Assessing the probability of private sector involvement in climate adaptation in developing countries

Karen Meijer
Maaike van Aalst
Deltares
P.O. Box 177
2600 MH Delft
The Netherlands
Karen.meijer@deltares.nl

Aleksandra Dobreva
Erasmus University Rotterdam
The Netherlands

ABSTRACT

The large investments required to adapt to climate change in developing countries ask for the involvement of the private sector. For the private sector to participate in infrastructural projects, there needs to be clarity about, amongst others, how and when returns on investments are made and who carries the risks. This may vary by types of infrastructural measure and country's institutional setting. The project Water2Invest under the European Climate-KIC (Knowledge Innovation Communities) programme develops an internet-based tool to support these types of decisions by showing both the effectiveness of supply-increasing or demand-reducing measures under various scenarios and by providing insight in financing possibilities in different institutional settings. To support the latter, this paper introduces a qualitative model of factors influencing the probability of private finance for climate adaptation, as a first step in understanding financial feasibility of infrastructural measures in developing countries.

INTRODUCTION

To combat the consequences of climate change it is expected that large infrastructural investments are needed in the coming century. The World Bank assessment of adaptation costs in developing countries (2010) estimates required investments between 2010 and 2050 in the range of USD 70 to 100 billion annually. Although these are large amounts, they are only a fraction compared to the potential damage costs if the investment needs are not met. According to estimates, global adaptation costs comprise only around 7-10% of the global total cost of potential climate change damage (Tol, Frankhauser and Smith, 1998). Thus, the rationale for investing in adaptation seems evident, however in reality there has been an apparent lack of action in this areas. The technical, financial and institutional characteristics of low- and middle-income countries define a relatively low capacity to adapt (Bouwer & Aerts, 2006), implying higher costs of infrastructure development in comparison with more developed regions. A limited amount of adaptation funding provided

internationally needs to be distributed among a myriad of countries; and even though poor regions suffer most from severe climate, budget constraints generally result in too little investment (Briscoe, 1999b). The current responses to the investment needs will to a large part determine the future vulnerability and resilience of urban and rural communities in developing nations. Their high dependency on agriculture and the natural environment, combined with deficiencies in infrastructure and limited access to financial and technological resources make them especially vulnerable to the effects of natural disasters (Muller, 2007).

Currently, in most developing countries, public finance is still the most important source for funding physical adaptation measures (Bouwer & Aerts, 2006). About 50% of all government spending in these countries is invested in new and rehabilitated infrastructure (Briscoe, 1999a). Such investments amount to approximately $250 billion a year (water-related infrastructure accounts for 15%), the majority of which (90%) is derived from government tax revenues or through government intermediation (World Bank, 1994 – from Briscoe, 1999a). Due to severe budgetary constraints, low- and middle-income countries are also dependent on the availability of (and access to) international climate-adaptation funds. Existing international funding to support adaptation needs of developing countries comes from two main sources – through the United Nations Framework Convention on Climate Change (UNFCCC) and through bilateral official development assistance (ODA) (Ayers, 2009). Another important multilateral source is the Global Environment Facility (GEF), which is managed by three implementing agencies, namely United Nations Development Programme (UNDP), United Nations Environmental Programme (UNEP) and the World Bank (Zhang and Maruyama, 2001).

Recognising the required investments and the reduced availability of public funds, the UNFCCC (2008) promotes the involvement of the private sector to close the investment gap. At the same time, attaining private financing may be difficult given project characteristics such as capital-intensive, unique, delayed and dispersed benefits and limited autonomous earning power (Gleijm & Gerdes, 2012). While private firms are concerned with making money through the delivery of public services, governments are concerned with saving money through private sector participation (IMF, 2006). As outlined above, governments in developing countries have been generally unsuccessful in independent provision of vitally important infrastructure. Private firms, on the other hand, are rather unreliable in building and delivering public infrastructures independently. Thus, identifying mutually beneficial public-private partnership arrangements is potentially very important for the construction and maintenance of climate-adaptation (water-related) projects. On the other hand, the task is also highly challenging since PPPs rarely provide an ‘easy fix’ for underinvestment in certain areas. And even though during the 90s PPPs have become popular in developing countries, since 2000 public and private parties’ enthusiasm for PPPs in the water sector has decreased substantially (Van Tulder and Van der Zwart, 2006). The political, institutional and legal setting in countries determine not only risks related to the investment itself, but also the capacity of the government to set up and supervise a public-private partnership.

The project Water2Invest,[1] under the European Climate-KIC (Knowledge Innovation Community) program develops an internet-based tool to provide insight in required investments to reduce water scarcity problems that can result from both climate change and socio-economic developments. A hydrological model (PCRGLOB-WB) and a water allocation model (WatCAM) are used to compute water demand and availability for various future conditions for the global scale at the resolution of 'water provinces'. Water provinces are created as intersection of countries and river basins. Subsequently the impact of alternative measures in reducing water scarcity as well as their costs and environmental impacts are assessed. As part of the this project, we analyze what factors affect the availability of financial resources for climate change adaptation, with specific attention for the role of private sector involvement. This information will be used to indicate, for different types of adaptation measures, whether the measure is financially feasible in a certain country.

When adaptation measures are found to be economically sound, this is not yet a guarantee that the financial means are available to implement the measures. Recognizing the gap that exists between required and available finance, the UNFCCC promotes the involvement of private sector parties (UNFCCC, 2008). Private sector involvement to achieve public goals will in many situations mean that some type of public-private partnership is required. This paper looks into the probability of that a public-private partnership can be used to implement adaptation measures in different countries. This probability is the result of 1) the need felt by the public sector to involve private sector parties, 2) the attractiveness of the required measures for the private sector and 3) the capability of the government to handle public-private partnerships (see Figure 1). The attractiveness for the private sector is represented by 'Return on Investment', we do not take into account that the private sector may be willing to invest in non-profitable projects if this gives them a higher chance for larger profits in a later stage. We analyse what factors affect these three elements and what this means for public-private partnerships for climate change adaptation in different countries.

Subsequent sections will provide an initial elaboration of the three sub-sections, after which their interlinkages are discussed. We end the paper with plans to further elaborate and substantiate the model.

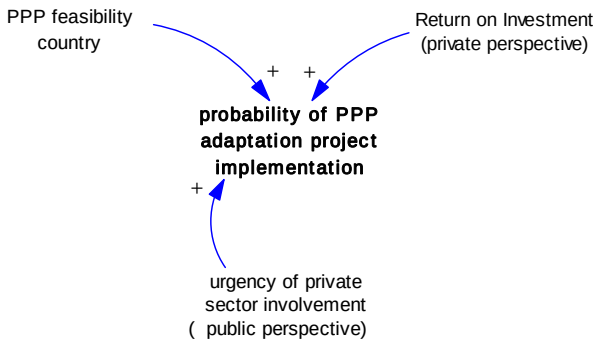

Figure 1. Three elements that determine the probability of implementation of climate change adaptation projects through public-private partnerships

[1] Water2Invest is carried out by a consortium led by the University of Utrecht, The Netherlands. Besides Deltares, partners in this consortium are Future Water, The Netherlands, Imperial College London, UK,

PUBLIC SECTOR PERSPECTIVE: URGENCY OF PRIVATE SECTOR INVOLVEMENTS

There are several goals the public sector may want to achieve with private sector involvement. The private sector may have more experience, means and capacity to efficiently and effectively carry out certain activities. This can be achieved through procurement of services, directly paid by government. A public-private partnership generally involves more than this and consist of longer term contracts in which it is often the case that the private partner provides (part of) the financial resources. The actual funding is then received either from government upon service delivery or directly from end users. When governments lack the funds to make investments in the short term it is attractive to set up a public-private partnership. For the financing of climate adaptation in developing countries we assume the provision of capital the main reason to involve the private sector when they perceive a public investment gap, while efficiency gains provide an additional benefit. The urgency of private financing is then determined by the both the public investment gap and the efficiency gains that can be achieve through a public-private partnership (Figure 2).

The public investment gap is the result of the local availability of public financial resources and the need to make public investments, which are in themselves considered to be economically sound. This economical soundness follows from the cost of adaptation measures and the expected prevention of economic impacts that would have otherwise been the result of increased water scarcity (water gap).

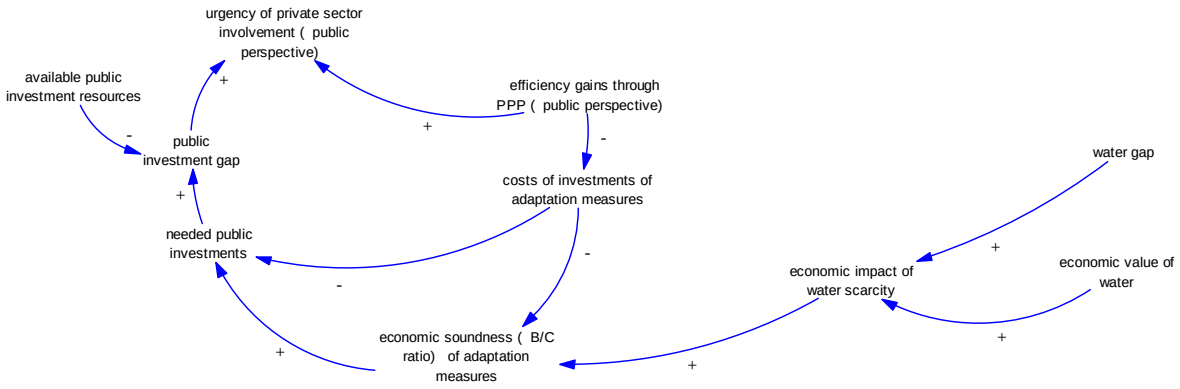

Figure 2. Factors affecting the urgency to obtain private sector involvement

In the Water2Invest project, the need for climate adaptation finance is assessed taking into account both climate change and socio-economic developments. The focus in the project is on water shortages, but similar analyses could be made for floods. Due to reduced precipitation and increased evaporation actual volumes of water available can decrease, while a change in availability of the year can exacerbate water shortage problems for various users. The main water user is agriculture, but supply of water for domestic and industrial use are considered as well. Whether a reduced or altered availability of water will cause problems, depends on future water requirements. Population growth, land use and crop change and increased water use efficiency will affect water demands, and hence the actual occurrence of water shortage.

PRIVATE SECTOR PERSPECTIVE: RETURN ON INVESTMENT

The private sector will be interested to be involved if revenues that can be generated are certain and can be realized within a certain time horizon. The factors that influence whether there will be a return on investments can be grouped into five categories (See Figure 3).

1. Risk that no payment is received for service

Depending on the type of measure and contract, payments for the service can come from individuals or government. If from individuals, it may be the case that benefits are dispersed over many individuals, which increases the risk that the private party will not be fully paid back to cover investments. On the other hand, if it is government who pays for the service upon delivery, financial risks may result in the situation of an instable government and delayed benefits. International guarantees can play a role in reducing this so-called sovereignty risk.

2. Possibilities for additional service provision

If measures include the possibility to not only construct but also to provide services, for example through operation and maintenance, for a longer period of the time, this increases the attractiveness for the private sector. The same is the case when the measure is not only meant to take reduce impacts resulting from climate change, but can provide additional benefits, such as hydropower generation.

3. Risk that service has to be delivered against lower prices

The business environment in a country has an influence on the attractiveness for the private sector as well. Although this factor needs to be further operationalized it represent the ease with which transactions can take place, required materials and human resources can be obtained. A good business environment may also mean more competition, which can present a risk for the private sector: if other service providers provide the same service they may make lower profits.

4. Risk that the service cannot be delivered or is not needed

Climate change and socio-economic developments are uncertain, and therefore the water gap which the investment intends to close is uncertain as well. If demands for water are lower than expected, there may be little demand for a service like additional water supply for irrigation. On the other hand, if the demand is there, but supply is hampered by upstream developments in the basin, there is a chance that agreed delivery cannot take place. Larger uncertainties therefore make it more difficult to design measures and increase the risk that a mismatch may result between supply and demand of the service.

5. Efficient service delivery

Investments are generally considered more efficient if they can be applied at a certain scale, or be repeated in other place in the future. The business environment plays a role here as well. If materials can be obtained easily, qualified labour is available, and competition keeps prices for hiring labour low, this may make reduce the costs of the delivery of the service.

If the climate adaptation measure itself is of limited commercial interest, the private sector may still be interested if involvement would help them obtain a positive image among the general public or if involvement provides opportunities for involvement in more lucrative projects in a later stage. We have left this factor out of our model in this stage.

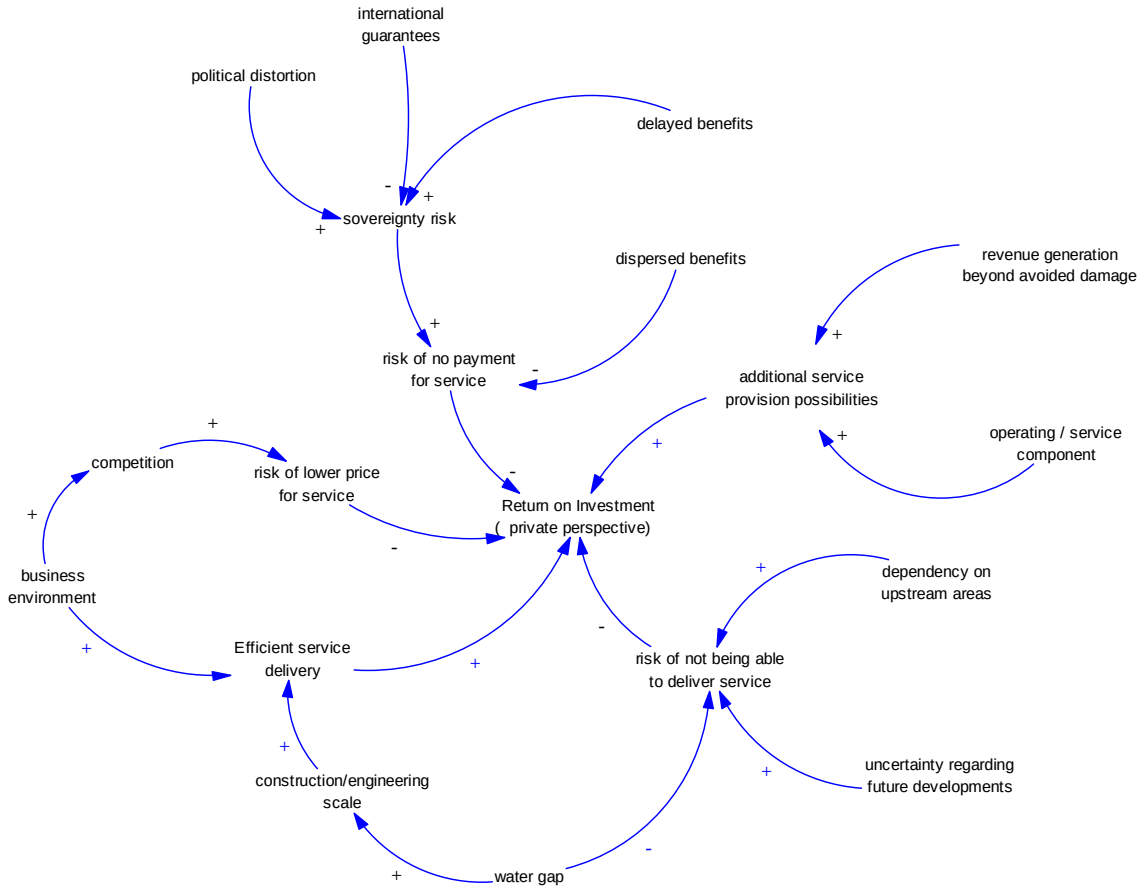

Figure 3. Factors affecting the Return on Investment

PUBLIC-PRIVATE PARTNERSHIP FEASIBILITY

Even with a need from the public side and an interest in a particular investment from the private side, it may not be feasible to set up a well-functioning public-private partnership in certain countries. The 2011 Infrascope report (Economist Intelligence Unit, 2011) assesses the readiness for public-private partnership in a wide range of countries using the following indicators: 1) legal and regulatory framework, 2) institutional framework, 3) operational maturity, 4) investment climate, and 5) financial facilities. We have covered the investment climate (as business environment) and financial elements under the private sector risks for not receiving return on investments. Operational capacity will depend on general government capacity and improve with every time a PPP is set up and carried out. Over time, this will also improve the legal and regulatory framework and reduce related risks. The institutional framework and related risks refer to the clarity regarding

responsibilities, accountability of government, and risk related to sudden policy changes. This influences both the feasibility of setting up a PPP and also influence the sovereignty risk. The urgency or private sector involvement influence the feasibility of PPP through an increased political will.

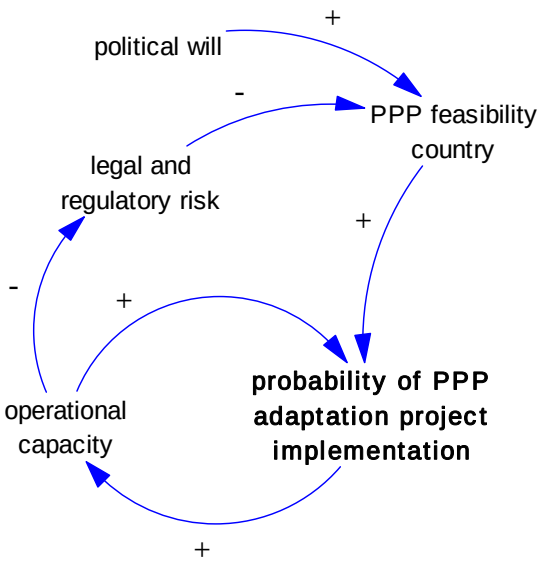

Figure 4. Factors affecting the public-private partnership feasibility

INTERACTION BETWEEN ELEMENTS

The main reason to develop a Causal Loop Diagram on the probability of public-private partnerships to implement climate adaptation in developing countries is that the literature seems to mainly provide lists of factors without paying attention to their interaction. Factors that increase the public sector interests in public-private partnerships may be the same factors that decrease the attractiveness for the private sector, such as competition. The three subsections of the model as discussed in the previous sections show very little feedbacks, the only feedback is found through experienced gained in setting up and supervising PPPs which increases the feasibility of future PPPs. The main feedbacks will result from actually implementing the PPPs. This is included in the model that combines the three subsections. PPPs when implemented are assumed to result in the efficiency gains, leading to an increased desire to have PPPs. If indeed all works out well it will lead to lower costs which reduces the need for public investments. However, since it also increases the economical feasibility of adaptation measures, this provide also a justification to invest more in public infrastructure and other measures. For now, without additional information, we assumed the reinforcing component to be stronger than the balancing component. Another reinforcing loop results when PPPs contribute to taking away risks of lower prices. It will depend on the type of contract how this is actually included. If this is the case it increases the return on investments and the interests in having the PPP. Figure 5 shows a simplified version of the complete model containing

only the loops and the interactions between the three subsections. The full Causal Loop Diagram is included in Annex A.

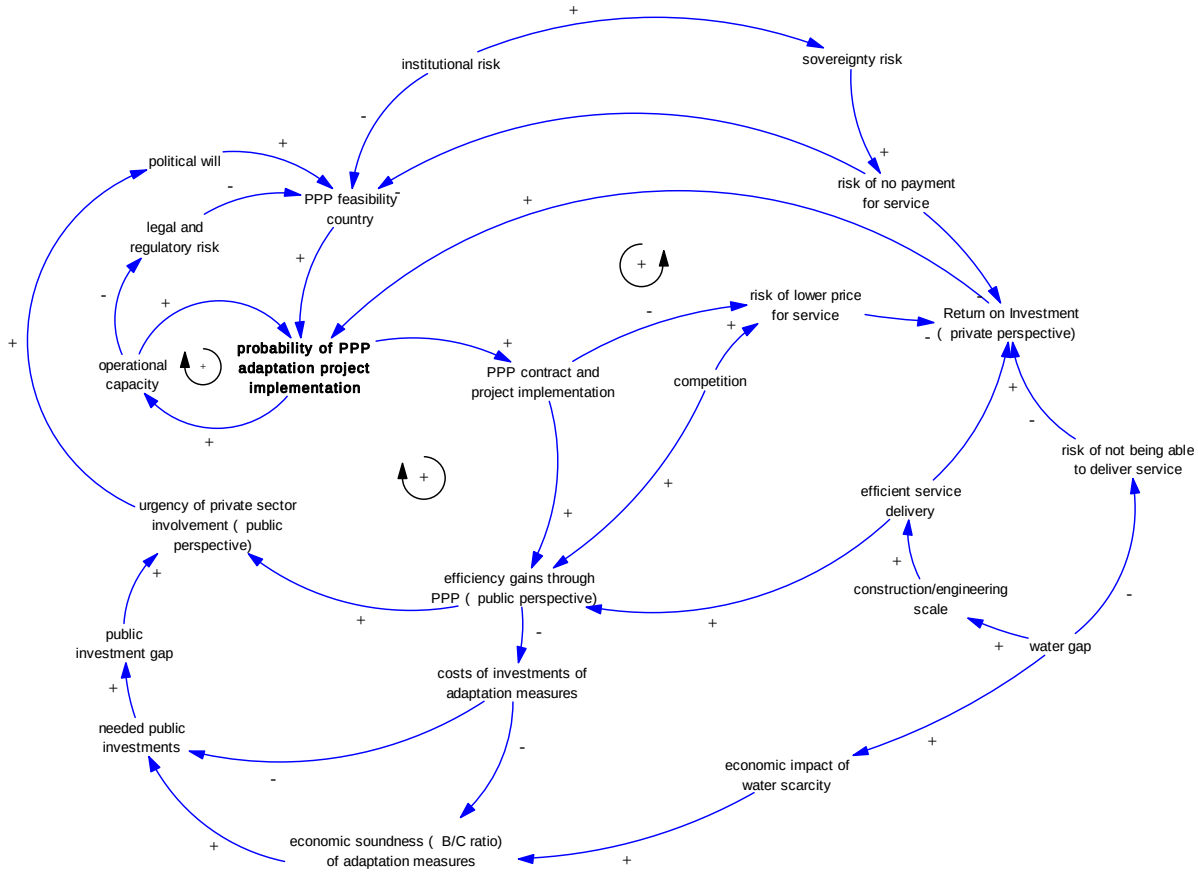

Figure 5. Simplified combined Causal Loop Diagram

INTENDED APPLICATION

The Water2Invest tool consists of a suite of connected models and tools, which can be run through a web-interface. Users can adjust parameters to make the model more representative of the setting in their countries. The global hydrological model 'PCRGLOW-WB' computes water availability for a number of climate scenarios. With the allocation model 'WatCAM' the gap between water availability and water demand are determined. A number of measures is subsequently considered to reduce this water gap in a cost-effective way. Output from these components of the combined modelling tool forms input into the financial component, of which the basis is presented in this paper.

In addition to information regarding the water gap to be closed, input into the financial component can be split into two types of factors: 1) those linked to the specific measure and 2) those linked to the specific country. For a selection of possible adaptation measures, the qualitative input values for the factors as included in the model are given in Table 1. For the country characteristics we will use

values as provided in global databases. Suggested sources and examples for three countries are presented in Table 2. Once the model relationships are further developed this input for a particular measure in a particular country, combined with the information on the water gap from the hydrological and water allocation model will result in a score for the probability of implementing climate adaptation through public-private partnerships.

Table 1. Measures and their scores for different factors

Factor / Measure	delayed benefits	technical project risk	revenue generation beyond avoided damage	construction / engineering scale (flexibility)	operating / service component
Expanding reservoir storage large scale	High	High	Yes	High	Yes
Expanding reservoir storage small scale	Medium	Medium	Yes	Medium	Yes
Reducing leakage	Low	Low	No	Low	Yes
Desalination using solar energy	High	High	No	High	Yes
Desalination using fossil fuel	High	High	No	High	Yes
Reuse domestic water	Low	Low	No	Low	Yes or no
Reuse industrial water	Medium	Medium	No	Low-medium	Yes
Reuse agriculture water	Low	Low	No	Low	Yes or no
Crop change	Low	Low	Yes	Low	No
Irrigation efficiency	Low	Low	No	Low	No
Household appliances	Low	Low	No	Low	No
Demand reduction through awareness	Low	Low	No	Low	No

Table 2. Sources for country scores for different factors

Factor	Source	China	Vietnam	Brazil
Legal and regulatory risk	Worldwide governance indicators1	High	Very high	Low
Institutional risk	Global Competitiveness Index2	High	Very high	Low
Business environment	Global Competitiveness Index2	Medium	Medium	Medium
Sovereign risk	Infrascope3	Low	Medium	Low
Political instability	Infrascope3	Medium	Medium	High

1 - World Bank (2012), 2 – World Economic Forum, 2012, 3 - Economist Intelligence Unit, 2011.

DIRECTIONS FOR FURTHER DEVELOPMENT

To better understand what factors affect the possibilities of developing countries to finance the measures required to adapt to climate change, we developed a qualitative model of the factors that affect the probability of public-private partnerships for the implementation of climate adaptation projects. The model consists of three subsections representing the interest in PPP's from both the public and private sides, and the country's institutional setting that enables the establishment and supervision of PPPs. This is a first step in our efforts to assess for a certain future situation whether implementation through private-sector involvement is probable.

The model is not yet complete and a number of factors currently included need to be better operationalized. In the coming year we will further elaborate the model, and use case study information to substantiate the relationships included. It will then become part of an internet-based tool to indicate the financial feasibility of climate change adaptation measures in different countries.

REFERENCES

Ayers, J., 2009. International Funding to Support Urban Adaptation to Climate Change. *Environment and Urbanization*, Vol. 21 (1), pp. 225-240

Briscoe, J., 1999a. The Financing of Hydropower, Irrigation and Water Supply Infrastructure in Developing Countries. *Water Resources Development*, Vol. 15 (4), pp. 459-491

Briscoe, J., 1999b. The Changing Face of Water Infrastructure Financing in Developing Countries. *Water Resources Development*, Vol. 15(3), pp. 301-308

Bouwer, L. and Aerts, J., 2006. Financing Climate Change Adaptation. *Disasters*, Vol. 30 (1), pp. 49-63

Economist Intelligence Unit, 2011. Evaluating the environment for public-private partnerships in Asia-Pacific. The 2011 Infrascope. Findings and methodology. The Economist and the Asian Development Bank.

Gleijm, A. and E. Gerdes, 2012. *Bridging the gap in water related climate adaptation projects*. The role of private initiative, Rebel Group.

IMF, 2006.

Muller, M., 2007. Adapting to Climate Change: Water Management for Urban Resilience. *Environment and Urbanization*, Vol. 19 (1), pp. 99-113

Tol R. J. S., Fankhauser S. and Smith J., 1998. The Scope for Adaptation to Climate Change: What Can We Learn from the Impact Literature? *Global Environmental Change*, Vol. 8 (2), pp. 109-123

UNFCCC, 2008. Investment and Financial Flows to Address Climate Change: an update.

Van Tulder, R. and Van der Zwart, A. ,2006. *International business-society management*. London: Routledge.

World Bank, 2010. The Costs of Developing Countries of Adapting to Climate Change. New Methods and Estimates. The Global Report of the Economics of Adaptation to Climate Change Study. Consultation Draft. Washington DC: The World Bank Group.

World Bank, 2012. Worldwide Governance Indicators. [online] Available at: http://info.worldbank.org/governance/wgi/index.asp [Accessed 16 August 2013].

World Economic Forum, 2012. The Global Competitiveness Report 2012-2013. Full Data Edition. Geneva: World Economic Forum.

Zhang, Z. and Maruyama, A., 2001. Towards a Private-Public Synergy in Financing Climate Change Mitigation Projects. *Energy Policy*, Vol. 29, pp. 1363-1378

Annex A. Full Causal Loop Diagram