitating communication (e.g. making it easier to organize sport events, easier to call long-distance friends and family) and more access to online materials (adult entertainment/porn, online gambling). Moreover, others mentioned bullying and abuse that happens over the internet and one interview brought the case of online quarrel that became real-world stabbing case. Another interview, however, when asked about online bullying or pornography, answered "Here (in Papua), the issue is neither bully or sexual crime; the issue here is (West Papuan) independence[2]—there are a lot of blogs writing about Papuan independence". However, the discussion of separatism will be carried out in empowerment part later. One interview mentioned that the issues come from a shift in lifestyle, where he further gave example about the use of social media (e.g. now people post selfies). Lastly, the issue discussed are also the rise of consumptive behavior or consumerism.

Several stakeholders also discussed how to mitigate these negative impacts, and they mentioned literacy on using technology, such as educating people to use gadget responsibly (e.g. no phone on the road) and *Internet Sehat* program at ICT Watch.

4.2.1.4.3 Evaluations from previous impacts

The interviews from Nusa Tenggara have mentioned several things, such as easier entertainment access (from pirated VCDs to video streaming) and cases of more consumptive behavior and euphoria of social media.

4.2.2 Equality

4.2.2.1 Based on gender, ethnicity, social class, and geographical area

With the potential impacts of broadband seen in other pillars, a question is raised: will the implementation of broadband close or widen the gap in the society. Tolbert and Mossberger (2006)

[2] There has been issues about the independence of Western New Guinea from Indonesia ever since the region becomes part of Indonesia, primarily championed by Free West Papua movement

found disparities in broadband access in US: genders, income, education, age, and race/ethnicities. Moreover, rural residents are less likely to have broadband access. Pepper and Garrity (2015) found that ICT decrease global inequality while at the same time contribute to within-country income inequality, in which they recommend to accelerate ICT adoption in the base of economic pyramid.

4.2.2.1.1 Expected Impacts – Main Actors

Based on the government's plan, the very reason why Palapa Ring is conducted is to bring equality across all regions in Indonesia, especially the eastern part. Coupled with Palapa Ring's scope to bring broadband to all the municipalities, it is expected to increase equality to municipality level. However, there is no other aspects of equality (e.g. gender, ethnicity) that is expected by the planners, at least explicitly. It is generally viewed positively, i.e. increasing equality (based on the inclusions to people who are previously excluded from services enabled by broadband). Further potentials of inequality are recognized as possible, but not explicitly addressed.

4.2.2.1.2 Expected Impacts – Direct and Indirect Stakeholders

Both direct and indirect stakeholders give mixed expectation to equality, where it could increase equality between certain aspects and increase inequality in other aspects. While there is expectation that Palapa Ring would close digital divide, there is a concern that it will create inequalities based on who will adopt broadband. The interviews also reveal the current inequalities and digital divides that could be perpetuated by broadband implementation: divides by ethnicity (especially native and non-natives in Papua), by geographical area, by gender, and by age. Another thing that is pointed out by the interview is that the extensions of Palapa Ring to last-mile implementation would depend on economic level in the corresponding region, because telecommunication operator would operate based on market mechanism. This has a potential of sustaining economic inequality between regions.

4.2.2.1.3 Evaluations from previous impacts

Based on the interviews, there is no definitive conclusion whether broadband impact positively or negatively to equality. However, there are several perspectives, such as sustaining inequality due to the reluctance of operators to invest in less developed regions. Moreover, from what is observed in Nusa Tenggara, the inequality comes from education level and whether the surroundings of someone is technologically friendly or not, rather from gender, ethnicity, or social class. Here, the problem comes from the utilization of uneducated vs educated people, where the educated people could utilize broadband more.

4.2.3 Sustainability

4.2.3.1 Environmental sustainability

In the literature, there has been two views about environmental impacts of broadband: negative and positive. The positive environmental impacts include the dematerialization, which is the capability of dealing with larger amounts of digital contents online, and new types of services that could positively impact the environment (Ericsson, 2013). Dematerialization includes, among others, enabled video conference, less need for paper, and the ability to work from home. These would help decrease CO2 emissions. About the new type of computer and network services, it includes smart electric grids or traffic flow models that could reduce energy consumption. Concerning negative environmental

impacts, they could include more energy use due to the emergence of new products and contribution to e-waste due to obsolete computer and network products.

4.2.3.1.1 Expected Impacts – Main Actors

The expected impact from the policy document is generally positive, where it is expected to reduce greenhouse gas emission (particularly CO2) and lower energy consumption via teleconferencing, telecomputing, and new method of doing activities (online newspaper, e-commerce). The government will adopt "green ICT" (from broadband infrastructure point of view) and "green with ICT" (from broadband utilization point of view) (Bappenas, 2014). In underdeveloped area where electricity isn't present, broadband will be supported by green technology equipment. Moreover, it is recognized that e-waste need to be managed (Tuwo, 2013). The interview with the planner confirms this positive expectation, especially that infrastructure implementation should be environmentally friendly. The interview also reveals the conditions to achieve that, such as institutional culture (for paperless habit) and local condition (that telecommuting might not be applicable in the villages).

4.2.3.1.2 Expected Impacts – Direct and Indirect Stakeholders

The direct stakeholders give mixed expectations, both positive and negative, and the indirect stakeholders either have no expectation or give little positive expectation. There are several discussion points here. First, that environmental issue is not yet becoming a concern in Indonesia, as shown by half of the indirect stakeholders. Second, the positive impact, which would be from the dematerialization, is not significant or difficult to achieve (e.g. telecommuting wouldn't be a case). Third, concerning the negative impact that it drives emission, while the infrastructure of broadband itself could be designed as using lower energy, the services and need that it induces would bring up energy need. This is especially because there is no perceived need of environmentally friendly devices (e.g. green data center isn't a trend in Indonesia). Fourth, broadband as a window to new information and a tool to raise citizen's awareness brought up one positive impact, which is to educate people about environmental issue. This discourse gains support from several of the stakeholders, even though it is also challenged—that the locals had already known how to take care of the environment based on local wisdom. Fifth, it could give rise to new services that would give positive impact to environmental sustainability. Even though the expected services are not the high-tech ones such as smart electricity grid, the (government) program such as waste management that utilize broadband is a good effort.

4.2.3.1.3 Evaluations from previous impacts

The actual impact of broadband to the environment is difficult to see. In one hand, the services that lower carbon emission is being used, but in the other hand, there are new services that drive carbon emissions. On top of that, environmental sustainability remains an unpopular discourse, where people aren't aware whether their activities impact the environment.

4.2.3.2 Community well-being

How community well-being is explored in this assessment specifically relates to the relationship between people after broadband is implemented. While the literature doesn't specifically mention the term, several topics could be included in here. Rampersad and Troshani (2012) mentioned that broadband could improve community participation, where community events could be announced in

websites and migrants could be socially included. In Hamel (2010), problems of child pornography and terrorism is raised.

4.2.3.2.1 Expected Impacts – Main Actors

The expectation from the main actors have been mixed. The government cited that the telecommunication infrastructure development in Papua could foster the sense of unity of the society, so that a disintegration issue could be prevented (Kemkominfo, 2014)—there is currently a separatism issue in Papua (see footnote 2 in page 50). On a negative side, social media bullying has been mentioned.

4.2.3.2.2 Expected Impacts – Direct and Indirect Stakeholders

The expectation from the stakeholders are mixed, where both positive and negative impacts present. Here, they liken broadband to a two-sided knife. In the positive impacts, there are more community participation in newly-formed online communities. In the negative impacts, there are rising radicalism/terrorism, online criminal offenses, fights on the internet, hoax and fake news, and other rising concerns such as online privacy.

4.2.3.2.3 Evaluations from previous impacts

The evaluation included positive and negative things. There are radicalism/terrorism, scams, and child pornography, but at the same time there are prevention efforts from community level. There is also an argument that in the beginning of the implementation, negative impacts will flourish, but as people mature digitally the uses for broadband would be for positive things. Another phenomenon that is worthy to be noted is that broadband is also used as a tool for religious preaching.

4.2.4 Empowerment

Hamel (2010) mentioned that ICT is linked to people's sense of empowerment, and it enhance ability to promote change through the creation of communication channel. Moreover, internet increases the ability of people to be active participant in social and political level. It also increases opportunity through online networks.

From government document, the expectation has been positive. Based on the policy document, the vision of the Indonesian Broadband Plan itself is to *empower the society* to support Indonesian transformation to a developed country through the development and utilization of broadband as an infrastructure and meta-infrastructure (Bappenas, 2014).

Within the theme of political freedom and engagement, the questions asked include whether broadband would stimulate political freedom and engagement. Here, bringing to the local context, Papua is special because of its special autonomy status and the current separatism issue there. Therefore, there is also a question about the relation to broadband and separatism movement there.

4.2.4.1 Political Freedom and Engagement

From Brown, Green, and Harper (2001) and Kleine (2010), Hamel (2010) suggested that the access to ICT could have tremendous impacts on people's ability to be active participants in the society, both socially and politically. Generally, internet is believed to make it easier for people to acquire political information and express political opinions (Wayansari, 2011). From (Norris, 2001), the internet can

increase opportunities of political activism through online network. It is capable to foster discussion through chat rooms, e-mail, and online news (Mossberger, Tolbert, & McNeal, 2008) and also social media. In Indonesia, the discussion and interactivity in the internet takes place in blogs, Facebook, and Twitter (Wayansari, 2011).

However, there are several challenges. The alternative voices and information could be threatening for authorities. Moreover, the debates on child pornography and terrorism raise concern of internet anonymity. Ultimately, these may be used as the reason for politically geared censorship (Hamel, 2010). Furthermore, the issue of online censorship and monitoring is fundamental to the use of ICT. This shows that while the internet and broadband could provide greater access to information and transparency, it could only be achieved if the government has the will and that people is institutionally empowered (Firth & Mellor, 2005).

4.2.4.1.1 Expected Impacts – Main Actors

The expectation from the actors have been positive. It is expected to increase political participation. The example that is discussed with the planner, Bappenas, is about e-government and e-procurement program, where the interviewee expects to have more engagement from the people to the government, especially local government. Another planner, Kominfo, stated that when broadband is available and affordable, this would increase political participation.

Related to separatism and disintegration issue, the actors, don't expect any significant impacts, even though they do recognize that separatist groups could communicate more easily with broadband.

4.2.4.1.2 Expected Impacts – Direct and Indirect Stakeholders

The expectation from the direct and indirect stakeholders have been mostly positive, where the stakeholders expect broadband to increase political freedom and engagement. Most of the stakeholders mentions that broadband makes it easier to communicate and to obtain information. There are several things that the stakeholders discussed here. First, that social media is used to express political opinion and mobilize people into action (interview 1). Second, that it has been used in political process, such as gubernatorial and presidential campaign, to some extent. Third, specific to Papua issue, one interview mention that "They (Papuan society) will finally see the truth (about the integration process of Papua to Indonesia"[3] (interview 3). Fourth, that whether broadband would bring empowerment depends on digital literacy of the people and mature communication channel or media that is used.

4.2.4.1.3 Evaluations from previous impacts

Seeing from the previous implementation, broadband and the internet have contributed to several changes and trends. First, information is sourced from the internet and citizens also voice their aspiration via the internet. In West Nusa Tenggara, there is a citizen journalism platform that is quite active called Kampung Media. This platform is quite popular and becomes a channel to express opinions. Moreover, internet is also used as the medium in political campaigns and citizen

[3] The west part of the island of New Guinea became part of Indonesia in May 1963 through a referendum; the whole process had sparked controversies.

engagement. However, there has been different opinions about this, where some of the interviews agree that it is crucial in political campaigns and others disagree.

4.2.4.2 Government Accountability

From Hamel (2010), governments can influence the adoption of ICT positively by being active users themselves. Here, other than promoting participation in policy debates, ICT can contribute to increasing the transparency of governmental processes. Several examples are seen where the government made administrative information freely accessible online, thus increasing transparency of a country's administration (Hamel, 2010). Moreover, Kelly, Mulas, Raja, Qiang, and Williams (2009) mentioned that broadband is seen as a vital device to ensure the implementation of good governance.

However, while citizens expect that ICTs increase transparency by empowering citizens to monitor government performance more closely, web sites that is analyzed in 19 OECD countries are predominantly non-interactive (Pina, Torres, & Acerete, 2007). The same study also concluded that ICTs do not promote financial accountability further away from legal requirements, even though internet's capacity of information dissemination have improved accountability. In another study in Latin America and Sub-Saharan Africa, it is found that broadening internet access could help increase voice and accountability, which leads to lower levels of government corruption (Kock & Gaskins, 2014).

4.2.4.2.1 Expected Impacts – Main Actors

Based on IBP, the government plans the use of e-procurement, which foster improvements of government transparency and accountability. It will also use e-government, which connects the government, government's employee, citizen, and business side. The interviewees also agree that the use of broadband would stimulate transparency, which would be achieved through e-government and e-procurement. Here, the broadband is expected to support transparent procurement process, which leads to the elimination of the potentials to corruption, collusion, and nepotism (KKN in Indonesian).

4.2.4.2.2 Expected Impacts – Direct and Indirect Stakeholders

Both direct and indirect stakeholders don't have explicit positive nor negative expectation for accountability. While it is used for e-government (currently, mostly on national level), stakeholders doubt whether it would stimulate government transparency or reduce corruption (citing that "white collar crime will transform to another form"). There is an opinion that the government would feel that they are monitored by the society, but the problem is more complicated than that, for example in Papua and West Papua province (Special Autonomy Law). Based on the law, procurement below 500 million rupiahs can use direct appointment method to local Papuan business—based on the interview, this is not the case because "if the government disclose every project they have, Papuan businessman would ask them to do a direct appointment to them, causing chaos" (West Papua Local Government, 2016). Moreover, while Indonesian legislation support government accountability (e.g. Public Information Disclosure Act or *UU Keterbukaan Informasi Publik*), stakeholders are not sure whether people know about it or whether they will access the documents/data provided by the government.

4.2.4.2.3 Evaluations from previous impacts

The interviewees from West Nusa Tenggara felt that there is a demand from the society to government institutions to be more accountable. There are efforts from the government (e.g. the forming of a documentation and information management official) to communicate their programs and the law of Freedom of Information). Concerning who are more engaged in demanding government accountability and paying attention to governance of the state, there are two opinions. From Telkom (interview 12), there is an opinion that previously only a few people and students who pay attention to what governments do; from a local organization (interview 8), the view is that the ones who demand for information is represented by NGOs, who have good funding.

Chapter 5 Discussions on the Impact Assessment Result

This chapter will continue to discuss sub research question 4: **"Can we apply the methods and criteria of human development impact assessment of broadband to Indonesian Palapa Ring project and what is the result if we apply it?"**.

In this chapter, several discussion points are presented. There are three sub-chapters in this chapter. First, the analysis of the case study is given (subchapter 5.1). The analysis follows the structure of the four pillars of human development and their sub-themes. Second, the summary of impacts is given (subchapter 5.2), which sums the previous subchapter. Third, a review of the Indonesian broadband implementation context is given to give more understanding on the policy challenges in implementing the broadband, in order to enhancing positive impacts and mitigating negative impacts (subchapter 5.3). This chapter is the continuation of the previous chapter, the human development impact assessment of Palapa Ring project. The outcome of this chapter serves as inputs to the recommendation (subchapter 6.2), lessons learned (subchapter 6.3), and the conclusion.

5.1 Analysis of the Case Study: Four Pillars of Human Development

5.1.1 Productivity

5.1.1.1 Health

Based on the interviews, from the utilization perspective, broadband could be used in e-health[4] in general (administration and information system purposes in hospitals and community health centers, collect data), telemedicine[5], to prevent and eradicate specific disease, to spread health-related information, and by the society to access health-related information. While most of the stakeholders expect positive impacts, they also raised concerns over how the positive impact could be achieved. A negative impact is also recognized from the evaluation interview.

Concerning e-health, positive impacts would be obtained through the use of health information system that requires internet connection. This will be possible if hospitals, community health centers, and other health-related service providers are connected to (broadband) internet. However, medical

[4] The term e-health has no formal definition, but generally it serves as an umbrella term for the use of information and communication technology in the field of healthcare. It includes, among others, health information system, telemedicine, and electronic patient records (Mea, 2001). I chose to use the term e-health here because of its usage in Indonesian Broadband Plan (as *e-kesehatan*, the Indonesian term of e-health) (Bappenas, 2014). However, in this document, e-health refers to health information system, national health network, and electronic patient record; I have a separate section for telemedicine due to its different nature as online medical application and that it gained a significant portion of the discussion to the interviewees.

[5] While telemedicine in general means "online medical application" (Firth & Mellor, 2005) or "the delivery of healthcare services and medical education from one geographical location to another" (Sood et al., 2007), this document discuss telemedicine as it is planned by the Indonesian Broadband Plan: to extend the healthcare service to underserved area. The Indonesian Broadband Plan also mentions telediagnostic and teletherapy.

record sharing will not be the case as it is currently not regulated. In e-health, the challenge lies on the willingness of the government to implement e-health nationwide. Several other issues are also found. First, as recognized across different groups of stakeholders, fund is crucial to implement e-health. Second, preparing the health workers to e-health is also important. Third, policies that support the implementation. Fourth, the implementation mechanism that ensures that e-health works. These correspond to the e-health challenges identified in developing countries (Khalifehsoltani & Gerami, 2010).

Concerning the use of telemedicine, while the planners have discussed the prerequisites (good plan on where to implement the technology, funding, facilities, proximity from the hospital to the landing point of the broadband), there are doubts from the stakeholders whether it would be successfully implemented after the broadband is ready—mainly citing the high requirement of telemedicine. However, it depends on which service would be enabled. Rampersad and Troshani (2012) suggested that the requirement for teleradiology and telediagnosis is different. However, in relation with the Palapa Ring itself, Palapa Ring only serves as a backbone that would reach municipality level. If telemedicine is meant to reach remote areas, (backhaul) network should be built to reach those areas. On top of that, in telemedicine, broadband only enhances the quality of images/video and reduces the download time, without removing organizational and inter-organizational barrier (Firth & Mellor, 2005).

Concerning specific disease, Papua still struggles with malaria, tuberculosis, and HIV/AIDS (Halaman Papua, 2014). Broadband could be utilized for eradicating these diseases. In HIV/AIDS, Indonesia AIDS coalition has tried to use technology in providing information (retroviral medicine, other general information) for people with HIV in the form of mobile app. In relation to eradicating disease, Hamel (2010) has also mentioned that ICT4D could support in making databases for tracking the spread of disease, creating online resources on treating and diagnosing illness, as well as collaborating in dealing with pandemics, all of which could also be supported by broadband.

Concerning health-related information, broadband could be used to provide information by the government or health providers, as supported by the interviews, the government plan (Bappenas, 2014) and the literatures (Firth & Mellor, 2005; Norman, 2012). Vice versa, it is used by the people to access health-related information, as supported by the interviews as well as the literatures (Cline & Haynes, 2001; Lambert & Loiselle, 2007; Rains, 2008). Here, the challenge is to improve the technology literacy of the people so that they wouldn't fall for not credible information source, as seen from the evaluation and Firth and Mellor (2005).

Generally, Palapa Ring as a backbone would enable the high-speed internet that would be implemented in health providers and households. However, the role of broadband itself in the health sector relies heavily in the services that are provided by health providers (and the government in general). Without it, the impact would be limited to the people obtaining health information from the internet.

If the government managed to implement national e-health, positive impacts could be received by the locals, at least until municipality level. Since it would be implemented in government hospitals and community health centers, people across economic levels or social class could expect the same thing. Moreover, if telemedicine is to be implemented, health could reach people in remote area. The uses

for specific disease could also reach the high-risk people, e.g. people with high risk of HIV-AIDS, with the prerequisite that they are sufficiently e-literate.

However, positive/negative impact concerning health-related information depends greatly on whether the people are technologically literate. To achieve the positive impact, it requires the ability to select credible and non-credible sources. Otherwise, misinformation may happen which leads to negative impact.

5.1.1.2 Education

Based on the interviews, there are mixed expectation and evaluation related to the impact of broadband to education, Besides the positive impacts, negative impacts are also recognized. However, the policy documents generally only discuss the positive impacts. While the expected positive impacts revolve around the administrative uses, learning activities (including distance learning), and uses for teachers, the negative impact is mainly about its uses by students. This is in line with the literature (Firth & Mellor, 2005; Hamel, 2010; Woessmann & Fuchs, 2004). Here, there are several discussion points.

First, about national education network and administrative uses. The government has planned to connect all schools and education facilities to national education network. Other than serving as a foundation in other possible uses of e-learning, this enables the education sector to consolidate data which could be used for further decision making. Moreover, it is also used for teacher education and certification. This finding is supported by the previous findings on ICT (Hamel, 2010; Trucano, 2005) and broadband (Ericsson, 2013) for education, where ICT and broadband helps promote efficiencies in education system for administrative purposes.

Second, about access to online materials. In the areas where broadband connection is present, online materials (from the government and from other sources) are used in pedagogical activities. This is especially helpful when the access to education material is limited. In Manokwari, West Papua Province, an interviewee mentioned that the access to bookstores and libraries is limited there, and internet would be an alternative to access information. However, the challenge is that most of the educational material online (outside of the government-provided resource, which isn't always up-to-date based on recent visit to government book repository) is not available in Indonesian. On top of that, Firth and Mellor (2005) and Rampersad and Troshani (2012) noted that whether the use would positively impact education depend on the quality of materials accessed.

Third, about e-learning, including distance learning. Concerning e-learning, literatures have mentioned that it doesn't always result in positive impact in student's performance. However, distance learning could reach the previously unreachable students. The problem is that in Indonesia, (formal) distance learning is only used in open university and several Ministry of Education programs, due to lack of regulation. The policy document also doesn't mention distance learning as one of the goals. Therefore, distance learning isn't to be expected in the near future as the impact of broadband in Indonesia; this is despite the "promotion" of broadband as the enabler of distance learning in various publication (Bauer et al., 2002; Smyth, 2005).

Fourth, about students' uses of broadband. The stakeholders generally agree that students' unproductive use of broadband take a big portion. The challenge is that parents don't necessarily

understand technology. In a broader view, there are still problems in what students' access while using broadband. Other than language barrier, in underdeveloped areas there could be no pressure to use internet and low technology literacy, which could hamper the achievement of positive impact.

The impact of broadband to education is realized both in connecting the school and the students. The main receivers of the positive impacts from education sector are students. If distance learning is realized, there is a possible inclusion of students in remote area. However, this is unlikely as there is no supporting infrastructure for distance learning. If seen further, there is also a possible exclusion of students who cannot afford the internet.

5.1.1.3 Income

The expectations from the literatures and the interviews have been mainly positive. However, the specific context needs to be found out. There are two discussion points here, as laid out below.

The first point is about the uses in firms. Broadband would support businesses in its processes. It would help in reaching more partners/suppliers and customers, stimulate firms' innovation, and gives information about market condition. Moreover, it could stimulate online businesses or e-commerce, and other technology startups. However, it raises question on whether the firms would actually adopt and utilize the broadband. From the evaluation of current SMPCS implementation, small firms have started to switch to broadband, but the first adopters are the big firms (national and multinational companies) in the region, e.g. banks. This raises concern to what Firth and Mellor (2005) noted: that large businesses might be benefiting from broadband more than SMEs. There are specific sectors that relies heavily on broadband (with tourism as the current identified sector), but other local businesses (e.g. farms, handicrafts) are more traditional and less likely to adopt it. Concerning e-commerce and other technology startups, while the potential is big, there should be a push from the government in realizing that. For example, Kominfo's 1000 startup program[6] should also reach Papua.

The second point is about individual and household income. In the digital economy landscape, the presence of sharing economy enables common people to have side jobs (e.g. motorcycle ride-sharing[7]). Moreover, people can participate in online marketplaces. In career, broadband is also used to advance career in the form of obtaining information and job searching. This is in line with the findings on income from Ericsson (2013) that broadband use leads to faster career path and that there are side jobs done from home (in online marketplace case), but sharing economy is quite different (see Liem, 2015; Pangestu & Dewi, 2017 about sharing economy in Indonesia) in the sense that it isn't done from home.

However, broadband is also seen as disruptive, where it could change how people do things. For example, sharing economy, that is partly enabled by broadband, has received negative sentiment from people whose livelihood are threatened (Wijaya, 2017). Here, the government should implement

[6] In 2016, Kominfo supported/co-initiated 1000 startup program with KIBAR, a company that specializes in developing technology ecosystem in Indonesia. The program aims to incubate 1000 startups in 10 cities in Indonesia (five cities in Java, one in Sumatera, one in Bali, one in Kalimantan, and one in Sulawesi) (PDSI KOMINFO, 2017)

[7] The biggest motorcycle ride-sharing in Indonesia, Go-Jek, claimed that they lift the welfare of drivers as well as raising more income of small businesses partnering with Go-Jek (GO-JEK, 2017).

appropriate policy. While there would be new jobs created by broadband, it is possible that there are jobs that would become obsolete, or at least transformed.

The presence of Palapa Ring as a backbone would in the end lead to adoption of broadband by businesses and households. If that happens, there would be increase of productivity in firms and households, which leads to more income. The main receivers of the positive impact would be firms that are ready for broadband (i.e. big business, national and multinational firms, less traditional SME) and households/individuals that has high technology literacy. There is a possible exclusion for "traditional" SMEs that aren't ready in adopting and utilizing broadband.

5.1.1.4 Individual well-being

In individual well-being, the interviews laid out cases of positive impacts (facilitating communication) as well as negative impacts that need to be mitigated (cyberbullying, consumerism, and access to entertainment/unproductive online materials). While not necessarily negative, addiction to services such as porn and gambling negatively impact well-being (see Gainsbury, 2015; Willson et al., 2009). Here, the possibly affected groups are the users of broadband, where it could affect children and adolescent (e.g. addiction to online games or porn), as well as adults (e.g. addiction to online gambling).

5.1.2 Equality

Generally, Palapa Ring is meant to bridge the gap between developed and less-developed regions in Indonesia. This is in line with the general notion that broadband would bring economic and social development, which are described in other parts of the assessment. Therefore, the whole notion of equality should be viewed as whether the impacts of broadband would be distributed among all groups in the society, or whether there are groups who are left behind or doesn't receive the impacts of broadband.

There are two points of view to see this. The first is identifying the factors and general expectation on equality, and the second is looking at the impacts from other pillars—whether they impact specific groups in the society. From the first point of view, the general consensus among interviewees is that while it could bring more equality to the regions that receive broadband, there could be more inequality between people who adopt or utilize the broadband and the people who are not. It could be based on ethnicity, geographical area, or generally between tech-literate versus non-tech-literate people. In this section, we will discuss from the first point of view, where the second point of view (identifying the "winners" and the "losers") can be seen in the next subchapter: 5.2 Summary of impacts.

Based on ethnicity, there is a potential problem for native Papuan versus non-native (commonly known as *pendatang*, e.g. Javanese and Buginese). Based on geographical area, it would be between regions that use and don't use broadband based on inequality of infrastructure. This is especially between urban and rural areas (based on Palapa Ring's scope of implementation and the reliance to market mechanism to extend the broadband to last-mile) and between the traditionally unequal regions (e.g. mountainous vs coastal area). Between the tech-literate versus non-tech-literate people, the condition could be traced back to economic inequality, age, educational background, or gender. While the economic level, age, and educational background gets support from the interviews, gender

isn't seen as a differentiating factor (whether broadband would make positive or negative impact to gender equality). Out of 12 interviews, only one specifically mentions gender (that there is violence against women in Indonesia and that LGBT people are discriminated in the Indonesian online sphere) and points out that there is gender inequality in place in the digital realm. In general, in Indonesia there is no gender gap in internet access: 51% female vs 49% male (APJII, 2015) and 47,5% female vs 52,5% male (APJII, 2016) in the surveys done in 2015 and 2016, respectively. The Indonesian Broadband Plan, however, did mention reference to gender: that the inclusion of women in ICT would lead to greater economic growth and that the government had held ICT award program for women (Bappenas, 2014).

If we compare this to the previous findings from the literatures, we can see that there are indeed socio-economics factors that determine broadband adoption. A study by Dwivedi and Lal (2007) found that in the United Kingdom, age, education, occupation, and income helped to explain the differences between broadband adopters and non-adopters while gender does not, while in the United States the disparities are between genders, income, education, age, and race/ethnicities, and geographical location (Tolbert & Mossberger, 2006). It is important to encourage broadband adoption in these groups in order to prevent more inequalities.

5.1.3 Sustainability

5.1.3.1 Environmental sustainability

While the literatures (Ericsson, 2013; Middleton, 2009; Teppayayon, Bohlin, & Forge, 2009) have provided examples on how broadband impact the environment both positively and negatively, when put into context of Indonesian implementation, it gives new perspective.

First, about dematerialization. While broadband enables services (video conference, information system that uses less paper, enable telecommuting) that will be used to certain extent, it would be treated as an advantage and not replacing the traditional method that is already there. The obstacles come institutionally (policy, e.g. paper would still be used) and based on culture of the certain institution. Moreover, telecommuting would not be appropriate in the settings of the places in which broadband would be implemented.

Second, about new broadband-enabled services that would positively impact the environment. The concept itself is foreign to the interviewees (i.e. smart grids, which do not get support from the interviewees), at least from high-technology perspective. Some interviews, however, mentioned that broadband could lead to lower-tech services that could positively impact the environment (through e-government program, e.g. waste management that uses broadband to make it more effective), even though the recognition is little.

Third, that there is a potential of using broadband to educate the society about environmental issues. This is related to the fact that in Indonesia, environmental issues are not a priority yet, or at least not something that is a "hot" topic. This is relevant despite the opinion that local people already care to the environment based on local wisdom. So far, this is the most likely scenario of broadband giving positive impacts to the environment: it is supported by the stakeholders despite its absence in the literature.

Fourth, about carbon consumption issue. The broadband would inevitably lead to more services that would emit more carbon. This issue is recognized by the interviews and there should be further investigation on how significant is the impact, given that the less-developed regions gives more room for more services to be delivered.

Fifth, the e-waste problem. Despite being lightly recognized by the government, the issue is not in the policy framework. While this might not be relevant now (based on the interviews, which discuss e-waste from consumer point of view), this is a potential issue for longer term.

Even though the expectation of the project itself is positive, the relationship between environmental sustainability and broadband is more complex, where there are both positive and negative impacts. Coupled with the non-awareness of environmental sustainability issue, the actual recognition and assessment of the environmental sustainability issue might be neglected. Putting this into the perspective of areas that are less developed, new services enabled by broadband might grow big and the (negative) environmental impact might be significant. However, the process where this negative environmental impact happen should be investigated more. Here, there is no identified specific group that would be affected (the impacts would affect all groups in the society).

5.1.3.2 Community well-being

In the community, both positive and negative impacts can be seen. There is more information sharing in social media and there is more community participation, and there are more online-based communities–this is in line with what's argued by Rampersad and Troshani (2012), that is based on Quan-Haase and Wellman (2004). While this could lead to more things such as the inclusion of certain groups, there is currently no indication of this in the evaluation. Moreover, since it is used by the religious community to preach good things, several interviewees viewed it as a positive thing. However, concerning online religious preaching, there might be a negative effect if it leads to religious extremism.

Concerning the negative impacts, there are several things to be noted. First, there is a rising radicalism that could lead to terrorism, where the radical organizations use social media to recruit people (supported by Nuraniyah, 2017). Other than to recruit people, social media is also used to provoke people to cause riot in the context of religious intolerance[8]. Moreover, as an information channel, the internet is also used as a communication channel of radical organizations.

Second, there are general criminal offenses that could be found on the internet. For example, there are online scams, frauds, and child pornography. From the Ministry of ICT (Kominfo), there has been an effort to solve this problem with TRUST+Positif program. In the program, Kominfo blocks websites that are related to radicalism/terrorism, racial/ethnicity/religious based hate, violence, child pornography and pornography, scams/investment fraud, gambling, malware/phishing/virus, and copyright infringement, among others (Kemkominfo, 2017). Here, Kominfo receive reports from

[8] One interviewee mentioned the case of Tanjung Balai, where in July 2016, two monasteries and five temples in Tanjung Balai, Medan, North Sumatera were burned by angry mob. It was triggered by a woman who complained about the sound of Adzan/calling of prayer from a Mosque, but then the case became a quarrel between people. After a false information broadcasted via social media, it made people angry and burn the places of worship (Kusumastuti, 2016).

citizens, review it, and put the website on a blacklist. The websites on the blacklist are then blocked by internet providers. While a portion of interviewees agree with this government "censorship", there are also criticisms to it, especially because the pornography is blocked. This leads to censorship of websites that also offer more contents other than pornography, such as internet forum Reddit and video sharing website Vimeo (Palatino, 2014). This leads to the discourse that the responsibility to protect children falls for the parents, not the government. Moreover, the mechanism creates confusion because the one who blocks the websites are internet providers, not the government, to which the access restriction is not mandatory. This causes internet providers to block different websites (Carrieri et al., 2013).

Third, hoax or fake news. In 2016, there is a larger spread of hoax and fake news, especially of political content (recognized by Azali, 2017; Jurriëns & Tapsell, 2017), where it is shared in social media and people believed it. Here, NGOs are campaigning how to distinguish trusted and untrusted sources. Moreover, there is a mainstream media neutrality problem, where media is dividing people. Here, there is a need of educating people about tech literacy, such as identifying authentic vs hoax news and cross-checking information.

Fourth, there are different challenges that apply to different characteristics of society. The interview revealed that in Papua, the society is known as very expressive, where there is a high number of quarrels and fights, including on the internet. In Papua, online clashes have also been brought to real world violence.

In sum, there are positive and negative impacts relating to community well-being, where the negative impacts are more discussed in the interviews. One thing that should be noted here is that the internet sphere is dynamic; while in 2016, when the interview took place, there were specific kinds of scam and hoax/fake news are on the rise, there might be new challenges in the coming years. Here, interviewees share the opinion that the community will sustain after something new is adapted and causing impacts, which may refer to the society's adaptive capacity towards the (negative) impacts of broadband. Lastly, to identify the affected groups in community well-being, radicalism could affect minorities group and the frauds, scams, and fake news could affect people with low tech literacy.

5.1.4 Empowerment

5.1.4.1 Political freedom and engagement

Consistent with the literature, the interviews suggest that broadband would give positive impact on political freedom and engagement. Here, there are several major things in the discussion.

The first is that with broadband, political engagement will be increased. There is a consensus from the actors and the stakeholders about this and it is supported by the literatures (Hamel, 2010; Mossberger et al., 2008). Broadband will serve as a communication channel between the government (executive, legislative) or candidates running for the government (i.e. election campaign). As the communication channel between the current government and the people (see Bonsón, Royo, & Ratkai, 2015; Reddick, 2005), the actors have mentioned the planned use of e-government and e-procurement. However, in the priority sectors chapter of the Indonesian Broadband Plan itself, there is no e-government program that plan to engage the people (G2C/government to citizen) other than e-education and e-health (Bappenas, 2014). One interview mentioned LAPOR application, which is a centralized social media-

based aspiration & complaint platform, but the interviewee said that not many people know the platform. LAPOR itself is aimed to increase people's participation for overseeing government's program & performance in public administration & national development (LAPOR, 2017; see Nugroho & Hikmat, 2017 for more Indonesian e-governance initiatives). It is an initiative of the central government and currently it covers complaints and aspirations to 81 ministries/government bodies, 5 local governments, and 44 state-owned enterprises in Indonesia. Generally, in Indonesia itself, the ones that have extensively used e-government are the central government and several local governments that are led by young politicians. Concerning the legislatives, one interview mentioned that some of the members of parliaments (MPs) in the national level have used online media to accommodate aspirations. However, this is not the case with local MPs.

In election campaigns, online media has also been used to reach people (supported by Abdillah, 2014 in Indonesia; Kluver, Jankowski, Foot, & Schneider, 2007 in its study across countries). Based on the evaluation in West Nusa Tenggara, stakeholders don't agree whether it is crucial in political campaign, with more opinions stating that people still prefers offline campaigns. In West Papua, despite the lack of broadband, governor candidates have started to use online media (website, polls, social media). In Papua, *bupati* (the head of regency, one level below province) candidate have also started using online media (Facebook) to campaign even though not all people access that. However, this would apply mainly to the modern society, where people could engage politically via the internet. In traditional community, this might not be the case. With low power distance and reachability of the community leader, the presence of broadband would probably have no impact on the decision-making process, because the people can already talk directly to their community leader.

The second is about the freedom of information and freedom of opinion. This is mainly mentioned as the impact of broadband by the direct and indirect stakeholder; the evaluation from West Nusa Tenggara as well as the literature also support this. In West Nusa Tenggara, one of the interview is conducted to Kampung Media, a citizen journalism portal in Nusa Tenggara. Here, the people voice their aspiration via the citizen journalism platform and the local government monitor the platform to hear the people's voice. In Papua itself, there is a blogger community (*Komunitas Blogger Papua*) and online media such as *Suara Papua* that voices local concerns. In Papua itself, currently there is a foreign media access restriction to West Papua and Papua provinces (Kine, 2017), which indicates that there is a problem of press freedom in Papua. While this may be tied with unstable political condition in Papua, the presence of broadband should lead to better freedom of expression and opinion there.

Concerning the presence of separatist group in Papua (Free West Papua Movement), the expectations about this is that it is possible that there could more separatist activities after broadband is implemented due to the ease of communication (see Widinugraha, 2016 for the movement's use of digital media). However, it is also expected that the government would "take care of it" (e.g. wiretapping). This report would not assume this to be positive or negative by itself; if broadband raises separatism movement, community well-being might be lowered; hence the impact is considered the same as radicalism/terrorism (community well-being).

Based on (Hamel, 2010), one of the challenge of freedom of information and opinion is a censorship from the government. Currently, internet censorship exists in Indonesia and several of the interviews also mention this, with some of the stakeholders agree to the censorship and several others disagree. However, the issue of censorship is discussed more in the previous subchapter, community well-being.

Another challenge lies in the rise of persecutions against people who have expressed opinions online that are considered "offensive", which take place in the context of defamation suits and court actions against Indonesian anti-pornography and hacking laws (Hamid, 2017).

The final issue in freedom of information and freedom of opinion is the use of social media. With a very big social media adoption, freedom of information and opinion has been the case in Indonesia and it would also be the case in Papua. Social media is expected to be the main platform of freedom of information and freedom of opinion (see Nugroho, 2011; Shirky, 2011).

In sum, broadband would mean that there is more political engagement, if seen from evaluations and from the opinions of stakeholders. In political freedom and engagement, the ones that would be empowered are the ones who will actively utilize broadband.

5.1.4.2 Accountability

In government's accountability, while the actors expect that broadband implementation will improve accountability, the stakeholders are more skeptical. The discussion around this theme can be found below.

First, one of the main points of how accountability would be achieved via implementing broadband is through e-procurement (Neupane, Soar, Vaidya, & Yong, 2012; Wahid, 2010). In Indonesian broadband plan, one of the utilization plans of the would-be-implemented broadband is e-procurement, whose first aim is to improve transparency and accountability (Bappenas, 2014). The actors' interviews also support this view, where broadband is implemented to support e-procurement, infrastructure-wise. However, from local perspective, there might be a problem. In Papua, there is a special autonomy region status for West Papua and Papua province. This indirectly impacts the government accountability, for example about procurement of goods and services by the local government. Presidential Regulation 84/2012 mentioned that procurement below 500 million rupiahs can use direct appointment method to local Papuan business (Pusdatin Kemendagri, 2012). While the regulation required all government projects to be announced in their website, in reality it is not. The interview from West Papua local government mentioned that if the government disclose every project they have, Papuan businessman would ask them to do a direct appointment to them, causing chaos (interview 7). This shows that the decentralized system of Indonesian government leads to possibly different local scenarios based on specific locality, as shown by Nurmandi and Kim (2015)

Second, the literature suggested that when administrative information is freely accessible online, transparency of a country's administration could be increased (Hamel, 2010). In Palapa Ring, broadband could also be seen as an infrastructure that connect the government to the citizen via the internet, particularly local governments. One of the examples that can be seen from the evaluation is Nusa Tenggara government's office of information and documentation, dubbed PPID. PPID is the manifestation of the Law of Freedom of Information (UU 14/2008), where essentially all government bodies should give access to people who ask for public information, and created with the support of Open Government Indonesia movement (opengovindonesia.org).

However, for this to work, there should be a commitment from local government to publish information and answer the requests for information. In West Papua, the local government suggested (interview 7) that the government websites are currently badly maintained—this should be the first

indicator because the administrative information would be accessed through local government websites. Moreover, there is a doubt on whether government officials understand the law and whether they are willing to comply to it. In short, there are challenges in how to actually implement open government.

Third, the discussion whether broadband will actually give any positive (or negative) impact to government accountability. Based on the evaluation, the stakeholders in Nusa Tenggara agreed that there are more demands from the society to the government institutions to be more accountable. Indeed, the internet gives more space for the people to demand accountability from the government and serves as a channel to disclose administrative data. From the society point of view, however, there is a discussion on where the demand actually comes from. In Nusa Tenggara, there is a difference of opinion on who are more engaged in demanding government accountability (one interviewee suggested general public, another suggested only the NGOs with good funding). From Papua, an interview doubts whether people would access the data provided by the government due to low tech literacy and digital divide. From the government point of view, as mentioned before, there should be a will to achieve more accountability. These challenges might have fueled the doubt of stakeholders on whether broadband would stimulate government transparency or reduce corruption.

In sum, broadband would serve as a channel for the people to demand for government accountability and for the government to disclose their administrative information, budgets, and procurement process. While on the surface it could make the government look more transparent, there is a doubt whether it would stimulate government transparency or reduce corruption. However, if accountability is achieved, the ones who will receive the impact is the general public.

5.2 Summary of Impacts

Based on the potential impacts that are presented in the previous subchapters, this subchapter will give a summary of selected impacts (i.e. identifying positive and negative impacts) along with their likeliness/unlikeliness based on stakeholder interview. Moreover, the affected groups are also identified here. The summary of impacts can be found in the Table 11 in the next page.

From Table 11, we can see the likely and unlikely impacts that are derived from the impact assessment. While the impacts mentioned can be interpreted as the primary effects of Palapa Ring implementation, every impact cannot be viewed as equal as the magnitude of those effect aren't currently known; more investigation needs to be made to the specific impacts to know what could be their magnitude, their secondary effects, and their impact to policy change in other contexts. Other than that, identification of "winner" and "loser" can also be derived; by looking at the likely impact from both positive and negative impacts, it can be concluded that the groups that receive positive impacts are the people that is the technologically literate, broadband adopters, residents of municipality level, and privileged groups. Moreover, the groups that would receive negative impacts are people with low technology literacy and underprivileged groups (based on ethnicity, based on economy, or other minorities). Other than that, general broadband & internet users can also receive positive and negative impacts. This reflects the needs of several things: to educate more people about internet and technology, to focus more to rural areas, and to include more underprivileged group (e.g. based on ethnicity and economics).

Table 11 Summary of selected impacts

Pillars	Sub-Theme	Uses/Impacts	Positive/ Negative	Likely/ Unlikely	Affected groups
Productivity	Health	**Impacts from e-health**	**+**	**L**	**Municipality level residents**
		Impacts from telemedicine	+	U	Remote area residents
		Disease prevention/treatment	**+**	**L**	**Specific risk groups, tech literate**
		Impacts from health campaigns	**+**	**L**	**General public**
		Health misinformation	**-**	**L**	**People with low tech literacy**
	Education	**Education network, administrative uses**	**+**	**L**	**Students, teacher in general**
		Access to online materials	**+**	**L**	**Student, teacher who can afford internet**
		(Formal) e-learning, distance learning	+	U	Students, students from remote area
	Income	**Support (large) businesses**	**+**	**L**	**Big firms (who are ready to adopt)**
		Support (small & medium) businesses	+	L/U	SME (depends on whether they are ready to adopt)
		Increase individual/household income	**+**	**L**	**Individuals & households with high tech literacy**
		Some jobs become obsolete	**-**	**L**	**Individuals & households with "disrupted" jobs**
	Individual well-being	**Facilitating communications to family, friends**	**+**	**L**	**Internet/broadband users**
		Internet related addictions, cyberbullying	**-**	**L**	**Broadband users (children, adolescents, adults)**
Equality	Equality	**More equality (geographical – municipality level)**	**+**	**L**	**Municipality level broadband adopters**
		More inequality (geographical – urban vs rural)	**-**	**L**	**Rural area residents**
		More inequality (ethnic groups)	**-**	**L**	**Less privileged ethnicity (e.g. Papuan natives)**
		More inequality (economic groups)	**-**	**L**	**Economically underprivileged people**
Sustainability	Environmental Sustainability	Dematerialization	+	U	General public
		New services based on broadband	+	U	General public
		Educate society about environmental issues	**+**	**L**	**General public**
		Increase carbon consumption	**-**	**L**	**General public**
		Rising e-waste	-	U	General public
	Community well-being	**Promote online communities**	**+**	**L**	**Internet/broadband users**
		Rising radicalism	**-**	**L**	**Minorities, general public**
		Frauds, scams, fake news	**-**	**L**	**People with low tech literacy**
Empowerment	Political freedom & engagement	**More freedom and engagement in politics**	**+**	**L**	**Internet users**
		More freedom of information & freedom of opinion	**+**	**L**	**Internet users**
	Accountability	More accountability/reduce corruption	+	U	General public

5.3 Discussions on the Indonesian Broadband Implementation Context

In this chapter, a review on how to attain a successful broadband implementation is presented; in a way, this would enhance positive impacts and prevent negative impacts. There are several aspects that matter when one implements broadband. In the policy documents of Indonesian Broadband Plan itself, there are several things mentioned: broadband and ICT infrastructure (including how to access internet), target speed and penetration, spectrum need, broadband price, broadband utilization, ICT readiness, regulation, and funding (Bappenas, 2014). This is in line with what is discussed in the World Bank's Broadband Strategies Handbook, where they discuss the basics of broadband, its policy approach, law and regulation, extending universal access and use, technologies, and driving the demands for broadband (Kelly & Rossotto, 2012). Others have also mentioned main dimensions in the environment of broadband decision makers, namely technology, market, and policy & regulations (Fijnvandraat, 2008).

Moreover, (Kelly & Rossotto, 2012) proposed to view broadband as an ecosystem of supply (broadband penetration: international connectivity, domestic backbones, metropolitan connectivity, local connectivity) and demand (broadband adoption: services, applications, and contents). Coupled with the absorptive capacity of broadband (where the society has the capacity to acquire, assimilate, transform, and exploit the capacities enabled by this platform), Kelly & Rossotto argued that this view could be used in designing policies that could "fully realize the potential impact of broadbands on economic, social, and policy goals". This model can be seen in Figure 12 in Chapter 3. This view on supply & demand in achieving the impact is quite similar to how Heeks and Molla (2009) proposed in ICT4D value chain (Figure 11) where supply can be seen as infrastructure availability and demand can be a part of adoption & use from uptake & readiness domain. However, readiness domain on ICT4D value chain also have other concerns, such as legal, institutional, human, and technological before arriving to infrastructure availability.

Based on these considerations, reviews on policy (includes regulations & legal framework), technology (as part of the supply), band adoption (including the utilization, demands, and uses) are presented in this section. This section is based on the literatures, relevant documents, and interviews.

5.3.1 Policy

Broadband Policy

The basis of broadband implementation in Indonesia is Indonesia Broadband Plan, which is legally recognized in Presidential Regulation No. 96/2014. The Indonesian Broadband plan itself has four key regulation: infrastructure (supply), adoption (demand), regulatory framework, and funding. The diagram is presented in the Figure 17 in the next page.

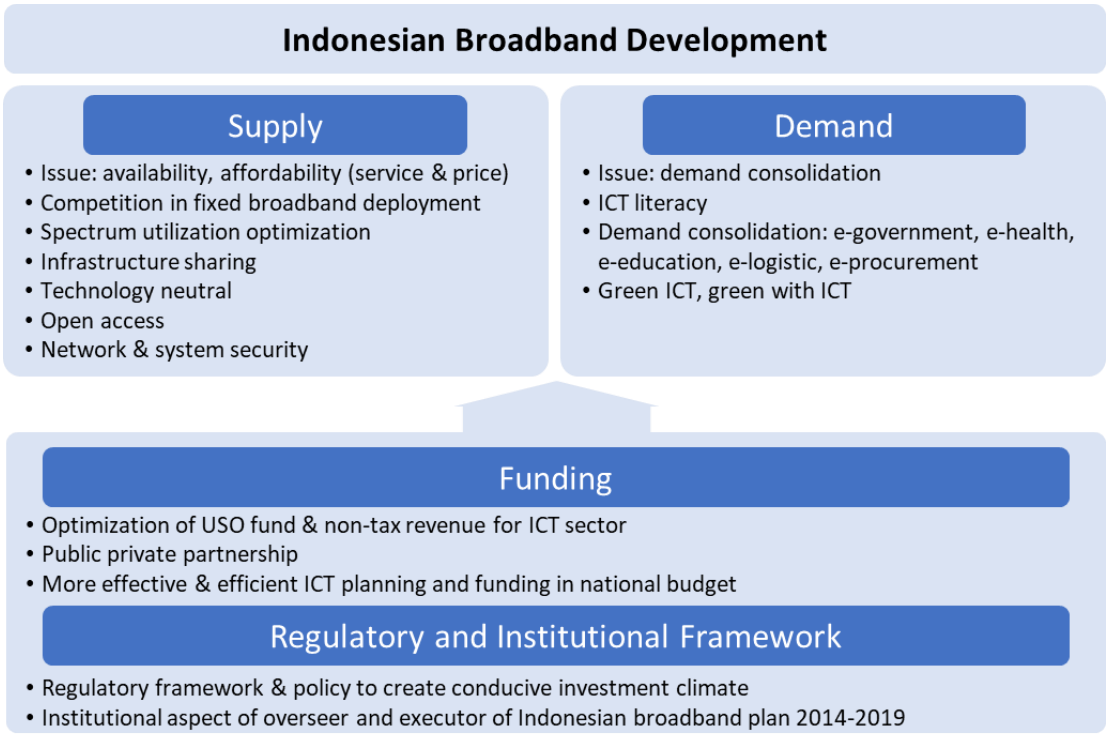


Figure 17 Indonesian Broadband Development (Bappenas, 2014, p. 59)

From the diagram, there are a few things to be noted. First, that Palapa Ring itself does not exist in a vacuum; it is a part of a bigger policy framework where there are other policy aspects and other projects. Second, the concept of supply-demand itself is similar to the broadband ecosystem as proposed by Kelly & Rossotto (2012). Third, while the diagram lists some of the issues, not all of that is mentioned in the diagram. Indonesian Broadband Plan has identified other issues that is spread over the policy document. On top of that, there has also been criticism to the policy document, for example that the individual elements of the ICT and broadband ecosystem have not been clearly stated and no description of how the ICT ecosystem would be improved (Rohman, 2014).

While the narration above is sourced from policy document, the stakeholder concerns from the policy perspective is also taken into account. Most of the actors and direct stakeholders, except local government, discuss the same issues and express the same concerns as the ones mentioned in Indonesia Broadband Plan. For example, about the funding scheme of Palapa Ring (as a solution to how to fund Palapa Ring, one of the reason why the project was delayed for years) and business models, supply (infrastructure) and demand (utilization plan: five priority sectors in IBP), relevant legislations (Telecommunications act 1999), stakeholders & institution perspective, potential pricing regulation issues (interconnection price, B2B), and open access. These issues also correlate with each other (e.g. interview 10 mentions that the government controls the price via the five priority sectors utilization). Concerning the indirect stakeholders, the local government mainly talks about local legislation or other legislation that matters locally (e.g. Presidential Regulation 84/2012 about Special Autonomy to Papua, as mentioned in Empowerment chapter) and criticized some policies based on practical experience. For example, a national NGO (interview 9) criticized that the policy leans toward technical side and that people is not the subject of the policy, which could cause inequality or non-inclusiveness to certain group of people (e.g. Papuan natives). On top of that, he also expressed concern that attention should be given to how the policy is implemented (maintenance plan, last mile

implementation). If we take a look at the policy document, IBP already tried to offer the non-technical side of the implementation by planning broadband adoption (five priority sectors, human resource development program in one of the flagship project). The concern however is based on the fact that previous USO-funded programs are mainly about infrastructure provision (in the underdeveloped area). However, marginalized groups aren't given attention in the plan. Moreover, how the policy is implemented is also a legitimate concern, where this should be supported by strong monitoring and evaluation from Bappenas and Wantiknas. When asked to these institution, the evaluation of Indonesian Broadband Plan is a work in progress, mainly covering the availability and affordability aspects of broadband; however, there is no publicly accessible documents about it.

Financing, business model, and affordability

Historically, Palapa Ring was implemented in several batches using different schemes and business models. While MKCS and SMPCS are implemented and funded by Telkom (and as a result the network is also owned by Telkom), Palapa Ring Western, Eastern, and Central Package use availability payment mechanism, where the government pays when the companies has finished building the infrastructure. Here we will discuss both of them.

First, the part that was implemented by Telkom (in the recent implementation, SMPCS). If we look at the history of Palapa Ring, there were no private telecommunication companies willing to invest in laggard area (Figure 9: 2005-2009), but Telkom decided to continue with the investment. Private companies felt that the investment would not have sufficient return. Moreover, they didn't feel the obligation to invest there—they have paid universal service obligation fund to the government that is supposed to develop laggard area. However, the fact that Telkom implemented a very big part of Palapa Ring leads to a worry of a monopolistic structure—after all, the network belongs to Telkom. To prevent this, infrastructure sharing and open access should be ensured and monitored (Rohman, 2014). With infrastructure sharing and open access, other network provider could also utilize the backbone infrastructure that is implemented by Telkom. The Indonesian Broadband Plan itself clearly stated that it promotes infrastructure sharing and open access; however, it doesn't give a specific instruction on how to achieve that. Based on the interview to the actor (Bappenas/interview 2), there is no regulation of infrastructure sharing and open access yet; he remarked that probably it is still being discussed in Kominfo. From the consumer perspective, one of the reason why these matter (monopoly structure, open access, infrastructure/network sharing) is that it could influence price and quality.

Second, the Palapa Ring implemented by the government (Western, Eastern, and Central Package). Here, the government pays the value of the project and a certain percentage of profit using the universal service obligation (USO) fund. The development itself is financed by banks and the consortium. After the network is ready, the network would be utilized by internet service providers and operators. They will then pay the access charge to the government via BP3TI. The diagram of this availability payment mechanism can be seen below.

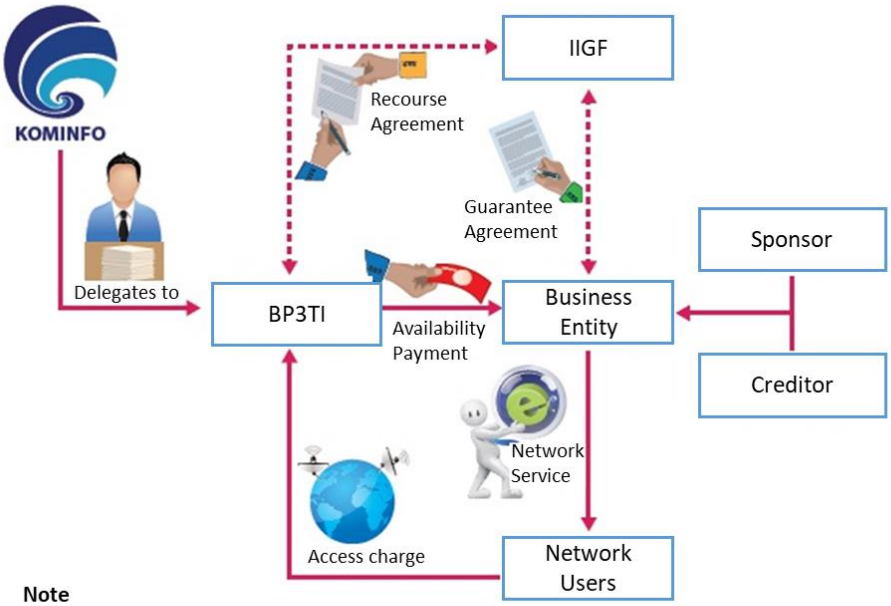


Figure 18 Availability payment mechanism (BP3TI, 2016a)

With availability payment mechanism, Kominfo aimed that the price could be controlled by the government, because the price that is paid for the backbone and backhaul network is paid to the government. The government does have a target price in IBP policy document, where broadband price should be less than 5% of the average monthly income. Moreover, by increasing demand in five priority sectors of utilization (as stated in IBP) and by driving up people's use of broadband, the demand is expected to go up, hence dropping the price. This pricing/affordability issue is especially important in Papua, because it has been long known that the prices in the provinces of Papua and Papua Barat are higher than other regions. Based on the interview, while the price of internet access and broadband (phone credit price, 3G mobile internet) has been dropped over time and after SMPCS implementation, the price is still high if compared to prices in Java.

In sum, the policy document has covered good principles that are necessary; however, the implementation of the policy itself should be done properly. Moreover, the concern of the stakeholders is legitimate and there should be an effort to make the policy more people-centered. Moreover, since broadband affordability is crucial for people to adopt broadband, the issues (e.g. infrastructure sharing, open access) should be addressed.

5.3.2 Infrastructure and Technology

Regarding technology, there are several things that worth noting. First, technology neutrality and technology mix. The IBP's policy of broadband infrastructure includes the principle of technology neutrality, where the government promote technology neutral broadband. Here, there is no specific technology that is being championed by the government; instead, there can be a mix of technologies to make broadband connection happen. On top of that, the Indonesian Broadband Plan also supports technology mix in backbone network that would enable fixed and wireless broadband (Bappenas,

2014). These principles are also supported by the interviews; mainly the actors and the direct stakeholders (i.e. the planners of Indonesian Broadband Plan). In Palapa Ring itself, fiber optic cable is used, with microwave in parts of inland Papua (Figure 2).

Second, about fixed and mobile broadband. After Palapa Ring is implemented as a backbone network, it will enable the backhaul network as well as fixed and mobile broadband (see Figure 13). In the IBP, both fixed and mobile broadband are included as the extensions of Palapa Ring backbone network (Bappenas, 2014). However, there have been criticisms where the IBP paid little attention in the strategy of further utilizations of mobile technology, despite the recent state of broadband development and that mobile broadband is more popular in developing countries. Moreover, the distribution of population is scattered in the eastern part of Indonesia.

Third, meta-infrastructure readiness. Palapa Ring backbone network will cover underdeveloped area, where the infrastructure is lacking. Specifically, road and electricity are major problems for broadband diffusion (Rohman, 2014). This poses a problem because broadband needs a good meta-infrastructure, mostly electricity. For example, in the underdeveloped areas, the electrification ratio (number of household with electricity per total household) could be as low as 45,93% in Papua province (ESDM, 2016). The interview with the actors and stakeholders also confirm this problem; in the urban area of West Papua, even though electricity is present, there are frequent power outages. From the evaluation of Nusa Tenggara implementation, an interview revealed that the power failure could shut off cell tower, making internet unavailable. From the actors' perspective, there are difference of approach; while Bappenas said that the implementation could use special allocation fund (DAK or *Dana Alokasi Khusus*) for the regions that does not yet have electricity, Kominfo left the electricity problem to government contractors (i.e. the consortiums for Palapa Ring projects) and to the Ministry of Energy and Mineral Resources. Furthermore, some of the interviews also acknowledged the importance of road infrastructure, especially for fixed broadband (fiber optic inland cable, backbone and backhaul).

Fourth, while it seems trivial, the Indonesian Broadband Plan also mentioned vandalism problem of telecommunication infrastructure (Bappenas, 2014, p. 38). We can view this as a form of societal readiness from infrastructure perspective, because a similar problem is reported from the interview in West Papua province (interview 11): fiber optic cables were burnt because of the locals' habit of burning garbage on the roadside.

In sum, the strategy of technology neutrality and technology mix is good; however, last-mile implementation policy (fixed vs mobile broadband) needs to be reviewed further. Moreover, better meta-infrastructure should be achieved and the society should be prepared not only from adoption point of view but also from infrastructure point of view.

5.3.3 Adoption

In the broadband ecosystem, the impact would be achieved if the demand/adoption side works. Therefore, not only managing the supply side (broadband penetration), the adoption of the broadband should also be planned. As put by (PriceWaterhouseCoopers, 2004),

"A broadband connection per se has no value to customers. Rather, the value to customers of broadband access arises from the applications for which it is used.....Subscribers receive benefit from the package of applications that they consume over their broadband connection."

In Palapa Ring case, from the Indonesian Broadband Plan perspective, the customers of the broadband connection are households, individuals, businesses, public service offices, and local governments. This is derived from the IBP's penetration target: fixed and mobile access, residential area, office buildings, schools, hotels, hospitals, community health centers, local government offices, police stations, public space (Bappenas, 2014, p. 53). Through this penetration target, positive expectations would be realized. In this case, an interviewee (interview 9) noted an important point: he argued that the implementation of Palapa Ring would not increase internet/broadband penetration; it would only increase the quality of the current internet connection. While other sources have argued otherwise (Purbo, 2017), it should serve as an important reminder that positive impacts of broadband could only be achieved by increased broadband penetration that follows an infrastructure deployment.

It should also be noted that different broadband uses need different intermediaries; while home access by a worker for skill building purpose would only need an e-learning platform and broadband connection, telediagnosis use in hospitals or community health centers would need certain medical equipment, a telemedicine platform, and certain skillsets by the medical professionals or health workers. Therefore, to achieve the positive impact of broadband, broadband access itself is not enough. At a minimum, there have to be services that run on top of broadband, relevant skillsets to utilize the broadband, and a system that ensures the utilization.

From the demand/adoption point of view, the IBP has identified several problems (e.g. lack of ICT leadership in national level, weak local ICT industry) as well as planning the demand/adoption of broadband. From Figure 17 (National Broadband Development), the focus of the demand side (utilization and adoption aspect) is ICT literacy, demand consolidation from five priority sectors, and green ICT/green with ICT. Putting the sustainability issues aside, we can see that ICT literacy and the government's five priority sectors (e-government, e-education, e-health, e-logistic, e-procurement) are the focus of the government. This is in line with the interviews that mention the importance of ICT literacy (nearly all actors and stakeholders) and that the government will focus on the five priority sectors (mostly the actors and direct stakeholders, i.e. the planners). On top of that, one of the flagship projects of IBP is the human resource development and national ICT industry development program that has three main aspects: ICT literacy improvement, ICT industry development, and the development of contents and applications. However, this flagship project lacks detail of what will actually be done (there are only examples of four digital literacy program that has been done by the government in the recent years) and who will conduct the program (the policy document only mentioned "ministries/institutions").

Eventually, this discussion on broadband adoption reveals that in obtaining the positive impacts, the broadband utilization is key. It calls for a working system in place (e.g. e-health with trained medical workers and sufficient health infrastructure) and, among others, ICT literacy. This issue of ICT literacy itself, if we look back to subchapter 5.2, is not only crucial in obtaining positive impact; it is also the key in mitigating negative impacts.

5.3.4 Institutions and Stakeholders

Regarding institutions, there are several perspectives that we will discuss here. First, we look at our actors and stakeholders' analysis from pre-assessment stage (for the complete table, see Appendix 2 Actors & Stakeholder Analysis). While there are differences of interests (e.g. the government in

general wants to achieve national or ICT development, private companies in general aim for revenue and profits, the people wants good infrastructure from the government to help their daily life), there is no significant conflicting interests/objectives: the stakeholders support broadband implementation.

Second, we look at potential issues that is raised from institutional and stakeholders' perspective. For the starting point, we will look at Telkom's role. Based on Indonesia Broadband Plan, Telkom and the government will implement broadband in 497 municipalities[9]. Excluding the implementation up to 2010, Telkom will cover 145 municipalities and the government will cover 51 municipalities. To achieve this, one of the projects that Telkom conducted is Sulawesi-Maluku-Papua cable system (SMPCS). Looking to the background of the project, we will understand why this happen. While the Palapa Ring consortium was disbanded in 2009, Telkom decided to continue with the project, starting with Mataram-Kupang Cable System (MKCS) and continued with SMPCS (see Figure 9). At this point, the government wanted the private companies to invest in the project but no other companies were willing to invest that—Telkom was the only company who built most of the planned Palapa Ring network with their own funding. The reason why Telkom do this was understandable. First, they have their own vision of Nusantara Superhighway and Indonesia Digital Network, which overlaps with Palapa Ring network. Second, Telkom is a fairly big company with a cellular operator subsidiary (Telkomsel), which would drive their demand[10]. Third, the government owns 51% share of Telkom, making it more able to be steered according to national interest. Meanwhile, the government let Telkom do that because at that time they have no fund to invest on their own (during 2010-2012, the ministry of ICT/Kemkominfo was negotiating the use of USO/ICT fund to Bappenas and the Ministry of Finance) as well as having no other companies willing to invest.

Rohman (2014) discussed potential problems that could arise based on the role of Telkom in Palapa Ring project. First, since the main aim of Telkom would be profit (due to its nature as a company), the project might be conducted to maximize financial benefit rather than social benefit. Second, since Telkom built most of the network in Palapa Ring project, there is a worry that there will be a monopoly. Concerning the first potential problem, we have to also see the other role that Telkom plays, where as a company it also helps stimulate demand by offering certain application (e.g. in health and education) to local institutions. From the government perspective, this could be solved by implementing monitoring and evaluation measure that ensure social benefit. The second potential problem has been discussed in earlier subsection 5.3.1 Policy, where the government needs to ensure healthy competition, where open access and infrastructure/network sharing policy should be implemented. In the Indonesian Broadband Plan, the government mentioned that competition would be encouraged, but nothing concrete had come out of it (Gunaratne et al., 2014). Moreover, unhealthy competition could also lessen the quality of the service offered, as mentioned by one of the interview in Papua when he complained about the customer service of Telkom (interview 7). In ensuring healthy competition, ISPs and other telecommunication operators should be involved as stakeholders.

Third, the institutional perspective and stakeholder engagement from the government's (from Indonesian Broadband Plan) point of view. The IBP has identified the institutions that will conduct the flagship projects as well as priority sectors and identifying the role of the institutions (e.g. private

[9] Currently >500 due to addition in the number of municipalities

[10] An insight based on personal communication with Agung Wahyudi, June 2016

sectors, central government, local government, and ministries/other government institutions) in broadband implementation (Bappenas, 2014). However, little is known about how involved are those institutions in real life and whether the arrangement of these institution is the best for Indonesian broadband implementation. There are several remarks about this. First, in the criticism of ICT ecosystem by Rohman (2014), he mentioned that the Ministry of Trade and Ministry of Industry are not part of direct stakeholders of Indonesian Broadband Plan, leading to the lack of discussion concerning ICT industry ecosystem. In the IBP, there is no explanation on how to engage the local ICT industry. Second, there is a criticism that there is a lack of inter-governmental synergy, where the line of thinking is very sectoral (interview 9). This is due to the specific role of governmental agencies, where each organization only focus on their own tasks. Third, regarding the engagement of local government, Kominfo (interview 5) mentioned that the central government has asked local governments for their assistance in Palapa Ring project (e.g. for local permit purposes). From other interviews, it is also known that several local governments (i.e. municipalities) are interested in smart city programs, where broadband has a pivotal role. However, there is also a criticism that the local governments are not involved in the making of the broadband plan (interview 6). Concerning stakeholder engagement, other than improving inter-governmental and actors' synergy, it is also important to reach stakeholders that is "left behind" by the broadband plan (e.g. ICT industry and other local stakeholders) in order to realize positive impacts of the broadband. For example, from the interview to local stakeholder (local university—interview 11), there is a hope that local university could play more role in the broadband implementation (e.g. alumni or research involvement) rather than only as broadband user.

Fourth, as an evaluation, observations of actors' and stakeholders' views in the interviews are presented here. The actors (Bappenas and Kominfo in the national level: interviews 2 and 5) are familiar with the Indonesian Broadband Plan, Palapa Ring projects, and the national broadband condition in general. The same is observed in national-level direct stakeholder (Mastel and Wantiknas: interviews 1 and 10) since they are involved in the planning and monitoring/evaluation, respectively. However, they added more perspective and criticism to the current government policy (e.g. open access, net neutrality, and cultural dimension of broadband uses). From the evaluation, Telkom as an actor gives more positive reviews about broadband impacts compared to direct and indirect stakeholders (local government and NGO).

More about direct stakeholders, the local-level direct stakeholders (local governments) gave input (i.e. expectation and evaluation) that is more specific to their own respective location. Meanwhile, in indirect stakeholder, there are differences in their opinions. One interview to Indonesian ICT volunteer (interview 4) gives mostly positive opinions; this is explained by the organization's affiliation to the Kominfo and that it was established by the initiative of Kominfo. Critics and skepticism mostly came from two other national and Papuan local NGO (ICT Watch/interview 9 and Kitong Bisa/interview 3). Other interviews (local university, another NGO in Nusa Tenggara) does not give any strongly positive/negative opinions.

Ultimately, the discussion about institutional and stakeholders' perspective revealed that certain stakeholders need to be engaged in order to ensure successful broadband implementation, enhancing positive impacts of broadband, and minimizing negative impacts of broadband. Moreover, inter-governmental synergy needs to be achieved.

Chapter 6 Conclusion

This chapter will answer the central research question "**What does a human development impact assessment of the Palapa Ring project look like, and what can be learned from its application?"**

In this chapter, the answer to the research questions are given (subchapter 6.1). Moreover, the recommendations for Indonesian broadband implementation are given (subchapter 6.2). Next, feedbacks to the framework are given as a lesson learned from conducting human development impact assessment to Palapa Ring project (subchapter 6.3). This chapter will also address the contributions (subchapter 6.4), limitations (subchapter 6.5), future research directions (subchapter 6.6), and personal reflections (subchapter 6.7) of the study.

6.1 Conclusion

This section discusses the results and conclusion of the research, broken down by the research and sub-research questions. The central research question here is ***What does a human development impact assessment of the Palapa Ring project look like and what can be learned from its application*?**

To answer the research questions, the four sub-research questions are first answered.

SRQ1: What is the relation between ICT in general and human development?

In exploring the relation between ICT and human development, the context of technology, ICT, and development in general have been explored in a literature review in Chapter 2. Furthermore, literature review has been performed in trying to find the connection between broadband and human development, both in Chapter 2 and Chapter 4 (as the introduction before discussing actors' and stakeholders' expectation). As a starting point, technology plays a role in development. It could also contribute to economic growth, sustainable development, and human development. One of the forms of technology is information and communication technology (ICT), where it enables services that promote development (e.g. mobile health, distance learning, farming apps), create opportunities for development (e.g. digital entrepreneurship). In general, ICT is viewed as enabling, promoting, or having critical role in socio-economic development. ICT has also been suggested to bring empowerment in the society. These areas of development (health, education, empowerment) that are promoted by ICT are closely tied to human development. However, concerning the use of ICT, disadvantages (e.g. inequality in labor market, ICT-induced stress) and policy challenges (e.g. the inclusion of underprivileged social groups) have also been found. In conclusion, **ICT makes positive contributions to elements in human development while at the same time having disadvantages and policy challenges**. Since broadband is one form of ICT, this concept becomes the foundation of the research, where the positive and negative contributions of broadband to human development are identified, as well as the challenges. Based on the literature review of the broadband itself and human development, several benefits have been found (e.g. that broadband raises income, enabling more advanced medical technology). However, disadvantages such as negative environmental impact has also been found.

SRQ 2: What criteria are relevant for assessing the human development impact of broadband implementation?

By reviewing literatures, this thesis research has explored relevant criteria. Here, the concept of human development (subchapter 2.3) serves as a basis. However, the research aims to look beyond human development index (life expectancy, education index, adjusted GDP per capita) and seeks a more complete understanding on the relationship between broadband implementation and human development. With the basis of previous human development impact assessment toolkit from UNDP and complemented from other sources of human development indicators (subchapter 3.2), criteria for assessing human development impacts of broadband implementation have been developed. **The resulting criteria consist of four pillars of human development that is broken down to several sub-themes**. The pillars and sub-themes are **productivity** (consists of health, education, income, and individual well-being), **equality** (constitutes inequality by gender, by ethnicity, by social class, and among geographical areas), **sustainability** (consists of community well-being and environmental sustainability), and **empowerment** (consists of political freedom and engagement and government accountability). The full explanation of the developed criteria was presented in subchapter 3.4.2.

SRQ 3: What methods are relevant for assessing the human development impact of broadband implementation?

By reviewing literatures, this thesis research has explored relevant methods, as shown in subchapter 3.1. The basis to develop the method is UNDP's human development impact assessment toolkit and it is further compared and complemented with social impact assessment methods; as the result, several concepts from social impact assessment such as mind-mapping and enhancing positive impacts are taken into account. On top of that, the context of ICT and broadband is also considered to understand the process by which broadband implementation could obtain development impacts; this raises the need to review elements of the "ecosystem" or "value chain" of broadband in order to be able to achieve positive impacts, which is later incorporated in the developed methods. The resulting methods, which is explained in subchapter 3.4.1, consist of three stages (pre-assessment, impact assessment, and post-assessment). In the **pre-assessment**, the broadband project and its related effects are identified, stakeholders are identified and analyzed, and linkages between broadband implementation and human development are mapped. In the **impact assessment**, consultation process and participatory approaches are identified, indicators are developed, impact assessment tools and techniques are identified and implemented, and the impact assessment results are analyzed. In the **post-assessment**, together with stakeholder, measures are developed and policies are redesigned.

SRQ 4: Can we apply the methods and criteria of human development impact assessment of broadband to Indonesian Palapa Ring project and what is the result if we apply it?

The methods and criteria **can be applied** in assessing broadband implementation of Indonesian Palapa Ring Project. In Chapter 4, I have illustrated the process of the assessment (subchapter 4.1) and presented the result of the impact assessment (subchapter 4.2). Furthermore, the analysis of the impact assessment result was presented in Chapter 5. However, due to the limitations of the research, several steps in the assessment methods previously developed are excluded, such as the policy dialogue in post-assessment stage.

As a backbone network, Palapa Ring would enable broadband and narrowband alike in the underdeveloped regions of Indonesia. The network that would be implemented could be utilized in several ways that promote human development, which leads to positive impacts. However, there are also negative impacts that are raised from the implementation.

The main result of the assessment is a list of positive and negative impacts of Indonesian Palapa Ring project and the discussions around it, including the issues and the policy challenges. Based on the result, which is mostly sourced from the discussions with several actors and stakeholders, Palapa Ring would mainly give positive impacts in the area of productivity and empowerment, while potentially giving both positive and negative impacts in the equality and sustainability dimension. The summary of impacts is given below.

1. **Productivity**
   In the productivity area, the positive impacts come from health (from uses of e-health, broadband use for disease prevention and health campaigns), education (use from e-education, access to online materials), and income (support for businesses and individuals/household), and the negative impact comes from health (potential health misinformation) and individual well-being (e.g. internet-related addictions, cyberbullying). The impacts would depend on the utilization of broadband (as well as narrowband/internet) that is implemented in health providers, education providers, businesses, and households as well as individuals (accessed by mobile phones). However, there are challenges in obtaining the positive impacts: in health, the role of the government is key in achieving e-health, telemedicine is not likely to be realized with current readiness, and the quality of online health information matters; in education, formal distance learning is unlikely to be realized and benefits from access to online materials depend on the proactiveness of the students and teachers; in income, traditional small and medium enterprises are unlikely to "automatically" adopt broadband and that the disruptive nature of broadband needs to be understood more (there are jobs that would likely be obsolete); in individual well-being, there should be a promotion of healthy online behavior.
2. **Equality**
   In equality, while the Palapa Ring might fulfill its task to bring about equality across municipalities, there are possibilities of more inequalities in other areas. First, geographically, since Palapa Ring would only connect regions until municipality level (*kabupaten* and *kota)*, rural areas and other regions where the broadband does not reach might be overlooked. Second, across social groups, there might be more inequality based on ethnic groups (e.g. between natives and non-natives) and based on economic groups (i.e. rich vs poor), since the privileged groups are more likely to access broadband. Here, the challenge is the inclusion of underprivileged groups and geographical area. Furthermore, age and educational background matters in the adoption of broadband.
3. **Sustainability**
   Concerning sustainability, especially environmental sustainability, the challenge is that sustainability is not yet viewed as important by the society in general. This explains the potential positive impacts: while dematerialization (e.g. paperless society, telecommuting) and new services that stems from broadband (e.g. smart grids) are not likely to be achieved, broadband will play a role in its basic function: in spreading awareness about environmental issues. Concerning the negative impacts, it includes the environmental sustainability (that the

use of broadband would lead to increased carbon consumption) and community well-being (e.g. where broadband is being used for frauds, scams, and fake news).

4. **Empowerment**
   Broadband generally gives positive impacts in empowerment, where freedom and engagement in politics, freedom of information, and freedom of opinion are expected from people who use broadband. However, the positive impact that is expected from government accountability is not likely to be achieved; the main challenge here is the political will from the government to achieve accountability.

However, these points only represent the impacts that potentially emerge from the implementation and it does not quantify the likelihood nor the consequence/magnitude of the impacts; moreover, there are other impacts that might have been overlooked due to a lack of understanding of the full impact pathways (which excludes second and higher order impacts). The research has also identified the "winners" and the "losers" of the implementation: the main receivers of the positive impact are the technologically literate people, broadband adopters, residents of municipality level, and privileged groups. Meanwhile, main receivers of the negative impacts would be people with low technology literacy and underprivileged groups.

Having answered the sub-research questions, we can answer the main research question.

***RQ: What does a human development impact assessment of the Palapa Ring project look like and what can be learned from its application*?**

The answer to this question can be linked back to the answers of the sub questions. The human development impact assessment of broadband implementation, or in this case Palapa Ring project, is built on top of the concept of human development and the concept that the broadband would positively contributes to human development while at the same time having several drawbacks. The stages of the assessment comprise of pre-assessment (understanding of the project, analyzing the stakeholders, mapping of the linkages between human development and broadband implementation), impact assessment (identifying consultation process, conducting the assessment, analyzing the results), and post-assessment (giving recommendations). The assessment investigates the possible impacts of Palapa Ring implementation based on four pillars of human development (productivity, equality, sustainability, empowerment) which are further broken down into sub-themes. As a result, mostly positive impacts are expected in productivity and empowerment pillars, while equality and sustainability pillar expects both positive and negative impacts. Based on social groups, geographical area, and literacy of technology, certain groups are more likely to receive positive impacts, while other groups are more likely to receive negative impacts.

From its application to the case, we learned that broadband utilization is crucial, as it is the utilization of broadband which would bring about the human development impacts instead of the broadband infrastructure per se. In this study, we have examined the possible utilizations of broadband in Palapa Ring case, in which public service offices, businesses, (local) governments, and individuals/households would be expected to adopt broadband. By the use of these institutions, broadband would positively impact (and negatively impact) people (or certain groups of people). Now, the challenges are to enhance the positive impacts and mitigate the negative impacts of broadband. In addressing the challenges, we look into the impacts and see what are their context. For some positive impacts, the

challenge is to have a system in place that would guarantee the positive impacts (e.g. from e-health and e-education programs, from political freedom and engagement). For others, it is how the government can make something happen, such as how to make traditional SMEs and local business (farms, handicrafts businesses) adopt broadband and receive as much benefits as larger organizations. In addressing the negative impacts, the challenge is to prevent and mitigate it: after recognizing the groups that would potentially be left out from broadband adoption, for sure they should be engaged in a way or a policy measure should be taken to prevent further inequality. Recognizing a root problem (e.g. in environmental sustainability: that environmental issues are not the priority for the Indonesian society) is also crucial in mitigating the negative impact. Other than looking at the context of the impact, it is also useful to see the context of the broadband implementation: by examining that, we learn that certain regulations (e.g. infrastructure sharing, open access) are crucial in promoting healthy competition of the broadband providers in the area, which in turn benefit the users/customers in term of quality and price.

Other than learning from the findings, we can also learn about the applicability of the framework that we previously developed. While there are several things from the framework that could be improved, for example the interpretation of human development concept and the integration of other concepts such as from broadband ecosystem, I would say that the framework has sufficiently provided insights about the impacts of broadband implementation to human development. While this framework will be useful in assessing further broadband implementations, the principles that are used while developing the framework can also be taken if one wants to create a human development impact assessment framework in other cases.

6.2 Key Recommendations

In this section, measures to mitigate the negative impacts and to enhance benefits and opportunities are presented. These recommendations follow the findings of the impacts of Palapa Ring (subchapter 5.1 and 5.2) as well as the discussion of Indonesian broadband context (subchapter 5.3). It answers the first additional question AQ1: "*What can we learn by assessing Palapa Ring project in order to make a recommendation on how to enhance human development positive impact & prevent and mitigate human development negative impact?*" There are eight points of recommendation that I propose here.

First, since the key to achieving positive impacts of broadband lies in its utilization, the government should **address implementation issues related to broadband utilization**. This is especially related to government programs such as e-health and e-education, where the government should prepare the services that would run on top of broadband, train the people who will utilize it (e.g. health workers), and provide funding for the programs. Other than government programs, the government should also condition digital economy environment that would enable businesses to reap benefits from broadband connection. In this case, engaging stakeholders and promoting inter-governmental synergy would help, since the programs would be conducted by different governmental organizations (such as Ministry of Health, Ministry of Education).

Second, the government should **promote technology and media literacy**. Based on the findings, technology literacy can enhance positive impacts (e.g. for students and teachers in obtaining educational information from the internet, for government employee in utilizing e-government) and mitigate negative impact (e.g. recognizing good quality health information and news article would

prevent health misinformation and falling for fake news). While the interviewed NGOs have tried to address this issue (e.g. see ICT Watch's Internet Sehat[11] program) and that ICT literacy has been included in the Indonesia Broadband Plan in the sixth flagship project, there should be a systematic plan in achieving technology and media literacy.

Third, it is recommended to **engage less privileged groups and extend the implementation to rural area** in order to mitigate the negative impact on the equality pillar. In this study, we have identified several social groups that would potentially be excluded: certain ethnic group (i.e. Papuan native) as well as the people who are less privileged based on economy and educational background. Moreover, implementation to rural area is important to mitigate inequality based on geographical area, as the Palapa Ring network is only implemented to municipality level. Lastly, the point of engaging less privileged groups could extend to engaging traditional SMEs that might not be benefiting as much as other businesses that are readier to adopt broadband.

Fourth, to enhance the positive impacts and mitigate the negative impact in the area of environmental sustainability, **promotion of (environmentally) sustainable use of broadband** should be made. This is related to the fact that there is only little concern over environmental issue in Indonesia. This promotion could involve, among others, promoting the use of environmentally friendly appliances (not only the broadband infrastructures as mandated in IBP, but also the IT infrastructures related to broadband utilization), promoting new services that use broadband to positively impact the environment, and promoting conscious efforts of utilizing broadband out of environmental concern.

Fifth, the government should ensure **free and safe online sphere**, because this is key to empowerment. Based on the findings, the society could be politically empowered through channels such as social media and citizen journalism platform, where there is a freedom of information and freedom of opinion.

Sixth, it is important to **pay attention to local context and engage local stakeholders** in broadband implementation. For example, in government accountability, a legislation was found to (unintentionally) hamper government accountability. In this case, it is important to engage local stakeholders in identifying issues that are specific to local condition, such as misalignments of national/local regulations. Furthermore, the involvement of local universities and local businesses is also important in utilizing broadband to meet local needs and address local issues.

Seventh, the government should **promote healthy competition** of the telecommunication industry in the region, since it would impact the affordability and quality of broadband; this is in turn determine the adoption of broadband. In promoting healthy competition, infrastructure sharing and open access regulation should be developed since they would encourage other network providers to utilize the backbone infrastructure, not only the implementer of the infrastructure (Telkom).

Eighth, the government should **ensure meta-infrastructure readiness**, especially electricity. Based on the findings, meta-infrastructure readiness is crucial in utilizing the broadband. This could be achieved by cooperating with the national electricity company and the Ministry of Energy and Mineral Resources.

[11] http://internetsehat.id/, an initiative by ICT Watch to use the internet safely and wisely

6.3 Lessons Learned

After implementing the framework to the case of Palapa Ring implementation, there are several lessons learned that can be summed below that serves as a feedback to the framework. This section answers the first additional question AQ2: "*What can we learn from the Palapa Ring project in relation to stimulating and assessing human development impact of broadband?*"

Based on the process of the assessment

This study has succeeded in assessing the first impacts of the implementation of Palapa Ring project in human development. This could serve as a basis for assessing further impacts, assessing the magnitude of each impact, and formulating further measures.

In the assessment, I tried to interpret the "expected related effects" (from the steps of pre-assessment: *HDIA1.1 Identify the broadband project/policy and expected related effects*) from the position of the broadband project itself in the broadband supply chain: a backbone network project would have different expected effects than a fiber-to-the-premises project. This works, but in the specific case, since a backbone network would support further backhaul and last-mile implementation in mobile broadband, fixed broadband, and narrowband, the scope of expected impact becomes wide as it covers further implementations and their utilizations. Moreover, this impact assessment does not distinguish between the impacts of mobile broadband, fixed broadband, and narrowband as Palapa Ring would cover them all. In further assessment, the concept that is specific to broadband implementation (e.g. broadband ecosystem) or ICT4D implementation (e.g. ICT4D value chain) should be incorporated more into the human development impact assessment of broadband. On top of that, there should be a classification of each of the application's (mobile broadband, fixed broadband, narrowband) impacts.

Concerning the steps of the assessment, constant reinterpretations have been done to each step when faced with challenges that come later in the assessment. It makes the process non-linear where previous steps are revisited later in the assessment, such as the interpretation of expected effects in RHDIA 1.1 and stakeholder analysis in RHDIA 1.2 and 1.4. It also means that the explanation of the process in chapter 3 is the result of several readjustments throughout the assessment, where the outline of the process remains the same before and after the case study is conducted.

Based on the criteria of the assessment

This assessment has tried to use the four pillars of human development in operationalizing the concept of human development. In doing so and in doing the assessment, I realized that the sub-themes set before are not enough in fully expressing the concept of the pillars. For example, while the concept of empowerment addresses "people's capability to shape processes and effects that affect their lives in terms of economic and socio-political/cultural aspects", with the current sub-themes it felt reduced to participation in decision-making process in the national and local/regional level. Meanwhile, the concept of empowerment from the economic point of view is 'taken away" in productivity pillar. Furthermore, the concept of empowerment in the sense of empowering people who previously "have been denied the rights" is lacking in this context, leaving the focus to underprivileged groups in inequality pillar. Here, I believe that the relationship between the pillars of human development should be assessed and constant reinterpretation of what could be considered as a sub-theme of the pillar should be done in order to fully represent the concept of human development.

On top of that, since this research focuses on the areas of human development instead of drawing more from capability approach, a real disconnect from the capability perspective is felt. Also, the concept of choice is lacking from the assessment. While it is difficult to directly link the capability perspective due to the scope of Palapa Ring assessment (instead of individually assessing a certain social group and giving them questionnaire about central human capabilities), in the upcoming assessment capability approach could be involved more directly, especially in a smaller scope.

6.4 Study contributions

There are several contributions that are accomplished by this study. In this section, we will discuss the academic contribution and the practical contribution.

6.4.1 Academic contribution

There are two main contributions that we will discuss below.

First, this study is **making a connection between the field of broadband, human development, and impact assessment.** This study has attempted to combine broadband, impact assessment, and the concept of human development in one context of study. A framework of human development impact assessment for broadband implementation has been developed based on literature research. The framework integrates elements from, among others, Yamamoto and Oh (2012), Vanclay (2015), Heeks and Molla (2009), and Kelly and Rossotto (2012). It provides a novel perspective of broadband impact by assessing it from human development perspective, which consists of productivity, equality, sustainability, and empowerment. This is important because the current studies of broadband impacts are mainly about its economic impacts (Fornefeld et al., 2008; R. Katz, 2012; Koutroumpis, 2009; Lee, Oh, & Shim, 2005; Lehr, Osorio, Gillett, & Sirbu, 2006; Qiang et al., 2009; Scott, 2012; Whitacre et al., 2014), even though some has also touched the social impacts (e.g. health, education), environmental, and political impact (Ericsson, 2013; R. L. Katz, 2014; Mack-Smith, 2013; Oomens & Munisteri, 2015; Rampersad & Troshani, 2012). In human development impact assessment, in addition to integrating the perspectives (economic, social, environmental, political), it also touches the subject of inequality as the impact of broadband implementation, which is largely absent from the studies of broadband impact. Inequality is usually discussed in broadband adoption literature as the disparity of broadband access (Dwivedi & Lal, 2007; Tolbert & Mossberger, 2006), which is part of a larger theme of digital divide (Norris, 2001). By looking at broadband from broader perspective, not only positive impacts from the economic and social perspective are expected; we can also see the potential negative impacts from the disparity of broadband access in the inequality pillar.

Second, **the result of the case study gives feedback to the literatures on broadband impacts to human development.** This study has provided insights on the impacts of broadband from single case study, which is the Indonesian Palapa Ring project. In a way, this study contributes both to the impact of broadband in a developing country and to the Indonesian context of the use of digital technologies. On top of that, it also contributes to the field of ICT4D since the adoption side of broadband essentially consist of ICT4D projects (e.g. the uses in hospitals and schools). In some cases, it supports previous findings, such as the findings in health and education which corresponds to previous findings on ICT4D and broadband impacts (Firth & Mellor, 2005; Hamel, 2010). It also foresees that some potential impacts would not materialize in Palapa Ring case, such as decreased carbon consumption from

dematerialization (from Ericsson, 2013; Teppayayon et al., 2009) and positive effects in health from telemedicine (from Firth & Mellor, 2005; Rampersad & Troshani, 2012). Moreover, it also found a potential impact that was not found in the literature, which is positive impact on the environmental sustainability based on creating the awareness on environmental issues. Other than that, from equality pillar, this study also contributes to the field of digital divide and broadband adoption (Dwivedi & Lal, 2007; Tolbert & Mossberger, 2006). This is based on a finding that there would be more inequality based on the disparity of broadband adoption from socio-economic and geographical perspective.

6.4.2 Practical contribution

While the proposed framework can be used for other broadband project and to model human development impact assessment in other areas, especially technology projects for development, the findings from the case study is especially beneficial for the Ministry of National Development Planning of Indonesia (Bappenas) as a means to enhance the positive impacts and mitigate the negative impacts of broadband implementation from the perspective of human development, especially in the Palapa Ring project. This study also serves as an evaluation of the previous implementation as well as a prediction of the impacts of the future implementation of Palapa Ring based on human development; this is important because two of the objectives of Indonesian Broadband Plan is directly linked to human development. Moreover, the Indonesian broadband context has also been assessed in order to ensure successful broadband implementation. Bappenas could apply the recommendations from our study after further consultation to stakeholders. Moreover, the predicted impacts of this study can be a baseline for further assessments.

Other than contributing to the government, other stakeholders can also benefit from this report. The range of discussed issues has identified opportunities to other organizations to contribute to human development through broadband. For example, since traditional social-medium enterprises are less likely to reap benefits from broadband compared to larger businesses, there is a potential for (local) sociopreneurs to market SME's product, especially in the regions where Palapa Ring would be implemented.

6.5 Limitations of Research

This study has several limitations, as we can see below.

First, **limitations related to the identified effects.** In this study, both positive and negative effects have been identified. However, this should be treated as preliminary findings of the impacts of Palapa Ring. Normally, in a full impact assessment, short and long term effects will be covered and the nature and magnitude of the primary effects are examined by descriptive and statistical analysis (Yamamoto & Oh, 2012), which are not addressed in this research. Moreover, this study does not examine the full impact pathways, which helps assess second and higher order impacts (Vanclay, 2015). In our case, the lack of full impact pathways leads to the mix of the uses of broadbands and the impacts in Table 11. In future research, it is recommended to address these limitations.

Second, **limitations based on the scope of case study.** This study was conducted in a specific context within two regions (Nusa Tenggara and Papua) in Indonesia where Palapa Ring project has been and will be implemented. While the findings are sufficient to provide insights of the impacts of broadband

implementation in the area of human development, they might not be generalizable to other cases. Moreover, since Palapa Ring is a backbone project which will enable both broadband and narrowband connection, we didn't distinguish clearly which impacts would arise from purely broadband connection (we use Indonesian government's definition: always-connected, ability of triple play, the speed of 2 Mbps for fixed broadband or 1 Mbps for mobile broadband) or whether narrowband is sufficient to achieve such impact. Hence, further research in other contexts is recommended.

Third, that **no further policy consultation is conducted**. Due to master's thesis limitations, further policy consultation to stakeholder, developing specific measures (in the form of action plans), and policy redesign are not done. As a consequence, before the recommendations are implemented, further consultation to stakeholder should be done.

Fourth, that **there are possibilities of biases and subjectivity in data collection**. In the data collection phase of this research, interviews to actors and stakeholders are performed. There are two concerns in this: first, that there may be important stakeholders or affected groups that are left out; second, that there may be biases from the interviewees as well as exaggeration or underestimation of the likely impacts (Fitzgerald, 2003; Joyce & MacFarlane, 2001; Sekaran & Bougie, 2009). Addressing the first concern, I have tried to find the right mix of stakeholders interviewed (central government, local government, NGO, company, and other relevant organizations). However, due to the limitation of the number of interviews, the local people are only represented by local NGOs, local university, and local government. This leaves out other local institutions (esp. the indigenous/native population) such as Papuan customary council (*Dewan Adat Papua)*. Addressing the second concern, the interview result is contrasted to previous studies and evaluation as well as cross-checked from other sources.

Fifth, the **limitations of discussed topics**. There might be topics that are not sufficiently discussed, overlooked, or excluded from this research, while still in the area of human development. This is caused by several reasons:

- Since the online sphere is constantly shifting and evolving, there might be more perspectives that emerge after the interviews to the stakeholders are done (July-October 2016) but before the thesis is finished. In that case, further developments in the media that might overlaps with the concept of human development (but not discussed with the stakeholders) are excluded from the research.
- There are topics that emerged from the discussion from some of the interviews but not sufficiently discussed, such as privacy, net neutrality, and the cultural dimension of broadband. These topics are deemed insufficient to be included in the discussion and conclusion and hence excluded from the thesis. However, further research could be done in these topics.

Sixth, the **limitations of documents review**. This study had planned to refer to evaluation documents produced by the government. However, such document is not available. The annual reports from Kominfo and BP3TI have also been checked, but there is no sufficient information about the evaluation of previous impact. Therefore, the assessment relies on the main policy document (Indonesian Broadband Plan/IBP 2014-2019). IBP is further referred by the government in creating national medium-term development plan as well as other regional and local development plans, but they are not referred here since they are very lengthy and elaborate.

6.6 Directions for future research

In this section, I recommend several future researches that are based on the lessons learned (subchapter 6.3) and the limitations (subchapter 6.5) of the study.

First, that **capability approach is more explicitly integrated** in developing the framework of human development impact assessment. This is recommended for the assessment that would involve individuals (Heeks & Molla, 2009), as compared to a more macro-level research. With this approach, it is expected that the assessment would be more people-centered (Kleine, 2008). In this case, there are several useful literatures: Anand, Hunter, Carter, Dowding, and Guala (2007), which developed a set of questions to measure human capabilities, Kleine (2008), which discusses the application of capabilities approach to ICT4D, and Heeks and Molla (2009), which discusses ICT4D impact assessment based on capabilities framework.

Second, to **integrate other concepts** specific to broadband implementation (Kelly & Rossotto, 2012) and ICT4D (Heeks & Molla, 2009) in the framework to understand more about how different technologies could give different impacts as well as to understand the adoption side of broadband. Moreover, in developing further measures, specific concept such as broadband transition theory (Røpke, 2012) can be incorporated to the framework.

Third, to conduct further impact assessments that would determine the **magnitude of the impacts** identified in this study as well as identifying further (secondary and higher order) impacts by developing **full impact pathways**, as recommended by Vanclay (2015) and Yamamoto and Oh (2012). By doing this, we can gain a more complete picture of the impacts and address the possible confusion between benefits and applications of broadband, as mentioned by Firth and Mellor (2005).

Fourth, to conduct impact assessments **in other contexts**. This is important to know the human development impacts of broadband in other cases, thus increasing the generalizability. For example, future research could analyze the impact of (specifically) fiber-to-the-premises or mobile broadband network (different technology context) or the impact of broadband in different regions (different geographical context).

Fifth, to **include more topics** that are related to broadband implementation (at least in Indonesia) such as the use of universal service obligation fund (IndoTelko, 2017; Prasad, 2013), the issue of net neutrality (Cheng, Bandyopadhyay, & Guo, 2011; Hogendorn, 2007; Wu, 2003), and the issue of data privacy (Bélanger & Crossler, 2011; see Meingast, Roosta, & Sastry, 2006 for privacy issues in e-health). These issues are important in realizing the positive impacts and mitigating the negative impacts, but are excluded in this research due to the study limitations.

6.7 Personal reflections

Studying Management of Technology at TU Delft, I had been made aware to the impacts of technology, both in an organization and in a wider societal context. In this thesis, I tried to view a large technological project from human development perspective, believing that if the positive and negative impacts are known, organizations and individuals alike could utilize the technology in question to obtain the positive impacts and take measures to avoid the negative impacts. However, the very first realization that this thesis would be beneficial to wider audience came to me when I found myself

quoting my work during a talk to my friend about our career path: that we can *actually* use broadband to advance our career! I discussed that in the productivity pillar, sub-theme income. Soon after, I subscribed to several online courses and Googled career mentoring, thanks to my thesis.

In conducting the research, I had to do literature reviews, perform data collection in the form of interviews, and analyzing the results. The literature reviews were challenging, where I had to learn about subjects I totally had no idea about. One of the most difficult parts was exploring the criteria of human development impact assessment, since it requires me to understand the extent to each sub-theme (e.g. what does individual well-being really mean?) and deciding on the criteria. The interview process was the most fun and inspiring part, since I was able to meet different people from a diverse background and talk about the impact of broadband. The most frustrating part was the data analysis. I put a lot of efforts in transcribing the interviews, then I had to structure and restructure the analysis part several times, learning-on-the-go how to perform the analysis. The analysis part was also the most time-consuming—I did this from November 2016 to July 2017. Thankfully, the period is now over and it provides me an opportunity to reflect on the process and the findings of the research.

To a lot of people, broadband is something they take for granted. To those people, connecting to the internet and have a Skype call with a friend abroad is as easy as turning on their tap to drink water. However, inequalities and digital divides exist, leaving some people unable to connect to broadband (and probably no clean running water either). While the starting point of the Palapa Ring project is inequality, it became quite ironic that the its implementation could pose inequality problems in other areas. I hope that by pointing the potential problems out, further inequality could be mitigated; same goes to sustainability. I realized nonetheless that this study is only a baby step in figuring out impacts and (policy) challenges of broadband, especially Palapa Ring project. When I was doing the analysis, I asked myself multiple times, "*When do I have to stop exploring*?" (i.e. to what extent should the case be discussed) and "*What's the point of this?*" (i.e. concluding the discussion). There are a lot more issues unaddressed, themes unexplored—this study has limitations and it is calling for further researches, further assessments. Nevertheless, my hope is for us all to contribute. After knowing the impacts, we can start doing something: to campaign for technology and media literacy, to help SMEs utilize broadband, to introduce technology to underprivileged groups, to protect online freedom of expression. To solve problems, to improve people's life.

Appendices

Appendix 1 Initial Expected Impacts

Pillars	Themes	Impacts	Explanation	Source	Category
Productivity	Health	Positive effect to health	E-health, telemedicine, enhanced emergency system, remote diagnostic. But better if incorporated in national health plan or strategy	Hamel 2010	ICT
		Positive impact, using telemedicine too	Can be used in diagnosing & monitoring disease remotely case in Australia, India	Rampersad Troshani 2012, Qiang et al 2009	Broadband
	Education	Believed to be able to enhancement of learning, but data to support the belief is still limited		Hamel 2010, from infoDev 2005	ICT
		Positive impact	Through benefit of synchronous education at home, quality of teaching material, access of education	Rampersad Troshani 2012	Broadband
		Negative impacts: above average use of computers & internet at home & at school		Hamel 2010, from Fuchs & Woessmann 2004	Internet
	Skill-building				
	Income/Prod general	Increased productivity & income	through more effective/productive way of working & decreased time for non-work obligation (eg bill payment),, and also make people better informed >> ultimately leading to a faster career path	Ericsson 2013	Broadband
	Well-being	More consumer benefit	distant communication, increased media quality, time saving, reduced costs, more access like online job sites	Ericsson 2013	Broadband
	Supporting tech				
	Income/Prod general	Productivity paradox		Hamel 2010	ICT
		General positive impacts	Positive correlation: internet access to entrepreneurship, business development, & consequently incomes of the poor	Hamel 2010 from Forestier et al 2002	Internet

		Broadband: stimulate productivity growth		Hamel 2010 from LECG 2009	Broadband
		Raise rural income	Through e-choupal		ICT
		Increase in economy & income level	Through good national policy	Hamel 2010	ICT
		Increased agricultural productivity	Through increase in information resources, through a specific project/business model (LifeLines India, e-Choupal model)	Hamel 2010	ICT
		Increased productivity in firms	From dial-up to 1mbps broadband	Ericsson 2013	Broadband
Equality	Inequality by gender	Gender matters for broadband access		Tollbert & Mossberger 2006	Broadband
	Inequality by ethnicity	There are disparities of broadband access by ethnicity		Tollbert & Mossberger 2006	Broadband
	Inequality by social class	There are disparities of broadband access by income		Tollbert & Mossberger 2006	Broadband
	Inequalities among geographical areas	Rural residents are less likely to have broadband access	not linked to inequality in general, but it should be investigated whether this will make any difference	Tollbert & Mossberger 2006	Broadband
Sustainability	Environmental sustainability	More energy uses → more CO2 emission		Hamel 2010, Ericsson 2013	Broadband
		More ICT waste		Hamel 2010, Ericsson 2013	Broadband
		Dematerialization	video conference, less paper, work from home: is this applicable?	Ericsson 2013	Broadband
		New types of computer & work service	E.g. smart electricity grid	Ericsson 2013	Broadband
		Child pornography	Censorship & regulation	Hamel 2010	Internet

	Community well-being	Terrorism		Hamel 2010	Internet
		Improved community participation	list community event in website, migrants not socially excluded	Rampersad Troshani 2012	Broadband
Empowerment	Political freedom & engagement	ability to be active participant in social & political level	Increase opportunity through online networks	Hamel 2010	Internet
	Accountability	increase transparency	Through e-gov	Hamel 2010	Internet
	Civil liberties				
	Awareness of rights				
	Empowerment in general	People's sense of empowerment		Hamel 2010	ICT
		Enhance ability to promote change	create channel of communication		ICT

Appendix 2 Actors & Stakeholder Analysis

The table below provides the analysis of actors and stakeholders.

Classification	Actor/Stakeholder	Abbreviation / Nickname	Involvement	Interest	Objective	Perception	Resources	RI	R	Dp	C	Dd	OS
Central government	**Ministry of National Development Planning**	Bappenas	Indonesia Broadband Plan	National development	Good policy and policy implementation on country's development	There is a gap of development across region, one of them being west – east development. There's a mandate from MP3EI to conduct broadband development in Indonesia. Broadband is needed as economic & social development	Authority to plan all development-related projects	Y	NR		C	D	S
	Ministry of Communication & Information Tech	Kominfo	Historical PR, Indonesia Broadband Plan	Provision of telecommunication infrastructure	Developed and evenly spread telecommunication infrastructure	National backbone network is needed to unify Indonesia and bridge digital divide	Authority to conduct telco/broadband projects	Y	NR	H	C	D	S
	The Center of Telecommunication Financing & Provision	BP3TI	PR Western, Central, Eastern Package	Provision of telecommunication infrastructure in underdeveloped area (USO fund)	Implemented USO related projects	USO-related projects need to be managed & conducted	Authority to manage USO-related projects	N	R	L	NC	D	S
	National ICT Council	Wantiknas	Indonesia Broadband Plan	ICT (infrastructure, application, & content) development	Good policy and policy implementation on ICT related policies	ICT related projects in Indonesia need to be conducted well	Network of telecommunication professionals Knowledge of IT industry	Y	R	M	NC	D	S

						Policy needs to be effective							
	Coordinating Ministry of Economic Affairs	CMEA	Indonesia Broadband Plan	Coordination of inter-ministry projects	Good coordination of inter-ministry projects	Broadband policy needs to be coordinated inter-ministry, especially when it will involve a lot of other ministries	Authority? >> coordination of regulation aspect	N	R	L	NC	ND	S
	Ministry of Finance	MoF	Historical PR	Economic growth	Sustained economic growth	Infrastructure projects needs to be financially healthy Broadband is needed to support the country's economy	Authority to approve budget	Y	NR	H	C	ND	S
	Ministry of Public Works	MPW	Interdependent project / prerequisite	Public infrastructure	Good public infrastructure		Authority & resources to conduct civil works infrastructure projects	Y	NR	H	C	ND	S
	Ministry of Health		Indonesia Broadband Plan: mentioned for broadband utilization	(Public) Health	Good health sector Broadband can help health sector	Broadband is needed for advanced healthcare services	Authority & resources to conduct health related programs/projects	Y	NR	H	C	ND	S
	Ministry of Education			Education	Good education sector Broadband can help education sector	Broadband is needed for better education services	Idem					ND	S
	Minsitry of Trade			Trade	Good trade climate Broadband can help trade-related sector	Broadband is needed for better trade	Idem					ND	S

	Ministry of Manpower and Transmigration			Manpower, Transmigration	Good manpower and transmigration sector Broadband can help manpower & transmigration sector	Idem	Idem					ND	S
	Ministry of Agriculture			Agriculture	Good agriculture sector Broadband can help agriculture sector	Idem	Idem					ND	S
	Ministry of Industry			Industry	Good industry sector Broadband can help industry sector	Idem	Idem					ND	S
Local Government	**Province of West Nusa Tenggara**		Telkom MKCS	Local/regional development	Broadband can improve local/regional development	There is inequality in development The presence of broadband hopefully can improve the local economy	Authority to permit projects in their area Local government organizations that can be broadband users	Y	NR	H	Y	ND	S
	Province of East Nusa Tenggara		Telkom MKCS, PR Eastern Package	Local/regional development	Broadband can improve local/regional development	idem	Idem						S
	Province of North Sulawesi		Telkom SMPCS, PR Central Package	Local/regional development	Broadband can improve local/regional development								S
	Province of Maluku		Telkom SMPCS, PR Eastern Package	Local/regional development	Broadband can improve local/regional development								S
	Province of North Maluku		Telkom SMPCS, PR Central Package	Local/regional development	Broadband can improve local/regional development								S

	Province of Southeast Sulawesi		Telkom SMPCS, PR Central Package	Local/regional development	Broadband can improve local/regional development								S
	Province of West Papua		Telkom SMPCS, PR Eastern Package	Local/regional development	Broadband can improve local/regional development								S
	Province of Papua		Telkom SMPCS, PR Eastern Package	Local/regional development	Broadband can improve local/regional development								
	Province of Riau		PR Western Package	Local/regional development	Broadband can improve local/regional development								
	Province of East Kalimantan		PR Central Package	Local/regional development	Broadband can improve local/regional development								
	Province of Central Sulawesi		PR Central Package	Local/regional development	Broadband can improve local/regional development								
Companies	**PT Telekomunikasi Indonesia**	Telkom	Telkom MKCS, Telkom SMPCS	Profit, company sustainability	Return on Investment on broadband projects, high profit, wide coverage in Indonesia	There are a lot of potential market in the underdeveloped area, because no one doesn't want to build there. Solution: build it themselves with their money except the area that is not profitable	Fund and expertise to conduct broadband projects and last mile implementations Subsidiary who can create the demand	y	NR	H	C	D	S
	Moratel Ketrosden Consortium		PR Western Package	Profit, company sustainability	Return on Investment on broadband	It is not profitable to invest in	Fund and expertise to conduct	Y	R	M	NC	D?	S?

					projects, high profit	underdeveloped area unless it is a government project	broadband projects						
	Pandawa Consortium		PR Central Package	Profit, company sustainability	Return on Investment on broadband projects, high profit	It is not profitable to invest in underdeveloped area unless it is a government project	Fund and technical resource to conduct broadband projects	Y	R	M	NC	D?	
	Smartfren Consortium		PR Eastern Package	Profit, company sustainability	Return on Investment on broadband projects, high profit	It is not profitable to invest in underdeveloped area unless it is a government project	Fund and technical resource to conduct broadband projects	Y	R	M	NC	D?	
	Other operators and internet service providers		PR utilization	Profit, company sustainability	High profit, good backbone and backhaul infrastructure		Technical resource to conduct last mile implementation of broadband	Y	R	M	NC	D later	S
	State Electricity Company	PLN	Interdependent project / prerequisite	Domestic electricity supply	Providing electricity supply where it's needed	There are a lot of regions with no good supply of internet and PLN is required to supply electricity there	Technical resource to provide electricity supply	Y	R	M	NC	ND	??
Central Non-Governmental Organization	**Indonesian Telematics Society**	Mastel	Indonesia Broadband Plan	ICT development & utilization	Fully utilized broadband	There is a digital divide in Indonesia, not only in underdeveloped area, and gov't measures need to be done Indonesia have a low tech literacy society *because*	Network of telecommunication professionals Knowledge of IT industry	Y	R	L	NC	D	S

						tech is a new thing and education level is low and							
	Indonesian Chamber of Commerce	CoC	Indonesia Broadband Plan	Further the interest of businesses	Broadband is utilized by businesses	Broadband as a tool to expand business should be available and affordable	Network of business professionals	Y	R	L	NC	D	S
	ICT related civil society organizations		PR utilization: educating people & expert	ICT development & utilization	Last-mile beneficial & mature utilization of broadband	There is a digital divide in Indonesia, not only in underdeveloped area, and gov't measures need to be done Indonesia have a low-tech literacy society	Knowledge of Indonesian ICT condition ICT expertise				NC	D	S
	Indonesian Infrastructure Guarantee Fund	IIGF	PR Western, Central, Eastern Package	Infrastructure project funding	Healthy financing in broadband projects						NC	ND	S
Organized / non-organized local interests	**Local residents and organizations**		Last mile utilization	Good infrastructure from the government, good livelihood, good living standard	Affordable and high-quality broadband	Internet isn't present in their area because…. Solution: gov't?	Demand for broadband internet				NC	D/ND	S
	Local business / Small & Medium Enterprises		Last mile utilization	Profits, sustainable business	Affordable and high-quality broadband	Good/cheap internet isn't present in their area because… Solution: gov't?	Demand for broadband internet				NC	D/ND	S
	Local university		Last mile utilization	Educating local students, beneficial technology for society	Affordable and high-quality broadband Last-mile beneficial & mature	The unavailability of good broadband cause the university to….. It is because the	Demand for broadband internet Knowledge / expertise to education				NC	D	S

					utilization of broadband	region is underdeveloped. Solution: gov't?	Human capital Research facilities						
	Local public service offices		Last mile utilization	Good service	Affordable and high quality broadband	The unavailability of good broadband cause the university to….. It is because the region is underdeveloped. Solution: gov't?	Demand for broadband internet				NC	D	S

Legend

RI Resource Importance

R Replaceability

Dp Dependency

C Critical/Non critical Actor

Dd Dedicated/Non Dedicated Actor

OS Objective similarity

Appendix 3 Interview Questions

Area	Sub-area	Question
Implementation	Policy	Is there any issue regarding broadband pricing?
		How is the penetration of broadband planned?
		Is there any issue regarding other broadband-related policy?
	Technology	Will the technology used maximize the potential of broadband positive impact?
	Readiness	Is there any electricity availability issue there?
	Stakeholder	To what degree is the stakeholders & the users engaged in the implementation?
	Others	Is there any other issue?
Previous implementation		What are the improvement of human development that can be observed in the previous implementation?
		• What are the improvement in productivity, and through what way is that achieved?
		• What are the improvement in equality, and through what way is that achieved?
		• What are the improvement in sustainability, and through what way is that achieved?
		• What are the improvement in empowerment, and through what way is that achieved?
Papua Condition		What are the specific condition of this area (Papua) that should be taken into account while assessing the HD impacts?
		• Will gender inequality have roles on this?
		• Will its high HIV rates have roles on this?
		• Will its high maternal & infant mortality rates have a role on this?
		• Will its political issue of separatism have a role on this?
		• Will a specific industry have a role on this?
		• What is the current condition of Papua's internet?
		• What is the majority of occupation in the urban & rural life?
		• Is there any limitations for the people from reaping the benefit of broadband?
Productivity	Health	Will broadband improve or decrease health condition in the area?
		• Is there any accompanying program after the implementation of broadband?
		• Will the implementation of broadband in hospitals likely to have any impact?
	Education	Will broadband improve or decrease education in the area?
		• Will it enhance student's ability to learn in school?
		• Will students' access to the broadband outside school harm their school performance?

Area	Sub-area	Question
		• Will it improve teacher education?
		• Is there any accompanying program after the implementation of broadband?
		• Will it improve access to education in general?
	Income	Will broadband improve or decrease income in the area?
		• Will it create or kill jobs?
		• Will it creates efficiency in people's life, or vice versa?
		• Will it make looking for jobs easier or vice versa?
		• Will it stimulate entrepreneurship & business development?
		• Will it increase agricultural & other firms productivity?
	Individual well-being	Will broadband have any impact on individual well-being?
	Others	
Equality	Inequality by gender	Will broadband increase or decrease inequality by gender?
	Inequality by ethnicity	Will broadband increase or decrease inequality by ethnicity?
	Inequality by social class	Will broadband increase or decrease inequality by social class?
	Inequalities among geographical areas	Will broadband increase or decrease inequality among geographic region??
	Others	Will there be a digital divide caused by this implementation?
Sustainability	Environmental sustainability	Will broadband improve or decrease environmental sustainability in the area?
		• Will broadband lead to more energy consumption, hence more CO2 emission?
		• Will broadband contribute to more ICT waste in the area?
		• Will broadband lead to dematerialization in the area?
		• Will broadband lead to more product and service that is beneficial for environmental sustainability?
		Is the community ready to tackle the negative effects of internet?

Area	Sub-area	Question
	Community well-being	• What are the possible negative effects following the broadband to the community?
		• Will there be issues on child pornography?
		• Will there be issues on terrorism?
		What are the possible positive effect of the broadband to the community?
		• Will there be improved community participation?
		• Will people's leisure improving?
Empowerment	Political Freedom & Engagement	Will broadband stimulate political freedom and engagement, or vice versa?
		• Through what way will political freedom and engagement be achieved?
		• Will broadband serve as the channel of communication for political freedom & engagement?
		• Is there any possibility of increased separatism?
	Accountability	Will broadband stimulate transparency by the government?
		• Through what way will transparency be achieved?
	Empowerment - others	Will broadband stimulate people's sense of empowerment?
		What other themes of empowerment will broadband have any impact on?

Appendix 4 Interview List

No/Code	Organization	Org. Role	Interviewee	Position	Date of interview
Interview 1	Indonesian Telematics Society (Mastel)	Participate in IBP planning	Eddy Thoyib	Executive Director	8 August 2016
Interview 2	Ministry of National Development Planning (Bappenas)	Create Indonesian Broadband Plan (IBP)	Rizki Sammyho Putera	Staff of Sub Directorate of Post, Telecommunication, and Informatics	8 September 2016
Interview 3	Kitong Bisa (Papua NGO on Education)	User, provide education for schoolchildren	Mulyadi Angga, Billy Mambrasar, Temmy, & team	Founder & staffs	13 September 2016
Interview 4	Relawan TIK Papua (ICT Volunteer)	User, conduct ICT-related projects & educate society on ICT	M. Mihram	Papua Coordinator	19 September 2016
Interview 5	Ministry of Communication and Informatics (Kominfo)	Initiate, plan, and implement broadband development/Palapa Ring	Marvels Parsaoran Situmorang	Head of Sub Directorate of Broadband Telecommunication Infrastructure	20 September 2016
Interview 6	West Nusa Tenggara/NTB Provincial Government - Agency of Transportation, Communication, and Informatics (Dishubkominfo NTB)	Users, regulatory function in its region, authority to permit project in its region	Lalu Arry Tri Laksono Harlan	Staff of Public Information and Documentation	23 September 2016, 26 September 2016
Interview 7	West Papua Provincial Government – Agency of Transportation, Communication, and Informatics (Dishubkominfo Papua Barat)	Users, regulatory function in its region, authority to permit project in its region	Indra Sulistyawan	Section Head of Telecommunication Facilities and Infrastructure	28 September 2016

No/Code	Organization	Org. Role	Interviewee	Position	Date of interview
Interview 8	Kampung Media (West Nusa Tenggara NGO on Citizen Journalism)	User, provide platform for citizen journalism	Fairuz Abadi	Head of Kampung Media	30 September 2016
Interview 9	ICT Watch (National NGO in ICT)	Conduct programs in internet safety, internet rights, internet governance, and digital literacy nationwide	Heru Tjatur	Board of Management	4 October 2016
Interview 10	National Information and Communication Technology Council (Wantiknas)	Monitoring & Evaluation of the Indonesia Broadband Plan	Gerry Firmansyah	Head of Wantiknas Secretariat Team	5 October 2016
Interview 11	Universitas Papua (local university)	User, provide education in the area	Fridolin F. Paiki	Head of Computer Center/IT Dept	9 October 2016
Interview 12	PT Telekomunikasi Indonesia (Telkom)	Implement Palapa Ring phase 1 (Nusa Tenggara & Sulawesi-Maluku-Papua) with their own resource	Erna Widayati	Manager War Room (Business Strategy) West Nusa Tenggara	11 October 2016

Glossary

Citizen journalism	The reporting of news events by members of the public using the Internet to spread the information
Dematerialization	Reducing the amount of material required for a product or process, for example converting paper to digital or electronic form
Distance learning	A method of studying in which lectures are broadcast or lessons are conducted by correspondence, without the student needing to attend a school or college
E-commerce	The buying and selling of goods and services, or the transmitting of funds or data, over an electronic network, primarily the internet
E-education	Education (system) assisted by computer technology
E-government	the provision of government information and services by means of the internet and other computer resources
E-health	The use of information and communication technologies for health
E-learning	Learning utilizing electronic technologies to access educational curriculum outside of a traditional classroom
E-literate	Being competent in the use of information technology
E-procurement	The use of the internet or a company's intranet to procure goods and services used in the conduct of business
E-waste	Any refuse created by discarded electronic devices and components as well as substances involved in their manufacture or use
Green ICT	Reducing the negative impact of ICT on the environment
Open government	A government with high levels of transparency and mechanisms for public scrutiny and oversight in place, with an emphasis on government accountability
Online marketplace	A type of e-commerce site where product or service information is provided by multiple third parties, whereas transactions are processed by the marketplace operator
Sharing economy	An economic model in which individuals are able to borrow or rent assets owned by someone else
Sociopreneur	Social entrepreneur; an enterprising individual that starts a venture not merely for profits but for inclusion of the communities that so far have been left out of the main stream
Telecommuting	Working at home by using a computer terminal electronically linked to one's place of employment
Telecomputing	The process of sending information to or receiving information from another computer using the Internet, a modem, or a local area network
Telemedicine	Remote delivery of healthcare services, such as health assessments or consultations, over the telecommunications infrastructure

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