Private Sector Involvement in Climate Adaptation

Studying the role and level of engagement of the private sector in public-private partnerships for food security in the global South and its justice implications

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01-07-2022

Sustainable Development – Master Thesis

Utrecht University

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Utrecht, July 1st 2022

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Acknowledgements

I have received a lot of encouragement and support from a variety of people while writing this master's thesis. First of all, I would like to extend my sincere thanks to my supervisor Prof. dr. Peter Driessen. He provided me with useful feedback, support and guidance during the process of writing this thesis, encouraging me to raise the standards of my research. Second, I would like to thank my second reader, Dr. Carole-Anne Sénit, for providing me with feedback on my research proposal, which allowed me to make most of this research.

Additionally, a special thanks to all the participants of the interviews, for making the time to meet with me and providing me with a lot of interesting information. Lastly, I would like to thank my friends and family for supporting me while writing this thesis and keeping me motivated.

Alessa F. Zoetbrood

Utrecht, July 1st 2022

Summary

Climate change poses an increasing risk to human and natural systems, and climate action is necessary to reduce these risks. The mobilisation of private sector investment and adaptation is needed but remains difficult. A strategy to encourage private sector engagement is through public-private partnerships. However, public-private partnerships are not always effective, and private sector engagement is sometimes still low in public-private partnerships. Furthermore, the desired higher private sector involvement could raise questions about the inclusiveness of vulnerable groups in these public-private partnerships. This research aims to investigate the role and level of engagement of the private sector, and its linked justice implications in public-private partnerships focused on food security adaptation in the global South. Stimulating and restrictive factors for the private sector to join the partnerships are additionally identified and used to explain the private sector involvement and justice implications. To do so, this research has conducted a case study analysis with four public-private partnerships concerned with agricultural adaptation in the global South. This research has conducted 15 interviews with case study actors, 4 expert interviews and a document analysis. An analytical framework has been applied to the case studies. This thesis shows that the private sector often plays a key role within the public-private partnerships and are responsible for the actual delivery of the program or project. Therefore, using public-private partnerships is an effective way to stimulate the private sector to help contribute to agricultural climate adaptation. Nonetheless, overall, the justice implications in the adaptation projects are mediocre, meaning that not all groups are included in the transition to a more climate-resilient future. No clear influence from the private sector involvement on the justice implications was found in this study. Nevertheless, the presence of an NGO and a smaller scale of a public-private partnership have been identified as a positive influence on the justice implications. These generated insights helped create a better understanding of the conditions that are necessary for reaching the vulnerable smallholders to increase their livelihoods. A one-size-fits-all approach is not effective for increasing the participation of the private sector, and also not for increasing the justice implications. A tailor-made approach to the specific context is needed to create a more effective and just transformation to a more climate-resilient future, which is needed to reduce the risks of climate change.

Keywords: Climate Adaptation, Public-Private Partnerships, Justice, Private Sector Involvement, Food Security and Agriculture

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1. Introduction

1.1 Private investments in climate adaptation

Human-caused climate change will put human and ecological systems at greater risk (Intergovernmental Panel on Climate Change [IPCC], 2014; Mitchell et al., 2006). However, these risks are allocated unequally, with disadvantaged communities and people facing higher risks (IPCC, 2014). Moreover, developing countries often have insufficient technological and financial means and governance structures to reduce the risks of climate change (Kalinowski, 2020). The Paris Agreement has acknowledged that adaptation is a global challenge and developing countries should receive more assistance in combating climate change and adaptation through mitigation, adaptation, finance, technology transfer and capacity building (United Nations Framework Convention on Climate Change [UNFCCC], 2015). However, there is still a shortage in adaptation measures, which can be called the adaptation gap (Buso & Stenger, 2018). The adaptation gap is the difference between the actual degree of adaptation achieved and a set goal, reflecting nationally determined needs related to climate change consequences, as well as resource constraints and conflicting priorities (Buso & Stenger, 2018). A key barrier to climate adaptation is the inability to finance adaptation (Agrawala et al., 2011).

Both the public and private sector are recognised as important in climate funding (IPCC, 2014; Nakhooda et al., 2014; Pauw, 2015). Moreover, given their responsibilities in scaling up adaptation of communities, households, and civil society, as well as managing risk information and finance, the private sector and local governments are increasingly acknowledged as important to progress in adaptation (IPCC, 2014). The private sector is considered essential because the amount of investment needed is greater than what can be expected from the public sector (United Nations Environmental Program [UNEP], 2011). This is supposedly insufficient to meet global adaptation needs because of limited available financial resources, especially in developing countries (Green Climate Fund, 2018). International private investments are therefore essential for the transition to a climate-resilient and low-carbon future (Patel, 2010; UNFCCC, 2015). The private sector has potential to contribute significantly to climate adaptation (Tall et al., 2021), and green investments in developing nations' real economies can be best mainstreamed by financial actors (Bowman & Minas, 2019). More specifically, the private sector has potential to contribute significantly to climate adaption through; 1) financing resilience-building and adaptation projects, 2) offering goods and services that make adaptation easier, such as expert advising to help identify climate risks and develop resilience, early warning systems, and technology and technical innovation, and 3) making climate-resilient adaptations to their own operations and assets, assuring business continuity, sustainability, and profitability (Tall et al., 2021). It is thus widely recognised that the private sector can play a significant role in climate adaptation.

However, mobilising private investment is difficult (Nakhooda et al., 2014). Especially adaptation projects generate little private investments, which can partly be explained because adaptation projects do not have a profitable business model for the private sector (Kalinowski, 2020). This is in contrast with mitigation efforts, which can often reduce costs in for example energy use (Biagini & Miller, 2013). Moreover, a company's capacity and ability to invest in adaptation action will be limited by a lack of suitable information and knowledge, insufficient resources, low levels of risk awareness, particularly indirect risks, and inadequate competence inside the company (Averchenkova et al., 2016). Adaptation as a goal is rarely pursued by the private sector. However, the private sector may occasionally contribute to adaptation without realizing it. Adaptation is thus a term that is more significant to policymakers than it is to the private sector (Pauw, 2015).

Existing literature has identified multiple strategies to increase private sector engagement, among which the strategy to encourage public-private partnerships (PPPs) (Biagini & Miller, 2013; Green Climate Fund, 2018). A PPP is defined by the Organisation for Economic Co-operation and Development (OECD) as “long term contractual arrangements between the government and a private

partner whereby the latter delivers and funds public services using a capital asset, sharing the associated risks" (OECD, 2012, p. 18). The government's service delivery goals are supposed to be aligned with the private partner's profit goals in a PPP agreement. The alignment's effectiveness is contingent on a sufficient and acceptable risk transfer to the private partners (OECD, 2012). Within PPPs, there is a range from partnerships mostly controlled by the private or public sector (Li & Akintoye, 2003). The private partner could be in charge of the design, construction, financing, operation, and administration of a capital asset needed for service delivery, as well as the supply of a service to the government or the general public using that asset. The private partner will either receive a stream of payments from the government for services performed or, at the very least, be able to charge end customers directly (OECD, 2012). The need for PPPs in climate action or adaptation has been recognised in various funds or organisations, such as the Green Climate Fund, World Bank, NAP Global Network and the European Union (European Commission, 2021; Green Climate Fund, 2018; Uzsoki, 2017; World Bank, 2021).

PPPs can be used to help increase private sector involvement in climate adaptation. Current barriers to private sector adaptation finance, such as the lack of a profitable business model or low levels of risk awareness, could be addressed by employing public finance to adjust the risk/return profile of adaptation projects and investments. PPPs have the ability to provide a beneficial framework for the public and private sectors to better coordinate and pool their financial and technological resources (World Bank, 2021). Moreover, PPPs can be utilized in climate adaptation to achieve an effective and equitable risk and reward distribution among public and private actors (Buso & Stenger, 2018). Therefore, by reducing the risk for the private sector through PPPs, private sector engagement in climate adaptation could be increased.

Despite the extensive use of PPPs, there are indications in existing literature that they are not always effective or successful (Beh, 2010; Harman et al., 2015; Johnston, 2010; Liu et al., 2013; Trangkanont & Charoenngam, 2014). PPPs might allow for broad participation of various groups, such as private and public sector, but also civil society. However, this does not ensure that the PPP always complies with its expected outcomes. Because of their endeavour to reconcile multiple and sometimes contradictory legitimacy notions among their audiences of diverse public and private entities, the legitimacy of partnerships is frequently contested (Lie, 2021). This problem was also identified by Schmidt (2013), who explained the concepts of input, output and throughput legitimacy. Input legitimacy can be considered as participation 'by the people', referring to the participation of all stakeholders involved. Output legitimacy can be understood as outcomes 'for the people', thus having a good and expected performance (Scharpf, 1999; Schmidt, 2013). Lastly, throughput legitimacy can be formulated as 'with the people', meaning that the PPP is transparent, accountable and efficacious (Schmidt, 2013). Thus, when a PPP allows for broad participation of all affected groups, it does not ensure that the PPP will achieve their desired outcomes, and that they are accountable or transparent.

More specifically focused on the private sector, one of the key reasons why PPPs fail is the lack of a solid business case and the ability to recover investments (Koppenjan, 2015). Furthermore, the private sector would have to expect more public accountability and accept public interest concerns (Linder, 1999), which could be discouraging for the private sector. Poulton & Macartney (2012) argued that the private sector has its own business objectives, and they will solely take part in a PPP when these objectives can be met. Another reason for the limited involvement of the private sector is that the benefits of being a lead partner in a partnership often do not exceed the disadvantages (Pattberg, 2010). More specifically, the research by Zhang et al. (2018) about a PPP focused on adaptation to drought in China showed that private sector engagement was still very limited. The private actors primarily served as conduits for the transfer of materials and information, and they had weak motivation and incentives to directly engage (Zhang et al., 2018). Moreover, the role of the domestic private sector in adaptation is poorly documented (Pauw & Pegels, 2013). The roles of the private sector are defined in this study as the specific tasks or activities that the private actors provide in a PPP. The level of engagement refers to

the number of tasks or roles the private sector has within the PPPs, and how much responsibility they carry for the fulfilment of these tasks. A more detailed operationalisation of the roles and level of engagement of the private sector is provided in chapter 2. Based on the research of Zhang et al. (2018) and Pauw & Pegels (2013), it can be questioned whether the use of PPPs increases the engagement of the private sector in climate adaptation sufficiently to fill the abovementioned adaptation gap, or if the private sector engagement still falls short. However, it should be recognized, as mentioned by Stoll et al. (2021, p. 1), that mobilizing private sector participation in adaptation is a means to an end, not an end in itself. The goal should be to effectively adapt society as a whole, including the most vulnerable groups and individuals.

1.2 Research scope: climate adaptation in the agricultural sector

This research focuses on the thematic adaptation area of agriculture and food security, as identified by the Green Climate Fund (n.d.). Changing weather patterns, resulting from climate change, may affect the demand across various sectors, amongst which agriculture (Druce et al., 2016). Food and water security go hand in hand in climate adaptation, because most agriculture in developing country is rainfed (Green Climate Fund, n.d.), and effective water management is important to adapt agri-food systems (Food and Agriculture Organisation of the United Nations [FAO], 2021). Water security was identified as one of the easiest adaptation entry points for the private actors, since they can react to already apparent climate consequences (Druce et al., 2016). The motivation from the private sector to help often originates from the desire to reduce immediate climate risks to daily operations, for example water scarcity affecting productivity of agricultural goods (Druce et al., 2016). Agricultural PPPs (agri-PPPs) are defined as a partnership that is formally established between public organisations and private actors, "designed to address sustainable agricultural development objectives, where the public benefits anticipated from the partnership are clearly defined, investment contributions and risk are shared, and active roles exist for all partners at various stages throughout the PPP project lifecycle" (FAO, 2016, p. 145). Since water and food security are identified as a relatively easy entry point for adaptation for businesses, it is relevant to investigate the exact role and level of engagement of the private sector in PPPs in this thematic area, in order to find whether the use of PPPs really influences the involvement of the private sector.

Various types of research have already been performed in the area of agri-PPPs (Boris et al., 2021; Bruni & Santucci, 2016; Gaffney et al., 2019; Nikolaevich et al., 2019; Obayelu, 2018; Senyolo et al., 2021), and is often focused on specific regions, specific cases, effectiveness for these agri-PPPs or on dissemination to smallholder farmers. The PPP model is according to Gaffney et al. (2019) successful in the agricultural sector, allowing agribusinesses to offer productivity and sustainability-improving technologies to small-scale farmers in low-income, developing countries. These technologies help alleviate smallholder's livelihoods and develop more climate-smart or drought-resistant seed varieties (Gaffney et al., 2019). Additionally, research by Obayelu (2018) focused on analysing whether PPPs are an effective strategy to reach sustainable and inclusive agri-business development in African countries. This research has found that a PPP is more effective when the private sector is more involved in the decision-making and the PPP (Obayelu, 2018). However, other research by Mutuku (2019) found the opposite outcome that more private engagement did not lead to more success or effective PPPs. There is thus still uncertainty whether more private actor engagement is beneficial for the effects of the PPP. Research executed by the FAO (2016) focused on the main roles that the private sector has in these agri-PPPs.

Furthermore, there is a prevailing focus on effective environmental protection, but not on simultaneously increasing justice (Kashwan et al., 2020). It was recognised in the Paris Agreement that adaptation actions should be country-driven and transparent, while taking into account vulnerable

groups and communities (UNFCCC, 2015). Adaptation should also include best available science and traditional and indigenous knowledge, with participation of the vulnerable groups (UNFCCC, 2015). This can be linked to the theory of justice, which concentrates on equity and the ways that injustice is created (Schlosberg & Collins, 2014). It can be defined as distributive, recognition and procedural justice (Burch et al., 2019; Kalfagianni et al., 2019; Schlosberg, 2007; Temper, 2019). However, existing literature indicates that PPPs have issues with themes such as transparency, accountability and stakeholder involvement (Harman et al., 2015). Moreover, it is debatable whether foreign private sector activity will reach least developed countries and the poorest segments of the population (Pauw & Pegels, 2013). The private sector is concerned with making profit out of their investments (Kalinowski, 2020). This could raise questions about the participation and recognition of vulnerable groups in PPPs for climate adaptation where the private sector plays a significant role. This was supported by the research of the FAO (2016), who found that within agri-PPPs there is only limited inclusion of smallholders. This was explained by the fact that to cut transaction costs, private partners may want to engage only with larger-scale farmers or integrate seed production into their own businesses (FAO, 2016), instead of including vulnerable smallholders. Nonetheless, research from Gaffney et al. (2019) mentioned that PPPs could be an effective tool to help vulnerable groups in developing countries. In the end, PPPs in developing-country agriculture are about alleviating poverty by bringing new technological possibilities to smallholders and other vulnerable social groups (Spielman et al., 2007). Uncertainty thus still prevails within existing literature whether PPPs actually reach the vulnerable smallholder groups or whether the focus on vulnerable smallholders is only limited.

Different actors are of importance when reaching the vulnerable smallholder groups in agricultural PPPs. The importance of small and local enterprises was emphasised, stating that adaptability is always context-specific (Intellecap, 2010). The local private sector is sometimes better able to respond to the needs of the vulnerable, poorest groups than NGOs or governmental agencies (Intellecap, 2010). Nevertheless, research by Yakubu et al. (2019) has found that NGOs often are able to help smallholder farmers with agricultural climate adaptation. Moreover, NGOs more often take into account gender vulnerabilities than other types of actors (Ford et al., 2015). The capacities of local private sector and NGOs to reach the most vulnerable or poorest groups are therefore still contested in existing literature.

To conclude, motivating the private sector is of importance for climate adaptation (IPCC, 2014; Nakhooda et al., 2014; Pauw, 2015; UNEP, 2011). However, encouraging them to participate is sometimes difficult (Averchenkova et al., 2016; Kalinowski, 2020; Nakhooda et al., 2014). PPPs can be a solution to increase the involvement of the private sector (Biagini & Miller, 2013; Green Climate Fund, 2018). However, their exact role and level of engagement in these PPPs remains unclear. Moreover, private sector engagement could raise questions about the justice implications these agri-PPPs have for the vulnerable groups, and a definite answer about the influence of different PPP constructions with private sector involvement on these justice implications has not been established in existing literature. This research therefore aims to fill these knowledge gaps.

1.3 Research aim and question

This research is twofold; first, it aims to contribute to the existing academic literature on climate change by providing insights on the role and level of engagement of the private sector in PPPs for climate adaptation. Moreover, it aims to study whether PPPs are a solution for increasing private sector engagement in adaptation by also identifying the stimulating and restrictive factors the private sector has faced to join the PPPs. This is relevant because PPPs are receiving increased attention as a strategy for climate adaptation. Secondly, this research aims to contribute to existing climate adaptation literature by explaining the effects of different PPP constructions, with more or less private sector engagement,

on the justice for the vulnerable groups. This research thus aims to extend upon the research of the FAO (2016), which explained the main roles of the private sector in agri-PPPs and shortly touched upon the inclusion of smallholder farmers in these PPP projects with private sector involvement. This is done by trying to find connections between the level of private sector engagement in the PPPs and the justice implications these PPPs have. This helps create a better understanding of what type of PPP models are most effective for targeting vulnerable smallholder groups. This research focuses on PPPs for climate adaptation in the global South, because these regions are affected more by climate change (IPCC, 2014) and have insufficient technological and financial means and governance structures to reduce the risks of climate change themselves (Kalinowski, 2020). The role of the private sector and justice implications are evaluated and explained through a framework that is elaborated in the theoretical background chapter. The unit of analysis of this research are public-private partnerships focused on food security adaptation in the global South, and this study investigated what the effects are of such a PPP construction with respect to private sector engagement and environmental justice for the most vulnerable groups. This study uses a case-study analysis to derive lessons about the influence of private sector engagement on the justice for the vulnerable groups, and concludes with recommendations for the involvement of the private sector in PPPs focused on food security adaptation. The research question is:

"What is the role and level of engagement of the private sector in public-private partnerships concerned with food security adaptation in the global South and what are the linked justice implications, and how can this be explained?

This research is guided by the following sub-questions:

1. What is the role and level of engagement of the private sector in the public-private partnerships?
2. What are the stimulating or restrictive factors that the private sector has experienced when joining the PPP?
3. What justice implications do the role and level of engagement of the private sector have?

This research is explanatory and evaluative. When conducting explanatory research, the aim is to show how a phenomenon develops (Verschuren & Doorewaard, 2010), and to identify the factors that cause this phenomenon (Rahi, 2017). The causes and effects of an event are thus identified in explanatory research. Explanatory research is supported by descriptive knowledge, and an explanatory research question can therefore often be supported by various, smaller descriptive sub-questions (Verschuren & Doorewaard, 2010). Sub-questions 1 and 2 are descriptive questions. Sub-question 1 is focused on giving a detailed description of the role and level of engagement of the private sector in the PPPs focused on agricultural adaptation. Sub-question 2 is focused on identifying the stimulating or restrictive factors the private sector faces. These stimulating or restrictive factors are used to explain the first sub-question, being the role and level of engagement of the private sector.

Moreover, in evaluative research, the current, observed situation is compared with a desired situation (Verschuren & Doorewaard, 2010). Describing and comparing are strategies used in evaluative research (Weiss, 1998). An evaluation requires an established set of standards or criteria that are compared to the current situation (Verschuren & Doorewaard, 2010). Evaluation research is frequently aiming to analyse the efficacy or effectiveness of a program (Powell, 2006). The outcomes resulting from evaluative research can help contribute to solving the problems around the current situation (Verschuren & Doorewaard, 2010), and increase efficiency (Powell, 2006). The evaluative component of this research is the justice implications of the PPPs. These justice implications have been evaluated according to a justice framework with a set of identified criteria that is shown in chapter 2. Evaluative knowledge is often based on descriptive and/or explanatory knowledge. If the evaluation's main goal is

to determine how effective an intervention is, explanatory knowledge is often necessary (Verschuren & Doorewaard, 2010).

This research is thus explanatory and evaluative. The roles and level of engagement of the private sector are thus identified, which are then tried to be explained by the stimulating and restrictive factors the private sector has faced when trying to participate in the PPP. The stimulating and restrictive factors are also tried to be explained by the level of engagement of the private sector. Furthermore, the justice implications of the PPP are evaluated, and the possible differences in the justice implications between the various projects are tried to be explained by the private sector engagement in the PPP. It is also aimed to identify other possible explanations for the justice implications.

1.4 Scientific relevance

The private sector is recognised in literature as essential for climate funding and adaptation (IPCC, 2014; Nakhooda et al., 2014; Pauw, 2015; UNEP, 2011). However, the mobilisation of private sector investment and adaptation efforts remains difficult (Kalinowski, 2020; Nakhooda et al., 2014). A strategy to encourage private sector engagement is through PPPs (Biagini & Miller; 2013; Green Climate Fund, 2018), and the need for PPPs in climate adaptation has been recognised in multiple large-scale funds and organisations. However, existing literature indicates that PPPs are not always effective (Beh, 2010; Harman et al., 2015; Johnston, 2010; Liu et al., 2013; Trangkanont & Charoenngam, 2014), and private sector engagement is sometimes still low in PPPs (Zhang et al., 2018). Specific roles of the private sector in agricultural PPPs have been identified in existing literature (FAO, 2016), but no distinction was made between various types of agri-PPPs or PPP constructions with different degrees of private sector involvement. This research thuss expand upon existing adaptation literature by focusing on the role and level of engagement of the private sector in agricultural PPPs focused on the global South. It helps provide insights on whether the use of PPPs is an effective solution to fill the gap in private sector commitment. Furthermore, there are indications that the increased role of the private sector in adaptation projects could create justice concerns for vulnerable groups. This is due to issues with transparency, accountability and stakeholder involvement (Harman et al., 2015), the private sector's primary goal to make profit (Kalinowski, 2020), and the private sector's preferred collaboration with bigger farmers than smallholders (FAO, 2016). This research is therefore focused on the justice implications the private sector has on vulnerable groups in these adaptation projects, and investigates whether certain types of PPPs with other amounts of private actor engagement are more able to reach vulnerable groups.

1.5 Societal relevance

Climate change poses an increasing risk to human and natural systems (IPCC, 2014; Mitchell et al., 2006) and climate action, such as climate mitigation and adaptation, is necessary on a global scale to reduce these risks (IPCC, 2014). Private sector involvement is necessary for sufficient climate funding and adaptation future (Patel, 2010; UNFCCC, 2015), and one way to encourage the private sector to help with climate adaptation is through the use of PPPs (Biagini & Miller, 2013; Green Climate Fund, 2018). In this research, the role of the private sector in PPPs for climate adaptation is analysed and explained, to create a better understanding of their potential to effectively adapt to climate change. This is relevant for organisations that are focusing on using PPPs to increase private sector involvement. Moreover, this research focuses on the justice implications that various PPP constructions, including different roles and levels of engagement of the private sector, have for vulnerable groups affected by adaptation projects. This study can help create a route toward more just forms of adaptation. More just and effective adaptation reduces people's susceptibility and increases a region's capacity to cope with

the effects of climate change. This is relevant for the organisations that are contributing to the PPPs for climate adaptation, and the actors on a local scale where the adaptation projects are implemented.

1.6 Thesis structure

The next chapter explains the theoretical background of relevant concepts and terms and operationalises the concept of 'justice'. Chapter three elaborates the methods that have been used in this research. It focuses on the research strategy, research design, data collection and data analysis. Furthermore, the results of the analyses are shown in chapter four. In the fifth chapter, a conclusion to the research question is formulated, the interpretations and implications of the results are provided. Lastly, recommendations for further research and reflections on this research are discussed.

2. Theoretical background

This chapter provides a three-step analytical framework based on a literature review to help answer the research question. First, the potential roles and levels of engagement of the private sector in PPPs are elaborated. Second, the potential stimulating and restrictive factors private sector engagement are explained. Third, the justice elements that can be influenced through the extent of private sector engagement are elaborated, resulting in a justice framework. This justice framework is used to evaluate the justice implications of the case studies. Lastly, this chapter ends with a visual representation of the research framework.

2.1 Classification of public and private organisations

In order to be able to study the role of the private sector in PPPs, it is of importance to know what organisations are classified as being part of the private sector to avoid misinterpretation and incorrect comparisons. Nevertheless, it should be noted that organisations cannot always easily be defined as a public or private sector, and the definition of an organisation as public or private can always be under discussion due to different contexts. This research uses the definition of Agrawala et al. (2011), who defined the private sector as "privately owned or controlled companies, organisations and entities, whereas the public sector is the part of the economy owned or controlled by the public, usually through public agencies" (p. 13). It was mentioned that this definition of private sector does not include households or individuals. In addition, because NGOs are also sometimes involved in PPPs, and they can fall under both public or private definitions depending on the NGO, a separate definition of NGOs is given. An NGO is defined as "any local, national or international non-profit group that is task-oriented, driven by people with a common interest, and that performs a variety of service and humanitarian function" (Kraak et al., 2012, p. 505).

2.2 Roles and level of engagement of private sector in PPPs

In this subsection different types of PPP constructions are explained with the corresponding levels of involvement of the private and public sector and their roles. There is a variety of PPP models with corresponding roles of the private sector that can be distinguished (Delmon, 2021). This is elaborated below, resulting in an analytical framework. This framework is used for the identification of the different PPP models with the corresponding roles of the private sector and levels of engagement. A role has in existing literature been defined as a collection of interconnected, goal-directed activities that characterize an actor in a given context (Mumford et al., 2008). Moreover, the roles of residents within climate adaptation have been defined by Hegger et al. (2017) as "the expectations and prescriptions regarding their actions, responsibilities and attitudes as held by themselves or others" (p. 337). This study defines the roles of the private sector as the specific tasks or activities that the private actors provide in a PPP. Understanding how people contribute to a team can be interpreted better using the role construct (Mumford et al., 2008). Therefore, identifying the roles of the private sector in a PPP can help understand better how they contribute to the PPP. The definition this research uses for the level of engagement is connected to the identified roles of the private sector. The level of engagement is measured in this research from the number of roles that the private sector has within the PPP, and how much responsibility they carry for the fulfilment of these roles or activities. Thus, if a private actor has more roles and carries more responsibility for fulfilling these specific activities, they are considered more engaged.

The PPP models used for the above-mentioned analytical framework are drawn from existing literature about agricultural PPPs. However, these PPP models are often applied to agricultural infrastructure PPPs. The focus of this research is on agri-PPPs concerned with delivering food security through climate-smart seed varieties. Therefore, it is possible that the PPP models drawn from the

existing agri-PPP literature is not comprehensively connected to the PPPs investigated in this study. Additionally, other roles that can be fulfilled by the private sector in PPPs, that do not fit the PPP models, are elaborated in order to allow for a better comparison between the roles of the private sector.

2.2.1 Types of PPPs and levels of engagement

Most PPPs include long-term contractual relationships between public and private actors (Farquharson & Yescombe, 2011). Regarding PPPs, a variety of models and frameworks exists (Delmon, 2021).

Varying in the degrees of private involvement, multiple types of PPPs exist (Kwak et al., 2009). The private sector normally contributes to more efficiency, technology and innovation, and sources of financing in a PPP (Delmon, 2021). The private sector often increases the efficiency of a project more than the public sector. This can be explained by the focus on cost-effectiveness by the private sector, for example in labour and materials costs (Delmon, 2021). Moreover, the private sector often provides innovation, technology and know-how in a PPP. The private sector often possesses technologies and skills that are not available for the public sector (Delmon, 2021).

Private sector engagement can range from providing a service to total ownership of facilities (Akintoye et al., 2008; Kwak et al., 2009; Zhang, 2005), depending on the level of government control and the size of the private sector. A continuum of the types of PPPs was established, showing the levels of private and public sector involvement with the corresponding risks for the public and private sector. In practice, the PPP variations are determined by the degree of asset, capital, and risk ownership between public and private sector actors (Mutuku, 2019; Roehrich et al., 2013). These types of PPPs are shown in figure 1 below, and can be applied to various sectors (Roehrich et al., 2013), as was done to the sector of agribusiness by Mutuku (2019).

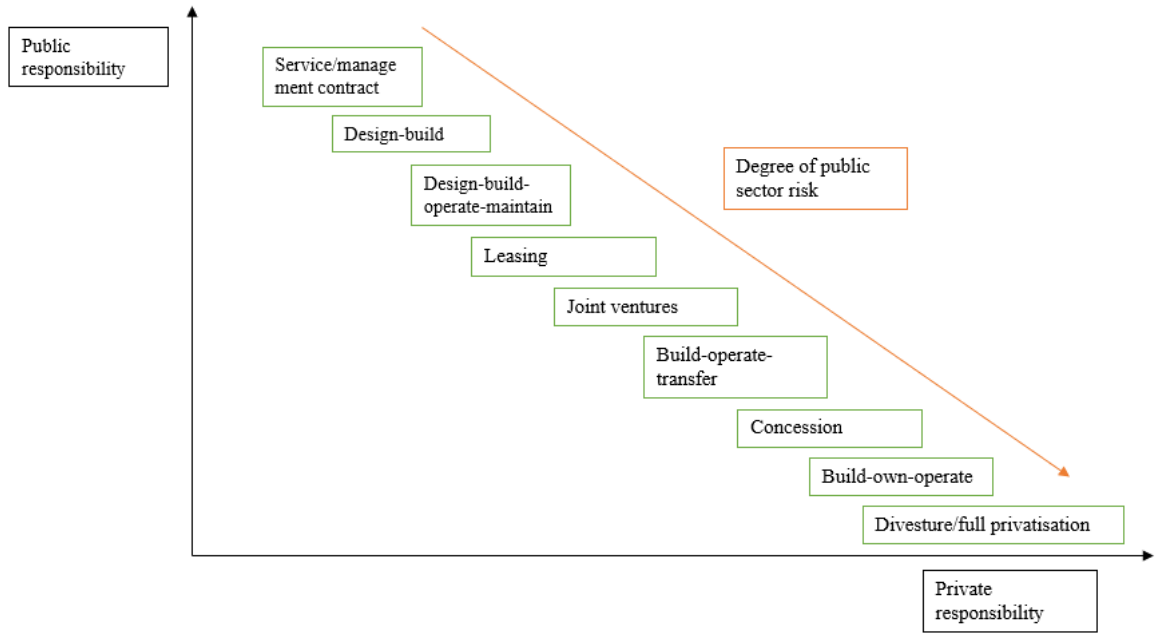

Figure 1: Types of PPP with corresponding responsibilities. Source: Adapted from Roehrich et al. (2013).

Service and management contracts are considered the simplest type of a PPP (Akintoye et al., 2008), and last typically one to five years (Akhmouch & Kauffmann, 2013). In a design-build model, the private sector designs and constructs the project, and the public sector plans, operates and finances the project (Pagano, 2010). In a design-build-operate-maintain PPP, the private sector is responsible for the design, construction, operation, and maintenance of a project for a predetermined period (Kwak et al., 2009).

The public sector intents to shift risks to the private sector (Edkins & Smyth, 2006). A lease agreement is one in which the private sector makes use of public facilities in exchange for a rental price (Akintoye et al., 2008), and has a duration of approximately eight to fifteen years (Akhmouch & Kauffmann, 2013). The service provider is liable for the assets' operating, repair, and maintenance costs in a lease arrangement. The service provider may also be responsible for collecting tariffs from service consumers, assuming the risk of non-payment (Akintoye et al., 2008), in this case meaning that the public sector carries the most risks. This type of PPP construction is often used for urban water utilities in developing countries, with the private sector operating and maintaining the facility, whereas the public sector is responsible for the financing (Farquharson & Yescombe, 2011). In joint ventures, the private and public sector share responsibility and ownership for the delivery of services in joint ventures. Joint venture PPPs are a platform for 'genuine' public-private partnerships, in which businesses, governments, non-governmental organizations, and others pool their resources to achieve a shared profit (Akintoye et al., 2008), and have an infinite duration (Akhmouch & Kauffmann, 2013). In a build-operate-transfer PPP type, the private sector is responsible for the financing, planning, construction, operation, and maintenance of a project (Kwak et al., 2009), during which the government leases the asset or buys it back after a certain period of time (Marbaniang et al., 2020). Concessions periods generally last 15 years or more (Koppenjan, 2015), or according to Akhmouch & Kauffmann (2013) even 25 to 30 years, awarding monopolies to private parties in order for them to recoup their investments (Koppenjan, 2015). In these constructions, the private sector is awarded full responsibility (Marbaniang et al., 2020; Mutuku, 2019). The public sector becomes a regulator to guarantee the performance, quality, and price control standards (Mutuku, 2019). Furthermore, in a build-own-operate project, the private sector keeps control of the asset in perpetuity. The government only agrees to buy the services for a specific period of time (Kwak et al., 2009). The final identified PPP model, privatisation or divesture, is the sale of an asset owned by the state to a private organisation (Akintoye et al., 2008). However, it should be noted that privatisation entails the transfer of a public asset to a private actor, and a PPP entails the enduring role of the public sector (Farquharson & Yescombe, 2011). It can be concluded that only in the last five types of private sector involvement, shown in table 1, private finance is generated. These types of PPPs with more private sector engagement can thus help generate more private sector investment, as was identified in the introduction as being an important incentive.

The types of PPPs described above and the corresponding roles of the public and private sector are summarised in table 1 below. The types of PPPs are arranged from the least private sector involvement to the most private sector involvement. This table can be used as an analytical framework for identifying the type of PPP model and roles of the private sector. A higher level of engagement of the private sector is characterised in this research by more roles or responsibilities by the private sector.

PPP Models	**Role of private sector**	**Role of public sector**
Service/management contracts	Provides managerial & technical assistance	Provides finance
Design-build	Designs and constructs the project	Executes the operation, maintenance, have ownership and provides financing
Design-build-operate-maintain	Designs, constructs, operates and maintains for a predetermined period	Has ownership and provides financing
Leasing	Designs, builds or operates, but does not provides financing	Financing, partly transfers risk
Joint ventures	Jointly provide finance, own and operate a facility	

PPP Models	**Role of private sector**	**Role of public sector**
Build-operate-transfer	Provides finance, builds and operates	Buys back or leases asset
Concessions	Is awarded full responsibility	Is the service provider or regulator to guarantee performance criteria, quality, and price control are met
Build-own-operate	Provides finance, builds, owns and operates the project	Regulates the resource allocation, only agrees to buy the services for a specific period of time
Divesture/full privatisation	Buys and owns the asset	Sells the asset

Table 1: Types of PPPs with corresponding roles of private and public sector. Sources: Akintoye et al. (2008), Edkins & Smyth (2006), Kwak et al. (2009), Marbaniang et al. (2020), Roehrich et al. (2013) and Shukla et al. (2016).

2.2.2 Additional roles by the private sector in agri-PPPs

Corresponding to the PPP models identified in the previous section, five different opportunities for private sector engagement in agriculture were identified by Marbaniang et al. (2020). These five opportunities are the operation, maintenance, design, construction and financing of programmes and projects. These functions in which the private sector can play a role align with the different PPP types identified by Roehrich et al. (2013). However, these roles are often related to infrastructure projects, and can, depending on the PPP, not always be applied to agribusiness focused on innovation and the development of drought-resistant and climate-smart seeds. Therefore, other roles by the private sector, apart from the ones connected to the PPP types identified above, are identified below. The level of engagement of the private sector are also analysed based on these identified roles. The results from the interviews with the private sector actors are compared to these previously identified roles.

As mentioned in the introduction, the FAO has done extensive research on agribusiness PPPs in 2016, based on data from 2013. They have established the roles of the public and private sector in these PPP cases, and gave an overview of the main roles played by the lead agribusinesses. Furthermore, Prasada (2020) has identified six other private sector contributions in agricultural PPPs. These roles, that did not fit the previously elaborated PPP models, are shown in table 2 and are explained below.

Role private sector	**Source**
Conducts market research	(FAO, 2016; Prasada, 2020)
Provides agreed-upon funding	(FAO, 2016)
Tests new innovation or technologies	(FAO, 2016)
Negotiates intellectual property ownership	(FAO, 2016)
Shares their knowledge	(Delmon, 2021)
Commercialises and distributes the technologies	(FAO, 2016; Prasada, 2020)
Makes sure the project reaches smallholders	(Prasada, 2020)
Provides technical support	(Prasada, 2020)
Documents the projects	(Prasada, 2020)
Supplies assistance and responsible for business development services	(Prasada, 2020)

Table 2: Extra roles of the private sector identified in literature

The first role that the private sector has played is conducting market research to identify the demand for new technology and potential returns on investment (FAO, 2016), and to develop business plans (Prasada, 2020). Second the private sector has contributed to the PPPs by providing agreed-upon funding

for the projects (FAO, 2016). Third, the private sector has engaged in the testing of new innovations or technology before the commercialisation (FAO, 2016). Fourth, businesses have also played a significant role in the negotiation of intellectual property ownership issues (FAO, 2016), which are often present in PPPs. The private sector has an important role in knowledge-sharing through technologies, innovations and know- how (Delmon, 2021). Fifth, the private sector is in charge of the commercialization and dissemination of innovative technology, including the establishment of distribution sites for sale to rural farmers and small and medium agro-enterprises, or securing the markets for end products, through for example contract farming agreements (FAO, 2016; Prasada, 2020). Moreover, the private sector is sometimes responsible the provision of outreach devices and incentives to reach smallholders (Prasada, 2020). Sixth, the private sector offers new technology adopters with post-sale technical support. Seventh, the private sector contributes to partnership monitoring (FAO, 2016). Moreover, in the partnerships studied by Prasada (2020), the private sector is responsible for the documentation of the projects to the public to allow for transparency. Furthermore, they supply assistance to agricultural producers, and are responsible for other business development services (Prasada, 2020).

This research has also tried to explain the role and level of engagement of the private sector through stimulating and restrictive factors, which are elaborated in the next section.

2.3 Factors influencing private sector engagement

This subsection elaborates on the stimulating and restrictive factors for private sector engagement in PPPs that have been identified in existing literature. Moreover, this subsection explains stimulating and restrictive factors for engaging in climate adaptation. These factors are used to try to explain the role and level of engagement of the private sector, and why they do not want to be involved to a higher degree.

2.3.1 Stimulating factors for private sector engagement

The various stimulating factors identified in existing literature have been shown in table 3. The elaborations on the factors are provided in the following sections.

Stimulating factors	**Source**
PPP can be used as way to make more profit through value-for-money	(Gardiner et al., 2015)
Private actors can use the participation in the project as a corporate social responsibility	(Spielman et al., 2010)
Less risks for investing through guarantees from public sector	(Gardiner et al., 2015)
Presence of legal and regulatory framework for PPPs	(Gardiner et al., 2015)
A clear determination of responsibilities and roles between actors involved in PPP	(Farquharson & Yescombe, 2011; Gardiner et al., 2015)
The creation of Special Purpose Vehicles entities to separate venture from rest of the organisation	(Chauhan & Marisetty, 2019)
Risks of climate change can be reduced for private sector	(Biagini & Miller, 2013; Pauw, 2015)
New markets and business opportunities for the private sector through climate change adaptation	(Pauw, 2015)

Table 3: Stimulating factors identified in literature

Stimulating factors for PPP engagement

In existing literature concerning PPPs, several stimulating factors for private sector involvement in PPPs have been identified. The first stimulating factor identified is “value-for-money”. For both public and

private parties, value-for-money is a major motivator (Gardiner et al., 2015). Risk management in PPPs might be assigned to the party that provides the best value for money to achieve this. Optimal resource use throughout the project life-cycle optimizes the process and leads to long-term value-for-money. Therefore, private sector engagement has the potential to open up new revenue streams and identify new ways to create value-for-money (Gardiner et al., 2015).

A second stimulating factor for the private sector to engage in PPPs is that it allows them to improve their corporate social responsibility (CSR) programs, investor trust, and brand recognition among the general public and customers (Spielman et al., 2010).

A third stimulating factor are guarantees provided from the public sector, as well as options to address technological hazards (Gardiner et al., 2015). Guarantees provided from the public decreases risks and thereby encourage private sector involvement.

Fourth, a legal and regulatory framework for PPPs should be established. This leads to more transparent governance and policy systems that can help the effectiveness of PPPs (Gardiner et al., 2015) and probably stimulates private sector engagement.

Fifth, clear determination of the responsibilities and roles through the process of the project is recommended (Farquharson & Yescombe, 2011). Clear determination increases accountability and transparency between the different actors, leading to more trust between the private and public sectors (Gardiner et al., 2015). A clear definition and distinguished roles for the public and private sector can therefore increase private sector engagement.

Lastly, in PPPs, sometimes separated 'Special Purpose Vehicles' (SPV) entities are created that separate the venture from other investments of the private sector. SPVs help improve attractiveness for private sector, transparency and accountability (Chauhan & Marisetty, 2019).

Stimulating factors for adaptation

Besides more general reasons for private sector actors to participate in a PPP, their participation can also be explained by stimulating factors to contribute to climate adaptation projects.

As Pauw (2015) identified, the private sector faces both direct and indirect climate risks. The direct and indirect risks, as well as the exposure to international and domestic private companies are shown in figure 2 below. Extreme weather occurrences can have a significant indirect impact on business. Ports, for example, may experience delays in the shipment of commodities as a result of flooding, even if they are adequately secured (Biagini & Miller, 2013). Since these climate risks can affect the continuity of the business, the private sector can be encouraged to participate in climate adaptation. Moreover, agriculture and small farms often account for the majority of jobs and GDP in the poorest countries. As a result, the resilience of private firms is inextricably tied to climate change adaptation in these sectors (Biagini & Miller, 2013).

Furthermore, in several sectors, the need for climate adaptation can create new markets for the private sector to invest in. For the agricultural sector, which is the thematic focus area of this research, the business opportunities identified for the private sector are 1) climate-resilient seeds, 2) disease and pest control products, 3) water-saving irrigation systems, 4) expectation of growth of the biological and reduced chemical market, and lastly, 5) weather risk and crop insurance (Pauw, 2015). These increasing climate risks and rising business opportunities from climate adaptation can be considered stimulating factors to participate in climate adaptation for the private sector.

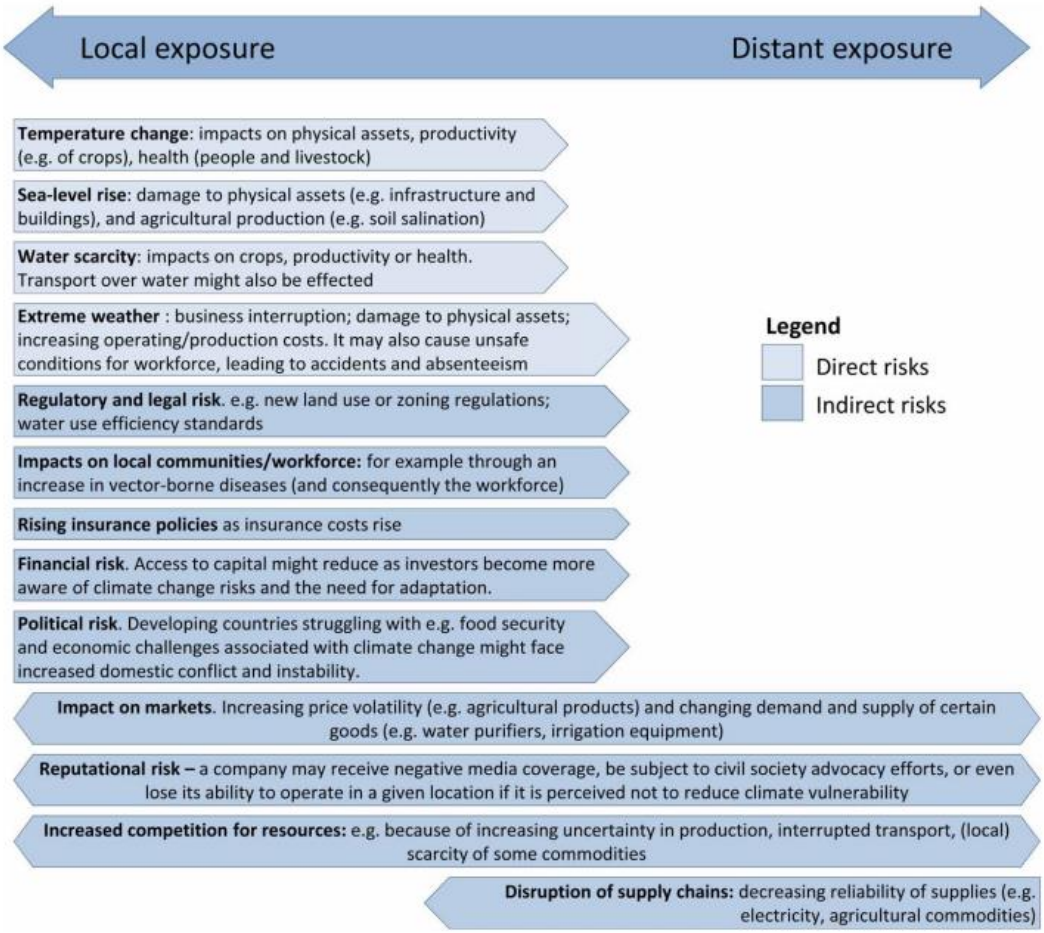

Figure 2: Direct and indirect climate risks for the private sector. Source: Pauw (2015)

2.3.2 Restrictive factors for private sector engagement

Restrictive factors for PPP engagement

Besides stimulating factors, existing literature has identified restrictive factors that work as a barrier for private sector engagement. These restrictive factors are shown in table 4. The elaborations on the factors are provided in the following sections.

Restrictive factors	Source
Joining the PPP can bring about financial risks	(Ahmad et al., 2018)
Uncertainty for the private sector due to unstable political environment	(Gardiner et al., 2015)
Uncertainty for private sector due to lack of clearly formulated policies and objectives	(Gardiner et al., 2015; Kwak et al., 2009)
Uncertainty for private sector due to unfavourable market conditions	(Gardiner et al., 2015)
PPP adaptation projects do not visibly reduce costs, making it less interesting for the private sector to participate	(Biagini & Miller, 2013)
Uncertainty for private sector due to lack of information, resources and risk awareness	(Averchenkova et al., 2016; Surminski, 2013)
Market failures can create a higher risk for the private sector	(Surminski, 2013)
Private sector often focuses on short-term growth, which does not comply with climate adaptation	(Surminski, 2013)

Table 4: Restrictive factors identified in literature

First, the restrictive factors for private sector engagement in PPPs in general are elaborated. The first barrier is connected to financial risks from the construction and development phase of a project (Ahmad et al., 2018). This revolves around the private partner's capacity to conceal project expenditures. As a result, there are incentives for private parties to breach contracts, or at least to conceal effort and costs (Ahmad et al., 2018). The higher the risk is for the private partner, the higher will be the costs of capital, because the private sector wants to reduce their risk as much as possible.

The second restrictive factor identified are instable political environments, especially in developing countries, where the public sector should mitigate risks for the private sector (Gardiner et al., 2015). Moreover, a shortage of clearly formulated policies and objectives is discouraging for the private sector (Gardiner et al., 2015; Kwak et al., 2009).

Furthermore, especially in developing countries, unfavourable market conditions make PPPs less likely to be effective. Uncertainty regarding financial structures can thereby decrease private sector involvement (Gardiner et al., 2015).

Restrictive factors for climate adaptation

As already mentioned in the introduction, adaptation projects face difficulties with generating private investments (Kalinowski, 2020). This is in contrast with mitigation projects, because they are more visibly reducing costs (Biagini & Miller, 2013). Furthermore, a company's capacity and ability to invest in adaptation action is constrained by a lack of appropriate information and knowledge, insufficient resources, low risk awareness (particularly of indirect hazards) and insufficient competence inside the company (Averchenkova et al., 2016). This was also identified by Surminski (2013), who argued that the main barriers for the private sector to engage in adaptation are their limited knowledge of the uncertainties associated with climatic hazards and socioeconomic trends, as well as the short-term nature of planning horizons, expenses, and expertise. Moreover, market failures can affect the climate adaptation by the private sector (Surminski, 2013). The business sector rarely pursues adaptation as a goal, yet it may occasionally contribute to adaptation without recognizing it (Pauw, 2015). Climate risk reduction and short-term growth are frequently trade-offs for businesses (Surminski, 2013). As a result, policymakers place a greater emphasis on adaptation than the private sector (Pauw, 2015).

2.4 Justice in climate change

Because the private sector is concerned with making profit out of their investments (Kalinowski, 2020), and prefer working with bigger farming companies and exclude smallholders in agricultural PPPs (FAO, 2016), questions about the participation and recognition of vulnerable groups in PPPs concerning adaptation projects where the private sector plays a bigger role can be raised.

Another actor that is discussed in literature for having an influence on the recognition of vulnerable groups in climate adaptation are NGOs. NGOs can help reach the poorest groups with better services because of their experienced field workers (Khanom, 2011). Moreover, it was identified by Kraak et al., (2012), that NGOs are significant players in promoting and implementing programs for vulnerable groups. However, collaborations between NGOs and multinational corporations sometimes face issues because of conflicting values or objectives (Kraak et al., 2012). More specifically focused on agri-PPPs, NGOs are generally able to help smallholder farmers with agricultural climate adaptation (Yakubu et al., 2019). NGOs can help with the capacity-building of smallholders (FAO, 2016). NGOs more often have the role of taking into account gender vulnerabilities than other types of actors such as the public or private sector (Ford et al., 2015). Nonetheless, local private sector was identified to sometimes better respond to the needs of the vulnerable or poorest groups than NGOs (Intellecap, 2010). The role of NGOs in climate adaptation is thus still contested in existing literature, even though there is a prevailing promise of the use of NGOs to help reach the vulnerable groups.

If vulnerable groups are not being acknowledged, they could face issues with distribution and have less influence over decision-making. Adaptation projects could therefore increase inequality instead of reducing it (Paavola, 2005). Therefore, the justice implications of the private sector engagement in adaptation projects should be analysed. This section lays out the key requirements (based on a literature analysis) for a just adaptation project.

Climate change impacts are often shown as global or national problems, although they are ultimately affecting local levels (Paavola & Adger, 2006), resulting in complex distributive justice issues since developing countries are considered more vulnerable to climate change impacts than developed countries (Burton, 1996; Paavola & Adger, 2006; Thomas & Twyman, 2005), and "communities that are burdened by climate change impacts have different vulnerabilities within each country" (Paavola & Adger, 2006, p. 594). National governments do not always protect the interests of all citizens equally, and the most vulnerable individuals frequently have the smallest say (Paavola & Adger, 2006), although it is acknowledged in research that poor and marginalised groups should not be disadvantaged (Kashwan et al., 2020). This emphasizes the significance of fair systems that recognize and enable impacted communities' participation in planning and decision-making processes (Paavola & Adger, 2006). Therefore, distributive, recognition, and procedural justice dimensions are important in adaptation projects. This study focuses on the extent in which these justice dimensions are included in the design and planning of the PPPs. The used justice categories, and some of the operationalised categories of the evaluation framework, are partly based on earlier work by the author (Zoetbrood, 2021). However, this study has elaborated on the different categories and specified it towards the objectives of this research.

2.4.1 Distributive justice

Distribution is the main focus within justice literature (Schlosberg, 2007). According to distributive justice, people have equal worth and should be given what they deserve (Raphael, 2001). Pavoola (2005) identified distributive justice as the incidence of positive and negative outcomes of an action. However, marginalised and vulnerable people are facing more environmental impacts and less environmental protection, possibly resulting from less governmental help (Schlosberg & Collins, 2014). Distributive justice focuses on favouring vulnerable groups to reduce inequality. Nevertheless, for climate justice, distributive justice is unlikely to suffice; procedural justice is required to ensure the legitimacy of the climate change regime (Paavola & Adger, 2006).

2.4.2 Recognition justice

Recognition justice focuses on which groups are respected and valued (Temper, 2019). Recognition as a principle of justice asserts that if a group or individual is not recognized in a society's social or political systems, it will contribute to inequality (Fraser, 2001). When people are undervalued, dominated, or insulted because of their identity or status, they suffer from a lack of recognition (Kalfagianni et al., 2019). In becoming recognized as an actor, recognition focuses more on fairness. Everyone should have the same rights and be safe from harm (Temper, 2019). The term acknowledgment can also refer to the recognition of injustice in the form of violence against certain communities or nature itself (Temper, 2019).

2.4.3 Procedural justice

Procedural justice focuses on the participation of marginalised and vulnerable groups (Paavola, 2005). Procedural justice was added by Fraser (2008) to the already existing concepts of distributive and recognition justice, since recognition is a broad term in environmental justice, whereas participation focuses on decision-making processes. Schlosberg (2003) describes it as a way to achieve both political recognition and even distribution. It is focused on involvement in the processes of decision-making

(Adger et al., 2006; Jenkins et al., 2016). Just procedures that incorporate all stakeholders in a non-discriminatory manner are required by procedural justice (Heffron et al., 2015; Jenkins et al., 2016). According to Delmon (2021), for a PPP project to be successful, the project information has to be open and transparent to the community affected by the project. Moreover, the involvement of the local communities in the development and selection of the project was identified as a determinant for the success of the PPP project (Delmon, 2021).

Distributive, recognition and procedural justice are often interconnected, because those who are disadvantaged in the distribution will have a smaller say in the processes of decision-making (Adger et al., 2006). Additionally, when people are not acknowledged, they could experience distribution issues and have less say in decision-making. Therefore, rather than reducing inequality, adaptation plans and policies might exacerbate it (Paavola, 2005), by only distributing the climate adaptation measures to people who are recognised and present at the decision-making. It is therefore proposed that the principles of avoiding harmful climate change, forward-looking accountability, prioritizing the most vulnerable, and ensuring equal participation will assist the global community in making progress toward just climate change adaptation (Paavola, 2005).

2.4.4 Operationalisation justice framework

In order to generate indicators for the justice framework, this paragraph provides an overview of the most commonly occurring variables in the literature relating distributive and procedural justice. The variables mentioned here are operationalised, which implies that indicators for abstract and complicated variables are chosen and described (Verschuren & Doorewaard, 2010). Due to the limited time this study had to be completed in, only the most relevant variables are discussed and evaluated in this section.

Climate adaptation capacity

There are differences between the possibilities countries and groups have to adapt to climate change, and also difference in the capacity of countries to cope with effects and shocks of climate change (Leal Filho et al., 2018; Mertz et al., 2009; Paavola & Adger, 2006). Disadvantaged and poorer people often have a lower capacity to adapt to climate change impacts (Dodman & Satterthwaite, 2008; Hurlbert, 2011), and thus the ability to adapt to climate change is distributed unevenly.

Adaptation efforts protect people's fundamental needs and abilities

People's essential capabilities and liberties should be protected as a result of climate adaption (Paavola, 2008; Schlosberg, 2012; Schlosberg et al., 2017). People living in different places and contexts can have different needs. Therefore, the basic needs should be taken into account under various conditions and in different places, and should defined in a more local context (Schlosberg, 2012).

Recognition of all groups

Environmental justice requires the recognition of indigenous people (Agyeman et al., 2016). As a result of misrecognition, certain persons and communities face nonrecognition and invisibility (Schlosberg, 2012). Lack of acknowledgement can manifest as, among other things, denigration and depreciation (Jenkins et al., 2016). All actors involved, particularly disadvantaged ones, should be taken into account while formulating policies (Paavola & Adger, 2006).

Enhancing the availability of (local) expertise and knowledge

The mobilization of local knowledge is critical to effective involvement (Jenkins et al., 2016), and ideas and perspectives should be openly exchanged. Not only may physical engagement have an impact on justice for the vulnerable groups, but use of local knowledge can also influence the making of policies

and decisions as well (Jenkins et al., 2016). When analysing a problem and developing solutions, it is critical to include all available information (Agyeman et al., 2016).

Participation and inclusion

Enabling everyone to participate and make decisions in these processes is a crucial component of procedural justice, which is connected to the idea that everyone should have the power to affect environmental choices that have far-reaching consequences (Heffron et al., 2015; Jenkins et al., 2016; Paavola & Adger, 2006; Schlosberg, 2012). This implies that access to decision-making should be fair (Adger et al., 2006). Participation could be a way to address distributive justice's flaws (Hurlbert, 2011). For the legitimacy of environmental decisions, fair methods and involvement are critical (Adger et al., 2006).

The variables mentioned above are operationalised. The variables with the operationalised indicators are shown in table 5 below.

Justice dimension	**Variable**	**Indicator**	**Sources**
Distribution	Climate adaptation capacity	Vulnerable regions are targeted by PPP	(Dodman & Satterthwaite, 2008; Hurlbert, 2011; Leal Filho et al., 2018; Mertz et al., 2009; Paavola & Adger, 2006)
	Adaptation efforts protect people's fundamental needs and abilities.	Needs of affected groups are taken into account	(Paavola, 2008; Schlosberg, 2012; Schlosberg et al., 2017)
Recognition	Recognition of all groups	Focus on vulnerable groups	(Agyeman et al., 2016; Jenkins et al., 2016; Paavola & Adger, 2006; Schlosberg, 2012)
Procedural	Enhancing the availability of expertise and knowledge	All parties can share their expertise on the subject	(Agyeman et al., 2016; Jenkins et al., 2016)
	Participation and inclusion	All stakeholders are involved and have the opportunity to participate in decision-making	(Adger et al., 2006; Heffron et al., 2015; Jenkins et al., 2016; Paavola & Adger, 2006)

Table 5: Operationalisation variables justice framework

2.5 Research framework

This section first explains the research framework shown in figure 3 below. Second, this section elaborates the connections between the three aspects of the analytical framework; 1) the role and level of engagement of the private sector, 2) the stimulating and restrictive factors, and 3) the justice implications for the vulnerable groups.

2.5.1 Explanation research framework

The research framework shown in figure 3 below illustrates the research objective and the steps leading towards this (Verschuren & Doorewaard, 2010). This research is twofold: it aimed to identify the role and level of engagement of the private sector in PPPs for climate adaptation, while simultaneously

researching how this influences the justice for vulnerable groups. As explained in the introduction, this can help create a route toward more just forms of adaptation and also create a better understanding of the potential of the private sector to effectively help regions adapt to climate change.

First, literature about types of private sector engagement in PPPs was reviewed, leading to an analytical framework consisting of possible roles and levels of engagement the private sector has. Furthermore, existing literature has identified a set of stimulating and restrictive factors the private sector faces when trying to participate in the PPPs. The identified stimulating and restrictive factors have thus been used find possible explanations for the roles and level of engagement of the private sector in the PPPs. The frameworks of the roles of the private sector and the stimulating and restrictive factors have been applied in the analysis of the interviews and documents in the case studies. This leads to a better understanding of the role of the private sector in the separate case studies. This explanatory component of the research, as identified in the introduction, is also shown in figure 3 below. The case studies are first assessed separately, to allow for a better comparison between the various case studies. This approach is further explained in chapter 3.

Furthermore, literature about justice was reviewed, resulting in an evaluative justice framework shown above. This evaluative justice framework allows to compare the current situation in the case studies to the desired situation where environmental justice is fully taken into account during the PPPs. This justice framework is, as well as the other two analytical frameworks, applied to the analysis of the interviews and documents in the case studies. These justice implications are thus evaluated for each case study separately. A comparative analysis of the case studies follows the individual case study analyses. In this comparative analysis, possible explanations for the differences in environmental justice for the most vulnerable groups are identified. This allows for a better understanding of the justice implications the private sector has in the separate case studies. Finally, this comparative analysis and synthesis results in overall conclusions to the research question and recommendations.

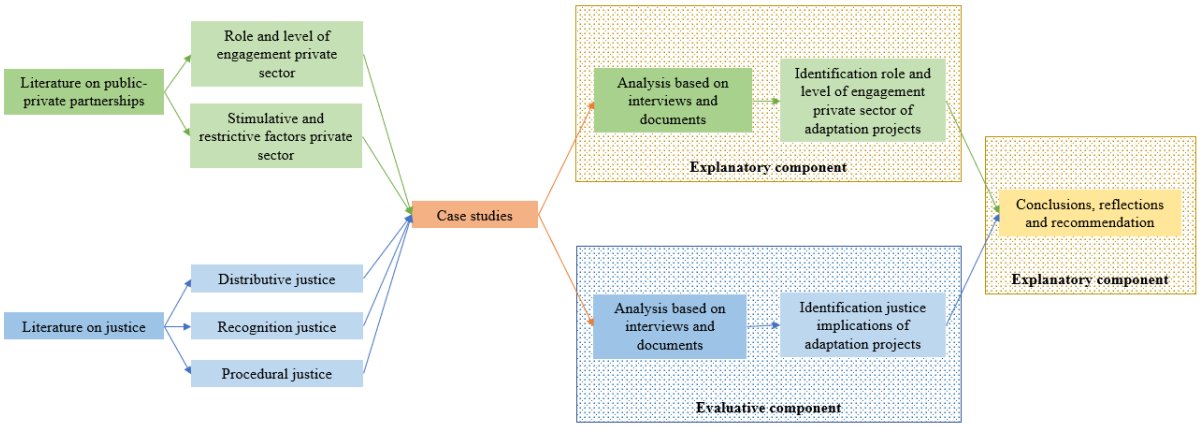

Figure 3: Research framework

2.5.2 Connections between the three analytical framework elements

The three elements of the analytical framework; the roles and level of engagement of the private sector, the stimulating and restrictive factors, and the justice implications of the PPPs, have been explained and elaborated separately above. This research aims to find relationships between the three elements, in order to provide explanations for the roles and levels of engagement of the private sector and the justice implications.

First of all, the role and level of engagement and the stimulating and restrictive factors are possibly connected in two ways in this research. This research tries to see whether the stimulating and restrictive factors can explain the roles or levels of engagement of the private sector. The two aspects

are also connected the other way around: This research tries to investigate whether the roles and levels of engagement can explain the stimulating or restrictive factors. By identifying possible relationships between these two aspects, it can help contribute to the question whether PPPs are an effective way to encourage the private sector more to contribute to climate adaptation in the global South.

Secondly, this research tries to investigate whether the roles and levels of engagement of the private sector are influencing to the justice implications. First and foremost, this research aims to identify whether a higher level of engagement of the private sector leads to lower justice implications for the vulnerable groups. Moreover, it aims to see whether certain roles for the private sector have an influence on the justice implications. This research thus tries to see whether a lower level of justice in the PPPs can be explained by the roles or level of engagement of the private sector. This is of relevance to research, because the question can be raised whether the essential higher involvement of the private sector in climate adaptation (IPCC, 2014; Nakhooda et al., 2014; Pauw, 2015; UNEP, 2011) is of a positive influence for climate adaptation for all, or whether less private sector engagement can also be beneficial for certain vulnerable groups.

Lastly, this research aims to investigate whether there is a relationship between the stimulating and restrictive factors for the private sector to join the PPPs and the justice implications for the most vulnerable groups. This research aims to see whether the justice implications for the most vulnerable groups can be explained by the stimulating or restrictive factors that the private sector faces. A possible connection between the two aspects also works the other way around, so where mandatory justice requirements in a PPP can have an influence on the restrictive factors for the private sector.

The research thus aims to identify and explain the relationships between the three aspects of the analytical framework, in order to create a better understanding of the interconnections between the private sector and the most vulnerable groups in PPPs. These insights can help identify certain PPP constructions that are more effective for encouraging the private sector to contribute to climate adaptation and certain PPP constructions that help vulnerable groups become more resilient towards the effects of climate change.

3. Methodology

This chapter explains the decision for using a case study analysis as the research strategy for this study. Second, the research design is explained. It will give an elaboration on the decision for a multiple-case study and the case selection. Lastly, the data collection and analysis are explained.

3.1 Research strategy

The research method that was chosen for this research is a case study analysis (CSA). It was chosen in order to go in-depth into the role and level of engagement of the private sector in PPPs, and to investigate what justice implications the role of the private sector has for the most vulnerable groups affected. A CSA has the benefit of providing depth (Creswell & Creswell, 2017; Gerring, 2004; Verschuren & Doorewaard, 2010) and the goal is to generalise theories (Yin, 2009). One common misunderstanding about case study research identified by Flyvbjerg (2006) is that case studies are mostly useful for generating hypotheses. He countered this misunderstanding and found that case studies are useful for both generating and testing hypotheses, but can also be used for other research activities. Moreover, it was explained that context-specific knowledge gained by conducting a CSA is more valuable than searching for anticipated theories (Flyvbjerg, 2006). Case studies are thus generalisable over other cases and do not represent a sample (Yin, 2009). This research looked into case studies to analyse and explain the role of the private sector and to see what types of justice implications this has. Therefore, CSA was considered an appropriate research strategy for this study. As already mentioned in the introduction, the unit of analysis of this research were public-private partnerships focused on food security adaptation in the global South, and this study has investigated what the benefits are of such a PPP construction with respect to private sector engagement and environmental justice for the most vulnerable groups.

3.2 Research design

3.2.1 Multiple-case study

When doing a multiple-case study, the contexts are likely to differ. The outcomes or results from a multiple-case study can be considered more generalisable than the outcomes from research only focused on one case. This is the case when the outcomes from the multiple-case study are the same across these numerous scenarios (Yin, 2009), because single-case studies can have the disadvantage of being context-specific (Aaboen et al., 2012). Therefore, a multiple-case study was used. Moreover, this research tried to find explanations for the differences in justice implications in the case studies, for which a multiple-case study design was also suitable. This research had a holistic multiple-case design. A holistic multiple-case design entails that all the case studies only have one unit of analysis. Since, as explained above, the unit of analysis of this research were public-private partnerships focused on food security adaptation in the global South, and it only has one unit of analysis, the holistic multiple-case design is suitable for this research. Moreover, a holistic case design means that the case is observed to generate a broad understanding of the phenomenon as a whole (Verschuren & Doorewaard, 2010). The objective of this research is to create a better understanding of the role and level of engagement the private sector has in PPPs focused on agricultural adaptation, and explaining how their engagement influences the justice implications for the vulnerable groups. This research is thus aiming to generate a better understanding of the phenomenon as a whole, which is why a holistic multiple-case design is suitable for this study.

3.2.2 Case selection

Multiple-case studies need a minimum of two cases (Yin, 2009). This research has analysed four cases. By doing a comparative analysis of the cases, it is attempted to find systemic variations between the

cases (Verschuren & Doorewaard, 2010). This research has used a most-different case design, meaning that the cases have been carefully chosen by the researcher, and these cases have a lot of variety in some areas but similarities in others (Verschuren & Doorewaard, 2010). A most-different case design is used to see if a relationship holds up in different situations and to rule out other possibilities (Bennett, 2004). The context of the case studies researched in this study is very specific. First, the PPPs are all focused on the global South. Moreover, all cases are focused on the agricultural sector, or more specifically, on climate adaptation through the distribution of climate-smart seed varieties. This research looks into the variety of PPPs that can be found within this context of agricultural PPPs focused on the global South. This research focuses on which roles the private actors have within the PPPs and what the linked justice implications are. When applying a most-different case design to this research, the cases within the similar context need to have different characteristics. The similarities that are identified between the case studies are then most likely characteristic of all cases of this type. Therefore, a most-different case design within the context of agricultural PPPs focused on the global South is applied in this research. The PPPs need to vary from each other regarding 1) the number of actors involved in the PPP, 2) the scale of the PPP, 3) the countries the PPP focuses on, and 4) the type of private sector involved (domestic vs. international). The selection criteria are schematically shown in table 6 below. Criteria 1 and 2 are focused on the same context of the cases. Criteria 3 until 6 are used to specify the different characteristics that the cases needed to have from one another.

Criterion 1	PPP should work in the agricultural sector focused on climate-smart seed varieties
Criterion 2	PPP projects should be focused on countries in global South
Criterion 3	Different number of actors in the PPP
Criterion 4	Different scale of the PPP
Criterion 5	Different countries as main focus
Criterion 6	Different types of private sector involved (domestic vs. international)

Table 6: Selection criteria

As explained above, four different cases have been investigated for this research. The case studies are addressed based on alphabetical order. The first case is the AAA Maize Program, which is currently operating in India, and is looking to expand to other Asian countries. The second case that has been looked into is the AICCRA Zambia Accelerator Program, which focuses on Zambia. The third case that was focused on is the TAAT Maize Compact Program. This program is operating throughout multiple countries in Africa. However, this research only focused on actors that were located in Kenya, in order to reduce the scale of the project and therefore create a better understanding of the program, and allow for better comparison with the other case studies. The fourth and last case that was investigated is the TAP5 project. This project is not yet being commercialised and implemented, but will first focus on Vietnam. The four selected cases are shown in figure 4 below. Deeper explanations of the case studies have been provided in the results section.

All studied PPP projects are focused on supplying climate-smart seed varieties to areas in the global South. Moreover, the scales and number of actors are also varying within the PPPs. The case studies are differing in scale and number of actors involved, ranging from two to approximately fifteen actors involved in the project. Moreover, some case studies work only with the international private sector, some case studies with only the domestic private sector, and some have both included in the project.

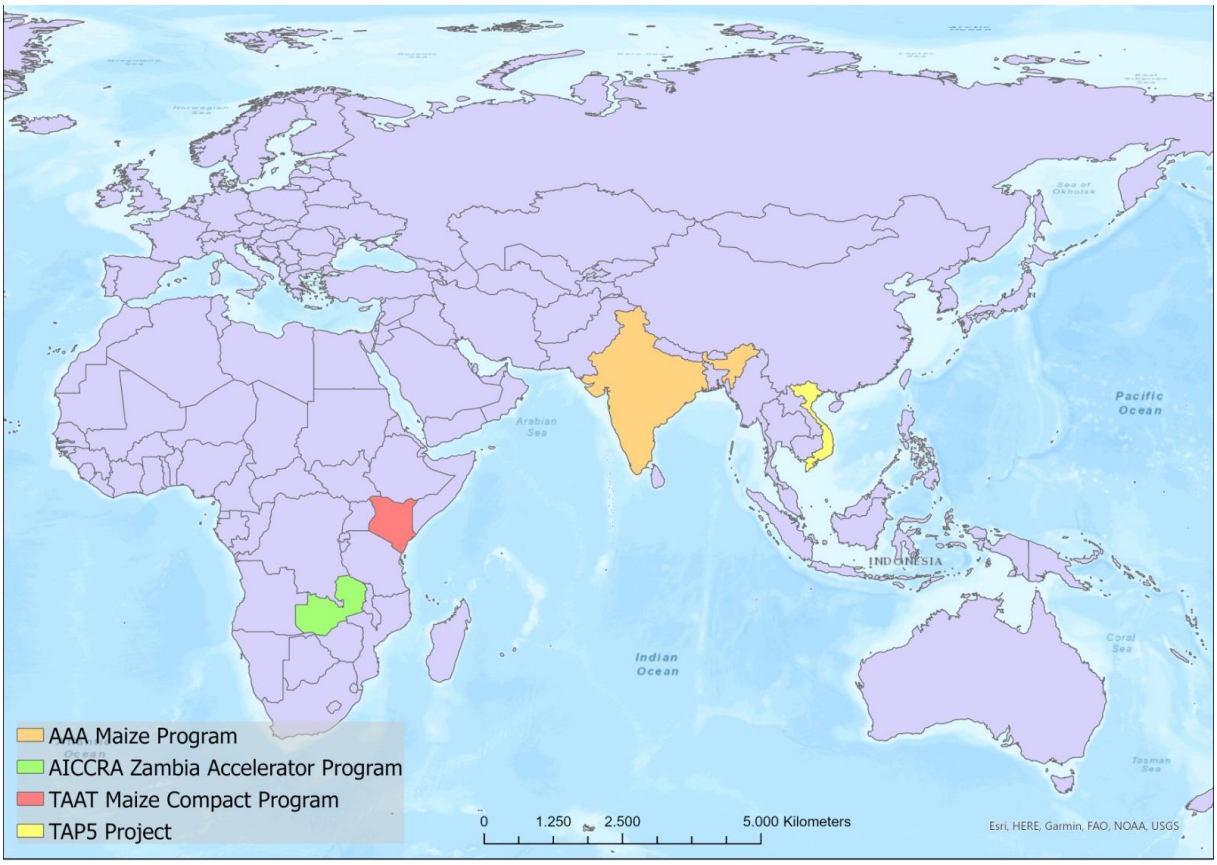

Figure 4: Case selection with main focus countries. Source: Esri (2021). Created by and used with the permission of Guido Mosch.

3.3 Data collection

This section elaborates on the chosen data collection strategies. Data triangulation is frequently employed to obtain a comprehensive understanding of the study object (Verschuren & Doorewaard, 2010), which is connected to the holistic multiple-case design that was used in this study. Achieving depth in a study is often realised by using data triangulation, or triangulation of sources (Verschuren & Doorewaard, 2010). This research used data triangulation through the use of in-depth semi-structured interviews with the various case study actors, additional document analysis, and several expert interviews, as is often used in case study analyses (Verschuren & Doorewaard, 2010).

3.3.1 Interviews

This study has conducted 15 semi-structured interviews with the case-study actors. The interviews were conducted with various actors within the PPPs. It was aimed to interview approximately two private actors involved per PPP in order to elicit the private sector's role and level of engagement, but also with approximately two public actors to get a more nuanced perspective on the role of the private sector and increase the credibility of the case study outcomes. If it was not realisable to reach a 50/50 division between the public and private actors interviewed, it was aimed to conduct one extra interview with preferably a private actor. The preference to conduct the interview with an extra private actor was to create a better understanding of their views and experiences within the PPP, since they are the main actor researched in this study. It was assumed that the private actors could better elicit their views on the PPP, especially regarding their stimulating or restrictive factors. In one case study, only three interviews have been conducted, of which one with two participants simultaneously. The interviews

lasted for approximately 30-60 minutes. The organisations and the corresponding types of actors that were interviewed per case study are shown in Appendix 1.

These actors were contacted over available email addresses online and through snowball sampling within the PPP projects. Snowball sampling could be used to find more participants, which is a sample strategy in which the researcher approaches participants using contact information provided by prior participants (Noy, 2008). Snowball sampling is a suitable alternative when gathering a list of the population or reaching them is difficult for the researcher (Etikan et al., 2016). In all cases, one key contact person was contacted and interviewed, who would then provide the contact details of other possible participants, which then in turn had been contacted for the research. In some cases, an overview of the actors involved was given, from which the researcher chose actors to interview. However, in some cases, the participants put forward specific people who could be interviewed. It should therefore be noted that this could lead to a selection bias of the interview participants in some case studies. This selection bias was aimed to be overcome by the use of the data triangulation, as mentioned earlier. This included the use of available documents and additionally expert interviews to create a better understanding of the research objectives.

Moreover, the interviews focused on the justice implications of the projects, and how the PPP aims to reach the most vulnerable groups. The focus was on researching to which extent the justice dimensions were included in the design and planning of the PPPs. This was chosen as the main aim, since reaching the vulnerable smallholders has been proven difficult without executing field visits.

The 15 interviews were semi-structured in order to remain flexible (Verschuren & Doorewaard, 2010), and to capture relevant information mentioned by the participants that was not foreseen in advance. Moreover, the interviews were conducted online over Microsoft Teams, since the analysed cases are located in the global South and traveling there is very time- and resource intensive. Moreover, conducting the interviews online helped accommodate for possible COVID-19 measures. Open-ended questions were used in the interviews to elicit the participants' experiences and opinions (Vincent, 2013). Subsequently, the interviews were transcribed to allow for data analysis.

Additionally, the interviewees have been asked whether they would like to remain anonymous and whether they give consent for recording the conversation and using the data for the research. Only one actor requested to remain anonymous in the research. A list of the organisations that have been interviewed is provided in Appendix 1, which was done with the consent of the interviewees. Only the organisation that requested to remain anonymous was labelled “anonymous” in the list. It was therefore decided to make the exact statements used in the results section anonymous. This study used a table to oversee which statements were mentioned by which actors. These codes (e.g. interview 1, interview 2) are used in the results section, but the link to which actor they connect is not visible for the readers. The interviews are numbered from interview 1 to interview 15 in the results section. It was attempted to receive both verbal as well as written consent from the interviewees. The written informed consent form used for this research was provided by Utrecht University and is shown in Appendix 2.

The interview guide topics were connected to the different aspects of the three-step framework that was elaborated on in the theoretical background chapter. Table 7 below provides an overview of the interview guide topics and to which aspects they were connected. Each of the colours shown in the table indicate another step of the analytical framework or theoretical background. First, the interview topics shown in the green cells are focused on the roles of the private sector which have been identified in tables 1 and 2 in chapter two. Second, the blue cells represent the interview topics that are connected to tables 3 and 4 from the theoretical background chapter. Third, the interview guide topics shown in the yellow cells is connected to the justice indicators that have been identified in table 5. The interview guide topics have been linked to these three frameworks identified in the previous chapter to ensure that all aspects of the frameworks are addressed during the interviews.

The interview guides have slightly changed over the interviews, because new information was gathered resulting in extra insights about the case studies. The full interview guides for the case study interviews and the expert interviews are shown in Appendix 3.

Interview Guide Topic	Analytical framework aspect
Who initiated the project	Role private sector
What role does private sector play	Role private sector
Who finances the project	Role private sector
Who owns the intellectual property	Role private sector
Who implements the project	Role private sector
Who produces the seeds	Role private sector
Who distributes the seeds	Role private sector
How does the producer get their seeds	Role private sector
Who finances the production of the seeds	Role private sector
Who monitors the partnerships/implementation	Role private sector
Who helps the farmers with the adoption	Role private sector
Who provides training for the farmers	Role private sector
Who distributes the seeds to the farmers	Role private sector
Why participating	Stimulating and restrictive factors
What are benefits from participating	Stimulating and restrictive factors
What would be a reason not to participate	Stimulating and restrictive factors
Why do other actors not participate	Stimulating and restrictive factors
Civil society participation in decision-making	Justice
Local knowledge	Justice
Are all vulnerable groups recognised	Justice
Who is the focus of this project	Justice
Are vulnerable groups targeted	Justice
How is targeting of vulnerable groups ensured	Justice
Which actor is mostly concerned with inclusion of vulnerable groups	Justice

Table 7: Interview guide topics and corresponding analytical framework aspects.
Note. Green is connected to tables 1 and 2, blue to tables 3 and 4, and yellow to table 5.

Furthermore, four expert interviews have been conducted with different actors who have substantial experience in the field of PPPs concerned with agriculture that are not connected to the case studies. An expert is defined as a person who operates as a knowledge supplier (Verschuren & Doorewaard, 2010, p. 209). The expert interviews are used in order to gain a deeper understanding of the roles of the private sector in agricultural PPPs in general, and what the balance between the private and public sector is. Moreover, these experts interviews are focused on how they perceive the involvement of the most vulnerable groups. This is used to create a better understanding of how the agricultural PPPs can help contribute to inclusive climate adaptation. Moreover, the expert interviews were used to verify the results of the comparative analysis of the case study analyses, and to see if the connections identified are also addressed in the expert interviews. The interviews conducted with the PPP actors from the case studies were in contrast designed to get a better understanding of the processes of the PPPs and how the roles are perceived by the different actors. All expert interviews were conducted with public actors. The interview guide for the expert interviews is shown in Appendix 3. The expert interviews are elaborated in section 4.5. They have not been included in the individual case study analyses, because these only focus on the individual cases without expert interviews. The expert interviews have therefore mostly been used as an addition, and the results are shown in section 4.5 and discussion section.

3.3.2 Document analysis

Multiple benefits of analysing policy documents have been identified, such as the availability of the information at any time and that the researcher can access the words and language of the participants (Cresswell & Creswell, 2017). Nevertheless, using policy documents also has a few limitations. First, not all parties were involved in the creation of the documents (Creswell & Creswell, 2017). Moreover, only some of the documents are open to the public (Creswell & Creswell, 2017). Conducting interviews as explained above helped overcome these shortcomings. In some of the cases the documents were provided by the participating actors during the interviews, and in other cases these were not. However, this could create inequalities in information availability for the research. Therefore, it was decided to base most of the analysis on the interviews, and the documents would only be used if the interviews did not provide sufficient knowledge, or some topics still remained unclear. The documents have thus mostly been used for additional information. Additionally, the documents have been used to check the information provided by the interviewees, in order to overcome issues of interviewees providing socially desired answers to the interview questions. This is also part of the data triangulation method as explained at the beginning of the data collection section.

For the use of these additional documents, publicly available documents on the selected PPP projects in the global South were analysed. Moreover, documents by the different actors within the PPPs concerning the adaptation project were analysed. Some of these documents were, as mentioned, provided by participants during the interviews. Two of these documents have not officially been published and can therefore not be officially cited, yet have been used for the analysis. These documents can be requested by the researcher of this study. These documents have been numbered document 1 and 2. A short explanation of these documents can be found in Appendix 4. It should thus be noted that some of these documents are not scientific articles but are often written by the organisations themselves and can therefore possibly be biased. Therefore, the documents had to be critically analysed. Nevertheless, the documents can contain factual information about the case studies that was useful for this study.

3.4 Data analysis

The transcribed interviews produced qualitative data. A thematic analysis was performed on this data. The data was analysed with NVivo, a tool to import and code data. This coding produced gathered data divided into themed containers (Richards, 1999), allowing for more easy identification of ideas, patterns, similarities or differences between the interviews. The qualitative data was analysed through both closed and open coding. Closed coding was used to categorise the data in the three main topic areas of this research, being the role of the private sector, stimulating and restrictive factors, and justice implications. Within these identified thematic containers for codes, open coding was used. Data is compared, labelled, and categorised throughout the process of open coding (Verschuren & Doorewaard). According to Tracy (2019), the term ‘open coding’ implies that you are attempting to “open up meaning in the data” (p. 189). Open coding was used to avoid pre-existing assumptions and biases, while simultaneously allowing for new insights to arise in the coding process. However, it should be noted that the coding process was an iterative process. Other codes that did not fit into the three beforehand established categories, were systematically organised into other codes that conceptually cohere. This process is called axial coding (Tracy, 2019).

Furthermore, in document analysis, data is investigated and interpreted in order to gain understanding and elicit meaning, as in other qualitative research methods (Bowen, 2009). Document analysis requires scanning, reading and interpreting of the documents (Bowen, 2009). As explained before, the documents have only been used in the analyses of the cases when the interviews did not provide sufficient data to answer all the questions adequately, or for additional information. This was decided, because some case studies have written more documents than other case studies, and this could

create information inequalities between these case studies. By focusing mostly on the interviews and only additionally using the documents in cases of insufficient data from the interviews to answer the necessary questions, this problem was overcome. Moreover, the documents were used for factual information about the case studies, whereas the interviews also focused on eliciting the views and experiences of the participants. The documents were therefore not thematically analysed, but used as an extra data source. Nevertheless, in the scanning and interpreting of the documents, similar identifiable topics to the interviews have been used to allow for integration of the two methods of data collection (Bowen, 2009).

This research used a hierarchic comparative case study design, meaning that the cases were first analysed independently and later compared based on the similarities and differences found in the first phase (Verschuren & Doorewaard, 2010). The coding of the interviews was therefore also executed per case study, to allow for these independent and individual analyses of the case studies. These cases were analysed through the assumptions and analytical frameworks identified in the theoretical background, and they then were compared based on these identifications. This allowed for a well-structured and substantial overall picture.

The justice indicators evaluated during the research are shown in the results section. Corresponding to what was mentioned before, the scores have first been evaluated in the individual case study analyses with explanations for the chosen scores, and are later, in the comparative analysis section, compared with one another. The justice indicators have been scored in order to provide a systematic and simplistic overview of the indicators, and to allow for comparison between the case studies (Morita et al., 2020). However it should be noted that this simplistic and schematic overview has decreased the nuances that are linked to the complex nature of the case study. There are three scores that have been given to the justice indicators. In existing research, scoring has also been used. In the research by Cesario et al. (2002), the lowest score indicated that there was no evidence that criteria were met. Furthermore, in research by Sharifi et al. (2015), they used the following scoring keys: Not included, different, similar, included or not applicable. The scores used for this research and the criteria for these scores are shown in table 8 below.

Score	**Explanation**
High	Indicator is present, formal measures in place
Moderate	Possible informal or small indications but no concrete measures in place
Low	Indicator is not incorporate in the PPP

Table 8: Justice indicator scores and explanations

In the results section, some quotes from the interviews have been added. These quotes have been used to illustrate explicit examples that support the main message from the text. These quotes have thus only been added if they are of relevance and support the results. Furthermore, the interviews and documents were combinedly used for the analyses of the individual cases. The findings from the interviews and documents are explained in the results section, and the interviews or documents have been cited in the text to allow for transparency and traceability. These citations have however been made anonymously, without naming the actual participant of the interviews. The names of the private and public organisations involved have on the other hand been named in the case explanations, to again allow for transparency and traceability and to generate a better understanding of the case studies.

4. Results

This section elaborates on the results leading from the case study analyses. It first lays out the four individual case studies. These sections are structured as followed: First, it analyses the role and the level of engagement of the private sector. Second, the stimulating and restrictive factors that have been identified in the interviews are elaborated, in order to explain the role and level of engagement of the private sector. Third, the justice implications on the most vulnerable groups are evaluated. These sections are first addressed individually. This chapter ends in a synthesis of the case study analyses, where connections between the three elements of the analytical framework are identified.

4.1 Case 1: AAA Maize Project

4.1.1 Case description

The public-private partnership of the AAA Maize program is focused on increasing food security by making tropical maize hybrids available to Asian smallholders. The maize hybrids are drought-tolerant (Syngenta Foundation, 2021). The drought-tolerant nature of this maize variety can therefore be considered a climate adaptation strategy to the new dryer weather-conditions, caused by climate change. The AAA Maize project is focused on one specific region in India that is prone to the effects of climate change, such as increasing temperatures and erratic rainfall (Syngenta Foundation, 2021). This region is located in the three states of Madhya Pradesh, Rajasthan and Gujarat. The location of these three states is shown in figure 5 below. The program thus aims to create a unique breeding program for maize (Syngenta Foundation, 2021). The AAA stands for Affordable, Accessible and Asian Maize. The project's goal is thus to make tropical, drought-tolerant maize hybrids available to Asian smallholders at an affordable price. The AAA Maize program is currently expanding into other regions in Asia such as Myanmar, but the scope for this case study was limited to these three Indian states.

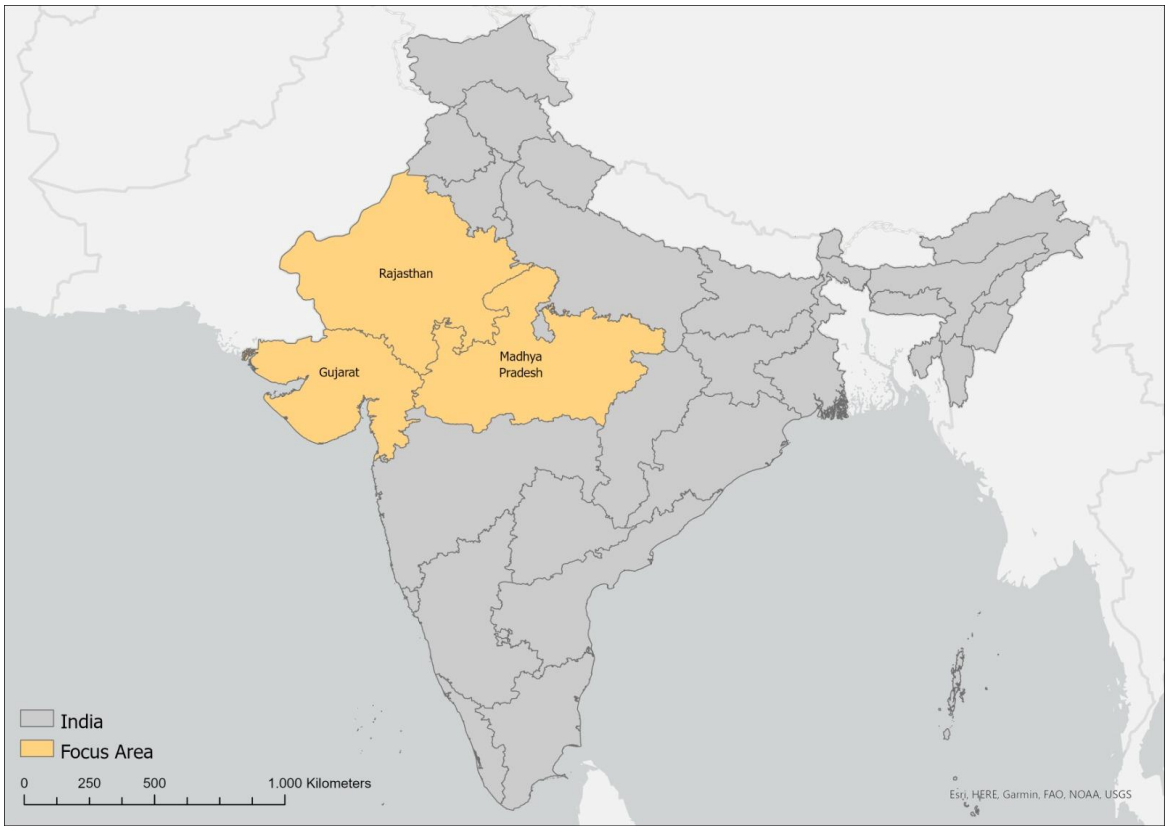

Figure 5: Focus area of the AAA Maize Program. Source: Hijmans (2015). Created by and used with the permission of Guido Mosch.

The project consists of two steps: the first being the breeding of these drought-tolerant maize varieties, which was initiated in 2010. The second is the production and distribution of the seeds to smallholders (Syngenta Foundation, 2021). The Syngenta Foundation funded the breeding program of the AAA Maize variety. The International Maize and Wheat Improvement Centre (CIMMYT) and Syngenta group were the actors that created the variety through research and development (R&D) and cooperation. CIMMYT is an international agricultural research centre, and therefore a public sector actor. Syngenta group is a large multinational firm, and therefore a private sector actor. The Syngenta Foundation however is a foundation that is independent from the Syngenta Group and has its own board (Syngenta Foundation, n.d.). It is a non-profit organisation, but since it was originally attached to the Syngenta group (Syngenta Foundation, n.d.), it is labelled in this research as a semi-public actor.

Furthermore, the new maize hybrid, the TA5084, is being commercialised since 2018 and is available on the market in the three Indian states since 2019. The seed partners are small private companies or NGOs (Syngenta Foundation, 2021). The AAA Maize Program does not have a set program duration, but new hybrid seed varieties are being developed for the program.

The program was initiated by the Syngenta Foundation, who at first was the intermediary actor between the Syngenta Group and CIMMYT in the R&D phase of the maize variety. In the commercialisation stage of the program, the Syngenta Foundation is also the actor who finds private sector and NGO partners for the distribution of the seeds, and is thus the main driver behind the AAA Maize program.

4.1.2 Role and level of engagement private sector

This section elaborates on the different roles that the private sector has. Various roles have been identified through the open coding process in the analysis of the case study. The identified roles have been shown in table 9 below, including a short explanation. A more specific elaboration about the roles is provided in the following section. Some quotes resulting from the interviews are provided, as explained in the methodology.

Role private sector	**Explanation**
Production and intellectual property	Main role for private sector. NGOs do not always participate own seeds. Seeds come from public actors
Distribution	Private actors use their network of distributers and retailers. NGOs work with large farming communities
Financing	Private actors finance all own activities. NGOs received small funding in the first year
Training	Private actors and NGOs provide various trainings, including demonstration plots
Monitoring	All actors need to report their progress, which the (semi-) public actors monitor
Marketing	Private actors market and promote the seeds themselves

Table 9: Overview of the roles of the private sector in the AAA Maize Program

The main role of the private sector, that has been identified in all four interviews, is the *production of seeds*. The process works as followed: the private actors receive the male line of the maize hybrid from CIMMYT for free (Interview 4), which they are allowed to keep multiplying by themselves (Interview 1). The female line of the hybrid is being provided by the Syngenta Group, for which the private seed companies have to pay royalties (Interview 1; Interview 4). The private seed companies have to pay royalties for the female line and not for the male line, because the male line is descending from a public

organisation, and thus is a public good (Interview 1). In contrast, the NGOs who are participating in the PPP do not always produce their own seeds. They buy the seeds and then sell them to the farmer production organisations they are connected with (Interview 2). The private sector also does the *marketing* of the products (Interview 1; Interview 3).

"Involvement starts from the production phase, and along with our maize hybrids we plant production for AAA hybrid as well."- (Interview 1)

Another role of the private sector that was often mentioned during the interviews is the *distribution of seeds* (Interview 1; Interview 2; Interview 4). The private sector thus produces the seeds, package the seeds, and then they send it to their dealership network (Interview 4). They are thus the actor who is in, either direct or indirect, contact with the farmers and make sure they receive the seeds. The private actors have distributers (Interview 1; Interview 4), who in turn have approximately 10-20 retailers who work under their supervision. So the private seed companies sell the seeds to the distributers, the distributers have their own sales counters, but also they distribute it further along the line to the retailers, who will then provide the seeds to the farmers (Interview 1). The retailers are used because they have better access across the targeted regions (Interview 1). The private actors are also responsible for the marketing of these seeds.

In contrast, the NGOs are often working with large farming communities themselves, so they can disperse these seeds to the farming communities directly, and thus do not need to use agro-dealers in the process. Another way for the NGOs to distribute the seeds is through farmer producer companies and cooperatives (Interview 2). Also, for the distribution of the seeds, the private actors need to forecast for the next couple of years how much seeds they would require from the Syngenta Group to fulfil the demand (Interview 1; Interview 4).

"They have, and the dealers, sitting in the villages, would sell on behalf of the seed companies, those seed varieties." – (Interview 4)

Furthermore, the private actors are responsible for the *financing* of the seed production and distribution. The Syngenta Foundation has funded the R&D of the seed variety in the first phase of the project, and the financing of the second phase lies with the private actors (Interview 4). The private actors also need to pay royalties to the Syngenta Group for using the female line of the maize hybrid (Interview 1; Interview 3). It was indicated that the private actors are also allowed to make profit on these sales, which is why they do not receive extra financing on their participation (Interview 1). However, one actor mentioned that the private actors are sometimes incentivized with small amounts of money from the public actors to participate (Interview 3).

However, the interviewed NGO did indicate that they also have to finance all the costs and pay royalties for the female line, but only from the second year on (Interview 2). During the first year, demonstration plots were set up to raise awareness for the seed variety and show the smallholder farmers what the variety entailed (Interview 2). These seeds were financed by the Syngenta Foundation, as well as the costs for setting up these demonstration costs.

"We don't need to get funded, because we are also making some profit on these sales." – (Interview 1)

Besides the production and distribution of the seeds, the private actors provide *training* for the smallholder farmers on how to optimally use the hybrid (Interview 1; Interview 4). These trainings are firstly focused on explaining for example how much seeds are produced per acre, when they should do

fertigation, when it is best to do irrigation if that is available and when they should be harvested (Interview 1). This training is often provided by the private actors, who provide these trainings themselves or through the distributers and retailers (Interview 1). Besides these trainings, the private actors provide leaflets to all distributers or retailers to hand to the farmers who buy the seeds. These leaflets are provided in local languages explaining these agricultural characteristics and what the special needs for these hybrids are, so the smallholder farmers can use those leaflets to get a better understanding of the optimal seed production (Interview 1). Furthermore, the AAA Maize Program is focused on arranging demonstration plots (Interview 2; Interview 3). These demonstration plots are used for the purpose of showing the farmers the performance of the seed and what the differences are with their regularly used seed varieties. This will help create a better understanding of the seed varieties and is also used as a marketing strategy (Interview 2; Interview 3).

"Our team does involve in basic agronomic training in those areas." – (Interview 1)

Lastly, the private actors are responsible for *monitoring* their progress (Interview 1; Interview 2; Interview 3). The Syngenta Foundation requests from the private actors to register where the farmer is located and what the phone number is so they can contact them and receive feedback (Interview 2; Interview 3). Moreover, the Syngenta Foundation requests that the private actors themselves are collecting feedback from the farmers on the seed varieties and the program progress (Interview 1; Interview 2; Interview 3).

"For these AAA hybrids; Syngenta Foundation does want to know in which areas we are selling these hybrids and how many farmers we have been able to touch base with." – (Interview 1)

However, since the private seed companies are not themselves in contact with the smallholder farmers, their contact normally ends when they provide the seeds to the distributers. Therefore, the monitoring of the process is not always complete but more a general guideline (Interview 1). The NGOs monitor how the project is doing and whether the production was good, but not with all farmers. It was also mentioned that the reporting does not occur on a regular basis, but once in a while they provide status updates (Interview 2).

"We just monitor whether the production is good or no, and we have our own consultant who sometimes calls up these farmers to monitor the progress. and if there is an inquiry, he addresses those. But not with all farmers." – (Interview 2)

4.1.3 Stimulating or restrictive factors

This section elaborates on the stimulating or restrictive factors that the private sector has for joining the PPP. The stimulating and restrictive factors that have been identified during the interview are shown in table 10 below. Further explanations for each of the factors are provided below.

Stimulating factors	**Restrictive factors**
By joining the PPP, the private sector can possibly help smallholders uplift their livelihoods	Project only allows for a limited market, since it only focuses on three targeted states
Bigger chance to make more profit	Project is difficult to join due to extensive contracts
Opportunity to go quickly to the market	Less opportunity to make profit due to maximum retail price cap
Option to receive a high-quality seed variety	Hard to join the project because the project can be full

Table 10: Stimulating and restrictive factors for participation in AAA Maize Program

Stimulating factors

The first reason for the private sector to join the PPP is to help the smallholder farmers uplift their livelihoods (Interview 1). This is for the NGOs also the main reason to contribute in this PPP (Interview 2).

"Apart from this being a noble cause like I said earlier, that it is great to be part of such a project" – (Interview 1)

Furthermore, the private sector wants to participate because it can help them make more profit by selling the seeds (Interview 1; Interview 3). Moreover, the quality of this hybrid ensured a repeated demand for this hybrid by farmers (Interview 1; Interview 3). However, the most important reason for the private sector to participate in this program is that they can quickly go to the market with a high-quality seed variety (Interview 1; Interview 2; Interview 3). The process of developing a new seed variety can take a long time (Interview 3). Also, after the new variety is being developed, it needs to be registered through the local governments (Interview 3) and it should be demonstrated to the farmers so they want to buy it. By joining the AAA Maize Program, they received a ready-made product, which would save both time and money for the private sector (Interview 3).

Restrictive factors

Besides these stimulating factors, there were also some restrictive factors that could limit the participation of the private sector. The first restrictive factor is that the AAA Maize Program only focused on the three targeted states (Interview 1). This could be a restrictive factor because some private actors might do have existing distribution channels within these area and they do not have the opportunity to distribute the AAA hybrid to more economically prosperous regions where they can make more profit (Interview 1). Second, the private partners needed to sign different types of contracts to be able to join the AAA Maize Program. Small seed companies at times do not have legal teams that can work through these extensive contracts, which then limits their participation (Interview 4).

"Those organisations, they don't have lawyers or they don't have legal teams to review all this, so it is not an obstacle, but you need to help those seed partners if they don't have the capabilities to look at that." – (Interview 4)

Thirdly, the Syngenta Foundation has implemented a Maximum Retail Price cap for the maize variety (Interview 1). This can decrease the willingness of some private companies to participate in the program, since they cannot make significant profits from the seed varieties (Interview 1). Lastly, a restrictive factor of the program is that it only has a limited geography, and they do not want multiple private companies to overlap in the areas where they work (Interview 3). As a result, the program can be 'full', and thereby limiting all other interested actors to participate in the project (Interview 3).

4.1.4 Justice implications most vulnerable groups

This section shows the evaluated justice implications of the most vulnerable groups in the PPP project. The five justice indicators that have been elaborated in the analytical framework section have been used to structure the results. The scores of the AAA Maize Program on the different justice indicators is shown in table 11 below. Explanations for the five scores are provided below.

Justice indicator	Score	Indication
Vulnerable regions are targeted by PPP	High	Specified target area, which is a is poor and climate-prone region
Needs affected groups are taken into account	High	Various formal mechanisms present to understand the needs of farmers
Focus on vulnerable groups	High	High focus on reaching vulnerable groups, including specific measures to ensure this present
All parties can share their expertise on the subject	Moderate	Feedback-receiving mechanisms are in place to take into account local needs and simultaneously local knowledge. No other formal mechanisms in place
All stakeholders are involved and have the opportunity to participate in decision-making	Low	Not able to sit at decision-making table. Sometimes representatives present.

Table 11: Scores justice indicators AAA Maize Program

Indicator 1: Vulnerable regions are targeted by PPP

The AAA Maize Program is focused, as explained above, on three Indian states, which are Rajasthan, Gujarat and Madhya Pradesh (Interview 1; Interview 3; Interview 4). Furthermore, the AAA Maize Program tries to avoid unnecessary competition between the different seed companies to prevent price differences and other conflicts to occur within the project (Interview 3). Therefore, the AAA Maize Program only aims to engage with one partner per district or block within the targeted areas, and finally covering the entire focus area (Interview 3). Within these three states, there are five certified areas which are the 'tribal belts' (Interview 1). These tribal belts are often resource-scarce areas, where the people normally do not buy expensive hybrids (Interview 1; Interview 3). The Syngenta Foundation has established these areas as the target areas of the project, where the seed partners have to sell their seeds. Moreover, these regions are especially targeted because besides the relatively large proportion of tribal farmers in the population, the regions have been prone to climate change and sub-optimal rains for a few years (Interview 1; Interview 4). The hybrid maize varieties of the program are especially designed for these remote locations without irrigation, dry weather conditions and poor soil conditions (Interview 1). It is expected that these vulnerable communities often live in those areas, and the program will thus especially reach those groups (Interview 4).

> *"There is prone in these particular states and it is meant for these 3 states tribal base only. So it is a kind of mandate from them that we can only sell this hybrid in a particular region." - (Interview 1)*

Moreover, maize is often grown in resource-scarce areas. It is assumed by the various partners in the project that when the seed is sold in these regions, it will reach the smallholder or marginalised farmers (Interview 1; Interview 2). This is assumed because the distributers and retailers that the partners are working with are located in these tribal belt areas with mostly marginalised farmers present. It is also expected that the retailers will not travel large distances to sell the seeds, and thus the seeds will mostly reach these tribal farmers (Interview 1). It can thus be concluded that the AAA Maize Program is focused on reaching the vulnerable regions which have a lower capacity to adapt to these dryer and resource-scarce conditions.

"The seeds are mostly going to resource-scarce areas, okay? … Maize is only grown in resource-scarce areas, mostly. So that is the tribal belt of Gujarat. So here the landholdings are small and the farmers are very poor. So obviously 90% of the seed will go to the most marginalised small farmers" - (Interview 2)

Indicator 2: Needs of affected groups are taken into account

The AAA Maize Program tries to take the needs of affected groups into account in a few ways. First of all, the program is trying to receive feedback from the farmers through multiple ways. The first way is that the private partners or NGOs get feedback from the farmers (Interview 1; Interview 2; Interview 3). However, it should be noted that not all farmers are being asked for their feedback by the partners (Interview 1; Interview 2). Besides the seed companies and NGOs being in touch with the farmers to receive the feedback, the Syngenta Foundation themselves is also in touch with the farmers (Interview 1; Interview 2; Interview 3). They go on field trips and discuss with the farmers what they are feeling and what they think about the hybrid (Interview 3).

"Go and take the feedback from the farmers and understand whether what we promised is being felt by farmers or not" - (Interview 3)

Moreover, they discuss what kind of characteristics of the hybrid could be improved (Interview 3). Third party research agencies are also involved in the collection of the feedback (Interview 3), possibly to get a more nuanced perspective on the feedback of the farmers. The contact numbers of the farmers that are documented by the seed companies and NGOs are provided to the third parties, and they in turn conduct telephonic interviews or do field visits, resulting in a detailed report that will be provided to the Syngenta Foundation (Interview 3). This feedback about the seed variety is used to create better suitable seed varieties for these targeted areas (Interview 3). Furthermore, representatives of farmer producer organisations are present in the board of the NGO partner interviewed (Interview 2). The needs of the farmers can hereby be taken directly into account in the implementation of the program, in contrast to the feedback-receiving systems, which are more focused on improving future practices. The AAA Maize Program thus aims to take the needs of the farmers in these various conditions and places into account through feedback-receiving systems in which the farmers can tell them how they experience the new hybrid and program.

Indicator 3: Focus on vulnerable groups

The aim of the public-private partnership was to make tropical maize hybrids available to Asian smallholders at an affordable price (Syngenta Foundation, 2021). Moreover, it is the objective of the Syngenta Foundation and NGOs that the seeds will also reach the resource-poor farmers and to uplift the livelihoods of the small farmers (Interview 3). The aim was also to increase the productivity and thereby food security of these farmers (Interview 4).

"The beauty of this program was not only to make it affordable but also to make it very much productive. Basically 2 to 3 times the yield they could get in their normal field conditions." – (Interview 4)

As already addressed in the first indicator, the AAA Maize Program aims to address tribal, marginalised farmers in resource-poor areas within the three targeted states (Interview 1; Interview 3). This is the first way to ensure the focus on the vulnerable or resource-poor groups. The second way for the program to ensure that these vulnerable groups are being reached, is the presence of NGOs in these programs. It

was mentioned during the interviews that NGOs are more capable reaching the smallholder farmers compared to the private seed companies (Interview 3). These NGOs operate in these smallholder farmer areas only, whereas the seed companies are not limited to these areas (Interview 2; Interview 3). Moreover, it was mentioned that the objective of these NGOs is to work with these vulnerable communities, so by working with an NGO it can be assumed that they will focus only on these vulnerable groups (Interview 3).

"The main objective of NGOs is they help the poor and resource-poor farmers." – (Interview 3)

There is thus a difference between the aim of the private sector and NGOs to reach these smallholder farmers. Nevertheless, the private sector involved in this program is also aiming to reach these marginalised and vulnerable groups (Interview 1; Interview 3).

Besides trying to make sure that the vulnerable groups are targeted by the program through focusing on specifically chosen resource-poor states and including NGOs in the program, there are also some more concrete measures in place to ensure that the vulnerable groups can also benefit from the program. Firstly, the maize seeds are made affordable because the smallholders often do not have the capacity to invest in the seeds (Interview 4). The prices therefore have to be kept low.

"We cannot oppose or price them in line with the market performance, we have to price them lower so more and more farmers can afford it and adopt this hybrid" – (Interview 1)

The NGOs sell their seeds through Farmer Production Organisations (FPOs), who sell the seeds at a discounted rate to the farmers, in order to make the seeds better available for them (Interview 2). The private sector also has to keep the hybrid seeds accessible for the vulnerable farmers. This is ensured by a maximum retail pricing (MRP) cap (Interview 1). This MRP cap was enforced by the Syngenta Foundation because the market driven price for an improved variety is too high for the vulnerable communities. The MRP cap is set at a level where the private sector can still make some profit on the sales, so they do not need funding from the public sector, but they cannot make access profit from the AAA hybrid (Interview 1). This MRP cap is thus set by the Syngenta Foundation for the private partners to protect the overall purpose and objective of the program to reach the smallholder farmers (Interview 1). Other ways to ensure that the program also reaches the smallholder farmers is through providing leaflets in local languages that the distributers and retailers have on their counters, so the farmers can get more information about the seed varieties and implement the AAA hybrid (Interview 1). Moreover, video or audio messages are made of farmers in the same area that are using the AAA hybrid, which can be sent to other smallholder farmers to get them engaged in the program (Interview 3). Lastly, it is also expected that intensive large-scale farmers will not be interested in the AAA hybrid variety, because it is not a top-variety and specifically designed for resource-poor regions (Interview 4). The AAA Maize program thus tries to ensure that smallholders are being reached out to in various ways.

Indicator 4: All parties can share their expertise on the subject

The fourth indicator of the justice framework was whether all parties can share their knowledge and expertise on the subject. For the AAA Maize program, the focus mainly lies on receiving feedback on the hybrid varieties and the program, and then trying to incorporate this for the next hybrid program. However, the hybrid variety is produced for harsh environmental conditions where these vulnerable farmers are located, because, as mentioned in the interviews, the local farmers often sow the seeds, and they do not rely on other information sources (Interview 1). Besides trying to incorporate the needs of the farmers in the seed varieties through feedback, not much local knowledge is taken into account

during the program. This can be explained by the small partners that are included in the program, and that these small partners do not have the available resources to focus on this (Interview 2). Nevertheless, the NGO would like to focus more on the local knowledge of the vulnerable groups if they have the capacity (Interview 2).

Indicator 5: All stakeholders are involved and have the opportunity to participate in decision-making

Connected to the previous indicator about the availability to share expertise and knowledge, this indicator is focused on the involvement of all stakeholders in the decision-making process of the program. The smallholder farmers cannot participate in the decision-making processes of the program (Interview 1; Interview 2). As mentioned above, the farmers mainly provide feedback to the various actors involved in the program who then attempt to make adequate adjustments based on the received feedback (Interview 1; Interview 2; Interview 3). However, the farmers are not actively present at the table for the decision-making of the process. Nevertheless, the NGO does have representatives of farmer producer organisations that are involved in various stages (Interview 2).

"They are simply just a beneficiary of this project. As such, they don't get involved in the project in any other way." – (Interview 1)

4.2 Case 2: AICCRA Zambia Accelerator Program

4.2.1 Case description

The AICCRA Zambia Accelerator Program is focused on increasing food and water security in Zambia (Consultative Group on International Agricultural Research [CGIAR], 2021a). AICCRA stands for Accelerating the Impact of CGIAR Climate Research for Africa (CGIAR, 2021a). Southern Africa is dealing with rising temperatures, erratic rainfall, more droughts and floods due to the effects of climate change (CGIAR, 2021b). Due to this hotter and drier environment, AICCRA Zambia's goal is to promote water and food security in southern Africa by providing access to knowledge, decision-making tools and technologies to strengthen climate resilience in Zambia's food systems (CGIAR, 2021b). The AICCRA Zambia consists of four bundles (CGIAR, 2022), shown in figure 6 below. This case study only looks at the third bundle, which is focused on climate-smart seed varieties.

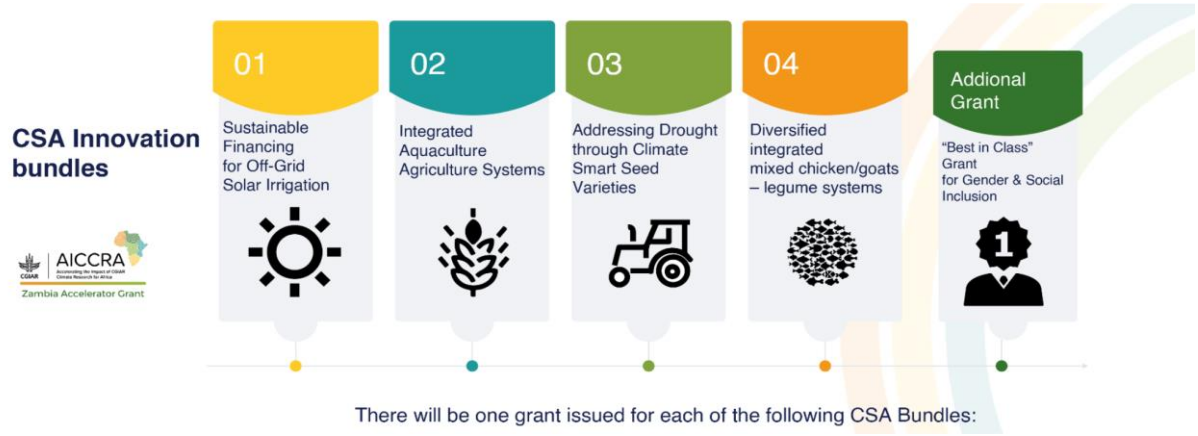

Figure 6: Four bundles of the AICCRA Zambia Accelerator Program. Source: CGIAR (2021)

In order to participate in the program, different actors had to submit a proposal to the CGIAR, who would in turn decide who would participate in the AICCRA Zambia Accelerator Program and receive the grant. For the third bundle, the actors Agova, Corteva, PlantCatalyst and iDE work together in Zambia in order to scale climate-smart agricultural practices and inputs (CGIAR, 2022). The public actor in this case study is the CGIAR, which is an international agricultural research institute. Corteva and PlantCatalyst are multinational companies who are producing respectively seeds and crop boosters, and thus being private sector actors. Agova is a domestic private consultancy firm, and the iDE is an international NGO. The AICCRA Zambia Accelerator Program will last two years, starting in January 2022 and ending in December 2023 (CGIAR, 2021a). The entire program was initiated by the CGIAR (Interview 8), but the initiators to write the proposal were Agova and PlantCatalyst (Interview 5). The program is focused on five Zambian provinces, which are shown in figure 7 below.

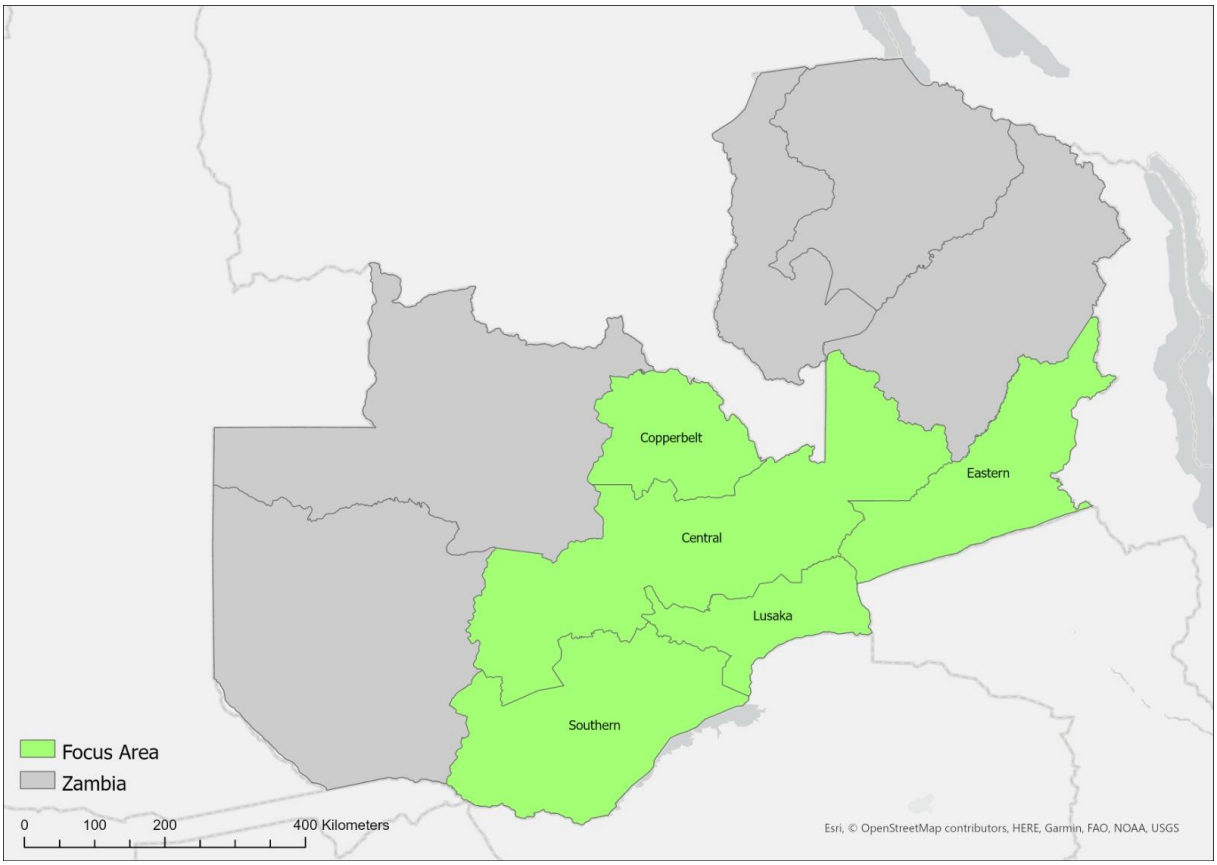

Figure 7: Focus area of the AICCRA Zambia Accelerator Program. Source: Disaster Management and Mitigation Unit Zambia (2020). Created by and used with the permission of Guido Mosch.

4.2.2 Role and level of engagement private sector

This section elaborates on the different roles that the private sector has in this case study. Various roles have been identified through the open coding process in the analysis of the case study. The various private actors have different roles within this partnership, of which an overview is shown in table 12. The following section elaborates the roles of the private sector in more detail.

Role private sector	**Explanation**
Proposal writing	The private actors have to write own proposal to participate in the program
Production and intellectual property	One private actor produce their own seed varieties
Research and development	
R&D	Private actor uses own varieties, for which R&D was done
Distribution	Private actors use own networks of distributers and retailers. Also use NGO's networks to reach smallholder farmers
Financing	Private actors finance 50% of program. Other 50% is provided by public actor. They can keep own profits
Training	Private actors and the NGO provide trainings, including demonstration plots. NGO main actor involved in the training.
Monitoring	Private actors monitor and evaluate progress. Report back to public actors
Project management	Private actors responsible for coordination
Marketing	Private actors market and promote the seeds themselves

Table 12: Overview of the roles of the private sector in the AICCRA Zambia Accelerator Program

The first role that the private actors had in the AICCRA Zambia Accelerator Program is to *write a proposal* for participating in the program. As explained above, the program is built around the bottom-up partnerships between different actors who wanted to work on addressing drought through climate-smart seed varieties (Interview 5; Interview 6). The main actor in writing this proposal was Agova, who received help from a grant writer that was hired by the private actor PlantCatalyst (Interview 5).

Moreover, one of the private actors is doing the *seed production* themselves. They are using their own seed varieties, so the intellectual property is also owned by the seed company (Interview 5; Interview 6), and they do the *research and development* of the product (Interview 5), as well as the *marketing* (Interview 5; Interview 7). Also, the crop booster is being produced by another private actor who also own the intellectual property of this product (Interview 6).

The *distribution* of the climate-smart seeds is done through the private seed company and the participating NGO (Interview 5; Interview 6; Interview 7). The private seed company, as explained above, produces the seeds and then introduces these to the market (Interview 6). The company uses external distributors and dealers, who are used to reach more farmers in the rural areas (Interview 5). Besides these regular distribution networks, the seeds are provided through the involved NGO (Interview 6; Interview 7). They are organisation demonstration plots where the farmers can see the seeds and review whether they want to buy them (Interview 5; Interview 6). The NGO will at these sites provide the seeds to the farmers. The other private company producing the crop booster use a different distribution network. First, they use community agents, who are located in the areas where the farmers live (Interview 6) These community agents then sell the crop booster to the farmers. Simultaneously they are using the NGOs distribution network, because they have direct links to the farmers (Interview 7).

"These are very *rural areas we are talking about, so they very likely won't have their own like stocking warehouses, so they'll... the way in Zambia it is structured is that you'll have community dealers, that are closer to the farmers in the fields, and then they'll come and pick up from the stocking warehouses in the regional area capitals, and then they'll sell... they'll distribute." – (Interview 5)*

The AICCRA Zambia Accelerator Program is *financed* by both the private and the public sector. The total program was budgeted at 100,000 dollars (Interview 8). More precisely, 50% of the contribution was provided by AICCRA, so the public actor, and 50% of the contribution would come from the private actors (Interview 5; Interview 6; Interview 7; Interview 8).

"Yes, it is 50% our contribution matched with 50% their contribution." – (Interview 8)

The private actors needed to budget their activities for the proposal and elaborate where the money would be attributed to (Interview 5). The private actors also needed to decide among themselves how much money each actor would receive from the AICCRA grant of $50,000, and how much each actor would have to contribute (Interview 5). Some actors would actually pay money for various activities in the project, whereas others would provide 'in-kind donations', meaning that they provide their product for free, financed by the budget (Interview 5; Interview 7).

"We provide a lot of [product of our company] for free as an in-kind donation" – (Interview 7)

Lastly, the private companies that sell their products within this program receive the profit from the sales. They do not have to share these profits with the other actors who do not provide products (Interview 5).

The private actors use multiple ways of *training*. One is focused on explaining the practical side of the product, for example on how to use the products, the practices and protocols (Interview 5). Moreover, demonstration plots are created to explain the farmers what the products do (Interview 5). The NGO is the actor that is mostly concerned with arranging the demonstration plots, field days and the trainings to the farmers, because they are often already working with these farmers in these areas (Interview 5; Interview 6; Interview 7).

"The field days have a lot of goals. so for once they are learning how to use the … product. But they are also learning some other climate-smart crop methodologies" – (Interview 7)

Another role that the private actors have in this program is *project management*. The private actors themselves are responsible for the coordination of the different activities of the various actors and making sure they are finished before the deadlines (Interview 5; Interview 7).

The private actors are also responsible for *monitoring and evaluating* their progress (Interview 5; Interview 6; Interview 7). The evaluation is focused on the results and achievements of the program, so how many farmers they have reached, how much the productivity has increased, how the incomes were increased etcetera (Interview 5). Before the project has started, they created a baseline, so they can precisely track the differences between before and after the program has been implemented (Interview 5). The private actors will do field research to collect this data. These reports are sent to AICCRA who will evaluate the reports and thereby check how the project is going (Interview 6; Interview 7).

4.2.3 Stimulating and restrictive factors

This section lays out the stimulating and restrictive factors that the private actors faced to join this program. The stimulating and restrictive factors are shown in table 13 below, and further elaboration on each of the factors is provided below.

Stimulating factors	**Restrictive factors**
By joining the PPP, the private sector can possibly help smallholders uplift their livelihoods	No restrictive factors were mentioned
Bigger chance to expand markets and make more profit	-
By participating in the PPP it allows the actors to use each other's networks	-
The partners can possibly use the program to scale up own business	-

Table 13: Stimulating and restrictive factors for participation in AICCRA Zambia Accelerator Program

Stimulating factors

The first stimulating factor that was identified through the coding process was to be able to help the farmers, especially focused on the smallholders (Interview 5; Interview 6; Interview 7). Moreover, by reaching those smallholders, the private actors can expand their markets and thereby generate more profit (Interview 5; Interview 7). The partners can use each other's networks to reach these farmers (Interview 7). This is one of the main reasons why they have decided to join the partnership together.

Lastly, the private actors were hoping to use the two-year AICCRA program to scale up their own business in Zambia, and after the program being able to continue with their work (Interview 7).

"We are hoping to use the grant of like a spring-board into a swimming pool to enlarge our impact... in the smallholder farmer community and a couple key regions of Zambia." – (Interview 7)

Restrictive factors

No restrictive factors were mentioned by the various private actors in the interviews. The absence of these restrictive factors could be explained by the fact that the private actors participating in this project have designed the precise project themselves. In this case study, the private actors had to submit a proposal themselves to participate in the AICCRA Zambia Accelerator Program. This could therefore limit the amount of restrictive factors that the private sector has faced, because they could design the project to their own preferences. Other procedural explanations for the lack of restrictive factors identified in the analysis are provided in the discussion section.

4.2.4 Justice implications most vulnerable groups

This section shows the evaluated justice implications of the most vulnerable groups by the AICCRA Zambia Accelerator Program. The five justice indicators that have been elaborated in the analytical framework section are used to structure the results. Table 14 below shows the scores of the AICCRA Zambia Accelerator Program on the various justice indicators. Further explanations for the various scores have been provided below.

Justice indicator	**Score**	**Explanation**
Vulnerable regions are targeted by PPP	Moderate	Focus on specific regions, although these are not the most vulnerable or poor states
Needs affected groups are taken into account	High	Before program starts data is collected about the needs of the farmers through various measures
Focus on vulnerable groups	Moderate	Large focus on reaching smallholders. Also measures to ensure poor farmers are targeted as well. However, no specific focus on most vulnerable
All parties can share their expertise on the subject	High	Initial data about local knowledge is gathered to incorporate local knowledge. Local knowledge is taken into account in demonstration plots
All stakeholders are involved and have the opportunity to participate in decision-making	Moderate	Not present at governance level of the PPP. Farmers can decide which actors they find most reliable and where they want the demonstration plots.

Table 14: Scores justice indicators AICCRA Zambia Accelerator Program

Indicator 1: Vulnerable regions are targeted by PPP

The program is focused five states within Zambia, which are the Eastern Province, Central Province, Southern Province, Copperbelt Province and Lusaka Province (CGIAR, 2021b; Interview 5). Moreover, the project is only focused on the rural areas of Zambia (Interview 5).

Indicator 2: Needs of affected groups are taken into account

The needs of the farmers are first of all taken into account through the collection of the baseline data of the farmers (Interview 5). This baseline data is collected in the first few months of the program in order to create a better understanding of the needs and experiences of the farmers. This way, the program can be adapted to these needs to make it as effective as possible (Interview 5).

"You know we are very aware of like you know the barriers that farmers face, the behaviour change again around these new types of seeds or fertilizers, how they... You know what type of messaging they need. I would say we are probably already aware of them, but again through the baseline we get more insights of that" – (Interview 5)

Indicator 3: Focus on vulnerable groups

As mentioned above, the AICCRA Zambia Accelerator Program is focused on five specific provinces within Zambia, and are also focused on rural areas (CGIAR, 2021b; Interview 5). Furthermore, within the program there is a specific focus on smallholders (Interview 5). For the private actors who are selling their products through the program, they are oriented on the smallholder farmers, because if you want to grow within Zambia you would need to focus on those smallholders (Interview 5; Interview 6). They thus have a more commercially-driven interest in reaching the smallholder farmers.

"The small scale farmers, they are the reason why we exist." – (Interview 6)

Besides the commercially-driven interest of the private companies, there is also a mission-driven interest in reaching the smallholders for the NGO and private consultancy involved in the program (Interview 5). These organisations are thus focused on the smallholder farmers because it is their objective to reach those groups (Interview 7). However, it came forward during the interviews that there is no specific attention for reaching the most vulnerable smallholders (Interview 5). They will incidentally be targeted by the program and through tackling the smallholder farmers, but there is no specific focus on reaching the marginalised farmers (Interview 5; Interview 8).

"I wouldn't say we are targeting necessarily the most vulnerable. I would say... it is... you know.. I would be lying if I said that." – (Interview 5)

However, reaching the smallholder farmer can sometimes be difficult. The partnership has various measures to ensure that the smallholder farmers are also affected. First of all, as explained in the section about the financing role of the private actors, they sometimes give in-kind donations, meaning that they provide their products for free to the smallholder farmers (Interview 5; Interview 7). Furthermore, the vulnerable smallholder farmers are often located in rural and low-literacy areas. The trainings about the products are therefore provided in the local language and with many visuals, to make it as understandable as possible for the farmers (Interview 5). Moreover, some private actors have created a financial agreement for the farmers, where they do not have to pay the full amount for the product in advance of the harvest, but they can pay parts after the harvest when they have earned more money (Interview 6). This will make the investment less difficult for the small farmers. Lastly, there is a focus within the program on using micro-distributers instead of larger big distributers, so the smallholder farmers do not need to travel but the products can be brought to their villages (Interview 5).

Indicator 4: All parties can share their expertise on the subject

The fourth indicator for justice is focused on the opportunities all parties have to share their expertise on the subject. Local knowledge is in this program taken into account. This is done through both the baseline data that was previously explained, where they focus on the needs and customs of the farmer (Interview 5). Furthermore, when the private actors are conducting the demonstration plots, they try to incorporate the local knowledge of the farmers (Interview 5; Interview 6), in order to learn from the and see how they can improve their operations (Interview 6).

Indicator 5: All stakeholders are involved and have the opportunity to participate in decision-making

Lastly, related to the previous section about the ability to share local knowledge and expertise in the program, this indicator focuses on the involvement of all groups in the decision-making process. The private actors participating in the program are meeting once every two weeks with the public actor to discuss the progress of the project (Interview 7). However, local groups are not included in these meetings (Interview 5).

"I mean they are not involved in the governance or in the management structures we have in place" – (Interview 5)

Nevertheless, the farmers are in some stages of the program involved in the decision-making. For example, the farming communities decide which community members will sell the products, and where the demonstration plots will be planned (Interview 6). This way, the communities can decide themselves what they find the most credible actors within the farming community to organise these demonstrations (Interview 6).

"And so when we go in their community, we hold a meeting, and we ask the community to select the people they think could be (...) dealers. This is how the community participates in the decision making, so they decide to choose what community agent to select so that person can sell the product in their area." – (Interview 6)

4.3 Case 3: TAAT Maize Compact Program

4.3.1 Case description

Climate change has increased the periods of droughts and low rainfalls in certain African regions, and thereby requiring more drought-resistant maize varieties (Technologies for African Agricultural Transformation [TAAT] Clearinghouse, 2021). This program can thus be seen as an agricultural adaptation project to reduce the upcoming effects of climate change. The TAAT Maize Compact Program aims to increase the adoption of smallholder farmers of climate-smart maize hybrids, increase the overall maize productivity in Africa, higher numbers of women and youth in the maize value chain and increased profit margins for maize (African Agricultural Technology Foundation [AATF], n.d.). The TAAT Maize Compact Program focuses on eleven countries throughout Africa, being Benin, Cameroon, Ethiopia, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, Tanzania, Uganda, Zambia and Zimbabwe (AATF, n.d.). However, since the context can vary over these different countries, it can be difficult to create a good understanding of the public-private partnership and TAAT Maize Compact Program. Therefore, this study only focused on Kenya and Kenyan seed companies to get a better understanding of the roles of the private sector and the corresponding justice implications.

The TAAT is a program initiated by the African Development Bank (AfDB) to increase the agricultural productivity in Africa and thereby increasing food security in Africa. The TAAT Maize Compact Program is implemented by the International Institute of Tropical Agriculture (IITA), which is part of the CGIAR. Moreover, other institutions such as the AATF, International Fertilizer Development Centre (IFDC) and the Forum for Agricultural Research in Africa (FARA) are also implementing the program (AATF, n.d.).

The TAAT Maize Compact Program works with over 30 domestic seed companies, of which four located in Kenya. Furthermore, the program works together with various research institutes such as the CGIAR and the National Agricultural Research and Extension System (NARES), specifically focused on Kenya. Moreover, this program has partnerships with multiple farmers associations, amongst which eleven in Kenya. The program lasts for 3 to 4 years (Interview 9; Interview 10), and is being led by the AATF (Interview 10).

4.3.2 Role and level of engagement private sector

This section elaborates on the roles of the private sector that have been identified during the open coding process. The identified roles are shown in table 15 below, and a further elaboration on the specific roles are provided in the following section.

Role private sector	**Explanation**
Production and intellectual property	Private actors produce the seeds. Sometimes their own varieties, sometimes varieties from public actors
R&D	The private actors that use their own varieties do own R&D
Distribution	Private actors use their network of distributers and retailers
Financing	Private actors finance all own activities. Sometimes funding for demonstration plots from public actors
Training	Private actors sometimes provide trainings; but not all. Demonstration plots are included
Monitoring	Report to the public actors, who monitor their performance
Marketing	Private actors market and promote the seeds themselves

Table 15: Overview of the roles of the private sector in the TAAT Maize Program

The first role that the private sector has in the TAAT Maize Program is being the *seed producer* (Interview 9; Interview 10; Interview 11; Interview 12). Some of the private actors produce their own

seed varieties for the program (Interview 12), and thus do the *research and development* of the products. The public actors then plays a role by selecting the varieties that they find relevant for food security adaptation by providing these climate-smart drought-prone varieties, and they support these (Interview 10).

"We go there and select the ones that we thing are relevant for these climate-smart mitigating against drought and promoted these. These are the ones that solve the farmers problems" – (Interview 10)

The intellectual property then lies with these seed companies (Interview 10; Interview 12). There are also some private actors that receive the seed varieties from the public actors or research institutes, and then produce these (Interview 9). The intellectual property of these varieties is then owned by the public research institutes, making it a public good that can be produced by others as well (Interview 9). The TAAT Maize Program thus does not have a one-size-fits-all strategy for all the private partners, but they have different forms of partnerships, where they either provide the seeds or use the private partners' own seed varieties.

Furthermore, the private actor is the *distributer of the seeds* (Interview 9; Interview 10; Interview 11; Interview 12). The private actors use their own distribution systems or networks, who often consist of independent companies (Interview 11; Interview 12). These distributers are not connected to the TAAT Maize program but they are their individual channels (Interview 11). These distributers then sell the seeds to the farmers (Interview 12).

"Mostly I would say 95% of our sales is to agrodeallers, and then the agrodealers sell to the farmers." – (Interview 12)

Moreover, the private actors are *financing* the production and distribution of the seeds mostly by themselves (Interview 9; Interview 11). However, part of the funding was also provided by the TAAT Maize program to the seed producers for creating demonstration plots (Interview 12). These private actors had to create a budget and send it to the TAAT program, who would then finance part of this. These demonstrations were funded for circa 80% by the TAAT Maize program, and for 20% by the private actor themselves (Interview 12). The production and distribution was however fully funded by the private actors (Interview 12).

"They finance it fully. They don't get... They are business entities so we don't have to pay them anything." – (Interview 9)

One private actor indicated that they did provide *trainings* to the farmers. They received instructions from the AATF on what information to spread to the farmers (Interview 11). They provide this information through two pathways: the first being through the distributers who then share the information with the farmers. The second pathway is through farmer meetings that are organised by the private actor, where the farmers are trained in a group setting (Interview 11). However, of the two private partners that were interviewed, the other indicated that they did not provide trainings to the farmers, because maize seeds do not require any special treatments from other types of seeds, so there is no specific training necessary (Interview 12). This interviewee mentioned that providing these trainings was the responsibility of the government.

Moreover, the private actors host demonstration plots, where the farmers can see how the crops grow and how they should be cultivated (Interview 10; Interview 12). This is both a marketing strategy

where the farmers can see how well the crop performs, and simultaneously a way to explain the farmers how to use the crops (Interview 10; Interview 12).

Another role from the private sector was *monitoring and reporting* their progress, and reporting this back to the public actors (Interview 10; Interview 11; Interview 12). These reports were focused on to who and where the seeds were sold, and about the performance of the demonstration plots (Interview 12). The public actor leaders then track this monitoring or reporting from the private actors (Interview 10).

"The requirement is all the partners to report back, but you know, when you are dealing with more or many partners some might delay, not write comprehensive reports. … But everyone is supposed to report whatever they are doing and the contracts we are doing with them, performance contracts with targets and timelines." – (Interview 10)

Lastly, the private actors are responsible for the *marketing* of the seeds that they have produced and distributed (Interview 9). This is, as mentioned before, partly done through the demonstration plots (Interview 10; Interview 12).

4.3.3 Stimulating and restrictive factors

This section lays out the stimulating and restrictive factors that the private actors faced to join in this program. They are schematically shown in table 16, and additional elaborations are provided below.

Stimulating factors	**Restrictive factors**
The PPP allows them to receive funding	The PPP is only focused on small companies, making it difficult for larger private actors to join
By joining the PPP, the private sector can possibly help smallholders uplift their livelihoods	Uncertainty for the private sector about program duration and using the provided seed varieties
Bigger chance to make more profit and expand existing market	Program uses only one or a few seed varieties, while the private actors want their own seed varieties
Opportunity to go quickly to the market	Difficult to join the project due to extensive procedures
Option to receive a high-quality seed variety	Difficult to join the PPP because of limited capacity of program to work with private actors

Table 16: Stimulating and restrictive factors for participation in TAAT Maize Program

Stimulating factors

The first stimulating factor identified by one of the private actors was the funding received from the TAAT Maize Program (Interview 12), and that was their only stimulating factor. The other private partner did not receive additional funding from the program, and they had different stimulating factors for joining the program. The first factor that stimulated this private actor to participate in the program was to make more money (Interview 11). These private actors indicated that they are both profit-seeking companies who mainly joined the program on a commercial basis (Interview 11; Interview 12). Nevertheless, another stimulating factor that was mentioned by one of the private actors was the ability to help the farmers (Interview 12).

"So, help the farmer and in the process make some money." – (Interview 11)

Furthermore, the private actor indicated that by joining the program, they could quickly go to the market, because they could skip a long process of research and development for the seed varieties (Interview 11). Connected to the quicker way to the market, a private actor mentioned the good quality of the seed variety as the last stimulating factor for joining the program (Interview 11).

Restrictive factors

Besides these stimulating factors, the private actors also faced some obstacles for joining the program. First of all, it was mentioned that some large companies do not have much incentive to join the project, because the project is mostly focused on small companies, and the larger companies do not require additional funding or seed varieties (Interview 12). Second, it was mentioned that there is some uncertainty around the program concerning the program duration. One private actor mentioned that they did not know what would happen if the program stopped, and whether they would have to start paying royalties for the seed varieties that they are using (Interview 11). They mentioned that this uncertainty is an obstacle for various companies.

"The second biggest challenge is we are also not sure where they are getting the germ-crossing come from, and whether these germplasm have property rights, and so is possible when the project is finished, we may have to fist with the organisations that have donated the germplasm to the project." – (Interview 11)

Third, the various seed companies that wanted to join the program and received the seed varieties from the public actors, wanted to receive their own seed varieties (Interview 11). However, they all received the same variety which created competition amongst them, which is why some private companies did not want to join the project anymore (Interview 11). Fourth, the procedures to join the program are sometimes complex and difficult, which is an obstacle for smaller companies to join the program (Interview 9). Lastly, the public actor leaders indicated that they do not have unlimited resources, so they cannot work with every seed company that would want to join (Interview 10). The limited capacity of the program is therefore also considered a restrictive factor.

4.3.4 Justice implications most vulnerable groups

This section shows the evaluated justice implications of the most vulnerable groups by the PPP project. The five justice indicators that have been elaborated in the analytical framework section have been used to structure the results. Table 17 below shows how the TAAT Maize Program has scored on the various justice implications. Further elaborations have been provided in the following subsections.

Justice indicator	**Score**	**Indication**
Vulnerable regions are targeted by PPP	Low	Has a more general approach, not specific vulnerable regions targeted
Needs affected groups are taken into account	Moderate	Farmer associations are partners. Focus on their needs on commercial basis, but no concrete strategies
Focus on vulnerable groups	Moderate	Focus is on smallholder groups, but not specific on vulnerable groups. Small seed packages available.
All parties can share their expertise on the subject	Moderate	Public actor looks into this. However no specific measures how to do this.

Justice indicator	**Score**	**Indication**
All stakeholders are involved and have the opportunity to participate in decision-making	Moderate	Agreement of farmers needed for public activities, so their approvement is sometimes needed. No involvement in decision-making from farmers in private sector activities.

Table 17: Scores justice indicators TAAT Maize Program

Indicator 1: Vulnerable regions are targeted by PPP

The TAAT Maize Program is focused on African countries (TAAT Clearinghouse, 2021). Their main aim is to increase the uptake of climate-smart maize varieties to increase the adaptive capacity of these regions to the increased drought (TAAT Clearinghouse, 2021). However, the TAAT Maize Program has not specified focus areas where they want to focus on, and does thus do not have an extra focus on vulnerable regions.

Indicator 2: Needs of affected groups are taken into account

The TAAT Maize Program aims to create climate-smart varieties for all farmers. It is assumed in the program that the private actors take the needs of the farmers into account, because they want to turn them into customers and this will only happen if they tailor their varieties and sale strategies to their needs (Interview 10). Furthermore, the TAAT Maize Program has farmer associations also included as partners (Document 1). Through having them as partners, they can collect more information about their needs.

"So there is a lot of engagement with the smallholder sector. Even by private sector because they want to tailor to deliver even to them, with the requirements and challenges they face." – (Interview 10)

Indicator 3: Focus on vulnerable groups

The TAAT Maize Program is focused on smallholder farmers. The majority of farmers who are producing maize in Africa are smallholder farmers (Interview 9). It is therefore considered a given that the seeds will reach these smallholders through the private actors. The public actors are also mostly concerned with the smallholder farmers (Interview 10). However, within the project there is no extra focus on vulnerable or marginalised farmers. The focus is to increase the productivity and food security of smallholders. The private actor has also indicated that they are not especially concerned with reaching these vulnerable groups, but they are a commercial entity who wish to reach as many customers as possible (Interview 12).

"Our objective is to convert farmers into customers. So we don't have classifications like poor farmers or others. Anybody who can be able to meet our objective is farmers. So, I think those are objectives of civil society groups and NGOs. For us as a private seed company we are purely a commercial entity." – (Interview 12)

One measure was mentioned in the available documents to ensure that the seeds are more available to poorer, more vulnerable groups. This was producing the seed varieties in small packages, so the smallholder farmers can more easily invest in those varieties (Document 1). Moreover, there are no specific measures in place to ensure that the seeds will also reach the most vulnerable groups (Interview 10).

Indicator 4: All parties can share their expertise on the subject

The local knowledge is partly taken into account during the program. The public actors are mostly concerned with understanding the local knowledge. This concerns mostly their farming techniques, what kind of knowledge systems for weather predictions they do, when their seasons start, etcetera (Interview 10). This knowledge and experience from the farmers in their own environment is mostly used for the creation of the seeds and other agricultural technologies (Interview 10). Furthermore, the local knowledge is by the private sector partly taken into account by distributing the seeds and locating the demonstration plots in regions they know and they know how the farmers cultivate their land (Interview 12). However, there are no clear measures on how to include the local knowledge more.

"We mainly targeted where we know. Because as I have said we have already done the demos and we already knew some of these places where the seeds will do well. So we put the demos in these places" – (Interview 12)

Indicator 5: All stakeholders are involved and have the opportunity to participate in decision-making

The farmers are within the processes of the private actors not very included in the decision-making. A private actor mentioned that they mainly rely on their own experience with questions such as where to implement a demonstration field (Interview 12). However, the farmers are included in the field days, where they can look at the crops and see how they have performed (Interview 12). They are not included in the exact decision-making.

"That is how they participate; in judging" – (Interview 12)

The public sector also partners with farmer associations where they want to introduce the activities (Interview 9; Interview 10). These farmers have to agree with the interventions that are being implemented through the program (Interview 9; Interview 10). This way, the farmers are included in the decision-making process through the public sector.

4.4 Case 4: TAP5 Project

4.4.1 Case description

The Tropically Adapted Potato 5 (TAP5) Project is focused on breeding potato varieties suitable fitting for South Asian markets. The project is focused on developing climate-resilient potatoes for sub-tropical and tropical conditions (Document 2). The project should thereby help increase the food security for these tropical or sub-tropical regions, by providing a potato variety that is both suitable for being produced in tropical regions, and has good production quality. Therefore, the project can be considered an agricultural adaptation project. The TAP5 Project is a public-private partnership between CIP and HZPC. CIP is the International Potato Centre, located in Peru, which is the public actor in this partnership. HZPC is a Dutch potato company focused on innovative breeding and seed potato trading, which is the private sector actor in this partnership. The actors concerned in this PPP are pooling their resources, expertise and germplasm to develop this new potato variety. This partnership was catalysed and initiated by the Syngenta Foundation. The Foundation has coupled the CIP and HZPC together and have funded most of the R&D of the new potato variety.

Vietnam will be the first country where the new potato varieties will be commercially available and distributed. These varieties will later on be launched in other Asian and African countries. The TAP5 Project does not have a set time duration. The official commercialisation has however not started yet. The first phase of the research and development has been completed, and they will now start implementing it.

4.4.2 Role and level of engagement private sector

This section identifies the different roles that the private sector has in the TAP5 project, that have been identified during the data analysis. An overview of the roles has been shown in table 18, and further elaborations on the roles including some quotes have been provided in the following section.

Role private sector	**Explanation**
Production and intellectual property	Private actor will produce their own seed variety. Third-party private actors can in future also be used for production
Distribution	Not realised yet, but private actors will use own networks of distributers and retailers once seeds will be commercialised
Financing	Funding for R&D partly done by private actor. Commercialisation of seeds will be financed by the private actor
Training	Technical support for farmers to explain how to grow the potato. Also demonstration plots included
Monitoring	Internal monitoring, report to the sponsor organisation. No reporting to public actor
Marketing	Private actor markets and promotes the seeds themselves
R&D	Private actor played big role in R&D of the variety
Project management	Private actor played big role in planning the project

Table 18: Overview of the roles of the private sector in the TAP5 Project

First of all, the *production* will be done by the private actor involved (Interview 13; Interview 14; Interview 15). They can also use third parties, being local seed companies, to do the production closer to the market where the products will be sold (Interview 13; Interview 14; Interview 15). Finding these local partners would then be the responsibility of the private actor. For the intellectual property of the new potato variety that was developed, both the public as well as the private actor are registered as a breeder (Interview 15). However, the commercial rights to sell the variety are for the private actor (Interview 13; Interview 15). The private actor is therefore the only actor who is allowed to bring this

variety to the market. The private actor is thus also the one who is responsible for the *marketing* of the product.

The *distribution* of the seeds is not realised yet (Interview 13; Interview 15), and this role is thus build upon predictions. However, it is planned that the private actor will distribute the seeds (Interview 13; Interview 15). It was agreed in the beginning of the partnership that the private actor would be responsible for the commercialisation of the project (Interview 15). They already have existing distribution networks that they can use to distribute the seeds once they will be commercialised (Interview 15).

"When we go commercially, that will be our responsibility. So we will be selling" – (Interview 15)

The *financing* of the R&D process is partly done by the private actor. However, the main funding for the R&D phase is provided by the Syngenta Foundation (Interview 13). For the commercialisation of the new potato varieties, the private actor will be the financer, because that will be part of their business strategy (Interview 13).

The private actor also provides some kinds of *trainings and trials*, and also arranging demonstration fields for the farmers (Interview 15). Moreover, the private actor provides technical support to the farmers and the partners who will distribute the potatoes (Interview 15). This is done to make sure that the partners and farmers understand how to grow the potato.

Moreover, the private sector played an important role in the *research and development* of the new potato variety (Interview 14; Interview 15). The private actor has provided the male line for the potato which contained good processing-qualities (Interview 14). The public actor on the other hand provided the female line, which brought the tropically adapted genetics (Interview 14). Furthermore, the private actor played an important role in the research and development by providing breeding know-how (Interview 15).

"We actually carry out joined breeding and we literally have for this variety a Dutch father and a Peruvian mother" – (Interview 14)

The public actor also pointed out that the private actor played an important role in the *project management* of the PPP (Interview 14). The private actor was more able to deliver the projects and plan the project, because they were more demand-led and goal-oriented (Interview 14). Furthermore, the private actor is more experienced in bringing the products to the market.

"And how they are organised, and how you go through you develop a product, then you test the product, say yes or no and getting it out there. They are more disciplined in say killing things. You know this sort of go/no go in project management. I think that is important so they bring those things as well." – (Interview 14)

Lastly, both the private and public actors have internal *monitoring and reporting* on the project (Interview 15). However, they do not need to report to each other how the activities are going (Interview 13; Interview 15). However, the actors do need to report to the Syngenta Foundation how the project is going, since they are the primary financer of the project (Interview 15).

"No we don't need to report to [organisation], we are equal partners in that, so we are obliged to report to Syngenta foundation. And we report internally and [organisation] reports internally." – (Interview 15)

4.4.3 Stimulating and restrictive factors

This section elaborates the stimulating and restrictive factors that the private actors faced to join this program. Table 19 shows the stimulating and restrictive factors, which is further elaborated below.

Stimulating factors	Restrictive factors
Reduced financial risks and catalysed relationship due to present intermediary organisation	Private sector faces financial risks when trying to produce new seed variety (but intermediary organisation reduced this risk)
Reduced financial risks for the private sector due to external financing	-
PPP provides opportunity to provide better varieties	-
Private actor can use the participation in the project as a corporate social responsibility	-
By joining the PPP, the private sector can possibly help smallholders uplift their livelihoods	-
Bigger chance to make more profit and expand existing market	-

Table 19: Stimulating and restrictive factors for participation in TAP5 Project

Stimulating factors

As mentioned before, the Syngenta Foundation was the initial driver behind the project, since they catalysed the partnership between the CIP and HZPC (Interview 14). Furthermore, the Syngenta Foundation was the main financer of the project, which made the project more inviting for the private actor, because their risks would be decreased (Interview 15). The presence of such an intermediary organisation was thus stimulating for both the actors involved in the project (Interview 14). Second, a stimulating factor for the partnership was the ability to create better varieties that they would not have been able to do without each other (Interview 13; Interview 14; Interview 15). A third stimulating factor for the private sector participation was the ability to use this project for their corporate social responsibility plans (Interview 13; Interview 14; Interview 15). They wanted to make a contribution besides making a profit from their work.

"And it quite actually nicely coincident also with the corporate social responsibility that was coming towards companies" – (Interview 15)

This is accompanied by the fourth stimulating factors, which is helping the farmers. They wish to help increase food security (Interview 15). Lastly, by joining this partnership, the private actor could more easily enter Asian markets (Interview 13). The public actors already had a network in Vietnam for governmental regulations and local staff speaking the language. This thus speeded up the process of the private actor expanding their markets.

Restrictive factors

The first restrictive factor identified was that this can from a financial angle be considered a high-risk project, but the involvement of the Syngenta Foundation as a sponsor of the project made the project more attractive to them (Interview 15). The private actor mentioned that there we no restrictive factors

and they were very willing to join the partnership (Interview 15). The public partner in this case was more hesitant to join a partnership with a private company, because of a general limited trust toward the private sector (Interview 15).

4.4.4 Justice implications most vulnerable groups

This section shows the evaluated justice implications of the most vulnerable groups by the TAP5. The five justice indicators that have been elaborated in the analytical framework section have been used to structure the results. Table 20 below shows how the TAP5 Project has scored on the various justice implications. Further elaborations on the scores are provided below.

Justice indicator	**Score**	**Indication**
Vulnerable regions are targeted by PPP	Low	General approach on reaching countries in the global South. No specific focus on extra vulnerable regions
Needs affected groups are taken into account	High	Direct feedback from farmers on the product to understand the needs, measures in place
Focus on vulnerable groups	Moderate	No exclusive focus on smallholders. Also not on reaching vulnerable groups. However, different formal measures in place.
All parties can share their expertise on the subject	Moderate	Public actors are focused on this, private actors less
All stakeholders are involved and have the opportunity to participate in decision-making	Moderate	Not part of the governance process, but they can vote for varieties, and are in this way included

Table 20: Scores justice indicators TAP5 Project

Indicator 1: Vulnerable regions are targeted by PPP

The TAP5 project is focused on reaching countries in the global South. They are, as explained, starting the project in Vietnam and will then continue to shift to other countries located in the global South (Document 2). However, they do not have specific focus areas within these areas to implement the project.

Indicator 2: Needs of affected groups are taken into account

For the second indicator, the TAP5 program does field research with the farmers to create a understanding of their needs (Interview 14). This is then tried to be incorporated into the potato varieties that are being created in the project (Interview 14). The specific needs from the farmers are thus taken into account during the breeding. Moreover, during the breeding process, a few varieties were shown to smallholders. These were organised through field days where the farmers could walk around and see the varieties. During these field days the farmers could vote what variety they like the most (Interview 14). Moreover, they would separate the men from the women to receive feedback from both those groups (Interview 14). The needs of these farmers are thus taken into account through various mechanisms.

"Because the thing is that in many cases farmers are the best people to know what they need in their varieties. Okay? So we try to get their input into our breeding plants and our breeding program" – (Interview 14)

Indicator 3: Focus on vulnerable groups

The TAP5 project aims to reach smallholder groups. Reaching these smallholder is mainly the goal of the public actor (Interview 13). The private actor is also focused on these smallholders (Interview 15). This project is also not exclusively focused on smallholders. It was mentioned that in the areas where the public actor works, almost no large commercial potato farmers are located (Interview 14). These areas mostly contain smallholder farmers, so it is assumed that the smallholders will be able to get these varieties (Interview 14). The public actor also agreed to let large-scaled growers use the varieties as long as the smallholders are also targeted (Interview 14).

The private actors also see serving the smallholders as a contribution to their mission to increase food security (Interview 15). However, bigger farmers are also the aim of the project in order to grow in the market (Interview 15).

"so we serve them both, but if you want to grow fast and big in a country, then you need to focus on the bigger (...) as well. But we do not ignore the small holder farmers, and they are certainly in scope." – (Interview 15)

Reaching the smallholders is mostly the responsibility of the public actor (Interview 13). They will provide small amounts of seeds to smallholders for their own needs in the beginning, to make sure they can also start using these varieties and are also reached by the new technologies (Interview 13). Moreover, the public sector organises field days and training activities to reach these smallholders and show them the performance of these varieties (Interview 13). Furthermore, the private sector needs to pack a certain percentage of the potato seeds in small bags, to ensure that the smallholders can also access the variety (Interview 15).

Indicator 4: All parties can share their expertise on the subject

The local knowledge and expertise is incorporated into the project through the field visits that are done by the public and private actors (Interview 13; Interview 14; Interview 15). The public actors are more actively approaching the farmers to receive their inputs into what types of variety they might need (Interview 14). In contrast, the private sector do not receive in-depth information about the farmers and their knowledge, but they receive more general knowledge on their needs and knowledge (Interview 15).

Indicator 5: All stakeholders are involved and have the opportunity to participate in decision-making

As mentioned earlier, the farmers can participate in voting for the varieties during the breeding process, so their needs are taken into account during this part of the decision-making (Interview 14). However, in the rest of the governance processes of decision-making they are excluded, and are mostly the consumers of the products (Interview 14; Interview 15).

"They were definitely involved in voting for the varieties. But they are not part of the governance process if you like." – (Interview 14)

4.5 Expert interviews

The expert interviews are used to expand upon the insights that have been generated from the interviews conducted with the actors involved in the PPP case studies. Moreover, the expert interviews have also added to the used documents to allow for the data triangulation as explained in the methodology chapter. The expert interviews were used to compare the findings of the comparative analysis with, and see whether the general trends identified by the experts are also visible over case studies in this research. This section first focuses on generating a general understanding of the balance between the public sector, private sector, and NGOs within the agricultural PPPs focused on climate adaptation. This helps elicit the roles and levels of engagement that the private actors generally have in the climate adaptation PPPs. The second part of this section elaborates on the insights generated by the expert interviews regarding the focus on vulnerable groups by the different types of actors. Third, the general inclusion of the vulnerable groups has been addressed. The section ends with the disadvantages of private sector involvement and possible improvements that have been addressed in the expert interviews. This section thus gives a more general or broad insight into the influence that the private sector has on the inclusion of vulnerable groups in adaptation PPPs. This therefores add to the previously analysed individual case studies who are more context-dependent.

Four expert interviews have been conducted with experts from public organisations. These public organisations are Public-Private Infrastructure Advisory Facility (PPIAF), Netherlands Enterprise Agency (Rijksdienst voor Ondernemend Nederland, RVO), Seeds2B Syngenta Foundation, and one public actor who had requested to remain anonymous. All experts had an overview over a large number of PPP projects focused on food and/or water security.

4.5.1 Balance responsibilities public sector, private sector and NGOs

In PPPs, there is a variety of actors involved. Because of this variety of actors with different interests, one of the most important things in a PPP is that the responsibilities and roles of all participating partners are clear from the start, and no misunderstandings about the roles and responsibilities can be made (Expert interview 3). The expert interviews have identified the private sector, public sector and NGOs as relevant types of actors in PPPs (Expert interview 3). This section shortly elaborates on the general roles that the different actors have within the PPPs focused on climate adaptation in the agriculture sector, and how these types of actors are interconnected.

One of the main responsibilities that the private sector carries in PPP is to ensure that the project can generate profit (Expert interview 1). Simultaneously, the public sector is trying to ensure that the project or service can be provided for an affordable price (Expert interview 1). There are often certain requirements to the PPP with regards to reaching certain groups, which would be the main reason why these NGOs are engaged in the PPPs (Expert interview 3). The government is often mandated to support the establishment of cooperatives, which they sometimes have difficulties with. The NGOs can be used to fill this gap (Expert interview 3).

"Although the government is often mandated also to support the establishment of cooperatives, they are not always good at it. The NGO sector can fill that gap, they can help capacitate that organisation." (Expert interview 3)

As was indicated in the introduction chapter, there is a need for more private sector finance in climate adaptation. The experts indicated that there is normally a mix between international and domestic private sector involved (Expert interview 3; Expert interview 4). One expert interview however mentioned that it is sometimes more difficult for the domestic private sector to be engaged in the PPPs, and therefore mostly international private sector is involved in agricultural PPPs (Expert interview 1). This was

explained by the fact that in the global South, the market is still young and the private sector can therefore less easily contribute to PPPs (Expert interview 1). To focus more on the need for private sector finance indicated above, expert interview 3 had indicated that a joint-financing PPP is better suitable to ensure equal roles between the various actors in the partnership. If for example the private sector is the only actor that is providing the financing, they will less be invested in thinking about the partnership than when the costs are shared between the various actors (Expert interview 3). An equal partnership is thus needed to ensure that the private sector is focused on the shared goals of the PPP.

"If the private sector is the one that is only doing the financing, means that they are in the driving seat and often will not work in a partnership type thinking, then when costs or investments are shared equally." – (Expert interview 3)

Furthermore, it was indicated that the private sector would probably not want to work together with a government or an NGO if they would not have to (Expert interview 3). This can be explained because the public sector or NGOs can obligate the private sector to focus on specific vulnerable groups that do not have a profitable business-model.

4.5.2 Focus public sector, private sector and NGOs on vulnerable groups

During the expert interviews, it was mentioned that water or food security is not only the responsibility of one actor. All actors are needed to insure that the poorest groups are benefited, or at the minimum are not harmed by the projects (Expert interview 3). The expert interviews thus pointed out that there is not one actor, either public or private, that has a more prominent role in including the smallholder groups, but they have different roles (Expert interview 1). This section shortly elaborates the findings from the expert interviews regarding each type of actor and their focus on the vulnerable groups.

Private sector

The private sector often has the incentive to ignore the poor people (Expert interview 2). This was explained because every connection you try to make with the poor groups costs money (Expert interview 2), possibly because of the difficulty to reach these groups. However, it was indicated that this is not because the private sector is bad or does not want to include the poor people, but because of their nature to want to make more profit (Expert interview 2).

"There is not private sector that says I don't want to help any poor people, right?" – (Expert interview 2)

Public sector

Connected to this incentive of the private sector to make more profit, it was identified in the expert interviews that the public sector can play an important role in ensuring that the private sector will include these poorer households. The public actors could in this case incentivise the private sector by funding parts of the project to bridge the gap (Expert interview 2). Within agricultural PPPs, seed companies are sometimes incentivised or supported by the public entities with grants or loans to make sure they support the vulnerable groups (Expert interview 4). If the public sector says that the private sector should also focus on the poorest or most vulnerable groups, the private sector has to do this because they are under a contractual obligation (Expert interview 2). A strong public sector who incentivises the private sector was therefore identified in the expert interviews as an added value in PPPs.

NGOs

NGOs also play an important role to bring the technologies to these small-scale farmers. Local NGOs are often well-embedded in local communities. They then also often play the role of ensuring that these local communities can participate in the projects (Interview 3). In contrast, it is often more difficult for the private sector to reach these vulnerable communities and the governments have a limited reach (Expert interview 3). The NGOs are then used to mobilise these communities, and thereby allowing for the private sector to more easily engage with those.

Local NGOs are well embedded in communities, in order to mobilize them to ensure that their participation is there. […] Private sector is often... find it difficult to reach these more vulnerable communities. And the governments of course have limited reach." – (Expert interview 3)

4.5.3 Inclusion of vulnerable groups in decision-making

The targeted groups are not equally involved in all stages of the projects. They are often included in the design phases of the project to ensure the local groups are happy with the project and is adjusted to their needs (Expert interview 2; Expert interview 3), and where they can share their needs, problems, priorities and how they work (Expert Interview 3). Some advising groups have frameworks that requires them to look how different stakeholders need to be taken into account during the entire project, to ensure that their needs are addressed properly (Expert interview 2).

"Often they are engaged at the design stage, right. In terms of being consulted about what are their problems, what are their needs, what are their priorities, how do they organize themselves. And then a project is designed around them, and during implementation they are often the focus of the project." – (Expert interview 3)

Sometimes in the first stages or a project, baseline data is collected in the regions that are being targeted, to map what the current situation is for these farmers. This allows for comparison of the situation between and after the implementation of the project to track the effectiveness and participation of the groups. (Expert interview 3).

Their needs are thus often taken into account in the project design. Later in the project, they will most likely only be the beneficiaries of the projects (Expert interview 3). Through organising them into farming groups, it is hoped that their involvement in the decision-making and participation in the projects in ensured. Nevertheless, the farming communities are often not engaged in the actual decision-making or governance processes of the projects.

4.5.4 Disadvantages private sector and suggested improvements

It was indicated in the expert interviews that the private sector is the main pathway to reach the poorest farmers, because they are often concerned with the implementation of the project or the distribution of the seeds. Nevertheless, it was indicated that the private sector's main aim is to make profit (Expert interview 1; Expert interview 3), and ensuring that the public good is effectively ensured is a lower priority. Therefore, it was mentioned that the private sector is affecting PPPs because of their profit-driven nature (Expert interview 1).

"The private sector is looking to make a buck." – (Expert interview 1)

"Because private sector is again ultimately looking to make money, they may not have the same interests as the other partners." – (Expert interview 3)

Certain improvements to be made in the PPPs have been suggested during the expert interviews. The first suggested improvement to be made was to ensure that these farmers are actually engaged in a suitable way (Expert interview 1). Another suggested improvement is for the public sector to support or fund part of the private sector's contribution to ensure that they will focus more on including the vulnerable groups (Expert interview 2).

"What the government could have done was to transfer funding to the private sector to cover the gap" – (Expert interview 2)

Overall, from the expert interviews it can be concluded that the different types of actors involved in the PPPs have different responsibilities, and different roles in including the vulnerable groups in the PPPs. Overall, the involvement of the vulnerable groups is limited in the PPPs and they are mostly involved in the design-phases where their needs are taken into account. A strong public sector is advised during the expert interviews to ensure that the private sector is incentivised to also include the most vulnerable groups in the projects.

4.6 Comparative analysis

The previous sections regarding the results of the various individual case studies have provided a comprehensive analysis of the role of the private sector within the PPPs, and to what extent they were engaged in these PPPs. Furthermore, the analyses have identified the stimulating and restrictive factors that the private actors have faced when joining the PPP. Lastly, the various justice indicators have been evaluated based on the operationalised indicators from the analytical framework provided in chapter 2.

This section compares the individual case studies to create a better understanding of the effects of the engagement of the private sector on the justice implications of the food security adaptation projects. The roles and level of engagement, stimulating and restrictive factors, and the justice implications are first compared individually, and some explanations for the various outcomes are provided. This paragraph ends with a section focused on explaining relationships between the three elements. The findings of this comparative analysis can help find types of PPPs which are suitable for encouraging an effective and inclusive adaptation strategy in the global South.

4.6.1 Roles of the private sector

The roles of the private sector are schematically shown in table 21 on the next page, based on the individual case study analyses provided in the previous paragraphs. The schematical overview is used to allow for clear and systematic comparison between the case studies. However, it should be noted that this is a simplistic overview of complex cases and thus leaves out nuances.

This study has, as explained in the theoretical background chapter, defined the roles of the private sector as the specific tasks or activities that the private actors provide in a PPP. The comparative table demonstrates that the private sector has similar roles within the different agri-PPPs. The analytical framework presented in table 1 and other roles in table 2 in chapter 2 were created to identify the PPP models and corresponding roles of the private sector. The roles identified were mostly corresponding to the roles identified in table 2.

The private actors play a significant role in the production and distribution of the seed varieties, and in all cases finances most (in some cases all) private sector activities. Moreover, the private actors play a significant role in giving additional trainings to the farmers who buy the seeds, often regarding the required cultivation of the seed variety. In all cases, demonstration plots are organised by the private actors where the farmers can see the crops and learn more about the cultivation, while simultaneously serving as a marketing strategy for selling the seed varieties. Furthermore, in all cases, the private actors monitor the progress of the program or project. The private actors need to report back to the public actors in all cases except for one. In all four cases, the private actors are responsible for the marketing and promotion of the products, which they in all cases produce and distribute. These six identified roles are thus similar throughout the four case studies, with only slight differences between the cases.

For the research and development of the seed varieties that are used in the agricultural PPPs for climate adaptation, the private sector played a role in three out of the four cases. In the case where this role is absent, the private sector receives the seed variety from the public actors included in the project. The other case studies (mostly) use their own seed varieties, for which the private sector plays a big, or sometimes even the full role of doing the research and development.

Moreover, in two out of the four case studies, namely cases 2 and 4, the private sector had the role of project management. They were the responsible party for the planning and coordination of the project or program, and making sure the project did not experience delays. In the other two case studies, this was the role of the public sector. Lastly, in case 2, the private sector had the role of writing a proposal to join the program. This proposal entails that they themselves had to propose a strategy of how to address the increased drought through climate-smart varieties, and which actors would be included with

what roles. This was in the case studies 1 and 3 done by the public sector. In case 4, the private and public actors are equal partners, so they developed this together.

As was explained in chapter 2, this research measures the level of engagement of the private sector based on the number of roles that the private sector has within the PPP, and how much responsibility they carry for the fulfilment of these roles or activities. Thus, if a private actor has more roles and carries more responsibility for fulfilling these specific activities, they were considered more engaged. The private actors in cases 2 and 4 have more roles and responsibilities within the specified tasks than the other two investigated case studies. This can possibly be explained by the number of actors that are involved in the case studies. Case 2 only has five actors, and case 4 only consists of two participating actors. This can therefore increase their number of roles and responsibilities within the project. Cases 1 and 3 have respectively more than 10 and more than 40 actors involved in the project. This larger number of actors involved can therefore have an influence on the responsibilities of the actors involved. Another possible explanation for the higher level of engagement of the private sector in cases 2 and 4, is that these private actors are (mostly) international actors. In case 2, circa half of the private actors participating were international private actors. In case 4, there is only one private actor involved, which is also an international company originating from the global North. This connection was indicated in the expert interviews, who mentioned that in the adaptation PPPs mostly international private actors were engaged. This was explained by the fact that the domestic private sector in the global South are operating in a young market and normally do not have the finances to contribute to the PPPs. Thus, based on this interpretation of level of engagement, the private sector involved in cases 2 and 4 are considered most engaged. Nevertheless, the private sector is considered relatively highly engaged over all cases.

The relatively high level of engagement of the private sector in this type of PPP focused on climate adaptation can thus indicate that the strategy of encouraging private sector involvement in climate change through PPPs is effective. Moreover, the private sector often finances (part of) the PPP, which is thus a useful way to generate more climate finance.

Role private sector	**Case 1**	**Case 2**	**Case 3**	**Case 4**
Production and intellectual property	Main role for private sector. NGOs do not always participate own seeds. Seeds come from public actors	One private actor produce their own seed varieties	Private actors produce the seeds. Sometimes their own varieties, sometimes varieties from public actors	Private actor will produce their own seed variety. Third-party private actors can in future also be used for production
Distribution	Private actors use their network of distributers and retailers. NGOs work with large farming communities	Private actors use own networks of distributers and retailers. Also use NGO's networks to reach smallholder farmers	Private actors use their network of distributers and retailers	Not realised yet, but private actors will use own networks of distributers and retailers once seeds will be commercialised
Financing	Private actors finance all own activities. NGOs received small funding in the first year	Private actors finance 50% of program. Other 50% is provided by public actor. They can keep own profits	Private actors finance all own activities. Sometimes funding for demonstration plots from public actors	Funding for R&D partly done by private actor. Commercialisation of seeds will be financed by the private actor
Training	Private actors and NGOs provide various trainings, including demonstration plots	Private actors and the NGO provide trainings, including demonstration plots. NGO main actor involved in the training.	Private actors sometimes provide trainings; but not all. Demonstration plots are included	Technical support for farmers to explain how to grow the potato. Also demonstration plots included
Monitoring	All actors need to report their progress, which the (semi-) public actors monitor	Private actors monitor and evaluate progress. Report back to public actors	Report to the public actors, who monitor their performance	Internal monitoring, report to the sponsor organisation. No reporting to public actor
Marketing	Private actors market and promote the seeds themselves	Private actors market and promote the seeds themselves	Private actors market and promote the seeds themselves	Private actor markets and promotes the seeds themselves
R&D	-	Private actor uses own varieties, for which R&D was done	The private actors that use their own varieties do own R&D	Private actor played big role in R&D of the variety
Project management	-	Private actors responsible for coordination	-	Private actor played big role in planning the project
Proposal writing	-	The private actors have to write own proposal to participate in the program	-	-

Table 21: Comparison of case studies based on roles of private sector

4.6.2 Stimulating and restrictive factors

This section compares the stimulating and restrictive factors that the private actors have identified over the individual case studies. These stimulating and restrictive factors have been identified in order to explain the role and level of engagement of the private sector, and see if there are possible connections between the factors and the engagement of the private sector. Table 22 and 23 show the stimulating and restrictive factors that the private actors have faced to join the PPPs.

Stimulating factor	Case 1	Case 2	Case 3	Case 4
By joining the PPP, the private sector can possibly help smallholders uplift their livelihoods	+	+	+	+
Bigger chance to make more profit and expand the markets	+	+	+	+
Opportunity to go quickly to the market	+	-	+	-
Option to receive a high-quality seed variety	+	-	+	-
By participating in the PPP it allows the actors to use each other's networks	-	+	-	-
The partners can possibly use the program to scale up own business	-	+	-	-
The PPP allows them to receive funding	-	-	+	+
Reduced financial risks and catalysed relationship due to presence of intermediary organisation	-	-	-	+
PPP provides opportunity to provide better varieties	-	-	-	+
Private actor can use the participation in the project as a corporate social responsibility	-	-	-	+

Table 22: Comparison of case studies based on stimulating factors

As can be seen above, in all cases, the private actors were stimulated by the prospect of helping farmers or smallholder farmers improve their livelihoods and food security. Furthermore, the private actors in all the cases indicated that they wanted to join the PPP to expand their existing market with these new business opportunities, and thereby make more profit. These two stimulating factors are thus the most prominent reasons for the private actors to join the agri-PPP.

Moreover, in case 1 and 3, the private actors indicated that they wanted to join the PPP because it would create a quick and easy entrance to the market. In these case studies, the private actors often receive the seed varieties from the partnership. These are the two cases where the private actors are considered less engaged. Therefore, by joining these PPPs, the private actors can reduce their time and expenses because they do not need to research and develop a new seed variety and can use the existing regulation structures that the other partners are using. The partners that use their own seed varieties therefore did not indicate this as a stimulating factor. Related to this, in case 1 and 3 the private actors identified receiving high-quality seed as a stimulating factor to join the partnership. The actors do not have to invest time and money into developing a new seed variety, and receive a high-quality and well-performing seed variety from the partnership, which will lead to increased and returning demand on the market. This was therefore identified by these case studies as a reason to join the PPPs.

Furthermore, the private actors in case 2 have identified two other stimulating factors that were not identified in other case studies. The first is the ability to use each other's networks. In this case, the various private actors are often in contact with each other, and they work together to reach their goal. They can therefore easily make use of each other's networks. This does not lead to more competition, because these private actors are different types of private companies with different products or goals, and can therefore more easily use each other's strengths and networks. Case study 4 only includes one private entity, which is possibly why this factor is not applicable there. In case 1 and 3, the various private companies are not, or very limited, in contact with each other, and can therefore not use one

another's networks. Moreover, the private actors in case 2 have identified the ability to scale up their own business in Zambia as a stimulating factor to join the partnership.

The private actors in case 3 and 4 have indicated the funding that they would receive by joining the partnership as a stimulating factor. In both cases, they would still have to finance part of the project themselves, but would receive additional funding.

The last three stimulating factors shown in table 22 are only applicable to the private actors in the fourth case study. They considered the presence of an intermediary organisation a stimulating factor, because this intermediary organisation worked as a catalyser between the various organisations, and by financing part of the project, the risk would be decreased for the private actor, making it more attractive to join the partnership. Furthermore, being an international private actor, they wanted to use the project as a corporate social responsibility strategy. Lastly, they found the opportunity to create better seed varieties a stimulating factor to join the project. They mentioned that they could now create a variety that they otherwise would not have been able to do alone. This differs from the stimulating factor that was identified by case 1 and 3 about receiving the high-quality seeds, because the private actor in case 4 is themselves working on developing this new variety, whereas the private actors from case 1 and 3 would receive them from another entity.

The stimulating factors thus partly overlap between the various cases, but there are also more context-dependent stimulating factors to join the partnership. It can be seen that there is often an overlap between cases 1 and 3 and their identified stimulating factors. This is possibly the case because these two types of PPPs are relatively similar to one another. Both the PPPs have a strong (semi-) public actor that is coordinating the programs, and control the activities performed by the private actors. The private actors are, as was also identified in section 4.6.1, considered less engaged in the PPP than the private actors in case 2 and 4. The private actors in cases 1 and 3 are thus probably more reliant on the public actors than the private actors in case 2 and 4. Furthermore, the private actors in cases 1 and 3 are joining an already existing PPP program, whereas the private actors in cases 2 and 4 are themselves concerned with the design of the PPPs. The stimulating factors that are identified by case 1 and 3 can therefore be different than the ones identified by cases 2 and 4 who have a bigger influence on the design of the PPPs.

Restrictive factor	**Case 1**	**Case 2**	**Case 3**	**Case 4**
Project is difficult to join due to extensive contracts or difficult procedures	+	-	+	-
Hard to join the project because the project can be full	+	-	+	-
Less opportunity to make profit due to maximum retail price cap	+	-	-	-
PPP only allows for a limited market space, since it has a specific and limited geographic focus area	+	-	-	-
The PPP is only focused on small companies, making it difficult for larger private actors to join	-	-	+	-
Uncertainty for the private sector about program duration and using the provided seed varieties	-	-	+	-
Program uses only one or a few seed varieties, while the private actors want their own seed varieties	-	-	+	-
Private sector faces financial risks when trying to produce new seed variety	-	-	-	+

Table 23: Comparison of case studies based on restrictive factors

In contrast to the stimulating factors that have been identified in the interviews, there were no restrictive factors that were applicable to all case studies. The restrictive factors are shown in table 23 above. This

possibly indicates that the restrictive factors to join the project are more context-specific than the stimulating factors to join the program.

The first restrictive factor that has been identified in the interviews are the complex procedures including extensive contracts to join the PPPs. This restrictive factor was identified in case 1 and 3. In these two PPPs, multiple domestic, small private companies are the private partners, who possibly do not have legal teams to work through these documents. This is therefore an obstacle for them to join the PPP, whereas case 2 and 4 have bigger, sometimes international private companies as partners who are more used to these procedures and extensive contracts. Moreover, case 1 and 3 have indicated the problem that the project has limited capacity and can be full as a restrictive factor. These were the only two overlapping restrictive factors identified in multiple cases.

Case 1 has identified the obligated maximum retail price cap and restrictive geographic focus area as restrictive factors to join the project. This MRP cap and targeted focus area limit the ability for private companies to make more profit, making this an obstacle to join the PPP. None of the other partnerships have a maximum retail price in place, making this only a restrictive factor for case 1.

Moreover, case 3 has identified three stimulating factors that are only applicable to them, being the focus on small companies, uncertainty about the program duration and use of provided seed varieties, and the private actors wanting their own seed varieties for the project. The uncertainty about the program duration is only applicable here, because this program will only have a duration of four years, whereas the other cases, with exception case 2, have a longer program duration. Case 2 on the other hand are less dependent on the public actors by using their own seed varieties, do not have this uncertainty. Also the absence of the restrictive factor of wanting their own seed varieties to distribute in the other case studies can be explained by the fact that case 2 and 4 use their own seed varieties in the partnerships. The private actors in case 1 do not use their own seed varieties, but the public sector coordinates the districts where the various private companies can sell their seeds, and thus excludes the possibility of competition between the seed companies, making it unnecessary for them to have their own seed varieties.

The last restrictive factor identified was mentioned by case 4, which is that the project is a high-risk project. Since the private sector in this case study is most engaged in the partnership together with the private sector in case 2, the absence of this factor in other cases can be explained.

It can be seen that case 1 and 3 have identified the most restrictive factors to join the PPP. These PPPs have more private actors involved than the cases 2 and 4. Moreover, as identified in section 4.6.1, the private actors can in cases 2 and 4 be considered more engaged in the PPP than the private actors in cases 1 and 3 because of their roles and responsibilities. Therefore, it could be the case that the PPPs are less tailored to the needs of these private actors than the other two cases, and therefore increase the restrictive factors. Since the private actors in cases 1 and 3 are joining an already existing PPP program that was designed by the public sector, they can face more difficulties to join the projects, than the cases 2 and 4 which are also partly designed by the private sector. It can however also be explained by the fact that, because there are less restrictive factors in cases 2 and 4, that the private sector is therefore more involved in the projects.

It can based on this section be concluded that the stimulating and restrictive factors are differing between the four case studies. The stimulating and restrictive factors can therefore be considered context-dependent. These factors are thus more dependent to the various types of PPPs, the type of private sector and the precise goals and focus points of the PPPs. However, in section 4.6.1 which focused on the roles of the private sector, it was seen that the roles and levels of engagement of the private actors between the cases did not differ that much. In section 4.6.1, the difference in the roles and responsibilities of the private actors between the various cases was mostly explained by the number of actors involved. The stimulating and restrictive factors for the private sector to join the agricultural adaptation PPPs are therefore more context-dependent on the type of PPP, type of private actor and focus and goals of the PPPs than the roles of the private sector are. This context-dependency of the

restrictive factors to join the PPPs should be taken into account when creating PPPs to address climate adaptation, in order to allow for broad participation of the private sector to help build a pathway for a more sustainable and climate-resilient future.

4.6.3 Justice implications

This section compares the justice indicators identified in the analyses of the four individual case studies. These justice indicators have been evaluated based on the evaluative framework shown in table 5, and were scored per case study. Table 24 shows and compares these scores for the four case studies. It should be noted that, like the previous tables, this table is used to provide a schematic, simplistic overview that allows for more easy comparison of the cases. It thus leaves out the more nuanced and highly complex outcomes that were elaborated in the sections of the individual case study analyses.

Justice indicator	**Case 1**	**Case 2**	**Case 3**	**Case 4**
Vulnerable regions	High	Moderate	Low	Low
Needs taken into account	High	High	Moderate	High
Focus vulnerable groups	High	Moderate	Moderate	Moderate
Local knowledge	Moderate	High	Moderate	Moderate
Inclusion decision-making	Low	Moderate	Moderate	Moderate

Table 24: Comparison of case studies based on justice indicators

The first indicator, which is the focus on vulnerable regions within the PPP, was only strongly present within case 1. This PPP was only focused on a vulnerable region that is strongly affected by climate change and where only resource-poor farmers are located. Case 2 had a focus on specific regions within Zambia, but these are not necessarily the poorest or drought-prone regions. Case 3 and 4 did not indicate a specific target area where the PPP is focused on, but they took a more general approach.

The second indicator, focused on whether the needs of the farmers were taken into account in the programs or project, was present in all case studies, but only on case 3 for a limited amount. All cases aimed to take the needs of the vulnerable groups into account in the programs. Case 1, 2 and 4 also had mechanisms in place to ensure that they would get feedback from the affected groups, either during the program to be able to change the program to their needs, or even up front to make sure that the needs of these farmers are addressed properly in the partnerships. Case 3 was also focused on the smallholder farmers, and often focus on their needs on a commercial basis, but no concrete measures or strategies are in place to take the needs into account. The finding that the needs of the vulnerable groups are taken into account in the first phases of the programs was also supported by the expert interviews, who mentioned this is the main way to incorporate the needs of the vulnerable groups. This justice indicator is, as can be seen in table 24, the justice indicator that is most present in the case studies. This can be connected to the stimulating factor of being able to use the PPP to make more profit and expand the markets of the private sector. In order to expand the markets, the needs of the farmers should be taken into account, especially regarding what they would want in a product. This allows for more sales of the product and thereby generating more profit. The higher presence of this justice indicator can thus be explained by this stimulating factors.

The focus on vulnerable groups, which is the third indicator, was only strongly present in case 1. This case has, as already mentioned, a specific target area where mostly vulnerable groups are located. This case also has concrete and formal measures in place to ensure that the seed varieties are available to most groups. The other cases either had some measures in place but were not focused on these vulnerable groups, or mentioned that they were focused on these groups but had no measures (formal or informal) in place to ensure that these vulnerable groups were also actually reached out to. It was in most cases also mentioned that ensuring that the vulnerable groups are targeted is often the main role of

NGOs instead of the private sector. This is also supported by the findings of the expert interviews, who also mentioned that the NGOs often have the best contact with the local communities. It was thus mentioned in all of the cases that reaching the vulnerable groups is of importance. Nevertheless, it can be seen that in 3 out of the 4 case studies there are no formal measures in place to reach the vulnerable groups. Increasing the focus on these vulnerable groups is therefore a necessary component for creating a just transition to a more climate-resilient future for all.

The fourth justice indicator, which was the capability for all parties to share their expertise or knowledge on the topic, was graded as 'moderate' in cases 1, 3 and 4. Only in case 2 the local knowledge is incorporated to a high extent. In case 1, 3 and 4 there was a focus on including the local knowledge. However, there are no specific measures identified to incorporate the local knowledge. Moreover, it is often the responsibility of the public actor to incorporate the local knowledge, whereas the private actors are not too concerned with this. Case 2 does have mechanisms in place to take into account the local knowledge, through doing baseline research on the target areas.

The last justice indicator, being the inclusion of all affected parties in the decision-making process, was moderately present in case 2, 3 and 4, and was rated 'low' in case 1. In cases 2 and 4, the smallholder farmers are not able to participate directly in the governance processes of the project or program. However, they are included in other ways, and they can express their opinions and preferences regarding the seed varieties, where to implement them and who to contact. In case 3, there is an agreement from the farmer organisations needed for the public sector to incorporate new activities in their areas. However, they cannot participate in the activities of the private sector, who are in contact with the farmer groups. The public activities therefore do allow the farmers to participate to some extent, whereas they are not involved in the private activities. In case 1, the smallholder farmers are not able to join in the decision-making processes of the projects. Therefore, cases 1 is scored low. This is in line with the expert interviews, who indicated that the farmer groups are often not able to participate in the real decision-making around the project, but they are sometimes requested to share their preferences or opinions, and in that way they participate in the projects.

The justice indicators are thus most often rated moderately. Since the private sector is the main contact point for the smallholders through their role as seed distributor, they can play a large role in assuring that the vulnerable groups are also targeted by the PPPs. Nevertheless, in most cases it was brought forward that the public sector is most concerned with addressing the most vulnerable groups, whereas the private sector has in some cases indicated that this is not their priority. This has also been identified in the expert interviews. This mismatch between the public sector being most focused on inclusion of the vulnerable groups, and the private sector being the connection to the smallholder farmers, should therefore be addressed in order to be able to include these vulnerable groups in the PPPs for climate adaptation.

Overall, it can be concluded that case 1 and case 2 have incorporated the justice indicators the most in their PPPs. Case 3 can be considered as scoring the lowest, and 4 as medium. However, above all, the general picture of the incorporation of environmental justice for the most vulnerable groups is unsatisfactory. In all cases, incorporating justice into the PPPs is recognised as important, but the actual implementation of these justice components is in most of the PPPs still low. In most cases, there are no formal measures in place to reach the vulnerable groups and allow for an inclusive approach in the PPPs. There are thus still a lot of improvements to be made within the PPPs regarding justice for the vulnerable groups. Possible ways forward are addressed further in the discussion section.

4.6.4 Connections private sector involvement, stimulating and restrictive factors and justice implications

In the previous sections, the roles of the private sector and their level of engagement, the stimulating and restrictive factors for joining the PPPs, and the justice implications of the partnerships for the most vulnerable groups have been identified and explained. This section explains the relationships that exist between the three previously explained aspects of the framework. This section starts by explaining the relationships between the private sector involvement and the stimulating and restrictive factors. Second, the relationships between the private sector involvement and the justice implications are elaborated. Third, the relationships between the stimulating and restrictive factors and the justice implications are explained. Other possible explanations for the justice implications are also addressed here in more detail. Lastly, this section ends with overall conclusions about the connections between the three factors and how this contributes to climate adaptation.

Private sector involvement and stimulating and restrictive factors

The case studies were all focused on the same topic, which was agribusiness for food security adaptation in the global South. The four case studies differed from each other in multiple criteria as shown in table 6. These were the number of partners in the PPPs, different types of private actors involved, the geographic location of the PPP and the different scale of the PPPs. Nevertheless, despite these differences in the natures of the PPPs, as mentioned in section 4.6.1, the roles of the private actors are relatively similar to one another in the various case studies. The private actors in case studies 2 and 4 are however slightly more engaged and have more responsibilities than the private actors in case studies 1 and 3, which could be explained by the type of private actor or the number of private actors involved in the PPP. The stimulating and restrictive factors were on the other hand differing more between the four case studies. The stimulating and restrictive factors are therefore more context-dependent on the type of PPP, type of private actor and the precise focus and goals of the PPP than the roles of the private sector.

More specifically focusing on the relationship between the two framework elements, several connections can be identified. It was found that the cases that had identified more restrictive factors had more private actors involved. Moreover, the cases with more restrictive factors had private actors who were considered less engaged in the PPPs. One explanation for this is that PPPs with more private actors involved are less tailored to the specific needs of these individual actors, and therefore increase the restrictive factors these actors face. Moreover, the cases with more restrictive factors were designed by the public sector, whereas the cases with less restrictive factors were also partly designed by the private sector. The amount of restrictive factors the private actors face can thus be dependent on the influence the private actors have on the design of the PPP. The level of engagement would in that case influence the number of restrictive factors for the private sector. Another explanation is that the private sector is less engaged in the PPPs where there are more restrictive factors. The number of restrictive factors would in that case influence the level of engagement of the private sector.

Private sector involvement and the justice implications

Furthermore, the justice implications differ across the four case studies and are thus dependent on the type of PPP, as well as the stimulating and restrictive factors as explained above. The private actors were most engaged in the cases 2 and 4, and to a lesser extent in cases 1 and 3, but the justice indicators were scored best in cases 1 and 2. The roles of the private sector do, as mentioned before, not differ much across the four case studies. There is thus no clear relationship between the roles and levels of engagement of the private sector and the justice implications visible in the case studies. This can be concluded because there is no clear distinguishment in the roles of the private sector, but there are clear

differences between the justice implications. This could either mean that there is no influence of the roles and levels of engagement of the private sector on the justice implications of the case studies, or that there are multiple roles that have an influence on the justice implications. However, this cannot be concluded from the outcomes of the case study analyses.

Stimulating and restrictive factors and justice implications

Moreover, a few relationships have been found between the stimulating and restrictive factors and the justice implications. As explained in section 4.6.3, there is a variety in the scores on the five justice indicators that have been established. The justice indicator focused on whether the needs of the affected groups are taken into account in the PPPs, scored the highest amongst the case studies. This was explained by the connection of this justice indicator to the stimulating factor of the private sector using the PPP to expand their markets and make more profit. The needs of the farmers need to be taken into account in order for the private sector to make a suitable product, or in this case seed variety, for the targeted group. If these varieties are more connected to the wishes and needs of the affected groups, these groups are more likely to buy the seed varieties. Taking into account their needs is thus beneficial for the private actors, which explains the higher scores for this variety. Moreover, the private actors in all cases identified the opportunity to help smallholders uplift their livelihoods as a stimulating factor to join the PPP. It is therefore noteworthy that the justice implications for the vulnerable groups are mediocre over all the case studies. The different actors thus notice that the PPPs should or can be used to help smallholder farmers or even vulnerable groups, but the actual rate of concern for reaching these groups is relatively low. This can possibly be explained because reaching the vulnerable smallholders is socially desirable, but the private actors or even the PPPs are not too concerned with implementing this in their own activities. The scores for the other justice indicators cannot clearly be connected to the stimulating or restrictive factors.

Nevertheless, the justice implications can also have an influence on the restrictive factors for the private sector. This can especially be seen in case 1, where it was indicated that there is a maximum retail price cap and a limited geographic focus area in order to reach the vulnerable groups. These conditions did improve the justice implications in the PPP, which is one of the reasons why they scored the highest on the multiple justice indicators. However, these two requirements from the PPP were mentioned as restrictive factors for the private sector to join the project. Mandatory justice requirements for the PPP can therefore increase the restrictive factors for the private sector, and thereby limit the involvement of private actors in the PPP. This can in turn have a negative influence on the overall ability to adapt all regions to the effects of human-induced climate change.

Other explanations for justice implications

Overall, the overall justice implications in the agricultural adaptation PPPs are mediocre. These unsatisfactory justice implications could not be clearly connected to the roles or level of engagement of the private sector. Nevertheless, other possible explanations for the level of environmental justice present in the PPPs have been found in the analyses of the individual case studies. As elaborated previously, the justice implications were the most present in cases 1 and 2. Corresponding, these two cases were the only cases where one or multiple NGOs were also present. These NGOs often have the objective to focus on the vulnerable smallholders and have existing networks to reach these vulnerable or marginalised groups, whereas the private sector often has more general distribution networks. The presence of these NGOs can thus possibly explain the higher scores on the justice indicators. This is in line with the findings from the expert interviews, who indicated that NGOs are often incorporated in the PPPs to ensure that the projects also reach the vulnerable groups, because they already have established connections with these local communities that are being targeted. Based on these findings, it can thus

be suggested that the inclusion of NGOs in the PPPs focused on climate adaptation can have a positive influence on the justice implications for the most vulnerable groups.

Moreover, cases 1 and 2 are focused on specific target regions and therefore also focus on a smaller scale than cases 3 and 4. This could indicate that smaller PPP programs that are focused on specific regions are better able to reach the most vulnerable populations than larger-scaled programs. Case 2 is a PPP consisting of only four private partners, and case 1 has five private partners and five NGO partners, whereas case 3 has over thirty private partners. Case 4 is not commercialised yet, which makes it difficult to predict how many private partners will be added for the distribution of the seeds. Therefore, one possible explanation for the difference in justice implications between the cases is the number of partners, and that it is easier to make sure these partners are reaching out to the vulnerable groups in smaller PPPs. However, the down-side of these smaller-scaled PPP programs is that they have limited reach and will not be able to target as many farmers as a large-scaled project. This can therefore be considered a trade-off between targeting the most vulnerable groups or reaching a larger amount of farmers.

Overall connections

Overall, it can thus be concluded that the roles of the private sector are similar over the various types of PPPs. The stimulating and restrictive factors are more context-dependent and differ over the various case studies. This is important to keep in mind when trying to encourage the private sector to participate in the PPPs, because apparently there is no one-size-fits-all strategy to encourage the private actors to participate in PPPs. This is needed to fill the gap in climate adaptation that is still present. The stimulating and restrictive factors are thus more dependent on the type of PPP, such as the number of actors involved, types of actors or the scale of the project, and the level of engagement the private sector has. Furthermore, the justice implications of the agricultural adaptation PPPs have shown relatively mediocre. This means that the use of PPPs for climate adaptation does not necessarily ensure that all groups are reached out to. In order to achieve inclusive adaptation to the effects of climate change, there should be an increased focus on the vulnerable groups in agricultural adaptation PPPs. These justice implications do not have a clear relationship with the roles or levels of engagement of the private sector, but are more dependent on other factors such as the presence of an NGO or the scale of a PPP. Mandatory justice requirements in PPPs can be a restrictive factor to the private sector to join the PPP, and thereby reducing the willingness of the private sector to join the PPPs. Focusing more on the inclusion of vulnerable groups can thus reduce private sector involvement, possibly suggesting a trade-off between having mandatory requirements to increase the justice for the vulnerable groups, or having more private sector involvement in the climate adaptation PPPs.

5. Conclusion and Discussion

This research aimed to create a better understanding of the role and level of engagement of the private sector in agricultural PPPs, and consequently explain the effects of the different PPP constructions with different levels of private sector engagement on the justice implications for the vulnerable groups. More just and effective climate adaptation in agriculture can contribute to reducing the vulnerability of people and increasing a region's capacity to cope with the harmful effects of climate change. This research has first identified the roles and levels of engagement of the private sector in various agricultural PPPs. Secondly, this study has determined the stimulating and restrictive factors the private sector faced to join the PPPs, and lastly analysed the linked justice implications of the private sector engagement. This section first provides a brief answer to the research question. Second, the various results of this study are individually discussed and placed in a broader context, while comparing it to the existing literature. Third, following from the outcomes of this research, recommendations for further research are provided. This chapter ends with reflections on the current study.

5.1 Answer to the research question

This research was focused on investigating the role and level of engagement of the private sector in PPPs that were created to help countries in the global South adapt to climate change, and how this influenced the environmental justice for the most vulnerable groups. The research question was: "*What is the role and level of engagement of the private sector in public-private partnerships concerned with food security adaptation in the global South and what are the linked justice implications, and how can this be explained?".* This research thereby aimed to add to existing literature by explaining the effects of different PPP constructions on the justice for the vulnerable groups, and how these different PPP constructions could increase the resilience to the changing climate through climate adaptation.

Resulting from the case study analysis based on 15 case study interviews, 4 expert interviews and a document analysis, it can be concluded that the roles of the private sector are similar over the various types of PPPs concerned with climate adaptation in the agriculture sector. The private sector plays an important role within agri-PPPs and they are the primary connection to the farmers. The private sector is often responsible for a large part of the activities that is undertaken within the PPP programs, although this is sometimes to different extents. Nevertheless, overall, the level of engagement of the private sector in the PPPs for agricultural adaptation can be considered as relatively high. Encouraging private sector engagement in climate adaptation through public-private partnerships is thus an efficient way to include them more in the thematic area of agricultural and food security.

The stimulating and restrictive factors are more context-dependent and differ over the various case studies. Where the stimulating factors still had some overlap between the various cases, the restrictive factors did not. The restrictive factors identified in this study are thus presumably more context-specific than the stimulating factors, although they are both varying between the individual case studies. This is important to keep in mind when trying to encourage the private sector to participate in the PPPs, because apparently there is no one-size-fits-all strategy to encourage the private actors to participate in PPPs focused on climate adaptation. The stimulating and restrictive factors are thus more dependent on the type of PPP, such as the number of actors involved, types of actors or the scale of the project, and the level of engagement the private sector has. The level of engagement of the private actor is an influence on their stimulating or restrictive factors, because it was shown that in case studies where the private actors were more engaged, they faced less restrictive factors. Another explanation can be given, where the number of restrictive factors has an influence on the level of engagement of the private sector.

Furthermore, the overall justice implications of the agricultural adaptation PPPs have been proved mediocre. There is still a lot of room for improvement regarding the environmental justice for

the most vulnerable groups. The justice implications varied between the different case studies, whereas the role and level of engagement did not differ that much. Therefore, no clear influence from the roles and levels of engagement of the private sector on the justice implications has been identified in this study. Nevertheless, a possible influence from the justice implications on the private sector involvement has been identified. Mandatory justice requirements from PPPs, such as a maximum price, were identified by the private sector as restrictive factors to join the PPPs. This can therefore limit the encouragement of the private sector to help contribute to climate adaptation through joining PPPs focused on agricultural adaptation. The justice implications are more dependent on other factors, comparable to the stimulating and restrictive factors. Identified possible influences on the justice implications for the vulnerable groups are the presence of an NGO or the scale of a PPP. The stimulating factor for the private sector to use the PPP to expand their markets and make more profit can be linked to the justice indicator which was present in (almost) all cases, where the needs of the various groups were taken into account.

In sum, this research has provided a comprehensive understanding of the three elements of private sector involvement, their stimulating and restrictive factors to join a PPP, and the justice implications in a PPP focused on agricultural adaptation. This comprehensive understanding can help create more effective strategies to improve climate adaptation through the use of PPPs, to limit the trade-offs between the various aspects that should be addressed, such as more overall climate adaptation through private sector involvement and the focus on the vulnerable groups.

5.2 Interpretation and implications

This section places the findings of this research into a broader context and connects it to existing literature. It first focuses on the roles and levels of engagement of the private sector and its connections to previous research. Second, it elaborates on the stimulating and restrictive factors. Third, it places the findings about the justice implications and its relationship with the private sector involvement in a broader context. This section ends with a short overview of how this research has contributed to existing literature.

As mentioned in the introduction, the private sector is an important factor in climate adaptation and funding (IPCC, 2014; Nakhooda et al., 2014; Pauw, 2015; UNEP, 2011). Therefore, encouraging them through the use of PPPs is of importance to help achieve enough climate funding and use of the technologies and knowledge that the private sector possesses (Tall et al., 2021). However, encouraging them to contribute to PPPs is sometimes difficult because of their lack of a solid business case and the ability to recover investments (Koppenjan, 2015), and they have their own business objectives that need to be met (Poulton & Macartney, 2012). In the theoretical background chapter, a framework to assess the roles and linked levels of engagement for the private sector has been established and shown in figure 1 and table 1. However, it was mentioned that this framework would perhaps not be quite suitable for the analysis of the researched case studies, because the framework was mostly based on agricultural PPPs regarding infrastructure, such as irrigation systems. This case study analysis however focused on PPPs concerned with agriculture, especially focused on providing climate-smart seed varieties. It was found that the established framework is not suitable for this type of PPPs, and the private sector is responsible for other roles in this type of PPPs. This can be explained by the fact that the roles in an infrastructure PPP are different, because different activities need to be undertaken, such as the building of an infrastructure project, which is not necessary in a PPP concerned with the distribution of climate-smart seed varieties.

This research has identified that the private sector is often relatively highly engaged in the PPPs. This is in contrast with the findings of Zhang et al. (2018), who found that private sector engagement is often still very limited. This difference could be explained by the different agricultural sector that the

research by Zhang et al. (2018) focused on, namely the water infrastructure sector for agricultural drought, whereas this research focused on the climate-smart agribusiness sector. A possible explanation for this is that the roles of the private sector are likely to differ between these two agricultural sectors. In the climate-smart agribusiness sector, the private sector is often responsible for the production and sales of the seed varieties. These business activities can have a return on investments and a business case. In the water infrastructure sector for agriculture drought, the private sector does, in contrast to the agricultural sector studied in this research, not receive direct return on investment based on their sales. The ability to have a solid business case and ability to recover the investments was identified by Koppenjan (2015) as necessary for private sector engagement in PPPs. The private sector might therefore be more encouraged to participate in PPPs in the climate-smart agribusiness sector, because they can more easily recover their investments. The overall level of engagement was thus found relatively high. However, sometimes the private actors had more responsibilities than in other cases, making their levels of engagement higher in some cases.

Besides the levels of engagement of the private sector, this research has identified the different roles that the private sector has in the various case studies. It was found that the private sector played very similar roles within the PPPs. The main roles that the private sector played in all cases are the production, distribution and marketing of the seeds, as well as the monitoring of the PPP progress and providing trainings to the farmers. A causal relation between the roles of the private sector in agri-PPPs and the type or scale of the PPP has not been identified in this study. The roles that have been identified in the research are similar to the roles that have been identified by existing literature (FAO, 2016; Prasada, 2020). The findings of this research thus correspond strongly to existing findings with regards to the roles of the private sector.

This research also aimed to explain the roles and levels of engagement of the private sector by identifying the stimulating and restrictive factors the private actors faced when joining the PPP. Moreover, by identifying the stimulating and restrictive factors for the private sector to participate in a PPP, this could help create a more tailor-made approach to attract more private sector engagement in climate adaptation, which was established in existing literature as important for closing the adaptation gap (IPCC, 2014; Nakhooda et al., 2014; Pauw, 2015). Two stimulating factors, being able to help the farmers and using the PPP as an opportunity to expand their market and thereby generate more profit, were found in all the cases. Existing literature has already defined a few of the stimulating factors that have also been identified in this study, such as the opportunities for private actors to expand their markets (Pauw, 2015), using the PPPs as a CSR strategy (Spielman et al., 2010) and lastly receiving funding or guarantees from the public actors to reduce the risks for the private sector (Gardiner et al., 2015). Nevertheless, this research has identified a few stimulating factors that were not described in the theoretical background, such as the use of an intermediary organisation to help catalyse the partnership and stimulating the private sector for reducing the risk, as well as the possibility to use the networks of other actors involved in the partnership. Furthermore, the stimulating factor to use the PPP to scale up their own business, and receiving or creating better seed varieties are also newly found stimulating factors. Most of the stimulating factors can thus be considered context-specific, because they vary between the various case studies. However, being able to help the smallholder farmers and using PPPs to making more profit were identified in all case studies, therefore being less context-specific and thus being present in most of the PPPs focused on agricultural adaptation. Identifying these stimulating factors can help create a better understanding of why or under which conditions the private actors are more likely to cooperate in a PPP, and thereby help fill the gap of private sector engagement identified in the literature (Averchenkova et al., 2016; Kalinowski, 2020; Nakhooda et al., 2014).

The restrictive factors identified in this study are presumably more context-specific than the stimulating factors, since they did not overlap as much between the various case studies. Some of the

restrictive factors have already been identified in the theoretical background, such as the uncertainty about the program (Averchenkova et al., 2016; Surminski, 2013) and the project being high-risk for the private sector (Ahmad et al., 2018). This study has also identified a few restrictive factors that have not been discussed in the theoretical background, such as the difficult procedures to join the PPP, the limited capacity of the PPPs to have private sector inclusion, maximum prices obligated by the public actors, a restrictive geographic focus area, the focus on solely small companies, and the private actors wanting their own seed varieties. Overall, it could be seen that in the cases where more private actors were involved and the private actors had a lower level of engagement, more restrictive factors were identified. One possible explanation for this is that the cases where the private sector had a higher level of engagement, the PPPs could be adjusted more to the needs of these specific actors. Less restrictive factors to join the PPPs were identified in these cases than in the cases that have less private sector engagement and more private actors to partner with. More private actors involved and a lower level of engagement resulted in a less tailor-made PPP regarding private sector involvement.

This research has thus identified that the stimulating and restrictive factors are often context-specific. This research therefore adds to the strategy proposed by Biagini & Miller (2013) and the Green Climate Fund (2018) to use PPPs to encourage the private sector to contribute more to climate adaptation. The findings of this research underline the importance of not using one strategy to encourage the involvement of the private sector but a tailor-made and context-specific approach. The strategy identified in existing literature to use PPPs to encourage the private sector can, based on the identified relatively high levels of engagement in this study, thus be considered effective, as long as it is combined with a tailor-made approach to encourage the private sector.

The third aspect of this research was to analyse the justice implications of the various cases. This research has found that the justice indicators vary between the different PPPs. However, it was found that the justice indicator for taking the needs of the vulnerable groups into account was present in all of the cases, mostly to a high degree and in one case to a moderate degree. This is then most likely the justice indicator where the participating actors had more stimulative or less restrictive factors to implement. This can be explained by the fact that taking the needs of the farmers and vulnerable groups into account is often also connected to the marketing of the products. The products should connect to the needs of the customers in order for them to buy them. Furthermore, no clear influence from the private sector involvement on the justice implications was identified in this study. This is because the roles and levels of engagement did not vary much, whereas the justice indicators did have a difference between the case studies. Nevertheless, an influence from the justice implications on the private sector engagement and the restrictive factors was identified. When there were more mandatory justice requirements in the PPPs, the private actors identified more restrictive factors to join the PPP. This can in turn limit their engagement in the PPPs. This could be related to the research by Pattberg (2010) who mentioned that the private sector involvement in PPPs can be limited when the benefits of joining the PPP do not exceed the disadvantages of joining the PPPs. In this case, this would be the mandatory focus on the vulnerable groups through for example a maximum price, which could reduce their capacity to generate more profit through the PPP. This finding could thus suggest a trade-off between having mandatory requirements to increase the justice for the vulnerable groups, or having more private sector involvement in the climate adaptation PPPs.

Overall, the justice considerations within the PPPs focused on agricultural adaptation are unsatisfactory. However, as explained by Paavola (2005), if vulnerable groups are not recognised, they could face disadvantages in distribution and have less say in decision-making processes. Adaptation projects could therefore increase inequality instead of reducing it (Paavola, 2005). Therefore, it is of importance to find ways to increase the justice implications for the vulnerable groups in climate adaptation PPPs. As found in this research, the private sector is the main distributer and thereby the

main connection with the smallholder farmers or vulnerable groups in the PPPs. They can therefore play an important role in improving the justice for these vulnerable groups. However, as was found in the case study analyses, the public sector is in most cases the type of actor that is most concerned with the inclusion of the vulnerable groups. It is acknowledged in almost all interviews that the inclusion of vulnerable groups is of importance. However, in contrast, there are often no concrete measures in place to actually reach these farmers. The actual implementation of procedures to include these vulnerable groups is thus very limited, even though the importance of this is acknowledged in almost all interviews. Finding specific strategies to encourage the PPPs to include the vulnerable groups is thus needed to increase the capacity of all groups to adapt to the effects of climate change and make the transition to a more climate-resilient future. A few suggestions for improved strategies to increase the inclusion of vulnerable groups can be made. A first suggestion is to include NGOs in the agri-PPPs, because they often focus on the inclusion of vulnerable groups (FAO, 2016; Ford et al., 2015; Khanom, 2011; Kraak et al., 2012; Yakubu et al., 2019). A second suggestion is to include mandatory requirements for the private sector to reach out to vulnerable groups, as was indicated in the expert interviews as a good strategy to include vulnerable groups more in the PPPs.

Connecting the justice-findings to existing literature, the FAO (2016) found that in agri-PPPs there is only limited inclusion of the poorest smallholders or vulnerable groups. They have explained this by the fact that the private partners might only want to focus on reaching large-scale farmers to decrease their costs (FAO, 2016) instead of focusing on vulnerable smallholders. In this research, it was found in only one case study that the private actors would want to work with large-scaled farmers. The lack of interest to work with large-scaled farmers in the other case studies was explained by the fact that smallholder farmers are the main user of the drought-tolerant and climate-resilient seed varieties, and are therefore automatically included in the PPPs. The large-scaled farmers most likely have more access to innovative technologies and good irrigation systems, making these types of drought-tolerant seed varieties less useful, resulting in less interest from these large-scaled farmers. The outcome of this study thus varies from the outcome of the FAO (2016). Furthermore, the FAO report mentioned that the agri-PPPs are most likely not targeting the poorest of the poor. However, this research found that for some of the cases, the PPP did focus on reaching the vulnerable groups and had specific measures in place to reach them. These cases however had an NGO participating in the PPP, which was mainly focused on the inclusion of these vulnerable groups. The FAO report (2016) defined NGOs also as private partners, whereas this study made a distinction between those actors. This difference in definition could possibly explain the dissimilar findings. The findings of this research, that the PPPs can be inclusive on smallholders and focus on vulnerable groups, is more in line with the research of Gaffney et al. (2019), who argued that PPPs could be an effective tool to help vulnerable groups in developing countries.

This research has found two possible influences that can explain the inclusion of the most vulnerable groups. The first possible explanation was the presence of an NGO. These NGOs were identified to be better able to connect to the poorest groups. This is however in contrast to the existing literature from Intellecap (2010), who mentioned that actors from the local private sector are sometimes more capable to respond to the needs of the most vulnerable or poor groups than NGOs. This research is more in line with the research conducted by Yakubu et al. (2019) and Khanom (2011), who found that NGOs can help smallholder farmers by for example connecting them to markets, and through their experienced field workers. This research is also in line with the research by Ford et al. (2015), who found that NGOs most often took vulnerabilities of groups into account, mostly related to gender vulnerabilities. This study has thus contributed to existing literature by emphasising the importance of NGOs in agricultural PPPs to include smallholder farmers or vulnerable groups more.

The second possible explanation for the focus on vulnerable groups is the scale of the project, corresponding to a specific target area. The findings of this study could indicate that there is a possible trade-off in choosing between serving the vulnerable smallholder farmers, or being a large-scaled PPP

reaching more 'general' farming communities. This does not mean that focusing on simultaneously serving the vulnerable groups and being a large-scaled PPP is inherently impossible, but that the PPPs do not pay much attention to the inclusion of the vulnerable groups when they aim to reach a larger scale. It can therefore be argued that a combination of both small-scaled PPPs focused on inclusion of the vulnerable groups, and large-scaled PPPs targeting a larger area is needed. The combination could help ensure that a large region is protected from climate change, and that the most vulnerable groups are also included in this transition towards a more climate-resilient future. If these smaller PPPs focused on vulnerable smallholder farmers did not exist, these groups would possibly be excluded from the transition to this climate-resilient future and could become even more marginalised and face even greater effects of climate change. It should be mentioned that not serving the smallholders or most vulnerable groups does not indicate that the private sector is not contributing to creating more food security or climate adaptation.

All in all, this study has contributed to the existing literature by identifying that the private sector often plays a key role within the PPPs and are responsible for the actual delivery of the program or project. Therefore, using PPPs is thus an effective way to stimulate the private sector to help contribute to climate adaptation in the field of agriculture. However, as was identified by Stoll et al. (2021), mobilizing private sector participation in adaptation is a means to an end, not an end in itself. The goal should be to effectively adapt society as a whole, including the most vulnerable groups and individuals.

Nonetheless, the justice implications in the adaptation projects are still unsatisfactory, meaning that not all groups are included in the transition to a more climate-resilient future. This could possibly create even more injustices and inequalities (Paavola, 2005). Nevertheless, the presence of an NGO in a PPP and a lower scale of a project have been identified as a positive influence on the justice implications. This can therefore be recommended to organisations that are aiming to work with PPPs in climate adaptation. These generated insights helped create a better understanding of the conditions that are necessary for reaching the vulnerable smallholders to increase their livelihoods. Lastly, it should be noted that a one-size-fits-all approach is not effective for increasing the participation of the private sector, and also not for increasing the justice implications of the PPPs. A tailor-made approach to the specific context or situation in which the PPP is working is needed to create a more effective and just transformation to a more climate-resilient future, which is needed to reduce the negative effects of climate change.

5.3 Recommendations for future research

Resulting from the outcomes of this research stated above, several recommendations for future research can be made. The first recommendation for future research is to look more into the role of the smallholder farmers, taking into account their perspectives. This could be done by conducting in-depth interviews with these smallholder farmers on location. This research would advise to conduct more in-depth and extensive interviews, through a larger number of interviews per case study. Use of an interpreter to create a better understanding of the views and experiences of these smallholders is recommended. Also, the justice implications could, by interviewing these smallholder farmers, be researched more extensively and from various perspectives. This would be an addition to the interviews conducted with the public and private actors who participated in the PPPs. It would then be interesting to investigate if there are differences in perceptions on the inclusion of the smallholder groups. Additionally, future research could, through interviewing the vulnerable groups, focus more on the actual processes for the implementation, and thereby add to this study which focused on the justice indicators within the design of the PPPs. This could then investigate the difference between the justice implications in the design of the process, and the actual implementation. This would allow for a better

understanding of the justice implications the PPPs have, and to make more targeted recommendations for policy makers and organisations focusing on using PPPs to increase climate adaptation for vulnerable regions.

Additionally, a longitudinal approach to this research is recommended. Some of the PPPs researched are still relatively new, and some are almost at the end of their duration. It would be interesting to see how the situation has changed over a few years, and to study the effects of the PPPs over time more comprehensively.

Another recommendation for future research that can be suggested is to execute the same research in other sectors of PPPs. As mentioned before, this research has focused extensively on the agri-PPPs focused on climate-smart seed varieties, but the results could possibly differ from other sectors, either in agriculture or other sectors where PPPs are used to increase climate adaptation. A more comprehensive understanding of the involvement of the private sector and justice implications in all sectors of PPPs concerned with climate adaptation can help contribute to a more climate-resilient future with inclusion of all groups.

Furthermore, as indicated before, explanations for the levels of justice in the PPP programs than the private sector engagement have been identified. Future research could focus on these newly identified explanations. The first would be to research the role of the NGOs in these PPP more extensively and see how they contribute to the project, and also what their stimulating or restrictive factors to join the PPPs would be, to ensure that they also want to participate in these PPPs. Moreover, as was identified by Kraak et al. (2012), collaborations between NGOs and multinational corporations sometimes face issues because of conflicting values or objectives. Further research focused on the roles of NGOs could also look further into these possible conflicts.

In addition, more research into the possible trade-off between the scales of the PPPs and reaching the smallholder farmers is recommended. This further research can also focus on ways to integrate these two types of PPPs. This can help create a better understanding of the effect of different types of PPPs and their influences on reaching more farmers or smallholder inclusion.

Lastly, future research could focus on developing tools to help these large-scaled projects reach smallholders more effectively and inclusively. As mentioned, it was indicated by almost all interviewees that it is of importance to include the most vulnerable or poorest groups in the projects. However, they had no specific measures in place to reach these groups. More specific strategies or tools on how to include vulnerable groups and farmers could be a good contribution and help identify a clear pathway to a more just and climate-resilient future for all.

5.4 Reflections

This section reflects on the chosen research methodology and the implications this had for the research. This research is mostly generalisable over PPPs that are working in the global South and are working in the field of food security regarding climate-smart seed varieties, as explained in the methodology section. The conclusions of this research might however not fully apply to other PPP sectors. Other sectors can have other roles of the private actors, other stimulating or restrictive factors and even other justice implications.

A few reflections should be made on the data collection of this research. First of all, the research did not conduct interviews with the smallholders or vulnerable groups directly. The reason for this was that the research was conducted from the Netherlands and the interviews needed to be conducted online. Therefore, it was very difficult to come into contact with the smallholder farmers. The effect of this is that the research did not incorporate first-hand experience from the affected farmers on how they experience their involvement within the PPPs, and is only based on the actors who are participating in the PPP. This shortcoming was tried to be overcome by focusing on how the different justice indicators

are incorporated within the design of the PPPs, and therefore receive less biased information about the inclusion of the smallholder farmers. Another reflection to be made on the data collection of this research is on the snowball sampling that was used to find participants for the interviews. The snowball sampling could in some cases have led to a selection bias of the participants, because they were put forward by other actors involved in the PPP. In some cases this problem was overcome because the interviewees provided an overview of multiple actors who could be interviewed, of which the researcher could choose. In cases where this was not possible, this shortcoming was aimed to be overcome through the use of data triangulation. Additional expert interviews and a small document analysis were added to create a better understanding of the cases and overcome the possible selection bias.

Another limitation of this research regarding the data collection is linked to the restrictive factors of joining the PPP. The interviews were only conducted with private actors who were participating in the PPPs, and thus wanted to join the program. This could lead to an incomplete picture or overview of the restrictive factors that other private actors have faced, who in the end decided not to join the PPP. This limitation was tried to be overcome by asking all interviewees, including the public sector, whether they know what restrictive factors the private actors may face. This was done, because these actors may also know more about other private actors who did in the end not join the PPPs. Moreover, the interviews were all conducted in English over Teams. However, this was proven to be difficult. This can be explained by the fact that most of the participants do not have English as their first language and therefore did not have a good command of the English language. Furthermore, the interviews were sometimes limited by bad Wi-Fi-connections, resulting in lagging answers. The combination of these two factors made the interviews more difficult to conduct, because it was more difficult to immediately understand what the participant was talking about, making it hard to answer them with more tailor-made questions about the topics. This could thus have limited the quality of the interviews in some cases. Therefore, in some cases it might have been useful to have used an interpreter, or even to travel to these locations and conduct the interviews face-to-face. However, because of the limited time and resources available for this study, hiring an interpreter or travelling to the PPP locations was not a viable option.

Furthermore, in the second case study of the AICCRA Zambia Accelerator Program, no restrictive factors had been identified. The absence of these restrictive factors was in the results section partly explained by the fact that the private actors participating in this project have designed the precise project themselves. In this case study, the private actors had to submit a proposal to participate in the PPP. This could therefore limit the amount of restrictive factors that the private sector has faced, because they could design the project to their own preferences. Nevertheless, the lack of restrictive factors identified could raise questions about the reliability of the interviewees. The absence of the restrictive factors could possibly be explained by the social norms around the program, and that the interviewees did not want to discuss negative aspects of the program. This research has tried to overcome such issues by conducting multiple interviews with various actors involved in the program, as well as expert interviews and a document analysis, which was identified as data triangulation. Nonetheless, it is always possible that these actors had no interest in naming those restrictive factors for the use of this research. A longitudinal approach to this research, as was recommended for further research, could be used to see whether the actors identify other restrictive factors over time.

Another reflection that can be made on this research is that the justice indicators have been shown schematically and based on scores. This was used to allow for a better comparison between the case studies. However, this systematic approach to the comparative case study also had some disadvantages. This systematic approach reduced the chances of nuancing the outcomes of the analyses. Therefore, these outcomes show relative differences between the case studies, but cannot be coupled to an absolute meaning. Therefore, using the scores for the justice indicators allowed for better comparison but did not allow for reflecting on the complexity of the different indicators within the various partnerships.

Overall, PPPs are a useful way to encourage the private sector to contribute to climate adaptation. However, there is not a one-size-fits-all strategy to stimulate their participation in these projects, since these factors are often context-dependent. The justice implications for the vulnerable groups vary much over the PPPs, but overall the justice considerations can be improved. This research thus helped create a more comprehensive overview of the various phenomena that are present with a PPP focused on climate adaptation, especially within the thematic area of agriculture, and also provided explanations for why these phenomena are present. This can help create more effective and tailored strategies or policies to address these issues that are still present within the PPPs. In turn, this can allow for a clear pathway to a more just and climate-resilient future for all, which is needed to adapt to the increasing risks posed by human-induced climate change.

6. References

Aaboen, L., Dubois, A., & Lind, F. (2012). Capturing processes in longitudinal multiple case studies. *Industrial Marketing Management, 41*(2), 235-246. https://doi.org/10.1016/j.indmarman.2012.01.009

African Agricultural Technology Foundation (n.d.). *Scaling Maize Technologies in Africa.* Unpublished manuscript. https://taat-africa.org/wp-content/uploads/2019/12/TAAT-MC-brochure-small.pdf

Adger, W. N., Paavola, J., Huq, S., & Mace, M. J. (2006). *Fairness in adaptation to climate change*. MIT press.

Agrawala, S., Carraro, M., Kingsmill, N., Lanzi, E., Mullan, M., & Prudent-Richard, G. (2011). *Private sector engagement in adaptation to climate change: approaches to managing climate risks.* Organisation for Economic Co-operation and Development (OECD) https://www.oecd-ilibrary.org/content/paper/5kg221jkf1g7-en

Agyeman, J., Schlosberg, D., Craven, L., & Matthews, C. (2016). Trends and directions in environmental justice: from inequity to everyday life, community, and just sustainabilities. *Annual Review of Environment and Resources, 41*, 321-340. https://doi.org/10.1146/annurev-environ-110615-090052

Ahmad, E., Bhattacharya, A., Vinella, A., & Xiao, K. (2018). Involving the private sector and PPPs in financing public investments: Some opportunities and challenges. *Fiscal Underpinnings for Sustainable Development in China* (pp. 123-159). Springer. https://doi.org/10.1007/978-981-10-6286-5_6

Akhmouch, A., & Kauffmann, C. (2013). Private-sector participation in water service provision: revealing governance gaps. *Water International, 38*(3), 340-352. https://doi.org/10.1080/02508060.2013.793573

Akintoye, A., Beck, M., & Hardcastle, C. (2008). *Public-private partnerships: managing risks and opportunities.* John Wiley & Sons.

Averchenkova, A., Crick, F., Kocornik-Mina, A., Leck, H., & Surminski, S. (2016). Multinational and large national corporations and climate adaptation: are we asking the right questions? A review of current knowledge and a new research perspective. *Wiley Interdisciplinary Reviews: Climate Change, 7*(4), 517-536. https://doi.org/10.1002/wcc.402

Beh, L. (2010). Development and Distortion of Malaysian Public-Private Partnerships–Patronage, Privatised Profits and Pitfalls. *Australian Journal of Public Administration, 69*, S74-S84. https://doi.org/10.1111/j.1467-8500.2009.00655.x

Bennett, A. (2004). Case study methods: Design, use, and comparative advantages. *Models, Numbers, and Cases: Methods for Studying International Relations, 2*(1), 19-55.

Biagini, B., & Miller, A. (2013). Engaging the private sector in adaptation to climate change in developing countries: importance, status, and challenges. *Climate and Development, 5*(3), 242-252. https://doi.org/10.1080/17565529.2013.821053

Boris, O. A., Vorontsova, G. V., Momotova, O. N., & Parakhina, V. N. (2021). Achieved level of agro-PPP development: factors of risk, successes and failures. Paper presented at the *IOP Conference Series: Earth and Environmental Science, 699*(1).

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal, 9*(2), 27-40. https://doi.org/10.1080/14693062.2018.1513358

Bowman, M., & Minas, S. (2019). Resilience through interlinkage: the green climate fund and climate finance governance. *Climate Policy, 19*(3), 342-353.

Bruni, M., & Santucci, F. M. (2016). Agribusiness at global scale and smallholders. *Bulgarian Journal of Agricultural Science, 22*(1), 1-9. https://www.agrojournal.org/22/01-01.pdf

Burch, S., Gupta, A., Inoue, C. Y., Kalfagianni, A., Persson, Å, Gerlak, A. K., Ishii, A., Patterson, J., Pickering, J., & Scobie, M. (2019). New directions in earth system governance research. *Earth System Governance, 1*, 100006. https://doi.org/10.1016/j.esg.2019.100006

Burton, I. (1996). The growth of adaptation capacity: practice and policy. *Adapting to climate change* (pp. 55-67). Springer.

Buso, M., & Stenger, A. (2018). Public-private partnerships as a policy response to climate change. *Energy Policy, 119*, 487-494. https://doi.org/10.1016/j.enpol.2018.04.063

Cesario, S., Morin, K., & Santa-Donato, A. (2002). Evaluating the level of evidence of qualitative research. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 31*(6), 708-714. https://doi.org/10.1177/0884217502239216

Consultative Group for International Agricultural Research (2021a). *AICCRA Zambia Accelerator Grant*. https://vc4a.com/cgiar/aiccra-zambia/.

Consultative Group for International Agricultural Research (2021b). *CSA/CIS Bundle 3: Addressing Drought through Climate Smart Seed Varieties.* Unpublished manuscript. https://cdn1.vc4a.com/media/2021/10/Bundle-3-Info-Sheet.pdf?_ga=2.130945420.2090453456.1654683980-836534269.1650974497

Consultative Group for International Agricultural Research (2022). *AICCRA Zambia announce Accelerator Program finalists*. https://aiccra.cgiar.org/news/aiccra-zambia-announce-accelerator-program-finalists

Chauhan, Y., & Marisetty, V. B. (2019). Do public-private partnerships benefit private sector? Evidence from an emerging market. *Research in International Business and Finance, 47*, 563-579. https://doi.org/10.1016/j.ribaf.2018.10.002

Creswell, J. W., & Creswell, J. D. (2017*). Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

Delmon, J. (2021). *Private sector investment in infrastructure: project finance, PPP projects and PPP frameworks.* Kluwer Law International BV.

Disaster Management and Mitigation Unit (DMMU) Zambia. (2020). *Zambia - Subnational Administrative Boundaries* [Data set]. OCHA Regional Office for Southern and Eastern Africa (ROSEA). https://data.humdata.org/dataset/cod-ab-zmb

Dodman, D., & Satterthwaite, D. (2008). Institutional capacity, climate change adaptation and the urban poor. https://opendocs.ids.ac.uk/opendocs/bitstream/handle/20.500.12413/8193/IDSB_39_4_10.1111-j.1759-5436.2008.tb00478.x.pdf?sequence=1

Druce, L., Moslener, U., Gruening, C., Pauw, W. P., & Connell, R. (2016*). Demystifying adaptation finance for the private sector*. The United Nations Environment Programme (UNEP). https://www.unepfi.org/wordpress/wp-content/uploads/2016/11/DEMYSITIFYING-ADAPTATION-FINANCE-FOR-THE-PRIVATE-SECTOR-AW-FULL-REPORT.pdf

Edkins, A. J., & Smyth, H. J. (2006). Contractual management in PPP projects: evaluation of legal versus relational contracting for service delivery. *Journal of Professional Issues in Engineering Education and Practice, 132*(1), 82-93. https://doi.org/10.1061/(ASCE)1052-3928(2006)132:1(82)

Esri (2021). *World Countries (Generalized)* [Data set]. ArcGIS Hub. https://hub.arcgis.com/datasets/2b93b06dc0dc4e809d3c8db5cb96ba69_0/explore?location=-0.784455%2C0.000000%2C2.17

Etikan, I., Alkassim, R., & Abubakar, S. (2016). Comparision of snowball sampling and sequential sampling technique. *Biometrics and Biostatistics International Journal, 3*(1), 55. https://doi.org/10.15406/bbij.2016.03.00055

European Commission (2021). *COMMISSION STAFF WORKING DOCUMENT. Closing the climate protection gap - Scoping policy and data gaps.* https://ec.europa.eu/clima/system/files/2021-06/swd_2021_123_en.pdf

Food and Agriculture Organization (2016). *Public–private partnerships for agribusiness development*. Rome: FAO. https://www.researchgate.net/profile/Eva-Galvez-4/publication/341821055_Public-private_partnerships_for_agribusiness_development_A_review_of_international_experiences/links/5ed5fe8292851c9c5e7255fd/Public-private-partnerships-for-agribusiness-development-A-review-of-international-experiences.pdf

Food and Agriculture Organization (2021). *Food security and water security go hand-in-hand*. Rome: FAO. https://www.fao.org/news/story/en/item/1442595/icode/

Farquharson, E., & Yescombe, E. R. (2011). *How to engage with the private sector in public-private partnerships in emerging markets.* World Bank Publications.

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry, 12*(2), 219-245. https://doi.org/10.1177/1077800405284363

Ford, J. D., Berrang-Ford, L., Bunce, A., McKay, C., Irwin, M., & Pearce, T. (2015). The status of climate change adaptation in Africa and Asia. *Regional Environmental Change, 15*(5), 801-814. https://doi.org/10.1007/s10113-014-0648-2

Fraser, N. (2001). Recognition without ethics? *Theory, Culture & Society, 18*(2-3), 21-42. https://doi.org/10.1177/02632760122051760

Fraser, N. (2008). Abnormal justice. *Critical Inquiry, 34*(3), 393-422. https://doi.org/10.1086/589478

Gaffney, J., Challender, M., Califf, K., & Harden, K. (2019). Building bridges between agribusiness innovation and smallholder farmers: A review. *Global Food Security, 20*, 60-65. https://doi.org/10.1016/j.gfs.2018.12.008

Gardiner, A., Bardout, M., Grossi, F., & Dixson-Declève, S. (2015). *Public-private partnerships for climate finance.* Nordic Council of Ministers.

Gerring, J. (2004). What is a case study and what is it good for? *American Political Science Review, 98*(2), 341-354. https://doi.org/10.1017/S0003055404001182

Green Climate Fund (2018). *Recommendations of the Private Sector Advisory Group on opportunities to engage the private sector in adaptation*. Songdo, Incheon, Republic of Korea: https://www.greenclimate.fund/sites/default/files/document/gcf-b20-12.pdf

Green Climate Fund. (n.d.). *Health, food, and water security*. https://www.greenclimate.fund/results/health-food-water-security

Harman, B. P., Taylor, B. M., & Lane, M. B. (2015). Urban partnerships and climate adaptation: challenges and opportunities. *Current Opinion in Environmental Sustainability, 12*, 74-79. https://doi.org/10.1016/j.cosust.2014.11.001

Heffron, R. J., McCauley, D., & Sovacool, B. K. (2015). Resolving society's energy trilemma through the Energy Justice Metric. *Energy Policy, 87*, 168-176. https://doi.org/10.1016/j.enpol.2015.08.033

Hegger, D. L., Mees, H. L., Driessen, P. P., & Runhaar, H. A. (2017). The Roles of Residents in Climate Adaptation: A systematic review in the case of the Netherlands. *Environmental Policy and Governance, 27*(4), 336-350. https://doi.org/10.1002/eet.1766

Hijmans, R. J. (2015). *First-level Administrative Divisions, India, 2015* [Map]. *No Scale Provided.* University of California, Berkeley. https://geodata.lib.utexas.edu/catalog/stanford-mw277wc3858

Hurlbert, M. A. (2011). Evaluating climate justice–attitudes and opinions of individual stakeholders in the United Nations Framework Climate Change Convention Conference of the Parties. Journal of Integrative Environmental Sciences, 8(4), 267-286. https://doi.org/10.1080/1943815X.2011.599812

Intellecap. (2010). *Opportunities for private sector engagement in urban climate change resilience building*. Hyderabad: Intellecap.

Intergovernmental Panel on Climate Change (2014). *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva, Switzerland: https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf

Jenkins, K., McCauley, D., Heffron, R., Stephan, H., & Rehner, R. (2016). Energy justice: A conceptual review. *Energy Research & Social Science, 11*, 174-182. https://doi.org/10.1016/j.erss.2015.10.004

Johnston, J. (2010). Examining 'tunnel vision'in Australian PPPs: rationales, rhetoric, risks and 'rogues'. *Australian Journal of Public Administration, 69*, S61-S73. https://doi.org/10.1111/j.1467-8500.2009.00660.x

Kalfagianni, A., Gerlak, A. K., Olsson, L., & Scobie, M. (2019). Justice 1. *Routledge Handbook of Global Sustainability Governance* (pp. 73-87). Routledge. https://doi.org/10.3390/su12218827

Kalinowski, T. (2020). Institutional innovations and their challenges in the green climate fund: Country ownership, civil society participation and private sector engagement. *Sustainability, 12*(21), 8827. https://doi.org/10.3390/su12218827

Kashwan, P., Biermann, F., Gupta, A., & Okereke, C. (2020). Planetary justice: prioritizing the poor in earth system governance. *Earth System Governance, 6*, 100075. https://doi.org/10.1016/j.esg.2020.100075

Khanom, N. A. (2011). Improving the effects of Public Private Partnerships on ultra-poor households in Bangladesh. *International Review of Business Research Papers, 7*(1), 118-133. https://doi.org/10.1080/23276665.2011.10779381

Koppenjan, J. F. (2015). Public–private partnerships for green infrastructures. Tensions and challenges. *Current Opinion in Environmental Sustainability, 12*, 30-34. https://doi.org/10.1016/j.cosust.2014.08.010

Kraak, V. I., Harrigan, P. B., Lawrence, M., Harrison, P. J., Jackson, M. A., & Swinburn, B. (2012). Balancing the benefits and risks of public–private partnerships to address the global double burden of malnutrition. *Public Health Nutrition, 15*(3), 503-517. https://doi.org/10.1017/S1368980011002060

Kwak, Y. H., Chih, Y., & Ibbs, C. W. (2009). Towards a comprehensive understanding of public private partnerships for infrastructure development. *California Management Review, 51*(2), 51-78. https://doi.org/10.2307/41166480

Leal Filho, W., Balogun, A., Ayal, D. Y., Bethurem, E. M., Murambadoro, M., Mambo, J., Taddese, H., Tefera, G. W., Nagy, G. J., & Fudjumdjum, H. (2018). Strengthening climate change adaptation capacity in Africa-case studies from six major African cities and policy implications. *Environmental Science & Policy, 86*, 29-37. https://doi.org/10.1016/j.envsci.2018.05.004

Li, B., & Akintoye, A. (2003). An overview of public-private partnership. In A. Akintoye, M. Beck & C. Hardcastle (Reds.). *Public-Private Partnerships: Managing Risks and Opportunities*, (pp. 3-30). Wiley-Blackwell. https://doi.org/10.1002/9780470690703.ch1

Lie, A. L. (2021). 'We are not a partnership'–constructing and contesting legitimacy of global public–private partnerships: the Scaling Up Nutrition (SUN) Movement. *Globalizations, 18*(2), 237-255. https://doi.org/10.1080/14747731.2020.1770038

Linder, S. H. (1999). Coming to terms with the public-private partnership: A grammar of multiple meanings. *American Behavioral Scientist, 43*(1), 35-51. https://doi.org/10.1177/00027649921955146

Liu, J., Love, P. E., Davis, P. R., Smith, J., & Regan, M. (2013). Performance measurement framework in PPP projects. Paper presented at the *P3BooK Proceedings of International Conference on PPP Body of Knowledge in Preston, UK, University of Central Lancashire, Lancashire*, (pp. 55-64). http://clok.uclan.ac.uk/11996/1/FINAL%20PROCEEDINGS%2019th%20of%20March%202013.pdf#page=67

Marbaniang, E. K., Chauhan, J. K., & Kharumnuid, P. (2020). Public private partnership (PPP) in agriculture: a step towards sustainable agricultural development. *Agric Food E-Newsletter, 2*(2), 387-391. https://www.researchgate.net/profile/Pynbianglang-Kharumnuid/publication/339850593_Public_Private_Partnership_PPP_in_Agriculture_A_step_towards_sustainable_agricultural_development/links/5e69403a92851c20f321e464/Public-Private-Partnership-PPP-in-Agriculture-A-step-towards-sustainable-agricultural-development.pdf

Mertz, O., Halsnæs, K., Olesen, J. E., & Rasmussen, K. (2009). Adaptation to climate change in developing countries. *Environmental Management, 43*(5), 743-752. https://doi.org/10.1007/s00267-008-9259-3

Mitchell, J. F., Lowe, J., Wood, R. A., & Vellinga, M. (2006). Extreme events due to human-induced climate change. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 364*(1845), 2117-2133. https://doi.org/10.1098/rsta.2006.1816

Morita, K., Okitasari, M., & Masuda, H. (2020). Analysis of national and local governance systems to achieve the sustainable development goals: case studies of Japan and Indonesia. *Sustainability Science, 15*(1), 179-202. https://doi.org/10.1007/s11625-019-00739-z

Mumford, T. V., Van Iddekinge, C. H., Morgeson, F. P., & Campion, M. A. (2008). The Team Role Test: Development and validation of a team role knowledge situational judgment test. *Journal of Applied Psychology, 93*(2), 250-267. https://doi.org/10.1037/0021-9010.93.2.250

Mutuku, K. (2019). *The contribution of Public-private Partnership to Agribusiness in Kenya: a case study of fruit processing enterprises.* http://41.204.161.209/bitstream/handle/11295/109213/Mutuku_The%20contribution%20of%20Public-private%20Partnership%20to%20Agribusiness%20in%20Kenya%20-%20%20a%20case%20study%20of%20fruit%20processing%20enterprises.pdf?sequence=1&isAllowed=y

Nakhooda, S., Norman, M., Barnard, S., Watson, C., Greenhill, R., Caravani, A., & Banton, G. (2014). Climate finance: is it making a difference. *A Review of the Effectiveness of the Multilateral Climate Funds.Overseas Development Institute:* London.

Nikolaevich, M., Fedorovich, O., Vladimirovna, N., & Igorevna, D. (2019). Public and private partnership: Innovation-driven growth of agriculture at the regional level. *Journal of Environmental Management & Tourism, 10*(7 (39)), 1435-1444. https://doi.org/10.14505/%7Cemt.v10.7(39).01

Noy, C. (2008). Sampling knowledge: The hermeneutics of snowball sampling in qualitative research. *International Journal of Social Research Methodology, 11*(4), 327-344. https://doi.org/10.1080/13645570701401305

Obayelu, A. E. (2018). Public-private partnerships for inclusive agribusiness sustainability in Africa. *Agriculturae Conspectus Scientificus, 83*(3), 251-261. https://hrcak.srce.hr/file/302728

Organisation for Economic Co-operation and Development (2012). *Recommendation of the Council on Principles for Public Governance of Public-Private Partnerships*. https://www.oecd.org/governance/budgeting/PPP-Recommendation.pdf

Paavola, J. (2005). Seeking justice: international environmental governance and climate change. *Globalizations, 2*(3), 309-322. https://doi.org/10.1080/14747730500367850

Paavola, J. (2008). Science and social justice in the governance of adaptation to climate change. *Environmental Politics, 17*(4), 644-659. https://doi.org/10.1080/09644010802193609

Paavola, J., & Adger, W. N. (2006). Fair adaptation to climate change. *Ecological Economics, 56*(4), 594-609. https://doi.org/10.1016/j.ecolecon.2005.03.015

Pagano, A. M. (2010). Public-Private Partnerships (PPP) in Transportation: An Analysis of Alternatives. Paper presented at the *Journal of the Transportation Research Forum, 49*(2). http://journals.oregondigital.org/index.php/trforum/article/view/4499

Patel, S. (2010). *Climate Finance*. World Bank, Washington, DC. https://openknowledge.worldbank.org/bitstream/handle/10986/27817/762370WP0Clima00Box374367B00PUBLIC0.pdf?sequence=1&isAllowed=y

Pattberg, P. (2010). Public–private partnerships in global climate governance. *Wiley Interdisciplinary Reviews: Climate Change, 1*(2), 279-287. https://doi.org/10.1002/wcc.38

Pauw, P. (2015). Not a panacea: private-sector engagement in adaptation and adaptation finance in developing countries. *Climate Policy, 15*(5), 583-603. https://doi.org/10.1080/14693062.2014.953906

Pauw, P., & Pegels, A. (2013). Private sector engagement in climate change adaptation in least developed countries: an exploration. *Climate and Development, 5*(4), 257-267. https://doi.org/10.1080/17565529.2013.826130

Poulton, C., & Macartney, J. (2012). Can public–private partnerships leverage private investment in agricultural value chains in Africa? A preliminary review. *World Development, 40*(1), 96-109. https://doi.org/10.1016/j.worlddev.2011.05.017

Powell, R. R. (2006). Evaluation research: An overview. *Library trends, 55*(1), 102-120. https://doi.org/10.1353/lib.2006.0050

Prasada, P. (2020). Public–Private–Producer (PPP) Partnerships in Sri Lankan Agriculture. In *Agricultural Research for Sustainable Food Systems in Sri Lanka* (pp. 353-369). Springer, Singapore.

Rahi, S. (2017). Research design and methods: A systematic review of research paradigms, sampling issues and instruments developed. *International Journal of Economics & Management Sciences, 6*(2), 1-5. https://doi.org/10.4172/2162-6359.1000403

Raphael, D. D. (2001). *Concepts of justice*. Clarendon Press.

Richards, L. (1999). Data alive! The thinking behind NVivo. *Qualitative Health Research, 9*(3), 412-428. https://doi.org/10.1177/104973239900900310

Roehrich, J., Barlow, J. G., & Wright, S. (2013). *Delivering European healthcare infrastructure through public-private partnerships: The theory and practice of contracting and bundling.* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2955071

Scharpf, F. W. (1999). *Governing in Europe: Effective and democratic?* Oxford University Press.

Schlosberg, D. (2003). The Justice of Environmental Justice: Reconciling Equity, Recognition, and Participation in a Political Movement. In A. Light, A. & A. De-Shalit (Reds.), *Moral and Political Reasoning in Environmental Practice,* (pp. 77-106). The MIT Press.

Schlosberg, D. (2007). *Defining environmental justice: Theories, movements, and nature*. OUP Oxford.

Schlosberg, D. (2012). Climate justice and capabilities: A framework for adaptation policy. *Ethics & International Affairs, 26*(4), 445-461. https://doi.org/10.1017/S0892679412000615

Schlosberg, D., & Collins, L. B. (2014). From environmental to climate justice: climate change and the discourse of environmental justice. *Wiley Interdisciplinary Reviews: Climate Change, 5*(3), 359-374. https://doi.org/10.1002/wcc.275

Schlosberg, D., Collins, L. B., & Niemeyer, S. (2017). Adaptation policy and community discourse: risk, vulnerability, and just transformation. *Environmental Politics, 26*(3), 413-437. https://doi.org/10.1080/09644016.2017.1287628

Schmidt, V. A. (2013). Democracy and legitimacy in the European Union revisited: Input, output and 'throughput'. *Political Studies, 61*(1), 2-22. https://doi.org/10.1111/j.1467-9248.2012.00962.x

Senyolo, M. P., Long, T. B., & Omta, O. (2021). Enhancing the adoption of climate-smart technologies using publicprivate partnerships: lessons from the WEMA case in South Africa. *International Food and Agribusiness Management Review, 24*(5), 755-776. https://doi.org/10.22434/IFAMR2019.0197

Sharifi, A., & Murayama, A. (2015). Viability of using global standards for neighbourhood sustainability assessment: insights from a comparative case study. *Journal of Environmental Planning and Management, 58*(1), 1-23. https://doi.org/10.1080/09640568.2013.866077

Shukla, R., Sharma, S., & Thumar, V. M. (2016). Role and importance of public private partnerships in agricultural value chain and infrastructure. *International Journal of Commerce & Business Management, 9*(1), 113-118. https://doi.org/10.15740/HAS/IJCBM/9.1/113-118

Spielman, D. J., Hartwich, F., & Grebmer, K. (2010). Public–private partnerships and developing-country agriculture: Evidence from the international agricultural research system. *Public Administration and Development, 30*(4), 261-276. https://doi.org/10.1002/pad.574

Spielman, D. J., Hartwich, F., & Von Grebmer, K. (2007). *Public-private partnerships in international agricultural research.* International Food Policy Research Institute: Washington, DC, USA.

Stoll, P. P., Pauw, W. P., Tohme, F., & Gruening, C. (2021). Mobilizing private adaptation finance: lessons learned from the Green Climate Fund. *Climatic Change, 167*(3), 1-19. https://doi.org/10.1007/s10584-021-03190-1

Surminski, S. (2013). Private-sector adaptation to climate risk. *Nature Climate Change, 3*(11), 943-945. https://doi.org/10.1038/nclimate2040

Syngenta Foundation. (2021). *Affordable, Accessible, Asian ("AAA") Drought-Tolerant Maize*. *Overview of a collaborative program between CIMMYT and Syngenta, supported and coordinated by Syngenta Foundation for Sustainable Agriculture*. Syngenta Foundation. https://www.syngentafoundation.org/sites/g/files/zhg576/f/2020/03/06/aaa_maize_overview_website.pdf

Syngenta Foundation. (n.d.). *SFSA & Syngenta*. https://www.syngentafoundation.org/sfsa-syngenta

Technologies for African Agricultural Transformation Clearinghouse. (2021). *Maize Technology Toolkit Catalogue*. Clearinghouse Technical Report Series 008. Cotonou, Benin: Clearinghouse Office, IITA. https://gatesopenresearch.org/documents/5-126

Tall, A., Lynagh, S., Blanco Vecchi, C., Bardouille, P., Montoya Pino, F., Shabahat, E., Stenek, V., Stewart, F., Power, S., & Paladines, C. (2021*). Enabling Private Investment in Climate Adaptation and Resilience*. World Bank. https://openknowledge.worldbank.org/handle/10986/35203

Temper, L. (2019). Blocking pipelines, unsettling environmental justice: from rights of nature to responsibility to territory. *Local Environment, 24*(2), 94-112. https://doi.org/10.1080/13549839.2018.1536698

Thomas, D. S., & Twyman, C. (2005). Equity and justice in climate change adaptation amongst natural-resource-dependent societies. *Global Environmental Change*, *15*(2), 115-124. https://doi.org/10.1016/j.gloenvcha.2004.10.001

Tracy, S. J. (2019). *Qualitative research methods: Collecting evidence, crafting analysis, communicating impact*. John Wiley & Sons.

Trangkanont, S., & Charoenngam, C. (2014). Critical failure factors of public-private partnership low-cost housing program in Thailand. *Engineering, Construction and Architectural Management*. https://doi.org/10.1108/ECAM-04-2012-0038

United Nations Environment Programme (2011). *Innovative climate finance: Examples from the UNEP Bilateral Finance Institutions Climate Change Working Group.* Paris: UNEP. https://wedocs.unep.org/bitstream/handle/20.500.11822/8037/UNEP_Innovative_climate_finance_final.pdf?sequence=3&amp%3BisAllowed=

United Nations Framework Convention on Climate Change (2015). *Paris Agreement*. https://unfccc.int/sites/default/files/english_paris_agreement.pdf

Uzsoki, D. (2017). Public–*Private Partnerships: Financing climate-resilient infrastructure*. https://napglobalnetwork.org/2017/09/public-private-partnerships-financing-climate-resilient-infrastructure/

Verschuren, P., & Doorewaard, H. (2010). *Designing a research project.* Eleven International Publishing.

Vincent, K. A. (2013). The advantages of repeat interviews in a study with pregnant schoolgirls and schoolgirl mothers: piecing together the jigsaw. *International Journal of Research & Method in Education*, *36*(4), 341-354. https://doi.org/10.1080/1743727X.2012.705276

Weiss, C. H. (1998). *Evaluation: Methods for studying programs and policies (2nd ed.)*. Upper Saddle River, NJ: Prentice Hall.

World Bank (2021). *Climate-Smart PPPs*. https://ppp.worldbank.org/public-private-partnership/energy-and-power/climate-smart-ppps-1

Yakubu, R. N., Birkmann, J., & Raumer, H. S. (2019). The role of international NGOs in climate change adaptation in the agricultural sector in the northern region of Ghana. *Int.J.Dev.Sustainability, 8*(3), 249-263. https://isdsnet.com/ijds-v8n3-03.pdf

Yin, R., K. (2009). *Case Study Research: Design and Methods* (4th ed.). Sage Publications, Inc.

Zhang, L., Hu, J., Li, Y., & Pradhan, N. S. (2018). Public-private partnership in enhancing farmers' adaptation to drought: Insights from the Lujiang Flatland in the Nu River (Upper Salween) valley, China. *Land use Policy, 71*, 138-145. https://doi.org/10.1016/j.landusepol.2017.11.034

Zhang, X. (2005). Criteria for selecting the private-sector partner in public–private partnerships. *Journal of Construction Engineering and Management, 131*(6), 631-644. https://doi.org/10.1061/(ASCE)0733-9364(2005)131:6(631)

Zoetbrood, A.F. (2021). *Research Proposal: Environmental Justice and the Green Climate Fund* [Unpublished manuscript]. Utrecht University.

Appendix 1: Conducted interviews

Case study	Sector	Organisation
AAA Maize Program	Public	Syngenta India
AAA Maize Program	Public	Syngenta Foundation
AAA Maize Program	Private	Sayaji Group
AAA Maize Program	NGO	Guj Pro
AICCRA Zambia Accelerator Program	Public	Consultative Group for International Agricultural Research
AICCRA Zambia Accelerator Program	Private	Agova
AICCRA Zambia Accelerator Program	Private	PlantCatalyst
AICCRA Zambia Accelerator Program	Private	Bridge Consulting (consulting company working for PlantCatalyst, but also involved in the bi-weekly meetings)
TAAT Maize Compact Program	Public	International Institute of Tropical Agriculture
TAAT Maize Compact Program	Public	African Agricultural Technology Foundation
TAAT Maize Compact Program	Private	Ultravetis East Africa Limited
TAAT Maize Compact Program	Private	Faida Seeds/Oil crop development limited
TAP5 Project	Public	International Potato Center
TAP5 Project	Public	International Potato Center
TAP5 Project	Private	HZPC
Expert	Public	Seeds2B Syngenta Foundation
Expert	Public	Public-Private Infrastructure Advisory Facility
Expert	Public	Netherlands Enterprise Agency
Expert	Public	Anonymous

Appendix 2: Informed consent form

Utrecht University

INFORMED CONSENT FORM for participation in:

Master Thesis: Private Sector Engagement in Public-Private Partnerships for Food Security Adaptation in the Global South

To be completed by the participant:

I confirm that:

- I am satisfied with the received information about the research;
- I have been given opportunity to ask questions about the research and that any questions that have been risen have been answered satisfactorily;
- I had the opportunity to think carefully about participating in the study;
- I will give an honest answer to the questions asked.

I agree that:

- the data to be collected will be obtained and stored for scientific purposes;
- the collected, completely anonymous, research data can be shared and re-used by scientists to answer other research questions;
- video and/or audio recordings may also be used for scientific purposes.

I understand that:

- I have the right to withdraw my consent to use the data;
- I have the right to see the research report afterwards.

Name of participant: _____

Signature: _____ Date, place: ___/___/____, _____

To be completed by the investigator:

I declare that I have explained the above mentioned participant what participation means and the reasons for data collection. I guarantee the privacy of the data.

Name: _____

Date: ___/___/_____(dd/mm/yyyy)

Signature:

Appendix 3: Interview guides

Interview guide case studies

Before starting the interview:

- Explain what my research is about
- Whether I am allowed to record the meeting
- The data that will be collected will be used and stored for scientific purposes
- The collected, completely anonymous, research data can possibly be shared and re-used by scientists to answer other research questions
- If I can use their name and the organisation's name or if they want to remain anonymous
- Follow the general flow of questions, but move around depending on what is discussed in the interview

➔ Send them the information consent form and ask to fill it in.

Context questions

- Can you tell me more about your organisation and your position?
- What PPP project is your organisation involved in?
- Which other organisations are involved in the PPP?
- How many partners are approximately involved?
- What is the project duration?
- Who initiated the project?

Private sector

- Generally, what role do you play?
- What role does the private/public sector play?
- Role:
    - Who finances the project
    - Who owns the intellectual property/whose varieties are used
        - How is this ensured?
    - Who produces the seeds
    - How does the producer get their seeds?
    - Who finances the production of the seeds?
    - Who monitors/documents the implementation?
    - Who implements the project?
    - Who helps farmers with the adoption?
    - Who provides training for the farmers?
    - Who distributes the seeds?
- Why is your organisation participating in this project?
    - What benefits?
    - What were restrictive factors?
- What do you think are obstacles for other private sector actors to join the project?
- Have other partners in the projects faced any conflicts since implementation began?
- Would you say it is necessary to improve relationships between the various actors in the project?
    - If yes, how do you want to improve this?

Civil society/Justice

- Can the civil society groups participate in the implementation and decision-making?
- How are the needs of farmers taken into account?
- Is local knowledge also taken into account in the project?
- What role do farmer groups play in the projects?
- Has your organisation been in contact with the civil society?
- Which actor is more concerned with the contact and inclusion of farmers?
- Is there a focus on the most vulnerable groups, such as smallholders?
- How do you ensure that the new seeds will also reach the poorest and vulnerable groups?
    - Do you have a certain percentage that should go to smallholders?
    - Will there be a maximum price?
    - Do you have smaller bags for the smallholders?

Ending

- Is there anything else that is relevant for my research that you would like to share?
- (Can you bring me into contact with other people involved in the projects?)
- Ask if they want to receive the report when finishing it
- Ask them to please fill in the informed consent form asap.
- Thank them for participating.

Interview Guide Expert Interviews

Before starting the interview:

- Explain what my research is about
- The data that will be collected will be used and stored for scientific purposes
- The collected, completely anonymous, research data can possibly be shared and re-used by scientists to answer other research questions
- Whether I am allowed to record the meeting
- If I can use their name and the organisation's name or if they want to remain anonymous
- Follow the general flow of questions, but move around depending on what is discussed in the interview

➔ Send them the information consent form and ask to fill it in.

Context questions

- Can you tell me more about your organisation and your position?
- How is your organisation involved to climate adaptation PPPs?
- What PPP projects is your organisation involved in?

Private sector

- Generally, what role do you see that the private sector plays?
- Do you more often see that the domestic or international private sector is involved in PPPs?
- Who would you consider the most important actor in a PPP and why?
- What are in your opinion the most important things a private sector actor can bring to the table in a PPP?
    - How important is the financing of the project?
- Do you think there are disadvantages of private sector involvement instead of only public sector?
- How do you think an intermediary organisation influences the process?

Justice

- In your experience, are civil society groups often recognised in the projects?
    - Also the most vulnerable and most poor?
- Can the civil society groups participate in the decision-making?
    - Can they share their opinions and knowledge?
- What are in your opinion ways to include the vulnerable groups better in the PPPs?
- Do you think that private sector participation limits the inclusion of vulnerable groups?
    - If yes, in what ways?
    - If no, why not?
- Does the public or private sector often have a more prominent role in defending the vulnerable groups?
- What do you think is the most important factor influencing inclusive smallholder participation?
- Do you think a certain type of PPP/an actor includes vulnerable smallholders the most?
- Are there generally structures in place to reach the smallholders of poor groups?
- Do you think there is a difference between the domestic and international private sector actors and the inclusion of vulnerable groups?

After the interview:

- Is there anything else that is relevant for my research that you would like to share?
- Can you bring me into contact with other people involved in the projects?
- Ask if they want to receive the report when finishing it
- Ask them to please fill in the informed consent form asap.
- Thank them for participating.

Appendix 4: Additional documents used for analysis

Document 1: TAAT PowerPoint Presentation
This PowerPoint presentation was provided by a TAAT Maize Program partner. The PowerPoint slides contain additional information about the program, their specific objectives, types of partners and the scale of the program and existed of 18 slides in total. This document was written by the TAAT Maize Program.

Document 2: TAP5 Unpublished News Article
This is a two-page document provided by the TAP5 project during an interview, containing additional information about the TAP5 project. Since the TAP5 project is not officially commercialised yet, there are not many published articles or reports online about the project. This document is mainly focused on explaining the main actors involved in the project, and the main objectives of the project.

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