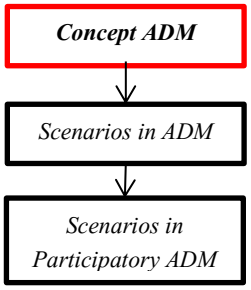
Background Appendices

Contents

B1: Literature study to the place of scenarios in ADM

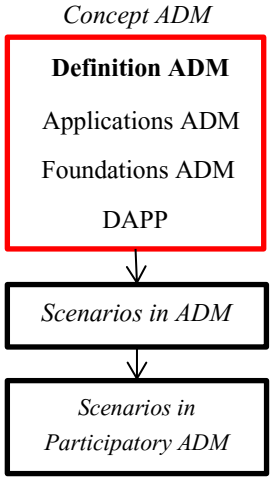
The purpose of this chapter is to provide a literature study to the use of scenarios in Adaptive Delta Management (ADM). I'll present the suggestion that the place of scenarios in the ADM framework matters in participatory applications of ADM. In the scientific foundation of ADM, the planning studies using ADM and participatory studies of ADM, scenarios are used in the different stage of the process, sometimes argued and sometimes scenarios seem to be used trivially. In general, the position of scenarios in the ADM cycle seems to be a poorly investigated domain. Based on these insights I'll define the main research gaps addressed in this thesis. Research gaps exist in the use of scenarios for participatory purposes, especially in a different cultural setting than in the Netherlands. Also, it is shown that no workshop design could be found showing the application of ADM for participatory purposes.

Adaptive delta management (ADM)



In this section, the concept of ADM is explained. First ADM is defined. It will be shown that ADM is not a clearly defined concept, though the main characteristics are provided. It will be demonstrated that ADM is increasingly used, and this will be illustrated by different applications of ADM. Then, a description is given of the several theoretical foundations of ADM. Finally, one specific framework of ADM is discussed in greater detail: Dynamic Adaptive Pathways (DAPP).

Definition of ADM



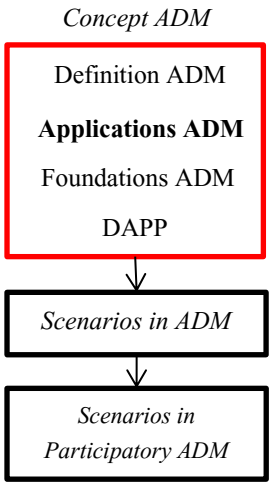
Adaptive delta management approaches are being applied over the world. As highlighted in the introduction, Argentinean governmental officials have shown a clear interest in its application for the Parana Delta**.** ADM originated in the Thames Estuary 2100 project (W. Walker, Haasnoot, & Kwakkel, 2013) and was further developed in the Netherlands for the Delta plan formation as a response to the integrated water challenges in the Netherlands (Delta Program, 2015).

Stratelligence (a consultancy company) was hired by the Delta Commission in order to give a manual for the vision and usage of ADM (van Rhee, 2012). Showing that the terminology of ADM is firmly rooted in secondary literary; however less in peer-reviewed articles (Timmermans et al., 2015). Furthermore, the definitions given of ADM (Delta Commissioner NL, 2018; van Rhee, 2012; C. Zevenbergen, Rijke, Herk, & Bloemen, 2015) seem to overlap, but do not entirely coincide.

The Delta Program (2015) formulated ADM as looking ahead at the tasking we face, taking the most (cost-) useful step-by-step measures based on those insights, and leaving options open to be able to respond flexibly to new insights and developments (while being both practical and alert). Furthermore, they mention that adaptive delta management links water tasking with other ambitions as nature and construction (by for example Delta Program, 2015; Deltacommissaris, 2011, 2018).

From literature, the following main elements of ADM can be defined as:

- Linking short-term decisions on the fields of water, land use and spatial planning to long-term issues in the fields of the water system (Delta Commissioner NL, 2018; Gersonius et al., 2015; van Rhee, 2012; C. Zevenbergen et al., 2015)
- Looking for adaptation pathways instead of final objectives (Gersonius et al., 2015; van Rhee, 2012; C. Zevenbergen et al., 2015) and ensuring the solutions are flexible (Delta Commissioner NL, 2018; Gersonius et al., 2015; van Rhee, 2012), and thus limiting the possibilities for too little or too high investments (van Rhee, 2012)
- linking flood risk management and freshwater supply investments to investments in, for example, spatial planning and nature, ensuring that redevelopments are water-resilient and climate-proof wherever possible (Delta Commissioner NL, 2018; Gersonius et al., 2015; van Rhee, 2012).
- Involving multiple stakeholders in a joint decision-making process to enhance legitimacy and feasibility (C. Zevenbergen et al., 2015)
- Taking a systems approach that takes into account various scales (C. Zevenbergen et al., 2015)
- ADM differs from other robust decision making approaches that the robust solution is chosen on business as usual and worst-case scenarios (van de Brugge & Bruggeman, n.d.).
- Inclusion of scenario analysis (Delta Commissioner NL, 2018; Deltacommissaris, 2011; Deltares, 2016; Timmermans et al., 2015; TU Delft, n.d.; van Rhee, 2012; WUR, n.d.; Chris Zevenbergen et al., 2018).



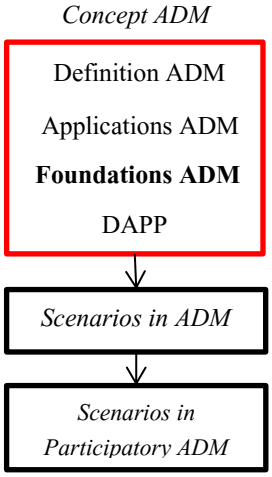
Applications of ADM

Several case studies of ADM have been applied over the recent years. As said before, the first case was the Thames Estuary 2100 study in the UK (Ranger, Reeder, & Lowe, 2013) followed by the Delta Program in the Rhine and Meuse delta in the Netherlands (Deltacommissaris, 2011), the New York city strategy after Hurricane Sandy (New York City Panel on Climate Change, 2013; Rosenzweig et al., 2011)and the Jakarta Coastal Defense (JCDS, 2011). Furthermore, ADM studies have been set up in Vietnam, Bangladesh, Myanmar and Australia (Zevenbergen et al., 2015; Zevenbergen et al., 2018). Furthermore, guidelines are provided for practitioners to develop adaptive policies in uncertain environments (Swanson et al., 2010; Swanson & Bhadwal, 2009). In the BASE-project different studies are being undertaken to develop pathways in Europe (Hildén, Jeuken, & Zandersen, 2018)

Moreover, multiple scholars have been evaluating the methodology of ADM, of which I'll highlight a few here, throughout the thesis other studies are also cited. Gersonius et al. (2016) investigate the use of ADM for the city of Dordrecht, the Netherlands (Zevenbergen et al., 2015). Bloemen, Reeder, Zevenbergen, Rijke, & Kingsborough (2017) present the suitability of pathways used for long-term planning in flood risk management for cases in the UK and the Netherlands and explore methodological challenges of the method. Zandvoort, van der Vlist, & van den Brink (2018) investigate the influence of the context of cases on the development of the method. They conclude that the approach is not able to adequately handle uncertainty. Finally, Lawrence & Haasnoot (2017) show how the use of a game can enhance the understanding of Dynamic Adaptive Pathways in a game of coastal implementation in New Zealand. De Rijke et al., (2018) and Zevenbergen et al., (2018) discuss the applicability of ADM in several cultural contexts. Furthermore, Timmermans,

(2016) address cultural aspects of countries regarding dealing with uncertainties relevant to adaptive delta management.

Some interesting new studies can be found. For example in a recent study, Carstens et al. (2019) developed a new approach 'DAPP light' as a practical workshop session to investigate adaptation planning and spatial planning for sea level rise for medium cities in Sweden. They combined the framework of DAPP with CRIDA (Collaborative Risk-Informed Decision Analysis), which is a comprehensive decision support framework for water resource management (Mendoza et al., 2018). Also, Flexible adaptation pathways is an approach combining adaptive pathways and adaptive management as presented by Holling (1978), next to designing the adaptive plan it follows highly on stakeholder inclusion (Rosenzweig et al., 2011).



Foundation ADM

In this chapter, the scientific foundations of ADM will be investigated, in order to use these in the investigation regarding the use of scenarios in ADM (Chapter 2.2).

It can be seen that ADM was developed by close cooperation between scientists and practitioners during the formation of the Dutch delta program (Delta Program, 2015). Therefore, its origin mostly lays in policy documents and advisory reports (Timmermans et al., 2015). These reports refer to different scientific foundations for ADM, building upon research on uncertainty in policy analysis (Timmermans et al., 2015). In the scientific foundations the concept of long term planning, while taking an uncertain future into account, seems valuable.

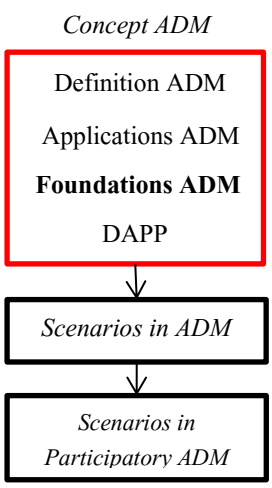
Jos Timmermans et al. (2015) show in a study to the roots and branches of ADM that the concept builds upon five different scientific frameworks. Furthermore, the review of W. Walker et al. (2013) of planning approaches under deep uncertainty also seems to be valuable. They show that different approaches exist for designing sustainable plans. Furthermore, Loucks and van Beek (2017) highlight that adaptive management can be represented by decision trees and by DAPP (Marjolijn Haasnoot et al., 2013). Moreover, a plan developed for IWRM can also be adapted based on scenarios. In the following section, the different theoretical foundation of ADM will be presented. I, however, do not claim to make a complete overview of all scientific foundations of ADM

Adaptive management is a more analytical process taking uncertainty into account. It is an iterative process in which robust decision making is accomplished in the vision of uncertainty, which is done by continuous learning process of system monitoring (Holling, 1978). Its primary challenge is forming knowledge for future implementations, while also having successful short term outcomes based on current knowledge (Allan & Stankey, 2009).

Transition management (Loorbach, 2010; Loorbach & Rotmans, 2010) seems to be very inclusive and participatory. It is a governance approach in which sustainable transitions are accelerated through a participatory process of visioning, learning, and experimenting. In this way, multiple viewpoints can be broad together, and a transition area can be created. It takes a long term perspective, in which short term objectives can be created through back-casting. Furthermore, it is focused on learning by doing (Loorbach, 2010; Loorbach & Rotmans, 2010)

Adaptive policymaking is a generic approach to the treatment of uncertainty. However, it recognises that over time we learn and thus reducing uncertainty. For this reason, we should plan adaptively, and allow learning (Warren E. Walker, 2000; Warren E. Walker, Rahman, & Cave, 2001). The approach was adopted (Hamarat, Kwakkel, & Pruyt, 2013; J. H. Kwakkel, Walker, & Marchau, 2010) by including dynamic strategic planning (an approach to ensure flexible planning) and flexible strategy planning (adds the notion of pro-active planning) (J. H. Kwakkel et al., 2010). The revised form is also called Dynamic adaptive planning (DAP) (Warren E Walker, Marchau, & Kwakkel, 2013).

Assumption based planning is developed by Rand cooperation to improve existing plans regarding adaptation and robustness (Dewar, 2002; Dewar, Builder, Hix, & Levin, 1993). It was the first step in the creation of adaptive planning(W. Walker et al., 2013). It examines all underlying assumptions for a proposed plan and investigates the effects when the assumption are untrue (W. Walker et al., 2013).



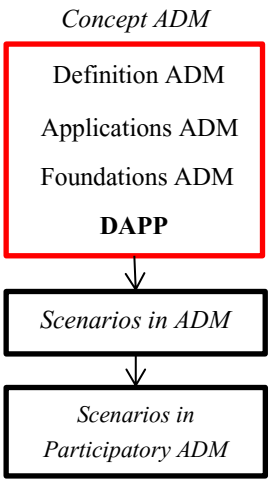
Furthermore, by practitioners of ADM (Deltares, 2018, personal conversation) it was identified that due to practical reasons an ADM approach was set-up by first making an Integrated water research management study (IWRM), and then analysing the scenarios using a 'what-if analysis'. IWRM is a debated concept (Biswas, 2009); however, it is defined as a management process that maximised social and economic welfare in a sustainable way (Rahaman & Varis, 2017). It forms the basis of many water planning studies in order to provide planning strategies for land and water (Biswas, 2009) If the scenarios turn out to have a significant impact on the selected strategy, the strategy should be adapted, or an additional study may be required to reduce uncertainties (Loucks & van Beek, 2017).

Adaptive tipping points (Kwadijk et al., 2010) considers the timing of actions in their approach, such that actions are assessed when to fail under certain conditions. Building upon this concept, adaptive pathways (AP) (Marjolijn Haasnoot, Middelkoop, Offermans, Beek, & Deursen, 2012) are considered in order to prepare a plan based on the conditions of failure for the actions. It aims to enhance flexibility to adapt the system to changing uncertainties. Various applications can be found of APin Rotterdam, Italy, risk management in New Zealand, risk management in the Elbe, the Dutch Delta plan and the UK Thames project (W. Walker et al., 2013).

Finally, DAPP (Marjolijn Haasnoot et al., 2013) is an approach in which seems to be the basis for many recent ADM studies. It integrates adaptive delta management with adaptive policy making, by including different types of actions, signposts and triggers. For this reason in this study DAPP will be taken as prime ADM method and is described in further detail in the next chapter.

In the previous approaches, the clear principles of planned adaptation can be found as described in the definition of chapter 2.1.1. Planners except or embrace uncertainty, instead of spending attention on reducing it. Other studies also seem to have influenced ADM, but do not seem to perform according to the definition of ADM.

Robust decision making (see for example Hall et al., 2012) takes uncertainties as the starting points and formulates a robust static plan, that performs well enough over different uncertainties. However, it does not aim to function optimally over a single future. Furthermore, it aims to avoid situations in which the objectives cannot be reached, and describes clearly the remaining uncertainties that are not handled. It is often used together with computational software (W. Walker et al., 2013). Yet, it does not seem to imply the principles of adaptation over its process and therefore will be disregarded in further analysis. Strategic management founds its foundation in management science, and the core idea is a prori a specific strategy for management can be chosen, but a part of the strategy will be formed as emergent responding during the process (Mintzberg & Waters, 1985). Decision tree framework is a framework to formulate decisionmaking and the development of an adaptive plan in the context of many uncertainties. It structurally assesses the uncertainties due to climate, and later also other uncertainties (Ray & Brown, 2015), it uses an approach by seeing uncertainties with probabilities.



Dynamic Adaptive Policy Pathways (DAPP)

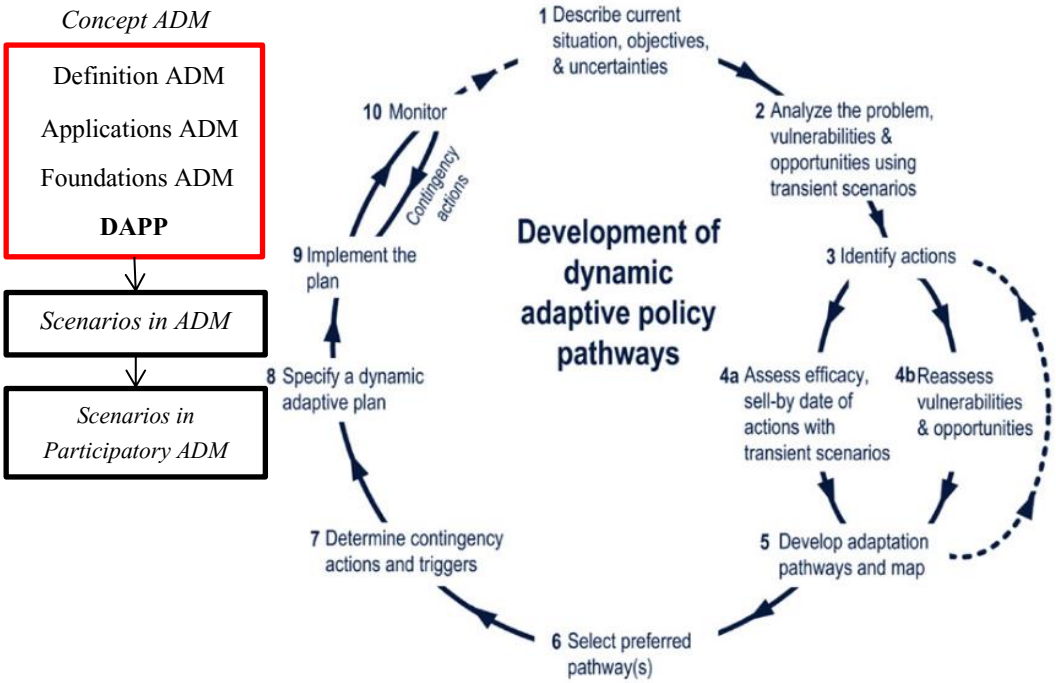
Haasnoot et al. (2013) have developed a methodology to bring Adaptive Delta Management that receives increasing attention: Dynamic Adaptive Policy Pathways (DAPP) (Haasnoot et al., 2013). The approach builds further on adaptive policy making (J. H. Kwakkel et al., 2010; Warren E. Walker et al., 2001), and adaptation pathways (M Haasnoot, Middelkoop, Beek, & Deursen, 2011; Marjolijn Haasnoot et al., 2012; Kwadijk et al., 2010 (concept of adaptation tipping points)). The key of DAPP is to plan all possible actions before, evaluate under which circumstances an option might fail (adaptation tipping point), identify actions that can be triggered later and represent these actions visualise by an 'adaptation pathways map' (Marjolijn Haasnoot et al., 2013).

An adaptation tipping point (ATP) is the critical value (threshold) under which the policies fail to meet their objectives (Haasnoot et al., 2013). These thresholds can have a variety of forms, such for example water level, time, norms or standards (such as water safety and watery quality norm) financial thresholds (economic growth and cost-benefit) and societal threshold (social agreement) (Marjolijn Haasnoot et al., 2013; Jeuken & te Linde, 2011). In order to identify the adaptation tipping point a trigger is identified, which specifies the condition under which a new action needs to be taken, that is previously identified (Marjolijn Haasnoot et al., 2013).

DAPP generates a variety of possible pathways, which can be compared to a variety of criteria (Haasnoot et al., 2013). Similar to a metro map, pathways may present different routes to go to the same point in the future (Haasnoot et al., 2013). In figure 2-3 a pathway map is shown. One can see that each pathway consists of a series of possible measure. When the pathway reaches an ATP than this implies that the current strategy is not effective in reaching its objectives and the strategy needs to be changed to another action.

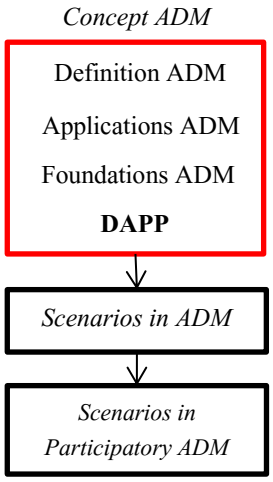
Adaptation pathways have the following claims to support decision making: use of objective-based thresholds, handling of uncertainty in principle drivers, structuring of a wealth of option, identification of lock-ins and incorporating of multiple stakeholders preferences (Marjolijn Haasnoot et al., 2012; M. Zandvoort et al., 2017). Important themes are robustness and flexibility, in which DAPP differentiates itself from traditional master planning (Loucks & van Beek, 2017).

A policy is robust when it is insensitive for errors, and other randomly chosen parameters (Matalas and Fiering, 1977). In robustness, the chosen strategy will function in a variety of circumstances and scenarios (van der Brugge & Roosjen, 2015). Due to its benefits to make policy insensitive for changes in the future and robustness ADM becomes the desired approach to use (Kwakkel, Haasnoot, and Walker, 2014).
On the other hand, flexibility relates to the ease a policy can be adapted under changing circumstances (Mens, Kwakkel, de Jong, A.H., & P., 2012). How changeable is the strategy when it appears that de future develops differently than expected, and we need to change the strategy (Marjolijn Haasnoot, Warren, & Kwakkel, n.d.; Loucks & van Beek, 2017; M. Zandvoort et al., 2017). Also, referred to by Walker et al. (2013) as dynamic robustness.



Dynamic Adaptive Policy Pathway approach (Marjolijn Haasnoot et al., 2013, p. 489)

The general framework is depicted in figure 2-2 and 2-3. The DAPP approach begins with describing the study area, including the system's characteristics, the objectives, and the relevant uncertainties and constraints in the current situation and the future(Marjolijn Haasnoot et al., 2013). These uncertainties are used in the sequent step, to create possible futures. In this way, the current situation or policy can be assessed under ensemble of possible futures in order to investigate when the status quo starts to perform unacceptable (tipping point)(Ray & Brown, 2015). Different approaches can be used to identify adaptation tipping points as 'bottom-up vulnerability approaches', in which the timing of the adaptation tipping point is assessed using model-based assessments, expert judgment or stakeholder consultation. It can also be done 'top-down' by using traditional scenario analysis to determine the range and timing of the adaptation tipping points (Marjolijn Haasnoot et al., n.d.). It is followed by an identification of different actions in order to reach the objectives of the system; these can be shaping actions, mitigating actions, hedging actions and seizing actions (J. H. Kwakkel et al., 2010). The fourth step is the design of multiple adaptation pathways consisting of the identified measures in step two. They are based on the tipping points pathways can be explored by using models, serious games or during stakeholder discussions that may develop storylines (Marjolijn Haasnoot et al., n.d.). These paths show when decisions should be made and which measures can be chosen. The paths generate insight into the consequences of the initial measure in terms of lock-ins and options that are still open. Opportunities arising as a result of other planned investments in the region may be considered to adjust the timing of implementation(Marjolijn Haasnoot et al., 2013). The fifth step is the design of an adaptive plan. They require an evaluation of the different adaptation pathways about the economic and socio-cultural feasibility, governance, robustness and flexibility of the pathways. The adaptive plan might be considered robust if the desired result can be reached under a variety of circumstances and assumptions. Also, it is necessary to identify critical values (triggers) and beyond which adjustments need to be made and investigate which preparatory contingency actions



should be implemented (Marjolijn Haasnoot et al., 2013). The implementation and monitoring component will not be feasible in the study.

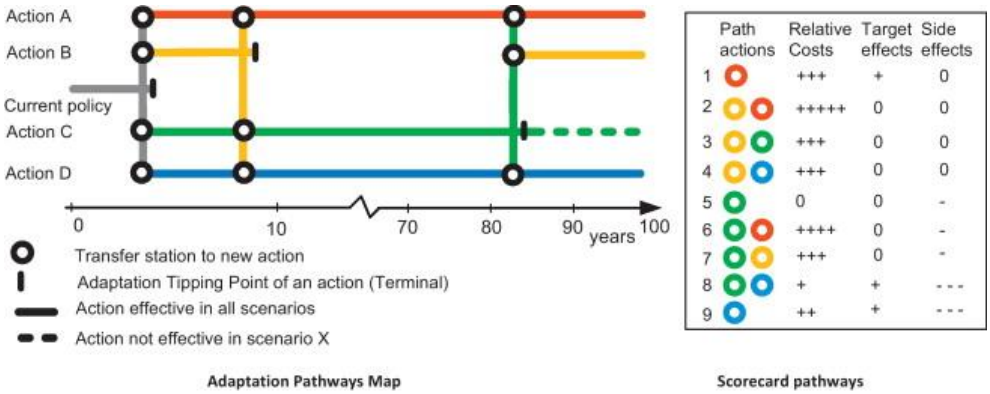
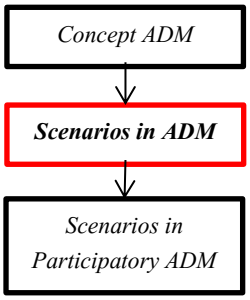


Figure 2-3 Example of an adaptation pathway map and scorecard representing the costs and benefits of nine alternative pathways. ***Explanation: As can be seen from the graph once an objective is missed, an adaptation tipping point is reached. The different paths can be quantified on different criteria on a scorecard.*** (Marjolijn Haasnoot et al., n.d., p. 7)**.**

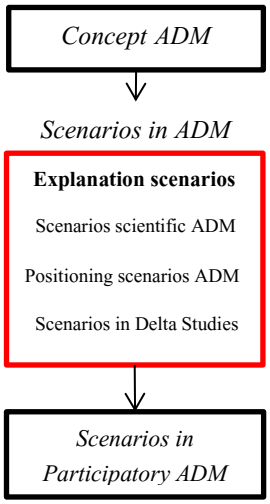
DAPP seems to bring great potential for ADM (Timmermans et al., 2015; W. Walker et al., 2013). To give some examples DAPP is be used to develop several ADM plans: Dutch Delta plan (Dutch Ministry of Infrastructure and the Environment & Ministry of Economic Affairs, 2014), Thames estuary project 2100 study (Ranger et al., 2013), the Bangladesh delta plan (Chris Zevenbergen et al., 2018), the development of a coastal plan for New Sealand(Lawrence & Haasnoot, 2017; Lawrence & Manning, 2012) and in adapted form in New York (Rosenzweig et al., 2011). Furthermore, it is applied in a variety of local cases as Miami, the Philippines (Deltares, 2010, personal conversation), Portugal, Czech Republik, Netherlands(M. Zandvoort et al., 2017), Vietnam (Ray & Brown, 2015), Sweden (Carstens et al., 2019) and applied in a series of hypothetical cases (see for example Marjolijn Haasnoot et al., 2013; Marjolijn Haasnoot, Warren, & Kwakkel, n.d.; van Veelen, Stone, & Jeuken, 2014).

The strengths of DAPP seems to be that it provides a relatively easy way to explain adaptive planning to policymakers (Ray & Brown, 2015). Furthermore, it also encourages decision making to think about a context of uncertainty. It helps to access path dependencies and lock-ins. Also, it is a way to frame that adaptation is a constant process over time, in this way transient scenarios are encouraged to be used instead of a few points in time (Marjolijn Haasnoot et al., 2013; Jeuken & Reeder, 2011; Ray & Brown, 2015; van Veelen et al., 2014). Even though some examples of local projects can be found, DAPP seems to be most applied in large scale planning projects. However, also suggestions for improvement can be found on DAPP (Bosomworth, Leith, Harwood, & Wallis, 2017; Carstens et al., 2019; Jeuken, Haasnoot, Reeder, & Ward, 2014; Lin et al., 2017; van der Brugge & Roosjen, 2015; Wise et al., 2014; Chris Zevenbergen et al., 2018), relevant critique on DAPP will be considered in the discussion section.

Scenarios in ADM



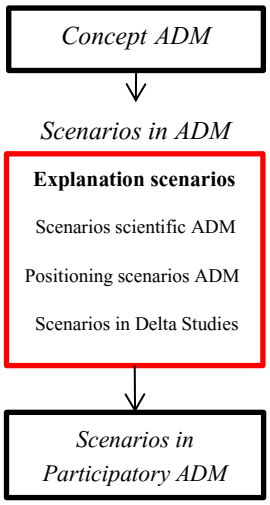
In the previous subchapter, the different foundations for ADM are described. It was shown that ADM seems to be built on many different theoretical foundations. It was already highlighted that these theoretical foundations might have another use of scenarios in their planning process. The use of scenarios seems to be one of the core themes of ADM. However they are used in many different ways, and the effect of this seems to be poorly understood (Jeuken et al., 2014). In this section, we will go into depth to understand how scenarios are used in the ADM cycle. Firstly, the concept of scenarios will be explained, and examples are given on how scenarios may be constructed. Then, it will be discussed what the value is of scenarios in ADM. Afterwards, it is shown that scenarios seem to be used in many different ways in current ADM planning studies and the different scientific frameworks described in the introduction. According to these approaches will be discussed how scenarios are implemented.

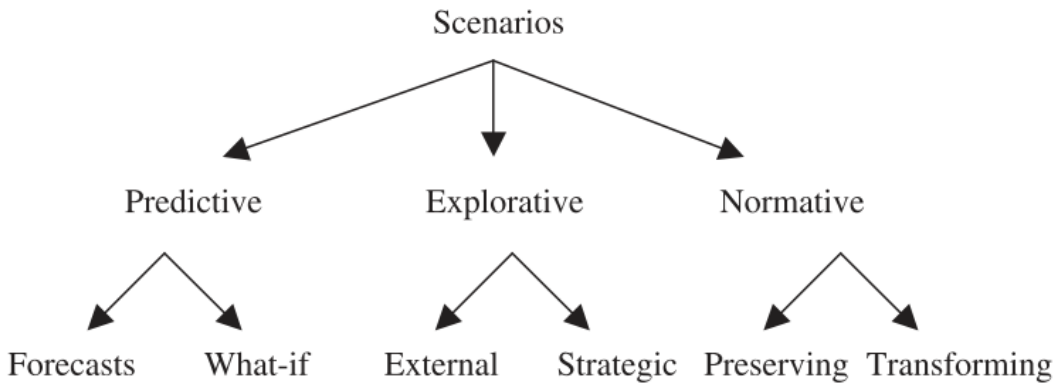


What are the scenarios?

Scenarios are descriptions and consistent stories about possible different futures. They are not predictions or forecasts when the future is assessed to be known. We accept that we cannot fully understand the future and create a plausible story with a logical plot and narrative to describe how events may unfold (ter Maat, Andrew, & van Aalst, 2018; Van Scheltinga et al., 2013). It helps us to guide the decisions we need to make today, as we do not know what will be possible tomorrow since the future is uncertain (ter Maat, Warren, & van Aalst, 2018). Scenarios differ from strategies since scenarios are beyond our control. Strategies, on the other hand, are packages of actions that can address themselves to identified vulnerabilities or take advantage of opportunities, are within our capacity of control (ter Maat, Warren and van Aalst, 2018). Often a set of scenarios is specified to describe the range of uncertainties (Van Scheltinga et al., 2013).

Various typologies have been suggested to differentiate scenarios (Börjeson, Höjer, Dreborg, Ekvall, & Finnveden, 2006). In this work, I will use the differentiation of the commonly used work of Börjeson et al. (2006). In Figure 2-4 below the scenario, typology can be represented, describing three main categories and six types. The three categories relate to 'What will happen?' (Predictive), 'What can happen' (Explorative) and 'How can a specific target be reached? '(Normative) (Börjeson et al., 2006, p. 725). The predictive scenarios aim to predict what will happen in the future. It can forecast exploring what may happen if a prediction may forecast, or it can be a what-if analysis exploring what will happen if a specified condition may take place (Börjeson et al., 2006). Explorative scenarios are aiming to investigate which scenarios might happen, based on external factors beyond our control or as consequences of strategic decisions. Finally, normative scenarios specify how a target should be reached by adjusting the current system (preserving scenarios) or when trend breaks needed to be achieved (transforming scenarios) (Börjeson et al., 2006), by back-casting the scenario will be described. It should be noted that the scenario logic is not static (Börjeson et al., 2006).

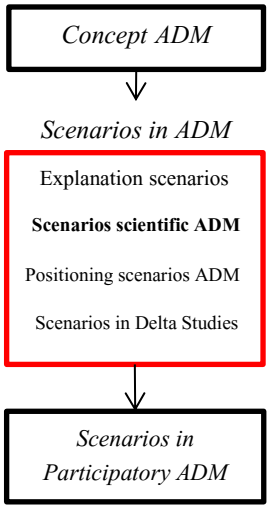




Scenario typology with three categories and six types (Börjeson et al., 2006, p. 725)

The most important characteristic of a scenario is that it will fulfill its objectives (Alcamo, 2001). Different objectives of scenarios can be differentiated in IWRM/adaptive planning. Firstly, it can help to assess the impacts of particular developments. Secondly, it is used to identify and test whether a strategy will work in different futures. It analyses if a strategy still will be robust in the future. Thirdly, it helps to envision opportunities and vulnerabilities. Finally, it may help to identify actions to prevent or enable certain developments. In order to make strategic development decisions, explorative scenarios seem the most applicable in IWRM and ADM (ter Maat, Warren and van Aalst, 2018). Therefore, it seems to be essential to differentiate actions/strategies from scenarios (Van Scheltinga et al., 2013).Furthermore, a scenario should be well documented and transparent (Alcamo, 2001). Also, a good scenario is a plausible scenario, in order not to be easily dismissed by experts or policymakers. However, scenarios may also help to questions the beliefs and broaden the understanding of experts and policymakers(Alcamo, 2001).

Scenarios can be constructed in different ways. They can differ on the type of developments to include (such as climate, socio-economic and subsidence), the type of scenarios (predictive, normative and explorative) , the time scale of the scenarios (projection years and horizon) and the temporal nature (discontinuous or trends) (Jeuken et al., 2014). Furthermore, they can be developed by experts, in combination with stakeholders, or completely participative (Tompkins, Few, & Brown, 2008). Also, they can be qualitative, quantitative or a mixture (Alcamo, 2001). Several examples: Carstens et al. (2019) use different scenarios of sea level projections from the US fourth National Climate Assesment. In the Dutch Delta Plan (Bruggemans, 2018) and the IPCC (IPCC, 2000) four different narratives were constructed based on socio-economic development and climate change using the so-called axe method in which four different narratives were developed describing the primary drivers per scenario. These scenarios are also implemented by Shell. The scenarios should be of the type of High impact-high uncertainty (Rhydderch, 2000). Another way to construct scenarios is the Branch analysis method; contrasting scenarios are formed looking like a tree, such as used for the Sudan elections in 2011 (Rhydderch, 2000). The cone of plausibility method identifies different drivers and, from this creates assumptions. An example is the creation of scenarios of India in 2020 (Rhydderch, 2000). Murphy, Yung, Wyborn, & Williams (2017) use a narrative scenarios building process to create scenarios for the in the Big Hole Value in the USA, instead of focussing only on climate projections they give the importance to include the place of the case dominant in the scenario. Many other examples for the construction of scenarios can be found.



Comparison use of scenarios in scientific foundations ADM

The focus of this study is to investigate the different use of scenarios in participatory ADM. However, it first seems interesting to understand how scenarios are used in the scientific foundations of ADM. First, the concept of level of uncertainties will be explained. Then the usage of uncertainties in different scientific frameworks of ADM is compared.

Level of uncertainties

The timing and usage of scenarios in the ADM process are studied in this chapter. In order to describe the uncertainties used in the different scientific frameworks of ADM, uncertainties are differentiated by their level (as suggested by Jan H. Kwakkel, Walker, & Marchau, 2010; Mens et al., 2012; W. Walker et al., 2013; W.E. Walker et al., 2003). Several levels of uncertainties can be differentiated in the adaptive policies (Jan H. Kwakkel et al., 2010; Mens et al., 2012). At the first level is the 'recognised uncertainty' in which recognition exists regarding the possible sensitivity of the plan for certain uncertainties. In 'shallow uncertainties' it is possible to acknowledge probabilities to different uncertainties. With 'medium uncertainties' it is possible to differentiate uncertainties or to rank them. However, it is difficult to determine their probabilities. Finally, in 'deep uncertainty' different uncertainties are differentiated, only their priority or probabilities cannot be differentiated.

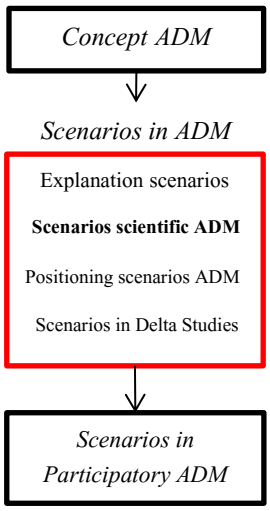
Usage of uncertainties in different scientific frameworks ADM

Based on the definition of types of uncertainties in the previous paragraph and investigation the use of scenarios in the ADM framework, for the different scientific foundations defined in chapter 2.1.3 a comparison will be made regarding their usage of uncertainties/scenarios.

Both adaptive policy-making and robust decision making, have similar steps regarding the use of scenarios. They do not assume that a plan already exists, such as with assumption-based planning, but first, formulate a first design of the plan. In ADM different types of actions are formulated based on identified vulnerabilities and opportunities. Yet, at first, a basic policy is represented, which is improved by identifying the vulnerabilities and threats and thus increasing the robustness of the policy (J. H. Kwakkel et al., 2010). Uncertainties are treated as medium uncertainties (Jan H. Kwakkel et al., 2010).

Also, a what-if analysis with scenarios can be done after the development of the pathways as shown by ADM practitioners in Bangladesh (Deltares, 2018, personal conversation). Similar ideas we can see in Integrated water resource management (Loucks & van Beek, 2017). After, development of actions in time a sensitivity analysis is performed to analyse the sensitivity of the policy to uncertainties. This means that scenarios are introduced at the end of the research. It was identified by practitioners that this seems to be especially useful for cultures scoring low on long term planning axes of Hofstede (Hofstede, Jan Hofstede, & Minkov, 2010). In this way, scenarios seem to be suggested as medium uncertainties.

In Adaptive pathways differently, scenarios after developed after actions. Sub sequentially, sell by date actions constructed, pathways developed, and in an iterative cycle pathways are improved. Then the actions are analysed and evaluated, and the process is reiterated. Scenarios are included in this method after the development of actions but before the development of the adaptive pathways (M Haasnoot et al., 2011; Marjolijn Haasnoot et al.,

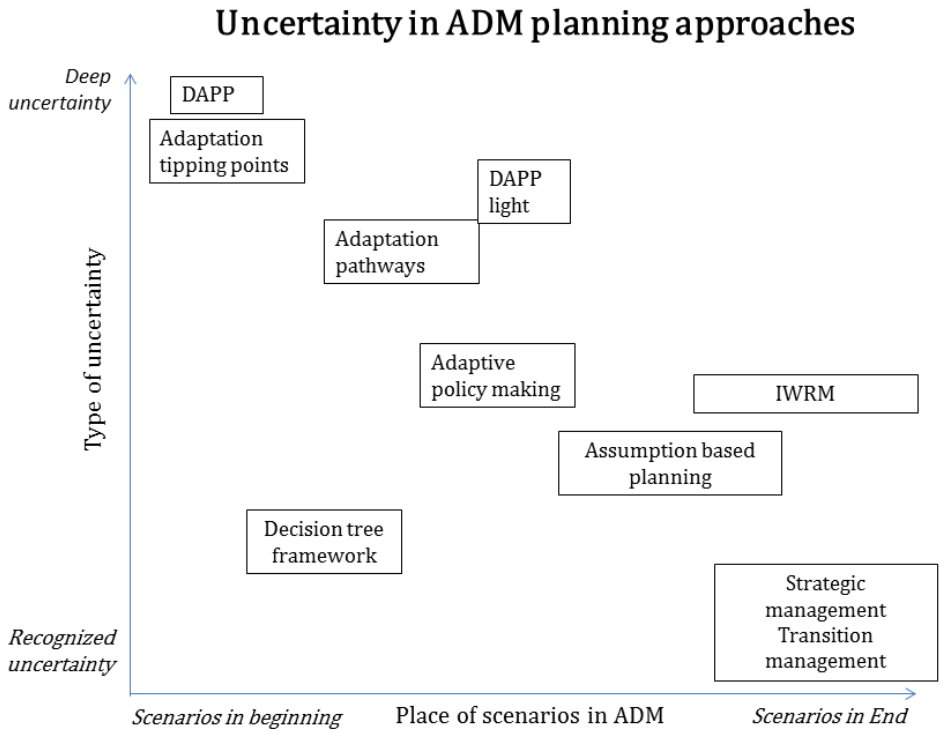


2012). Scenarios are included as medium uncertainties (Jan H. Kwakkel et al., 2010). Also, in the DAPP-light approach first actions are developed, and re-evaluated based on chosen scenarios (Carstens et al., 2019).

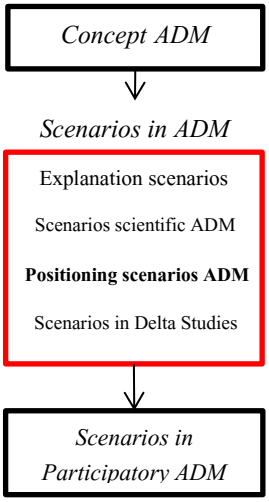
Interestingly, DAPP does not provide an establishment of an initial plan or initial actions as the approaches suggest (adaptive policy and adaptive pathways). After describing the current situation, objectives, uncertainties are formulated. In the second phase, these are translated to scenarios by analysing the opportunities and threats. Afterwards, actions are identified. In DAPP, scenarios are considered as deep uncertainties (Jan H. Kwakkel et al., 2010)

This shows much more similarities with adaptation tipping point (Kwadijk et al., 2010). Scenarios are implemented after describing the impact and the state of the system. It represents uncertainties with sets of plausible futures, instead of probabilities of future states of the world. In this way, uncertainties are presented as deep uncertainties (Jan H. Kwakkel et al., 2010). It is assessed at which moment the system can reach its objectives, by investigating the influences of the uncertainties on the system (Kwadijk et al., 2010). This approach seems to be opposing the classical approach of climate change, as can be seen in the ex-ante version of decision trees. In decision trees, different approaches can be formulated for the use of scenarios: ex-ante and ex-post. Ex-ante scenarios, also described as the scenario led approach, describe scenarios in which different storylines are described before the investigation of the vulnerabilities and opportunities for the project under investigation. By using ex-post scenarios, scenarios will be parametrically or stochastically varied to identify vulnerabilities in identifying the performance of the suboptimal system. Furthermore, a relative probability of the scenarios may be assigned (Ray & Brown, 2015), here uncertainties seem to be seen as shallow uncertainties. Finally, the frameworks of strategic management and transition management: In strategic management, uncertainties also play a small role and seem only to be included in a reflective stage. In transition management not a significant role for uncertainties seem to be made, and uncertainties are not positioned clearly in the process.

Figure X is a map of the discussed approaches for developing adaptive policies according to the level of uncertainty and the place the scenarios have in the ADM cycle in order to make a visual overview of the discussed frameworks.



Uncertainty in ADM planning approaches the place of scenarios and type of uncertainty



Value of positioning scenarios in ADM

In DAPP (representing ADM) scenarios are used to represent a variety of relevant uncertainties over time (Marjolijn Haasnoot et al., 2013). The established future consists of 'reference cases', assuming that no new policies are implemented, and they are set-up by the uncertainties identified in the first step of the DAPP cycle.

Related to the objectives of scenarios defined by ter Maat, Andrew and van Aalst (2018) it is mostly done to assess if strategies would work in different futures (robustness), and also to identify actions to enable certain developments (flexibility) (Loucks & van Beek, 2017). Furthermore, scenarios are used to envision future opportunities and vulnerabilities, based on this envisioning; tipping points can be distinguished. Based on these tipping points actions can be developed and pathways can be formulated. Due to the scenarios, the system can be described when it is not functioning well enough anymore. Scenarios, therefore, seem to be core in the DAPP approach, since due to the scenarios tipping points can be established. Also, when looking at the definition of ADM "leaving options open to be able to respond flexibly to new insights and developments", this can only be achieved by the implementation of scenarios. Due to the significant role of scenarios, already in the beginning of the DAPP cycle to analyse vulnerabilities and opportunities, and thus creating the adaptation tipping points, it seems to be a logical decision to use scenarios at the beginning of the DAPP cycle. Theoretically, in ADM the focus lies on the development of actions that may change on tipping point conditions. These tipping point conditions may be formulated based on uncertainties. Therefore, positioning scenarios at the beginning of the ADM cycle seem to be logical since all other steps can be influenced by the idea of decision-making under deep uncertainty. While, using scenarios only in a later stage of the ADM

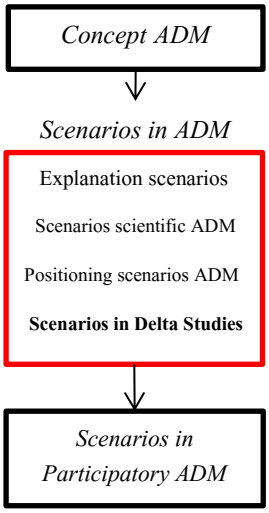
cycle will mean that the development of actions, vulnerabilities and opportunities not is done by taking scenarios in mind. Furthermore, by reiterating tipping points while taking scenarios into account might mean that the quality of the pathways will be lower since the tipping points are not constructed while taking deep uncertainty into account. As we could see in DAPP (Marjolijn Haasnoot et al., 2013) actions are only being established after the investigation to vulnerabilities and opportunities.

Also, Loucks and van Beek (2017) show the difference between ADM and traditional master planning. They highlight that the main differences are the use of a dynamic long-term strategy, that deals with an uncertain future, and thus having future no regret. In comparison with classical IWRM focussing on an optimised and integrated short term strategy, with only no regret at present. Showing the importance of incorporating uncertainty from the beginning, and developing a strategy that not only tells us what to do now but also what if conditions develop differently (Loucks & van Beek, 2017).

Already, in the scientific applications of DAPP (W. Walker et al., 2013). (Marjolijn Haasnoot et al., 2013) Implement two diverging scenarios of the Delta scenarios in their example. In other computational intensive studies, a large variety of uncertainties may be considered, to be evaluated with Robust optimisation (Jan H. Kwakkel, Haasnoot, & Walker, 2015; Jan H. Kwakkel & Pruyt, 2013). The aim in ADM seems to establish explorative scenarios (Börjeson et al., 2006) in order to specify actions in an uncertain context beyond our control.

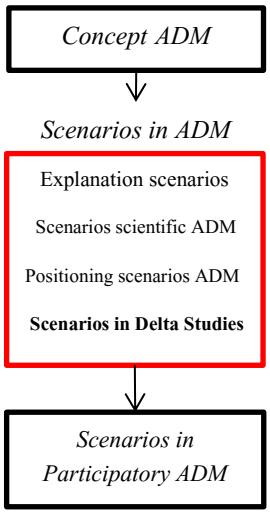
In the next section will be shown how scenarios are being used in different Delta studies. It will be shown that in different delta studies only in the exploratory phase many uncertainties are considered in a description of the use of scenarios

Use of scenarios in Delta studies



As could be seen in the previous section, DAPP seems to apply a usage of deep uncertainty in the development of adaptive plans. Jeuken et al. (2015) show in their investigation to the application of adaptive planning in four deltas and coastal cities that the broadest set of scenarios can be defined differently. For example, in the Thames estuary project, a wide range of scenarios was used for explorative purposes, while in the New York PlaNYC 2013 and the Dutch Delta Program a moderate range of scenarios was used, and in the Jakarta JCDS, a small range of scenarios was used. (Jeuken et al., 2014)

Furthermore, the inclusions of developments differentiated. In the TE2100, NYC and Delta Program detailed climate scenarios were derived, while in Jakarta the focus was mostly on subsidence. Regarding, socio-economic changes these were developed in the Dutch Delta programs, as well as in Thames estuary and Jakarta, they were not detailed considered for NYC. In the European cases, the time horizon was much longer. However, only the TE2100 explored policy actions under high-end scenarios with low probability. In Jakarta projections for sea level rise were based on one scenario, and little scientific background for region-specific scenarios could be found, but this might be explained due to the relative importance of subsidence. In New York, the full range of scenarios considered seems mostly to be used for illustrative purposes. Jeuken et al. (2015) state that the perceived uncertainty seems to be of relative importance once a severe uncertainty is detected a broad range of scenarios is used; while a clear trend is detected a lower range of scenarios is considered. Also, they show that once a tolerance level is low due to the protection of



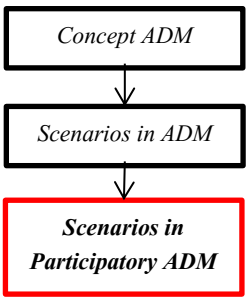
vulnerable infrastructure, more high-end scenarios will be used. Finally, the urgency is stressed by presenting the high end of the scenarios.
Furthermore, they highlight that a wide range of scenarios is only accepted in an exploratory phase of planning. However in the policymaking phase scenarios are significantly limited (Jeuken et al., 2014). In both, the Dutch and Bangladesh Delta plan scenarios were developed by using the axe method to access the preferred strategies. In this method, the main drivers of uncertainty were represented using an axe method (climate change and social, economic growth)(Seijger et al., 2017)

If we see how scenarios were implemented in the Dutch Delta Plan and the Bangladesh Delta plan (Seijger et al., 2017)scenarios were set-up as four diverging explorative scenarios by the axe methodology. These scenarios provided answers to what might happen beyond the control of the actors. However, in the Dutch Delta Plan scenarios were driven by a preserving philosophy, in order to preserve the current Delta. The BDP scenarios were not entirely external since they also specify the preferred type of economic end product (Seijger et al., 2017).

Furthermore, in a comparison between different DAPP studies of the Water resource management IJsselmeer in the Netherlands (Mark Zandvoort, van der Brugge, van der Vlist, & van den Brink, 2018), Coastal Management in Portugal (Campos, Vizinho, Lúcia, Moreira Alves, & Penha-Lopes, 2015), urban heat island effects in Prague Czech Republic (BASE, 2016; M. Zandvoort et al., 2017) and Flood risk management in Rotterdam (BASE, 2016; M. Zandvoort et al., 2017) show that the uncertainties in all cases were used a limited number of cases. In the IJsselmeer can the pathways were not able to identify a wealth of options and identify lock-in. In Portugal, the scenarios did not seem to include real uncertainties. In Rotterdam, all option was left open until 2100. Finally, in pathways in Prague remained uncertain until the effectiveness of the options (Zandvoort et al., 2017).

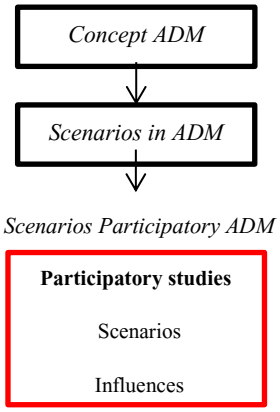
Will it matter in which stage of ADM scenarios is used? The topic seems poorly investigated, however might be an influencing factor in the success of ADM planning, given the significant position of scenarios in ADM. Especially, for participatory purposes this seems to be highly relevant. This is the central theme of this research. In the next section to use of scenarios for participatory ADM will be further discussed.

Participatory ADM and Scenarios



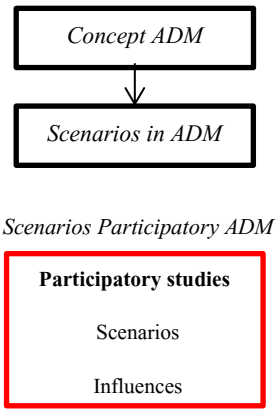
In the previous section was shown how the use of scenarios differed across several phases of the study. It was shown that in real planning studies the use of scenarios differed from theory. In this section, the main focus of this thesis will be introduced: the use of scenarios in participatory ADM. First, an overview will be given of the limited studies using participatory ADM. I will show that scenarios are used in different ways in the participatory ADM approaches, just as the scientific foundations and the planning studies. Then, an impression is given of different factors that influence (participatory) ADM scenario planning. The most important factor that seems to play a role is highlighted in the following paragraph: the influence of culture. I will also show that the influence of the use of scenarios was not investigated in participatory practices, even though it is highlighted by scholars that culture might influence the application of ADM. From these thoughts, I will present the main research gaps this research aims to investigate.

Participatory ADM



Different possibilities exist for the set-up of an ADM study, from model-based assessments to expert judgements to participatory ADM (Marjolijn Haasnoot et al., n.d.). In little general research can be found to the application of ADM in a participatory setting. As could be seen in the former sections most work seems to be focused on the application of DAPP on a theoretical case study or for larger planning purposes(Aguiar et al., 2018), see for example Hildén, Jeuken, & Zandersen (2018). (Lin et al., 2017) Show that little work has been done to evaluate the current use of adaptation pathways and their utility for practitioners and decision makers. If pathways are also applicable to other local scales, given their institutional setting, culture and resources is not thoroughly tested (Lawrence & Haasnoot, 2017). A lack exists regarding the implementation of participation and leadership in ADM studies(Campos et al., 2015). However, (M. Zandvoort et al., 2017) show in their comparison of cases that in participatory research was most successful in reaching the objectives of ADM in comparison to other studies. Participatory studies seemed more successful than a managerial or top-down approach (Campos et al., 2016).

In order to identify the possibilities of participatory research for ADM for this reason, participatory action research was organised for the Base project in Portugal. The study of the Ílhavo and Vagos Coast in Portugal was related to the development of coastal adaptation (Campos et al., 2015). The study focuses highly on stakeholder inclusion, selection and implementation, but it does not describe their exact workshop design (Campos et al., 2015). The study helped stakeholders to design together with an adaptive plan and created space for the institutional bodies to communicate (Campos et al., 2015). An opportunity of the research was that it could be seen as a new approach of stakeholder interaction to promote dialogue and increase adaptation possibilities in the area. A threat was the possibility of limited stakeholder motivation when the plan is not fulfilled. The project was a start to increase inter-municipality intervention and engage action researches in meetings with local stakeholders, including political actors (Campos et al., 2015). The focus of the study was to engage and inform stakeholders on the coastal adaptation. The approach was based on the scenario workshop method (Campos et al., 2016), which is detailed described
DAPP was combined with the scenario, called SWAP. Based on scenarios provided, visions were sketched, and actions were provided then Pathways were developed by the



researchers, and participants got a possibility to comment. However, the approach presented did not include the use of scenarios for TippingPoint's generation, and the creation of the pathways based on tipping points remained unclear. A little amount of review was done regarding the quality of the adaptive pathways. It was highlighted how the stakeholders could adapt the presented pathways, but not on how exactly the pathways were developed (M. Zandvoort et al., 2017). In their case study of the Big Hole Valley, USA Murphy et al. (2017) develop scenarios by active stakeholder inclusion., a so-called narrative scenarios building process. They did not describe additional ADM steps in the process.

Barnett et al. (2014) investigate the application of a local adaptation pathway in Lakes Entrance, Australia. They developed a pathway by using detailed stakeholder interaction. They show that adaptation pathways are feasible on a local scale, help to bring consensus among different stakeholder groups and form a beginning of a long process of adaptation. However, not a presentation is given on how pathways were developed with local stakeholders, it is only shown that first using workshops pathways were developed, and in focus groups, stakeholders could comment (Barnett et al., 2014b).

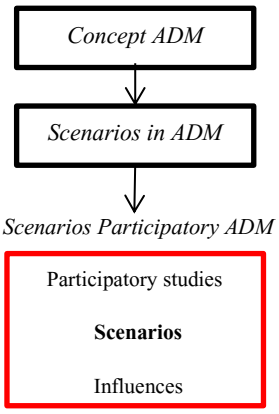
Lawrence and Haasnoot (2017) developed a sustainable development game, which is shown to overcome many obstacles associated with ADM. Moreover, the purpose of the game is to be played before the pathway construction. The game itself is very detailed described in the manual. Yet, the participatory ADM work afterwards is described poorly. It is used in a later stage in combination with the adaptive delta program of the New Zealand government (Lawrence & Manning, 2012) The program of the workshop is shown, however a clear linkage to adaptive pathways is not presented. Furthermore, it was used in the development of an adaptive flood management plan of the Hutt River (Lawrence & Haasnoot, 2017). It was highlighted that both technical sessions and policy decisions were organised by using the game primarily. The practical work was organised according to the DAPP methodology. However no design of the practical work could be found (Lawrence & Haasnoot, 2017).

Carstens et al. (2019) developed an adapted DAPP workshop design for a series of expert and local workshops by combining DAPP with CRIDA. They test their workshop design in several experimental cases in Sweden. However, they did not compare different types of frameworks or aimed to improve their framework

As can be seen, a lack of literature seems to be present in designing a suitable ADM participatory workshop design. This introduces the first research gap:

Research Gap One: Most ADM research can be found on a higher policy level. The research to DAPP is not designated for making appropriate workshop designs for participatory ADM.

Scenarios in participatory ADM

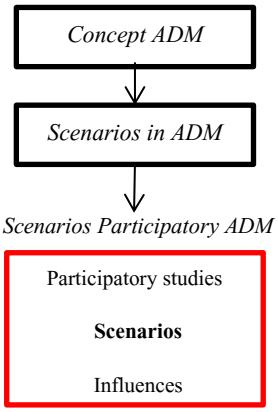


When evaluating the different scientific foundations of ADM, DAPP is a generally used method to represent ADM. In DAPP scenarios are introduced at the beginning of the ADM cycle. Scenarios play a significant role in the exploratory phase of DAPP to identify opportunities and vulnerabilities in the future and thus identifying the adaptation tipping points on which the pathways can be based. We can say that in other frameworks uncertainties can have a different level and have a different place in the ADM cycle. For example, in adaptive policy making scenarios play a role after the introduction of an initial base policy. In IWRM scenarios play only a role in a what-if analysis after the construction of the policies.

For the application in practice, it could be seen from the comparison of the Delta studies (Jeuken et al., 2014) that scenarios are applied in different ways. In Jakarta, only one scenario was used in the exploration phase, while in the Thames estuary project a wide range of scenarios was used, also for action evaluation. Furthermore, scenarios did not seem to be used extensively in the real planning phase in New York but mostly for illustrative purposes. This means that scenarios are used differently in these planning studies as suggested by DAPP (Marjolijn Haasnoot et al., 2013).

Participatory applications of ADM are increasingly getting attention. However, little research is found on the application of DAPP for participative purposes. While participative use of ADM seems to be very valuable as the case in Portugal and Sweden suggest. In the different participative applications, an explorative phase of scenarios was only limited implemented. For example in the study proposed by Carstens et al., (2019), scenarios were introduced after an initial action generation, then the actions could be improved. However, first a risk assessment was done, and vulnerable objects were identified using a risk analysis before identifying actions. The approach seemed to generate new ideas regarding long term impacts of sea level rise. Surprisingly scenarios were mostly used to defend static actions. Still, the workshops were a possibility for participants to appreciate large uncertainties, gave them crucial insights on formerly unknown uncertainties, and gave them the feeling these uncertainties were manageable (Carstens et al., 2019).

In Portugal (Campos et al., 2016) Scenarios were initial presented based on global climate change scenarios of the IPCC regarding changes on the shoreline and risk of overtopping and floods until 2100. In a Scenario workshop scenarios were presented as storylines, of which a vision of the system and actions could be related. Scenarios were used mostly as visions, not as ways to check the robustness of the policy as the framework seems to suggest. Furthermore, scenarios were set up as a combination of actions, and they did not seem to represent real uncertainties showing possible strategies that could take place in the future. Scenarios did not seem to be used to identify tipping points. Scenarios were used at the beginning of the study, even before identifying the objectives or describing the system. Scenarios were not used in a participatory way to address uncertainties, to identify tipping points. This was done beforehand using a computational tool by the researchers. Pathways were improved by the participants, but only the strategy changed, the relation with uncertainties seemed to be made unclear. The action research element can be found clearly in this workshop since by making use of the storylines, the need for the long-term strategy was stressed. Even though, uncertainties were not considered to develop adaptation pathways, (M. Zandvoort et al., 2018) show that the participative approach seemed to reach most of the requirements of DAPP in comparison to the other studies, using a less participatory approach.



In the context of New Zealand uncertainties are very clearly defined, and introduced at the beginning of the workshops. However, the audience of the workshops was rather large (76 participants) consisting of professional practitioners of New Zealand's local governments, elected councillors and the business community. Adaptation tipping points were not identified based on the uncertainties, but actions were directly formulated (Lawrence & Manning, 2012). In the DAPP experience in the Hutt River (Lawrence & Manning, 2012) pathways were defined, based on tipping point conditions and scenarios. Scenarios played an essential role in the exploratory phase.

For the case of Barnett et al. (2014) in Lakes Entrance, US first pathways were developed based on goals, triggers and actions. In later organised focus groups participants could comment on these pathways and evaluate by use of scenarios, they initiated regarding which triggers were meaningful for the participants.

Furthermore, by practitioners of ADM it was highlighted to adapt the DAPP framework at times due to practical reasons, and use scenarios in what-if analysis afterwards (Deltares, 2018, personal conversation). The use of scenarios in a later stage of ADM was also seen by ADM practitioners to function successfully.

These examples seem to show that as well as in the scientific foundation of ADM, and in planning studies, the use of scenarios is poorly investigated, addressing the second research GAP:

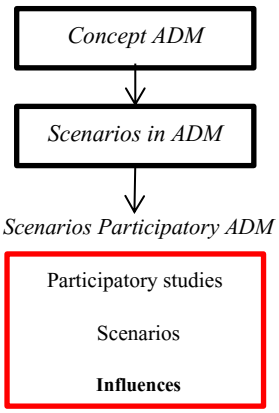
Research Gap Two: Use of scenarios for participatory purposes has not been studied and integrated into literature.

Furthermore, as Timmermans et al. (2015) highlight a particular interest should be made when facing methodological choices in the application of ADM in cultures that score extremes on the long term orientation in cultural dimension of Hofstede (Hofstede et al., 2010) (Timmermans et al., 2015). Seeming to suggest that in a society with a low focus on uncertainty and long term vision, the focus on scenarios at the beginning of the ADM cycle will have complications. This idea will be further discussed in the final section of this chapter.

Influences on scenario planning in participatory ADM

Several factors seem to influence participatory ADM, while most research has been done on a policy scale. Furthermore, only a little research could be found regarding the influence of scenario planning in ADM. In this section, I will give a concise description of several factors which seems to influence participatory planning. In the discussion section of chapter 10, I will go into more detailson the critique of ADM and DAPP of my case in reflection to other cases.

Regarding general influence on participatory planning Carstens et al. (2019) highlight the influence of lack of experience with adaptive pathways and the unwillingness of participants to describe actions that could be difficult to enforce in the future. Furthermore,



the methodology was found to be relatively complex. Also highlighted by Bosomworth et al. (2017). An explanation of how scenarios were used, was not given in these studies.

Regarding the understandability of the method, Jeuken and the Linde (2011) show that in their experience the concept of tipping points in their experience fits with policymakers, it helps to fit with the communication with them. However, practitioners of ADM have highlighted the difficulty to explain the concept of tipping points to local stakeholders (Deltares, 2018, personal conversation).

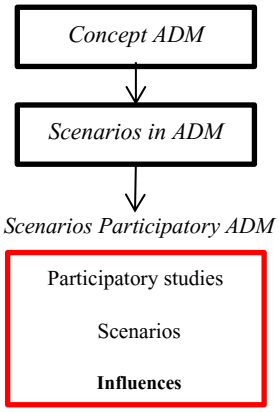
Regarding the implementation of adaptation strategies, van der Brugge and Roosjen (2015) show that institutional conditions, such as legislation and responsibilities or socio-cultural conditions as belief systems, economic activities or the state of knowledge will impact the success of specific adaptation measures to change the current governance structure regarding adaptation. About the use of participatory ADM, the social domain also seems to of influence. The success of the participatory work will depend on the belief system and create awareness of ADM, or its ability to change it.

Furthermore, according to Wise (2016) presentation National Climate Change Adaptation Conference, Adelaide, 4 – 7 July 2016 possible factors that influence pathways approaches are the level of capacity, the regulations, levels of risk and uncertainty associated, number of affected stakeholders and the type of goals (resilience, adaptive or transformative) all play a role (de Rijke et al., 2018).

Zandvoort et al. (2017) show that in a comparison of four ADM studies, the institutional diversity, planning culture and framing of objectives and uncertainty influenced the design choices of a study. These design choices were (1) setting of objectives, performance metrics and thresholds values, (2) assessment of tipping point conditions under different scenarios and (3) chose of policy responses and assessment of tipping point condition. The assessment of the tipping point condition could be done by experts or by stakeholders. Finally, an assessment of the alternative pathways and the impacts was made using modelling, or a more participatory scenario workshop/multi-criteria analysis. These design choices in its turn affect the claimed contributions of pathways as suggested by Haasnoot et al. (2012).

As Timmermans et al. (2015) show the different planning concepts mostly seem to differ in their orientation on the present, orientation on the future and orientation on decisionmaking. As Wise et al. (2014) show, the broader attention of the process dimension of DAPP is required. In comparison to the other scientific foundation of ADM, DAPP pays only a little attention to the decision-making process (Timmermans et al., 2015). Furthermore, as Timmermans et al. (2015) highlight the dimension of orientation on the future is of particular importance for ADM due to its focus on uncertainty and adaptation to future developments. It is of particular interest when facing methodological choices in the application of ADM in cultures that score extremes on the long term orientation in culture dimension of Hofstede (Hofstede et al., 2010) (Timmermans et al., 2015). Also, by ADM practitioners is highlighted that the success of ADM might be affected by the use of scenarios(Deltares, 2018, personal conversation).

Different studies relate to the effectiveness of ADM to cultural characteristics of the associated country. As Hofstede defines ‘it is the collective programming of the mind that distinguishes the members of one group or category of people from others’ (Hofstede et al., 2010, p. 6). Culture is learned from one's social environment, in comparison to genes which

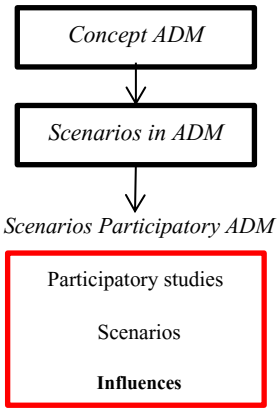


are inherited from the biological parents. Furthermore, it can also be differentiated from one's personality. Earlier researchers, especially in the field of anthropology, studied societies and communities (Joy & Kolb, 2009), in the latter half of the 20th century this changed to a study of a comparison of cultures by means of a numerical approach, such as by the work of Hofstede (Hofstede et al., 2010), the GLOBE study (House, Hanges, Javidan, Dorfman, & Gupta, 2004), the analysis by Trompenaars (Trompenaars & Hampden-Turner, 1997) and the European Value survey (Hofstede et al., 2010; Inglehart & Baker, 2006; Minkov & Hofstede, 2012). A lot of critism can be found on the numerical approach especially by anthropologists regarding the simplification of the issue, the fact that it does not reinforce stereotyping and reflect how the local population sees it (Jones, 2007). Hofstede introduces the concept of continuous cultural dimensions for comparison. In this dimensions the cultures are grouped into: power distance, uncertainty avoidance, individualism-collectivism, masculinity and femininity, long-term vs short term orientation (Hofstede et al., 2010).

Regarding the cultural transferability of the approach Chris Zevenbergen et al. (2018) show, in their comparison between the Dutch and Bangladesh Delta Program, that ADM is not an approach to easily transfer, but depends on the fundamental change in institutions, relationships and policy frameworks. Furthermore, it depends on local socio-economic characteristics, culture and governance. They compare between the objectives of ADM specified in the Delta program. They show several choices made in the Delta program in the Netherlands and the Bangladesh Delta plan. The same is found by van der Brugge and Roosjen (2015). Also, Dapp practitioners highlight that the local context is assumed to have an impact on the successful implications of DAPP outside the Netherlands and that the framework should be adopted towards it (Lenselink, Meijer, & van de Guchte, 2013). Most ADM studies (for example van der Brugge & Roosjen, 2015; Chris Zevenbergen et al., 2018) are related to a higher policy scale related to the set-up of a national policy level. Little work can be found on the factors and design choices made on studies on a more participatory scale.

In the study of Hofstede, Argentina is seen as a country with a medium to large power distance (score 49 of 110), the power difference is much less than the other Latin American countries. An explanation could be the massive immigration in Argentina (Hofstede, n.d.) Regarding individualism, the society is relative collectivistic (46/95, with 95 is most individualistic) but by far the most individualistic of the Argentinean countries (Hofstede et al., 2010). Furthermore, society seems to be slightly more masculine than feministic; often a strong ego seems to be required — also the need to excel stands out. Argentina seems to show a relatively high uncertainty avoidance (86 of 105), which is the extent members will feel threatened by unknown situations and have created beliefs and institutions to avoid this (Hofstede et al., 2010). They have a complicated, abundant and sometimes conflicting legal system, however for the individual, this does not count, and corruption also plays a role (Hofstede, n.d.). Most interesting for this study seems the long-term orientation. Argentina has a very low long term orientation (20 of 105), which has a very normative culture. They have great respect for traditions and remain with strong links to the past (Hofstede, n.d.; Hofstede et al., 2010). Finally, Indulgence in Argentina is high, meaning that people exhibit a willingness to conform to their impulses and desires.

This reflection seems to imply that culture may have a strong influence on the application of participatory ADM, and especially in the use of scenario. No studies could be found addressing this issue using a participatory study. Only the study of DAPP in Sweden (Carstens et al., 2019) seemed to present a counter-argument. Here scenarios were



introduced after an initial action generation. Still, the participants seemed to think the method as severe, and used uncertainties to justify static, instead of adaptive solutions. The argument is given that it can be explained by legal constraints, lack of experience with adaptive pathways and unwillingness to prescribe actions that could be difficult to enforce in the future (Carstens et al., 2019). Then, the question arises what if a participatory study of DAPP would be applied in the cultural context of Argentina?

Furthermore, as Timmermans et al. (2015) highlight the sensitivity dimension of orientation on the future is of particular importance for ADM due to its focus on uncertainty and adaptation to future developments. Being of particular interest when facing methodological choices in the application of ADM in cultures that score extremes on the long term orientation in culture dimension of Hofstede (Hofstede et al., 2010) (Timmermans et al., 2015). Seeming to suggest that in a society with a low focus on uncertainty and long term vision, the focus on scenarios at the beginning of the ADM cycle will have complications

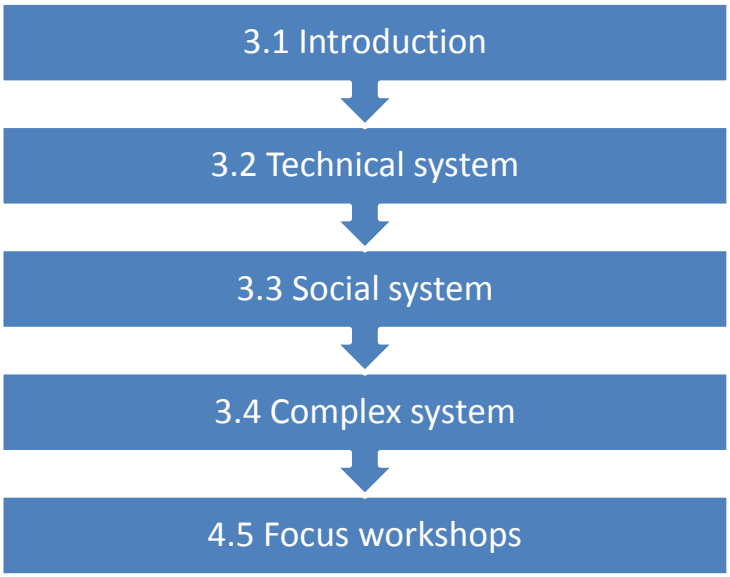
Research Gap Three: No practical work can be found investigating the influence of a culture with a low certainty and long term orientation index for a participatory ADM.

Conclusion research gaps

In the previous sections is shown that scenarios are used differently in the various scientific foundations of ADM. The same is found for planning studies using ADM, as participatory ADM studies. Notably, in participatory studies, the placement of scenarios can be significant for a successful application of ADM. In DAPP scenarios have an effect on all the steps following it in the cycle, and thus have influence, on the opportunities and vulnerabilities, tipping points, action development and adaptive plan construction. Therefore, it seems logical to place scenarios at the beginning of the ADM cycle. However, in cultures scoring low on long term planning and uncertainty, it might be very complicated to place scenarios in the beginning. As is shown in the previous sections little information could found in the literature regarding the design of a workshop for participatory ADM, especially regarding the use of scenarios and in a culture different than the Netherlands (where ADM was developed). The research approach investigation of this issue will be discussed in Chapter 4. In the next chapter the case on which this study is applied is explained: the lower Parana Delta.

B2: Case Lower Paraná Delta

In this chapter, the case of the lower Paraná Delta used for this study is described in detail. It will be shown that the Paraná Delta is a highly complex system, facing both severe social and technical issues. The focus of this thesis is mainly associated with the polder development in the delta. However, this development links to main issues, of which a few are addressed in this chapter. First, an introduction is given to the case. It is followed by a description of the technical system, social system and complex system. The chapter ends with a presentation of the main issues discussed in the workshops.



Reading guide Chapter 3

The strategic reader interested in only the main elements of this research is advised to read the introduction to the case (3.1) and the focus of the workshops (3.2), in order to understand the exact focus of the workshops. The reader interested in the dynamics of the case is suggested to read the other chapters as well.

1 Introduction to the case

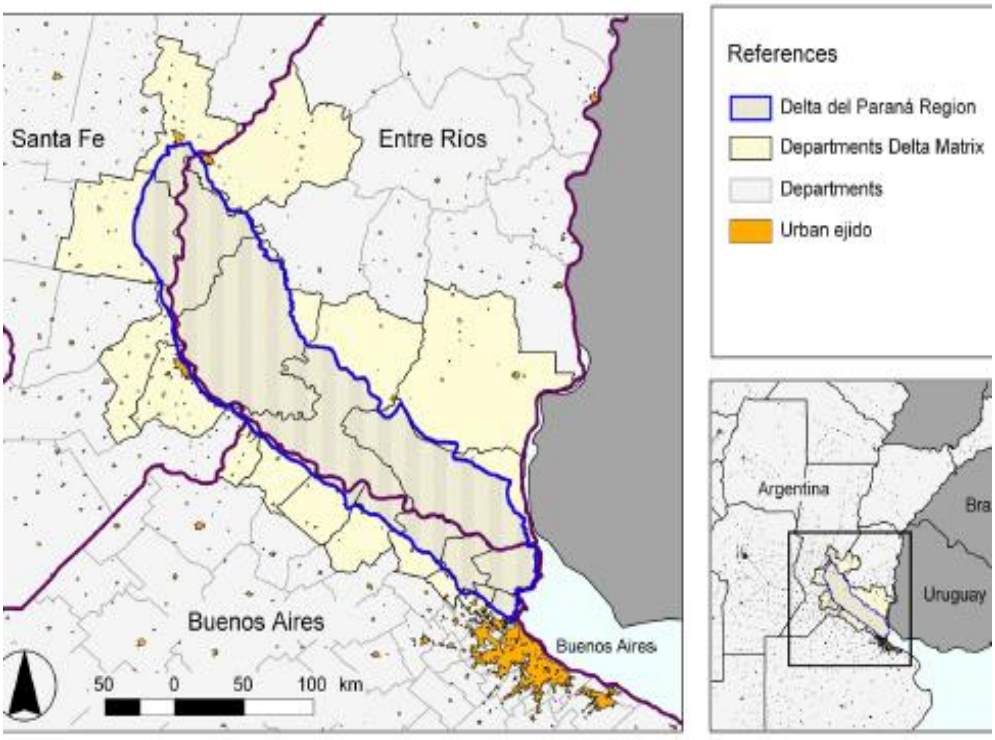


Figure 3-0-1 Map of Parana Delta→ change to own map of GIS

In this section, the case of the Parana Delta is introduced. A description is given of the location of the Delta, its history, current developments, and general characteristics.

The Parana Delta presents a complex system (V. Zagare, 2018). It consists of the natural delta full of wetlands, and other the other hand it faces intense urban pressures from the continental side. The Parana river starts in Brazil, flowing through Paraguay and Argentina, and ending up in the Rio de la Plata(Zagare, 2014). It is the third largest river of the continent of America, after the Mississippi (United States) and the Amazonas (Brazil) Delta (Zagare, 2014). The focus of this work is on the Lower Parana (see figure 3-1). The lower Parana Delta is situated from Entre Rios until to coast of the La Plata river (V. Zagare, 2018). Currently, it has a length of 320 km and a maximum with of 60 km(Badano, Sabarots Gerbec, Re, & Menendez, 2012) In the north the city of Rosario is situated, in which 1.2 million inhabitants live (V. Zagare, 2018). In the south, it faces the greater Buenos Aires, with a population of around 12.8 million inhabitants (V. Zagare, 2018).

Along the continental side of the Delta, a formation of gated communities can be found, as well as industry (workshops). For the formation of these gated communities, private polders are created. In the Delta itself also polders, dykes, and attajerepuntes (low dykes) are constructed to make it possible to have economic activity in the Delta (workshops). All these dykes are constructed on private initiative. The hydrological and social consequences of the dykes are poorly investigated; they can be seen as uncertainty (workshops). Furthermore, the system is very susceptible to flooding, having pressures from different directions that cause flooding's and droughts in the delta (workshops).

Policymaking seems to be extremely difficult due to the fragmented legislation for the different governmental authorities (Zagare, 2014), the recent hyperinflation and the uncertainties of a continuation of the current government policy if a new government is elected (workshops).

Still, the current government seems to have made a high interest in the development of the Delta (binational reference conference). Other stakeholders, such as environmental NGO's may see a different future for the Parana Delta (interviews experts). Many stakeholders are continually adapting the Delta in various, sometimes conflicting ways. For example, dykes are continued to be build or strengthened (Minotti & Kandus, 2013), also sessions are organised to enhance a natural Delta (workshops Wetlands). Activities are set up for the development of strategic projects (binational conference). Furthermore, research is performed to establish an early warning system (Sabarots Gerbec, Borús, Irigoyen, & J, 2017) and understand the effects of the dykes. Finally, workshops are organised to assist the planning of the Delta from a bottom-up approach (Wetlands workshops, workshop Zarate). In such a context of many uncertainties, different interests and a complex environment adaptive delta management could give new and valuable insights. In the following sections, an explanation is given of the vulnerabilities and threats the system faces in more detail.

2 Technical system

In this chapter, a description is given of technical characteristics of the Parana Delta and its relation to opportunities and vulnerabilities in the Delta. It will be shown that the case is a Delta, a wetland and an estuary, which means that different dynamics of all these systems can be found in the Parana Delta. Then an overview is given of the main influences in the system. Finally, it is highlighted what sort of effect climate change may have on the system.

3.2.1 Delta, wetland and estuary

FIGURE 4.2 Paraná Delta. Elaborated from Google Inc. (2018) Google Earth (Version 7.3.1.4507).

Zagare (2014) clearly shows that the delta can be seen as different types of systems: A delta, a wetland and an estuary. It can be seen as a delta since it is an area dominated by sedimentation and due to the interaction of fluvial and marine forces (Marcolini & Parker, 1992). Secondly, a wetland, which are terrestrial and aquatic ecosystems along watercourses that are permanently flooded, making a connection with the groundwater (Junk & Piedade, 2010). Wetlands are known for their

possibilities to observe floods, depending on the type of wetlands (Acreman & Holden, 2013). The floodplain river-fed wetlands, as can be found here seem to have the highest possibilities to adsorb floods (Acreman & Holden, 2013). Finally, it also an estuary since it is a transition of two distinct water bodies; a river and a sea (Savenije, 2005). Typically the riverine characteristics are the flowing water with sediment transport and in the upper area the availability of fresh water(Savenije, 2005). The marine characteristics are the presence of tides and saline waters(Savenije, 2005). In an estuary, these two regions interact, given a dynamic environment, a funnel shape and full of nutrients. This lead to a high presence of flora and fauna (Savenije, 2005).

The Parana Delta is a complex estuarine system since it does not discharge its sediments on the Sea, but first on the river Rio de La Plata (Marcolini & Parker, 1992). The Rio de la Plata is formed by the confluence of the Rio Parana and the Rio Uruguay. This causes a mainly freshwater environment, and a tidal influence can be found up to Zarate (interview Minotti). The delta itself is new land, formed by sediments of the Parana's tributaries, while the edges of the delta are ancient (Zagare, 2014).

The Delta is a system subjected to pulses of floods and droughts (Kandus et al., 2011), due to the different drives of flooding. From the North, the influence can be found of the Parana river. The origin of the Parana is in Brazil and has a path of 2570 km before reaching the Rio de la Plata(Zagare, 2014). From the South-west, flooding occurs due to strong winds that Steer up to the water level of the Rio de la Plata. From the West, flooding takes place, due flooding of the tributaries (as for example the Lujan river). Finally, from the west, the Uruguay river causes at times extreme flooding's.

The constant flooding due to these different angles, make the Delta a challenging area to live. Furthermore, no well-functioning early warning system is present to warn its inhabitants (workshops) Its inhabitants live in Paladino's (houses on piles),due to the high variability in water levels over the day, seasons and years. At times, also droughts occur leaving the rivers completely dry and making sailing impossible (interviews measurements). The uncertainty of extreme water levels seems to be increased with the influence of climate change (reference Merendez). In the next section, different dynamics that play a role in the delta are highlighted.

3.2.2 Dynamics in the Delta

Various influencing factors are highlighted in the literature to determine the central dynamics in the Parana Delta. These are the Parana River, Sudestadas and the influence of the river Uruguay. The different dynamics are combined in the following picture. In the following sections, I'll shortly describe the different influencing factors.

Add picture GIS dynamics Delta

Parana river

The Parana river is one of the main driving forces in the Parana Delta. From the North the Parana river causes floodings, that can take place for a longer duration. It sometimes can even be months or years. In the flood of 1952/53 when the lower Delta was flooded for more than two years (workshops). In the investigated area the Rio Parana splits between Rosario in the Parana de Las Palmas and the Guazu river, with average river flow of 18000m3/s (Bucx, Driel, Boer, & Graas, 2014) to approximately 20% and 80% for the rivers respectively (interview Sabarots). This is highlighted in figure X.

Furthermore, the river transports 160million ton/year (Badano et al., 2012) of sediments causing a continuous growth of the Delta front of approximately 72 m/year the Parana de las Palmas along its 60 km frontline and 27 m/year m northern sub front close to the Guazu river (Badano et al., 2012) .

Figure 3-0-2 Advance of the Delta Front (Zagare, 2014)
(make own picture?)

The growth of the delta is formed by deposition of fine sands and coarse silts, accounting for 15% of the sediments (Badano et al., 2012). It has direct implications for the city of Buenos Aires, which outskirts are situated on 11 km from the delta front (Badano et al., 2012). Due to the high growth it has averagely grown with 617 km2/year (Medina and Codignotto,2011) and is expected to reach the city of Buenos Aires in 110 years (Sarubbi & Menendez, 2007), however Badano et al. (2012)mention that the sea level rise is critical in the reduction of the area growth rate in their hydro-sedimentologic model pf the advance of the delta front. This seems to imply that the delta is a river-dominated delta; however, it is also influenced by tide or waves (Bosboom & Stive, 2015). The delta growth is shown in figure X.

The river is crucial for navigation, and due to the high sediment transport, dredging is needed to make navigation possible (Zagare, 2014). However, Zagare (2014) shows that a scientific debate exists regarding the environmental consequences of dredging along the Parana river.

Sudestada

A Sudestada (Southeast blow) is a phenomenon when the wind blows South East in the direction of the La Plata river inland. This means that the water is stewed up by the wind, increasing the water levels up to 7 meters (add reference). The time of a Sudestada is also very variable; it can be hours or days. In Tigre for example, the recurrence of a sudestada is between 4 and 8 weeks (Fundación Metropolitana and Municipio de Tigre, 2013). In the workshops, a different vision could be seen on the influence of the Sudestada. However, it averages it influences up to Campana, as can be seen from figure X. Furthermore, Sudestadas are associated with the ENSO (El Niño Southern Oscillation) cycle, which is a phenomenon that takes place in the tropical Eastern Pacific Ocean and is characterised by a change in temperature and pressure of surface waters. The ENSO is the leading cause of climate variability in South America (Berbery et al. 2006).

Uruguay River

The Rio Uruguay, with an average flow of approximately 4620 m3/s, is the river that separates Argentina from Uruguay. It also is a driving force for flooding's close to the la Plata coast (workshops). The influence of the river Uruguay is often not taken into account in modelling for the Parana Delta (M. Re, Sabarots Gerbec, & Storto, 2015), however it, was highlighted in the workshops as a primary reason for the massive floods at the border of the Parana Delta and the Rio de la Plata. Furthermore, in recent years flooding's due to the river have increased (Guizzardi & Sabarots Gerbec, 2018).

3.2.3 Climate change

The influence of climate change is investigated by various studies (Barros, Clarke, & Silva, 2006; Barros, Menéndez, & Nagy, 2003; Medina & Codignoto, 2013; Mariano Re & Menéndez, 2006). However, the exact implications on water level and water flow variations are unknown. Bucx et al. (2014) mention that different impacts of climate change can be found such as the variation in the discharge and sediment load of the Parana river. Furthermore, a change in the Sudestada frequency and intensity may occur (Barros et al., 2003). The level of the la Plata river seems mostly to be influenced by sea level rise (Barros et al., 2006, 2003), as well as winds (Barros et al., 2003). It's is likely that a change in the water level of the Rio d la Plata will affect the lower areas of the La Plata basin (Mariano Re & Menéndez, 2006) The combination of a change in streamflow and flooding frequency of the Parana river and the change in Sudestada may impact the occurrence of extreme droughts and floods in the Parana Delta (Bucx et al., 2014). Furthermore, as demonstrated by Barros and Bejarán (2005) an upward trend of precipitation levels can be found of 16% comparing the periods from 1951-1970 and 1980-1999, mainly for the Western Buenos Aires area and that of the province of Corrientes. Furthermore, for every percentage point of change in precipitations river streamflow will increase 2 per cent (Barros et al., 2006). The upper and middle sections in the Parana Delta are assumed to be affected by the change in precipitations of the Parana and Uruguay river, while the lower section mostly by sea level rise of the la Plata river (Barros et al., 2006). Furthermore, Bucx et al. (2014) also mention the impact on local temperate changes, impacting the local water balances and land use.

3 Social system

(presentation Zagare change picture or reference)

As can be seen from figure X a significant difference can be found between the continental side and in the islands (presentation Zagare). The river Parana is a natural separation between them. The social system and its vulnerabilities are described for both the islands and the continents. Information is used from literature, interviews and workshops organised.

3.3.1 Continental side

Even though, the city of Buenos Aires is not located along the Parana Delta it still gives pressure on the islands. Due to a railway connection to Tigre (a municipality in the Delta), a lot of growths took place from the city of Buenos Aires towards the Delta(Zagare, 2014). Furthermore, going to the Delta is a popular weekend destination for its inhabitants. Law. No 427 (in 1934) gave private investors the possibilities to develop coastal land. The law did not show a clear development strategy (Zagare, 2014). During the 1990s a state reform occurred giving privatization of public services and new urban codes (Zagare, 2014). This gave a possibility to private developers for the development of large gated communities along the border, and sometimes even in, the Delta (Zagare, 2014). A gated community is a neighbourhood that is closed from the rest of the urbanisations (Zagare, 2014). The development of the gated communities caused a displacement of the higher and middle-income groups of Buenos Aires towards the borders of the Delta (Zagare, 2014). Today the number of gated communities exceeds 400 (Bucx et al., 2014). Furthermore, the surface they occupy is nearly 500 km2,which is larger than the surface of the city of Buenos Aires (Zagare, 2014)Different types of gated communities can be found, such as mega urbanisations, which is like a large city consisting of various gated communities (Fabricante, Minotti, & Kandus, 2012)

On the other hand, since the economic crisis in 2001, very high inflation took place, many people lost their jobs and were forced to live in informal settlements (also called villas or asentamientos) (V. M. E. Zagare, 2012). These villas are located at the edges of the gated communities, causing severe social segregation(Zagare, 2014). Furthermore, other claims are made that the gated communities due to their construction of dykes are actually causing flooding of the lower placed villas. In a close by the area around the Rio Lujan, similar processes can be found, and water dialogues are organised to connect the inhabitants of the villas with the gated community developers this process can be observed (interviews representative Lujan). Furthermore, different industries and port activities can be found along the continental side, such as steel, petrochemical and automotive industry, which are causing pollution in the rivers (Bucx et al., 2014).

3.3.2 Islands

The main economic activities that can be found in the islands are forestry, cattle raising, beekeeping, fishing, hunting and recreational tourism (Bucx et al., 2014). The delta represents a long, rich, artisanal tradition in which with natural materials and products are generated. Also, it provides a basis for food for its inhabitants (Bucx et al., 2014). These activities are threatened by large scale agriculture of soy and large scale cattle raising (Bucx et al., 2014), and intense forestry (add reference, workshops).

In the Delta large production and geographical changes can be found over the last century. In the 1940s the high time of the Delta took place, with more than 40.000 inhabitants and intensive fruit production in small productive units (Zagare, 2014). However, due to the decreasing market prices of fruits (Zagare, 2014) and several extreme floods (Bucx et al., 2014, interview Merendez, workshops), many people moved to the continent, leaving the Delta to be developed by large forestal investors (Zagare, 2014). In Tigre still, the old remains of this time can be found at the fruit market (interview Merendez, tour Tigre). Tigre now is famous for its weekend tourism activities, however other islands as for example San Fernando the population has decreased and as a strategy to declare the reserve as a biosphere reserve (Zagare, 2014).

Furthermore, due to the change to soy on the mainland, the cattle production, famous for the pampas in Buenos Aires shifted to the Delta (Bó et al., 2010). Conditions in the Delta favoured this allocation of animals as well, due to the construction of new bridges, dams and embankments and

the possibility of leasing public land (Bucx et al., 2014). The cattle production multiplied almost by ten times between 1997 to 2007 (from 160.000 animals to 1.500.000), affecting the ecological quality of the wetlands (Bucx et al., 2014)

The government has not installed any system for the prevention of the floods in the islands, meaning that all protection is made by individual actors(Bucx et al., 2014). Most people live in palifitos, which are houses on piles (interviews local inhabitants). Furthermore, due to the lack of an early warning system, it is difficult for inhabitants to prepare for possible floods (Sabarots Gerbec et al., 2017).

During the interviews at the **'Dia de islenos,'** the isolation that the island people face was highlighted. It is not easy to live in the Delta. The local inhabitants depend on a public boat system that often does not function due to strikes, floods from the Parana River or Sudestada's. Furthermore, due to the limited amount of work in the delta, many people move to the continents. Little future is present for the inhabitants of the Delta. Therefore its populations keep decreasing. However, it's part close to the city of Buenos Aires remains popular for a weekend destination (Zagare, 2014)

.4 Complex system

In this section, complex problems in the lower Parana Delta are highlighted, in the cases where the social and technical system come together., The effects of the construction of dykes for production, life stock and housing and the effect these have on the wetlands are mentioned. Furthermore, the legal context in which the planning of the Parana Delta takes place is highlighted.

3.4.1 Dykes and embankments on islands

In this section first, the impacts of the production polders in the Parana Delta are described, then the spread of gated communities from the continent to the islands is highlighted.

Production polders in the Delta

Numerous dykes are constructed over the recent years in the Parana Delta, to form polders. Over recent years, the area of dykes for forestry production has drastically increased (Minotti & Kandus, 2013). The primary purpose of the polders is forestry (36% in the entire delta). Some polders seem to be changing the function from forestry to livestock production (workshops). Also, several polders are being abended, but their structure is still there (Minotti, workshops). In the upper and middle delta livestock production can be found, but recently this can also be found in the lower Delta , in which it is combined with forestry (called silvopastoral) (Bó et al., 2010) About 35.800 ha of silvopastoral can be found in the study area (Bó et al., 2010). The type of trees grown are mostly Salicaceae (Salix spp., Populus spp., Willow and Poplar (Bucx et al., 2014).

Another technique that can be found are attajerepuntes, which are lower dykes in which flooding can occur to let sediments in. Often another dyke is placed behind the attajerpunte, in which with gates water can be let in for irrigation purposes (Bucx et al., 2014) By using an open ditch system (Sistema de zanja abierta) water can run off by gravity from the fields by means of open ditches (Bucx et al., 2014).

Zagare (2008) shows by a participatory approach an assumed growth of the forestall sector in different scenarios. While in the workshops, for this thesis, the participants seemed reluctant in the further development of a forestall sector. This might be explained by the .recent publications showing the harm of forestry polders on the ecosystem (Blanco & Méndez, 2010; Bó et al., 2010; Minotti & Kandus, 2013) and the practical workshops organised by wetlands international in the framework of corridor Azul.

The construction of dykes and drains, make it possible to have forestry, livestock and agriculture, The floodplain river-fed wetlands, as can be found here seem to have the highest possibilities to adsorb floods (Acreman & Holden, 2013) For example, 0.4 hectares of wetlands are able to store 6000m3 of floodwater (Davis, 1993). ,Therefore, by constructing the polders, natural flood protection will be eliminated (Bucx et al., 2014). Furthermore, the quality of the wetland's functions will also be limited due to the loss of the natural regime of floods and pulses . For example, an ecological habitat that can only be found in the wetlands may be lost (Bó et al., 2010)This process is extravagated due to the introduction of foreign species typical in terrestrial ecosystems substances and loss of wildlife due to agrochemical (Bó et al., 2010). Also, special wetland functions might be lost as decontamination of the water (Bucx et al., 2014). The biodiversity hold in the area helps to retain nutrients and sediments, purify water by removing nitrogen, phosphorus and other chemicals and retain carbon dioxide (Zagare, 2014). Furthermore, it is a natural barrier for storm surges, win, waves and other climatic events, by protecting the lower delta from Sudestadas (Zagare, 2014). In order to sustain a part of the ecological habitat, ecological corridors are proposed in the workshops. Also, several forestry companies, as Arauco, have formulated a plan for the development of these corridors (workshops).

In some cases, the hydrological regime of the Delta was changed due to the construction of dams and water blockages(Bucx et al., 2014). The influence of the dykes on altering the water levels on the Parana Delta seems to be highly debated. Both in the expert interviews as in the workshops, the experts showed different visions on the gravity of the issue, however, agreed to the need for additional research for the investigation on the impact of the blockage of the dykes for the river flow. Furthermore, Angel Merendez showed that in a study of the flood of 1952/1953 to one long dyke, it would increase the water level with 7 cm. Initial steps are being made in the investigation on the effects of dykes, a cooperation of INA and INTA has performed measurements to cross sections of dykes (add website) and has set up a 1D hydrodynamic Hec-ras model (M. Re et al., 2015; Sabarots Gerbec, 2014).

Urban spreading to the islands

As shown in the section of the continental side on the social system, due to the construction of the private developments, that can be mostly associated with dykes and the public vulnerable depressed zones an alternating landscape can be found, possibly leading to flooding in the vulnerable zones(Zagare, 2014). Due to the Sudestadas, the drainage system of the urban developments at the continental side is limited (Zagare, 2014).

In the recent years, the advancement of urban developments can be found in the island section as well at a rate of 1650 ha/year (Bucx et al., 2014), due to the lower prices of the land than in the pampas areas. Furthermore, in the workshops, the participants highlighted the possibility of an increase in the gated communities in the Delta. Notably, the nautic neighbourhoods can be found in the islands, changing the geography, biodiversity and new socio-economic and cultural circumstances on the islands (V. M. E. Zagare & Manotas Romero, 2014). The new type of neighbourhoods also change the type of work and the social conditions of the original island

inhabitants that live outside these gated communities. While the original island population lives on palafitos adapted to the floods, the new communities are situated in polders, changing the river flows(V. M. E. Zagare & Manotas Romero, 2014).

The gated communities are constructed in polders reaching a height of 5m AMSL (Bucx et al., 2014), approximately 10% of the polders in the area. In 2013 1060 segments could be found with a length of 5181 km (Minotti & Kandus, 2013). Notably, in the selected study area the Delta bonaerence many polders can be found (Minotti & Kandus, 2013).

Also, the workshops show an increase in other types of housing in the Delta. The contamination that can be found a point sources in the continental side also spread into the Delta. Furthermore, with urbanisation in the islands, contamination is likely to increase (workshops).
However, several municipalities as Tigre and San Fernando have forbidden to the building of gated communities (workshops). This might be a reason that in the workshops of Zagare (2018) the growth of the gated communities to the islands was not shown, possibly due to the prohibition by law in several municipalities.

Legislation and planning attempts

In the delta, a fragmented legal context can be found (V. M. E. Zagare & Manotas Romero, 2014)., and the delta can be characterised by a lack of interdisciplinary insight from the governing institutions (V. M. E. Zagare & Manotas Romero, 2014). The national government, three provinces, and 18 municipalities can be found in the entire lower Parana Delta. The largest area can be found in the province Entre Rios (82.2%), then Buenos Aires (16.3%), followed by Santa Fe (1.5%)(Bucx et al., 2014). In my specific case area for the workshops, 2 provinces (Entre Rios and Buenos Aires) and 4 Municipalities could be found. To simplify the responsibilities the national government is responsible for a healthy environment, the province is responsible for natural resources, while the municipalities are responsible for urban development (Zagare, 2014).

The provinces and municipalities have different and conflicting legislation and visions on the delta, making it very complex to implement policies and measures. Furthermore, often decisions made are conflicting between the organisations (Bucx et al., 2014). For example, the following has been told to me during the interviews with an activist and with the province, for the building of a gated community the municipality is responsible for the approval of the land for building. The private enterprise than buys the land, but is not allowed to build on it since the level is below 5m above Sea level. Then the private enterprise gives dykes and roads to the relevant municipality and simultaneously increases the level of the ground by digging canals and dredging from the main rivers. Once the land has the needed surface, and dykes are established, houses are built and sold to buyers. Remember that still no permit has been given. Then a permit is requested from the municipality and given since the houses are built above 5 m of the sea level. However, by building the dykes possible the hydrodynamic regime of the rivers is changed. The rivers are under the responsibility of the provinces, but they cannot do anything against the building of the gated communities since these are already approved by the municipalities. In one case (Colony Parc) an entire gated community had to be stopped by court order after significant protests (Graham & Levenzon, 2016).

Furthermore, often lack of resources is present in the provincial and municipal organisations, meaning that the in practice decisions are guided due to the practical possibilities of the organisation (Bucx et al., 2014). Also, often the departments inside the organisations have conflicting agenda's a promotion of forestry, against the protection of the environment. Or even, an organisation promotes other things than their official motto, such as production while their aim is to protect the environment (Bucx et al., 2014).

Regarding forestry production officially the provincial government is responsible for the natural resources. However, the national government can also have a significant influence on their policies of increasing production activities (Bucx et al., 2014). Moreover, due to its institutions, INTA (Instituto Nacional de Tecnología Agropecuaria INTA) plays a very active role in developing policies in the Delta. In the workshops, this clearly could be seen that the provincial authorities questioned INTA why they were promoting such unsustainable production activities. The national government is also active due to the presence of several natural Parcs in the area (V. Zagare, 2018).

Zagare (2014) shows that planning has played a minor role in the area, and she proposes different integrative planning strategies by looking at a spatial and participatory dimension. She mentions that a considerable fragmentation exists between environmental and planning legislation on individual issues, however very limited on the governing issues between them (Zagare, 2014) Also, during my visits to the Parana Delta I had the feeling of a 'wild west' in which development could take place, without regulations. Furthermore, an integrative development plan is desired by the secretary of hydraulic resources. This also shows the usefulness of this study for the Parana Delta.

However, different first planning attempts are being developed. Firstly, the different provinces together with the National government developed a plan for sustainable development (PIECAS) in order to overcome the differences in legislation. Sustainable delta development is central to this plan by laying down principles of protection and development. The regulations of the continental side are not addressed. The motivation for making such a plan was the smoke that could be seen, due to unsustainable use of fire in the Parana Delta (Secretaria de ambiente y desarrollo sustentable, 2014). After signing of the letter of intention (Secretaría de Ambiente y Desarrollo Sustentable de la Nación, 2008) a baseline document is developed (PIECAS-DP, 2011b), an environmental evaluation (PIECAS-DP, 2011a), the final PIECAS document is formed (Secretaria de ambiente y desarrollo sustentable, 2014) proposing future steps for the sustainable development of the Delta. However, the plan is not fully implemented yet(Zagare, 2014 and workshop Deltares-INA). Secondly, the municipality of Tigre together with Fundación Metropolitana a management plan for the management in the islands of Tigre. One of the outcomes was to forbid the further development of gated communities on the island (Fundación Metropolitana, 2015). It is an example in which local policies are combined with regional policies. Thirdly; workshops are organised by architects in Zarate for an integrative development of the islands (Gullen reference). Finally, under the leadership of the secretary of hydraulic resources Deltares and INA (Institute National de Agua), a large workshop is organised to formulate opportunities, threats and planning for the delta and also a binational conference in which different architects presented several scenarios for the Delta is organised. Moreover, a common GIS database for the Delta is developed. This work is part of the last project.

Regarding the political system, many uncertainties can be found as well. Will the current government policy still remain with the next government? Can the country go bankrupt or can economic growth occur? (workshops), due to the extreme economic variation that Argentina has been facing (give numbers). Argentina, once the wealthiest countries in the world, which its bankruptcy in 2001, and its hyperinflation in the last years, leading to uncertainty to many of its inhabitants and policymakers.

As can be seen that an interest exists for integrative planning of the Delta, and this seems to be the momentum to act. In the following section I will show what the focus will be of the case for the organised workshops.

B3: Experiential Learning

The study involves the investigation of the place of scenarios in participatory ADM for the

Initial hypothesis

In this chapter, reflection is given on possible background motivations for the results answering the main question. It is shown that the motivation for the initial hypothesis, did not seem to be the real case. A new explanation is provided: Experiential learning studies. The concept is explained, and why this might be an explanation for the results. Then, different elements from experiential learning studies are proposed in future work.

In this section, the initial assumption on the research is discussed regarding the effect of scenarios and the cultural motivation for using scenarios in a later stage of the research.

From the literature research, it was assumed that In DAPP scenarios have an effect on all the steps following it in the cycle, and thus have influence, on the opportunities and vulnerabilities, tipping points, action development and adaptive plan construction. Therefore, it was assumed that possibly in the "Action Approach", the quality of the pathways would be less, since scenarios were only applied for the final what-if analysis. Even though, theoretically this argument maybe can be made, in practice in the 'Scenario Approach' this did not seem to be the case since the uncertainties were not used for identifying vulnerabilities and opportunities, and only very limited for tipping point evaluation, action development and pathway development.

Also, the hypothesis initially established was that the 'Scenario approach' would work better than the 'Action Approach', due to cultural motivations. However, even though the participants highlighted that they found it difficult to plan long term and create a long term vision, due to the ever-changing politics in Argentina, this seemed to affect both approaches equally. The creation of scenarios did not seem to be specifically affected by cultural implications. So why did the 'Action Approach' seems to be functioning more appropriately for the given case study? In the next chapter, I aim to give an explanation for this.

Experiential learning

In the workshops, the main difference seemed to be the way the participants were learning. In the 'Scenario Approach,' the participants received a lot of information simultaneously. They have explained the concept of scenarios, they had to create actions keeping scenarios in mind, and from this, they had to create pathways. This seemed to make the participants overwhelmed. Also, in ADM research is shown that social learning occurs stronger on the individual stakeholder level and less at the collective level (Mutahara, Warner, Wals, Khan, & Wester, 2018). While in the 'Action Approach' participants were explained the theory step by step, improving their former work such as actions and pathways. Even though the concept of scenarios was not explained to the participants, they themselves linked this concept to adaptive delta planning. The reason for the difference in success can be the different learning styles (de Byl & Brand, 2011).

The 'Action Approach' seemed to apply the ideas of experiential learning it proposes a constructivist theory of learning in which knowledge is created by the learner (A. Y. Kolb & Kolb, 2005), while the "Scenario Approach' seemed to use the 'transmission model' in which pre-existing ideas are transmitted to the learner (A. Y. Kolb & Kolb, 2005). Experiential learning can be defined as 'learning through reflection on doing'(de Byl & Brand, 2011, p. 1003). Experiential learning theory (ELT) is first introduced by Kolb (D.A. Kolb, 1984; David A. Kolb, 2014).

The work of A. Y. Kolb and Kolb (2005) shows the preferred four modes of a learning cycle in experiential learning the learning should have to adsorb information: Learning Style

Inventory (LSI) . Firstly, the learner should be aware of the immediate concrete experience (CE).Followed, by observation and reflection of this concept (RO) , thirdly a formation of abstract concepts (AC) and generalizations, as a final phase testing of hypothesis to create new experiences, active experimentation (AC). This process is continuously re-iterated; once the new behaviour and knowledge are implemented a new learning process can occur (A. Kolb & Kolb, 2012; A. Y. Kolb & Kolb, 2005). The process is visualized in the figure below. Games can be used to create an initial experience (de Byl & Brand, 2011). The process is shown as an idealised learning cycle. However individual people develop their preferred learning modes (Joy & Kolb, 2009).

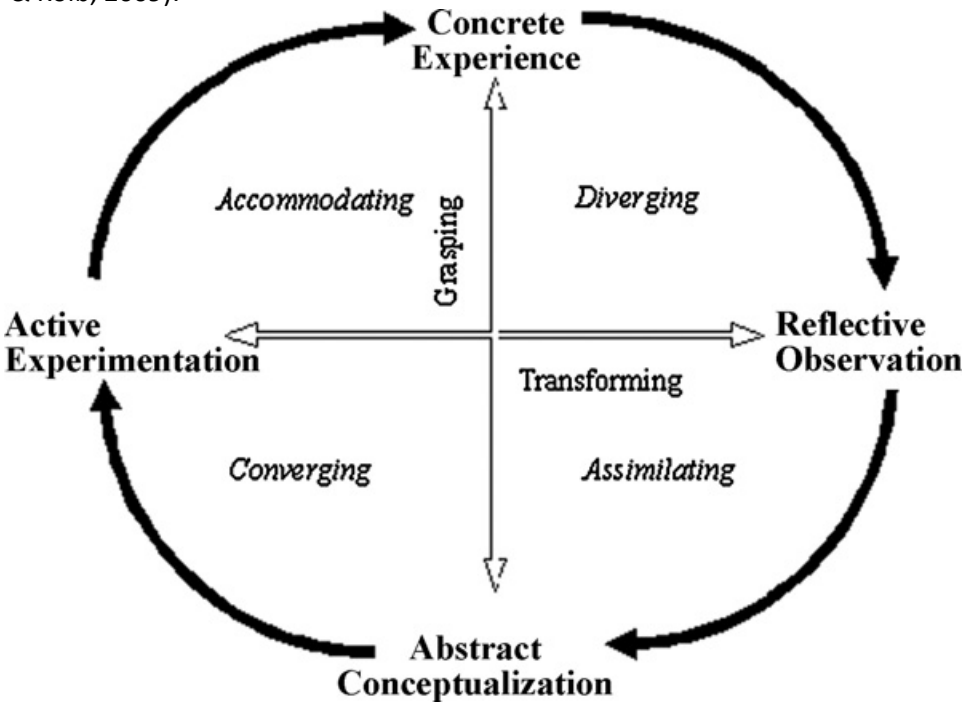


Figure 0-1 The experiential learning cycle (Joy & Kolb, 2009, p. 71)

Use Experiential learning theory in DAPP

In the following sections, the use of Experiential learning for DAPP is highlighted.Reflecting on the relevance of DAPP the inclusion of experimental learning together with re-iteration seems to give interesting insights for its participatory applications with stakeholders involved in the Delta. The application of the pathways should next to creating the pathways, also seen as training for stakeholders to use in their future work. Limited research could be found on the inclusion of experimental learning in the set-up of DAPP. Mutahara et al. (2018) advice that in times of increased uncertainty and climate vulnerability for tidal, more attention needs to be paid to coordination and facilitation of multi-level learning that includes all stakeholders. Taking this into account for practitioners of DAPP can lead to more successful results. It could be relevant to include in future studies. Campos et al. (2016) advise in their participatory ADM study in Portugal, the need to incorporate social learning in the framework, by preparing stakeholders for scenarios and knowledge on the topic.

In DAPP in Argentina, this could be translated into a first experience of working with actions and scenarios in earlier work or by means of a game. The Sustainable delta game (Valkering, van der Brugge, Offermans, Haasnoot, & Vreugdenhil, 2013; Van der Wal, de Kraker, Kroeze, Kirschner, & Valkering, 2016; van Pelt et al., 2015; Warren & Haasnoot, 2018) that was also used in Argentina one time for a stakeholder workshop and one time for students, and both times positively evaluated, could be a possibility for experience. Also, due

to earlier work of other organizations in the Parana Delta, stakeholders already seemed to know the concept of scenarios. The use of a game to create experience is already applied by ADM/ IWRM practitioners (Aubert, Bauer, & Lienert, 2018) and seem to enhance social learning (Van der Wal et al., 2016) , to foster a broader understanding of uncertainties (van Pelt et al., 2015), and understanding of the element of surprise in water management (Valkering et al., 2013). These studies seem to imply that the use of games in creating an experience and reflecting on this has received attention in the academic field. However, the components of social learning, creating experience during the workshop and reflection, as is suggested in ELT could not be found.

Cultural dimensions

As a hypothesis was suggested that due to cultural dimensions differences could be found between the case studies, these did not seem to be relevant for the main questions. However, as can be seen in the following chapter cultural aspects did seem to play a role in general DAPP. The influence of culture for the set-up of the learning also may play a role. Experiential learning is concerned with the way how individuals learn, but in this case, it seems relevant to investigate cultural preferences for specific learning styles. However, culture seems to be a strong influencer in the way people process information (Earley, 2004), and the suggestion is made that cultures can influence learning processes(Reynolds, 1997). Yamazaki (2005) provides an overview of different studies comparing different cultures, with different learning styles. However, South American countries were not included in this study. Joy and Kolb (2009) investigate in their study the impact that culture plays in the way individual learn, with a large sample of countries. In order to divide culture they the framework provided in the Globe study, in which cultures are examined by regional cultural clusters and individual cultural dimensions (House et al., 2004). The Globe study refined the work by suggesting nine dimensions: in-group collectivism, institutional collectivism, power distance, uncertainty avoidance, future orientation, performance orientation, humane orientation, assertiveness and gender Egalitarianism (House et al., 2004). When looking at the individual's approach to learning, different values on the learning axes of Kolb (A. Y. Kolb & Kolb, 2005) can be found (Joy & Kolb, 2009; A. Kolb & Kolb, 2013). It is found that the cultural dimensions seem to play a significant role in the learning styles, and in particular for the roles of how individuals relate to experiences in relation to the way how they learn. However, educational specialization seemed to have a more significant influence than culture, followed by other factors. Individuals from Brazil and Italy had the most concrete learning styles, with active experimentation while for example Germany and Singapore had the most abstract learning styles. This can be a motivation for the preference of the participants to work in the 'Action Approach' in which steps were made concrete by activities, while the 'Scenario Approach' seemed to be more abstract by presenting many concepts. Argentina seems to share many cultural characteristics with Brazil and Italy (Hofstede et al., 2010) . However when looking at the cultural dimensions Argentina characterized by a high uncertainty avoidance that the participants prefer abstract conceptualization then concrete experience (Joy & Kolb, 2009). Furthermore, it also implies that they would prefer reflective observation over active experimentation. On the other hand, when future orientation increased preference for abstract conceptualization was increased. Argentina has a low future orientation (Joy & Kolb, 2009). This seems to imply that culture plays a role, but it can be unclear in which learning method is supported based on cultural characteristics. Moreover, one can ask the question if the preference of participants is the same of effectiveness. Many participants mentioned they appreciated the participatory set-up of the study but initially felt uncomfortable, since they were not used to it. Meaning, that preference will not directly mean that this will also lead to the most successful results.

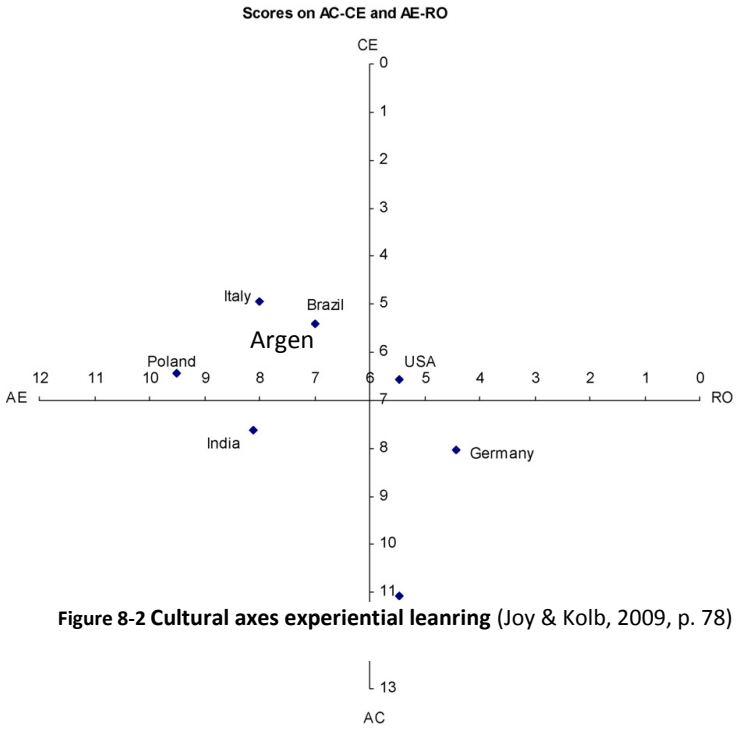


Figure 8-2 Cultural axes experiential leanring (Joy & Kolb, 2009, p. 78)

The concepts of ELT seem to be relevant for DAPP and ADM during the actual participatory workshops and not only in the preparation stage. As could be seen in this chapter experiential learning might be a reason for the more successful application of the "Action Approach" than the "Scenario Approach". Cultural dimensions still might play a role, however maybe differnet than initially suggested.

Experiential learning in ADM workshop design

In this chapter different elements from experiential learning studies are proposed in future work. In the discussion chapter was shown that in the workshops, the main difference seemed to be the way the participants were learning. In the 'Scenario Approach,' the participants received a lot of information simultaneously. They have explained the concept of scenarios, they had to create actions keeping scenarios in mind, and from this, they had to create pathways. This seemed to make the participants overwhelmed. The 'Action Approach' seemed to apply the ideas of experiential learning it proposes a constructivist theory of learning in which knowledge is created by the learner (A. Y. Kolb & Kolb, 2005), while the "Scenario Approach' seemed to use the 'transmission model' in which pre-existing ideas are transmitted to the learner (A. Y. Kolb & Kolb, 2005).

The concepts of ELT seem to be relevant for DAPP and ADM during the actual participatory workshops and not only in the preparation stage.

Firstly, the development of actions for the issue (the respondent should be working in the field of the issue). The participants may describe the problems they are facing, and reflect on these issues how to solve this. They formulate actions to solve these issues and reflect how these actions can work. Then they can reiterate thinking about scenarios; they can observe the actions they have chosen and reflect and the missing of issues for policy formulation, a discussion of the concepts of scenarios and their usefulness and the formation of the concept to include scenarios in the pathways. Once they have included the scenarios in the pathways, they can observe and reflect on the use of scenarios in the pathways. They can see if they can form new concepts on the application, and can try to improve the pathways with the scenarios.

The workshops were not initially set up in the framework of experimental learning. However, as is shown above the principles of experimental learning seemed to be of importance. In the framework should be a possibility for learning about scenarios, and how to use it. Asking questions if the participants thought themselves about scenarios, if not encourage them by questions to come up with the concept. The 'open to outcome questions' presented by Jacobson and Ruddy (2004) for facilitators in experiential learning may form a solution here. Their questions are the following(Jacobson & Ruddy, 2004):

- Did you notice?
- Why did that happen?
- Does that happen in life?
- Why does that happen?
- How can you use that?

By including these questions when the participants already discuss the concept of scenarios during the action stage, possibly a more significant learning experience can be achieved. If the

concept is not brought up by the participants themselves, the questions can help in the what-if analysis. Even though a good facilitator may contribute to the learning experience, the most important aspect seems to be a reflection (David A. Kolb, 2014). Relevant experience also seems to be found in transition studies (Loorbach, 2010; Loorbach & Rotmans, 2010), see chapter 2.1.

Adjust to the participants

However, different learners have different capabilities in the different phases of the learning cycle (A. Kolb & Kolb, 2012). For example, people who are preferring abstract conceptualization are logical and analytical in their approach (Joy & Kolb, 2009). In this way four different learning styles can be differentiated: accommodating, diverging, converging and assimilating (Joy & Kolb, 2009), which are also presented in the figure. Learning styles are influenced by personality type, education specialization, career choice, current job and tasks. Each type of learner can be found to be more successful in one of the phases (A. Kolb & Kolb, 2012; A. Y. Kolb & Kolb, 2005). More than nine different learning styles can be differentiated (A. Kolb & Kolb, 2012; A. Y. Kolb & Kolb, 2005). This seems to suggest the need in ADM to reflect on different learning styles of its participants.

In order for all participants to have a similar learning experience possible, natural roles should be shifted so that also learning styles can be achieved that usually would be less natural. For this reason, it seems to be essential to be prior to the workshop aware of the participants, and let them do tests to access their learning styles. Furthermore, an individual learning experience can be very different from a team's learning experience. Teams of different learning styles performed significantly better than uniform teams (A. Y. Kolb & Kolb, 2005).

To which policy level relevant

It seems to be essential to note that this study focuses on the stakeholders working in the Delta, and knowing the practical issues of the Delta. The role of experimental learning seems to play a role, in the acquaintance of the theory to use in their further work. However, on a higher level of policymaking, on the national level, I'm not sure these learning effects will play such a role. Policymakers will be less related to the field and issues, and also practically will not apply the pathways themselves in their day to day work. It is sooner expected that they are informed in the overall decision-making. The training and hands-on approach seem to be less of an issue, since the policymakers may have less experience with the subject, which seems to be a key for strategic learning. Therefore, a study associated with the need for learning in the national policy-making context seems to be of relevance.

Cultural dimensions

As highlighted in the Discussion, culture also influences the different learning methods. Culture seems to be a strong influencer in the way people process information (Earley, 2004),. When looking at the individual's approach to learning, different values on the learning axes of Kolb (A. Y. Kolb & Kolb, 2005) can be found (Joy & Kolb, 2009; A. Kolb & Kolb, 2013). It is found that the cultural dimensions seem to play a significant role in the learning styles, and in particular for the roles of how individuals relate to experiences in relation to the way how they learn. However, educational specialization seemed to have a more significant influence

than culture, followed by other factors. This seems to imply that culture plays a role, but it can be unclear in which learning method is supported based on cultural characteristics.

The inclusion of experience and reflection stages, the adjustment to participants and the implementation of cultural dimensions might improve a successful application of the learning studies. However, this aspect of learning only seems to be relevant to a certain policy level. It seems to be an interesting direction for future research.

Threats to validity in research outcome

Various limitations of the study are discussed in this chapter. The first limitations relate to the case design, as the number of cases and the diffusion between experimental case study research and action research. Furthermore, a critique can be made regarding the composition of stakeholders for the study, since in the last two workshops mostly experts were present not as suggested by the stakeholder analysis. However, it is shown that most of these limitations did not seem to impact the study outcomes significantly. Furthermore, the scenario was constructed by using visual storylines with quantitative numbers, and by means of the axe method. Participants were encouraged to construct the pathways in order to learn the approach thoroughly. However, if stronger computational support was given or scenario would be constructed based on one uncertainty axes, it might have been more easy for the participants. Still this might only have made the process more complciated.

Another type of limitations could be found regarding the action elements of the research. Firstly, limited empowerment of the stakeholders took place since the main aim of the research was to make a comparative analysis. Furthermore, different than initially set-up the observer, also performed facilitation functions, also bringing a social activist approach into the observation. Furthermore, due to the empowering motivations of the facilitators they highly pushed the participants for all the workshops to create dynamic adaptive pathways, that took actions in sequence into account, also for the long term. However, due to the same influence in both workshops, this does not seem to impact the overall results significantly. On the other hand, due to the design of the study, many initial beliefs and values of the facilitator were to overcome due to constant communication on these issues in the facilitation team.

Regarding the different methods, also points of critism were highlighted. Regarding triangulation, the different methods seemed to give exciting insights, and if this means this can help for additional validation can be debated. The main limitation of the observation was if the way it assigned how a person was behaving was correct. However, by combining two observation forms, this was aimed to overcome. The quality of the pathways seemed at times a bit trivial to investigate due to the high influence of the facilitators on both of them. However, this was clearly presented already in the results section. Regarding the survey, due to the high non-response, a comparison of the results was less valuable. However, the non-response seemed to be a proxy for the enthusiasm of the participants. Finally, all limitations of critical incidents were aimed to be addressed, to evaluate the critical incidents for a multi-day process, with a multidisciplinary, international team, which had experience in participatory work in Argentina.

This shows that all the main limitations in this study are addressed, and that the research outcomes can be seemed as valuable. Therefore, conclusions can be reached of the research outcomes.

B4: Extended discussion and limitations

Discussion Research set-up

Several comments regarding the research set-up can be made; these will be evaluated in this subchapter. The chapter includes a description of the limitations of the case study design, a discussion on scenarios, followed by a discussion on the use of action research and an evaluation of the implications on the use of action research actions of the researcher

Case study design

In this section, the case study design of the work is discussed regarding the number of cases in the workshop, the influence of action elements and the creation of an artificial situation for comparison.

Firstly, one could argue that more cases could increase the validity of the results due to the availability of more data for comparison. In my research, I have organised one preparatory workshop and four real workshops. However, in similar studies, as Carstens et al. (2019) or Zandvoort et al. (2017), the same number of cases is applied. These studies seem to give valuable insights into the participatory usage of ADM. Therefore, I argue that the number of cases applied still seems to be sufficient to give valuable insights in the light of the MSc. thesis.

Another critique could be that the actions elements in the research, made it more difficult to compare the different cases. However, as will be argued in the next section, the action research had great importance in improving and adapting the research design. Therefore, it was necessary to included in the case design. A suggestion for future research might be to separate these steps and set-up a multiple experimental case study (yin, 2011), after the establishment of a workshop design constructed by means of action research workshops.

Furthermore, the unequal composition of the stakeholder for the workshops could be criticized. Firstly, several limitations can be found regarding the stakeholder analysis. The initial power-interest matrix constructed during the first visit in Argentina was focussed on developing a workshop on the planning of the gated communities, later this was changed to the entire Delta. Also, no detailed analysis was done to the sample frame, every stakeholder was accepted of the relevant groups of stakeholders, possibly in the group also a sampling should have been done, in order to select the participants. Now we were already happy if the stakeholders had the possibility to participate.Furthermore, many stakeholders participated in another workshop than they were invited for, harming the same composition of the workshops. Notably, in the last two workshops, only experts were present. This is supposed to have a significant influence on the results since the experts had difficulty in developing policy without the presence of real stakeholders. Also, participants seemed to have difficulties in making pathways since they were afraid what the consequences of their results would be. We told them it was a theoretical exercise, but the participants mentioned that in Argentina always everything has real-world consequences. Selecting stakeholders, with less a direct influence on the policymaking in Argentina could have been beneficial. However,as Carstens et al. (2019) highlight in their DAPP-light method, it is difficult to include a sufficiently high number of participants and experts. By requiring the participation of these groups, this also limits the feasibility of the implementation, especially for a study, without direct policy implication afterwards. In this light, the large number of decision-makers and experts that did participate in the workshops was very successful.

Also, it is important to stress that for the research an artificial situation (Flick, 2006) is constructed to test the central question of the research, get an understanding of the vulnerabilities and opportunities in the Delta, and for the case of Sabrina Couvin form a basis for a dashboard for the region. However, the work was mostly scientific orientated (besides

the action research elements mentioned in the methodology and in the next section). It would have been interesting if the investigations could have been applied on workshops used for policy development in the Delta. In real planning studies, participants might demonstrate strategic behaviour. However, also in my workshops, strategic behaviour can be observed since participants mentioned that this study might be used for real policy applications. Then, also the debate for the testing of pathways could have been much more different. One could also argue that the same artificial environment was created in all the workshops, and therefore the influence on the research outcomes was limited. However, the difference between artificial cases and real planning cases is challenging to understand.

Overall, I tried to show that even though the case study design could be critiqued regarding the number of cases, the action influence of the research, the representation of participants and the occurrence of an artificial situation, the research outcomes still seem to be valid.

Discussion scenarios

In this section, I present a discussion regarding the decisions I made regarding scenario construction.

As the DAPP theory suggests (Marjolijn Haasnoot et al., 2013), the scenarios, I constructed up front most likely have influenced the developed pathways in the workshops. Scenarios were based on information established by the research activities in the first missions to Argentina and verified with local experts and supervisors. During the workshops was asked to the participants if they had improvements or adaptations to the scenarios. The participants seemed to understand and agree on the scenarios. In order to prevent a detailed discussion on scenarios and make them relatively easy to understand for the participants, we decided to present the scenarios as visual storylines. These storylines also included a quantitative dimension with social and climatological KPI's and the construction of times series regarding water level and discharge in the basin. However, detailed model-based support was not used to construct tipping points; the tipping points were defined by expert judgement. The workshop design decision might be debated since modelling could have made the tipping point construction easier. The motivation for leaving out a model-based assessment was to limit a lengthy debate on the modelling and give participants a possibility to truly understand the creation of adaptation tipping points (since they had to construct the tipping points themselves). Furthermore, in many participatory purposes detailed models, quantitative support to construct adaptation tipping points, will not be available, and therefore expert judgement will be used. Therefore, it seemed useful to create a similar situation here as well.

Furthermore, the scenarios were constructed based on the axe method, in order to represent different dimensions of uncertainties significant in Argentina. However, in other DAPP applications(Marjolijn Haasnoot et al., 2013), only the climate conditions of the scenarios were considered, while we specifically addressed social-economic dimensions due to their relevance in Argentina as well. Even though this seems to be a wise choice, since the social, economic dimension was of high value in Argentina, for the workshop itself it might have been easier to make use of one-dimension.

I aimed to show in this section that the design choices made regarding the scenarios might be debated; however, decisions were made in order to make a fluent workshop flow, while taking the complexity of Argentina into account.

Action research

As mentioned in the research approach, action research is used for the participatory aspects of the study. The primary motivation to apply action research was to teach participants ADM, since this was a precondition to test the most appropriate application of

ADM (McNiff & Whitehead, 2009). However, action research does not only attempts to change people's behaviour, and gather data continuously (Punch, 1998), it also challenges neutrality and objectivity of traditional social science, seeking the collaboration with participants to change society by empowering them (Marshall & Rossman, 1999). In the research I applied several ideas of action research, besides focusing on the central question of this research; however, I adapted the approach to fit in my research. In this section, I first aim to describe how I used this adapted form of action research related to the topics of empowerment, the role of the researcher and the adaptations in the research design. I believe it is essential for readers to understand which decisions I made in the use of action research. Then, I defend this approach as being suitable for my research.

Empowerment

The main reason to apply action research is to empower the community (Marshall & Rossman, 1999). While my prime research aim was to investigate the place of scenarios in participatory ADM. Empowerment was a necessary pre-condition since I could only test the place of scenarios once participants would have learned about scenarios before. Therefore, I needed participants to be empowered. Still, my intentions were not purely academic and also socially motivated. First of all, I wanted to see how ADM could be adjusted to be useful for the Parana Delta. Secondly, I aimed to empower the participants to use ADM in their future work by providing training on ADM during the workshop, since I really believe of the value of ADM for Argentina. I aimed to make a change in peoples mind to believe in the value of dynamic long-term planning, as action research suggests (McNiff, 2013; McNiff & Whitehead, 2009). Finally, I aimed to provide a research design for the participants to use in their own work, so that they could become experts on ADM themselves. However, it was not the aim of the participatory work, developed together with the participants, to produce directly usable pathways. While, action research suggests that participatory work should lead to directly usable outcomes (Bryman, 2016).

Furthermore, action research is done with participants, never on them (Herr & Anderson, 2005). While in my research, I designed my problem statement with participants, I also analysed their behaviour and their reaction to the approach. I only included a small number of stakeholders in the development of the workshops, invitations. Also, my research approach I mostly set up with my supervisors.

Therefore, not as action research suggests (Bryman, 2016) my initial standpoint was not of a social activist, it was my aim to liberate the work of conventional rules of the research game (Blair, 2016; Marshall & Rossman, 1999), and to liberate the study from the 'quest for Truth' (Marshall & Rossman, 1999, p6) . My academic stance of the research was to strive for workshops as cases that could be compared while empowering participants to learn ADM. The workshops were set up to investigate the main question, if they had been set-up with empowerment as prime motivation, I would have set-up a multiple day workshop, with more feedback and learning moments.

Researcher Role

Generally, in action research, the influence of the researcher in the research outcomes is not an issue since the researcher's presence is considered as an integral part of the research, collaborating with the participants (Marshall & Rossman, 1999). This was not my case at first, I aimed to observe the social phenomena that were happening during the workshops, and the aim was to place myself outside the research. However, together with the facilitator Sabrina Couvin I entirely designed the workshops, and if she was limited in her explanation to the participants, I explained the concepts to the participants in order to motivate them for applying ADM. This means that during the workshops I was in close cooperation with the participants. I also tried to check on the influence of Sabrina, that she would only explain the

concepts of ADM to the participants, but not steer them in their outcomes. However, sometimes the differentiation was a bit vague.

Improving workshop design

Typically, action research can be found in educational science (teacher action research or self-study action research (Herr & Anderson, 2005)), in which a teacher or practitioner would change concepts in their teaching and would evaluate the impact of these changes (for example see Kitchen & Stevens, 2004, 2008). I also have continuously made adjustments in the design of the workshops, mostly after the preparation workshop, but also after or during the other workshops. However, even though I reflected and learned of these changes to improve the workshop quality, this was not the main aim of my research, and I did not perform a detailed evaluation ***of*** how changes impacted the final results (such as Kitchen & Stevens, 2004, 2008), besides the work in the next section.

Applicable adaptation of action research

To conclude though the scientific aim of the research was to compare the two approaches of ADM, action research was used to empower the participants, improve the workshop design and assist in the facilitation. I have used several elements of action research to improve my workshops. I believe that the use of this limited type of action research can be justified since it was needed to commit participants to the research and also improve the quality of the workshops. Since we did not have any earlier experience in organising ADM workshops, this also needed to be discovered. However, I also believe it was an excellent decision not to fully engage in action research by engaging more strongly with the participants. Since, it would have been challenging to compare the two approaches, without influencing the outcomes myself. The aim of the research was not to find a solution for the Parana Delta, but to make a comparison. Even though my usage of action research was relatively limited, my active presence still will have resulted in changes in the research outcomes. So, such as suggested in action research, an evaluation of the researchers' influence needs to be made, which can be found in the next chapter.

Implications of Action research

In the former section, the adapted form of action research is discussed and motivated. In this section, the implications of using action research will be motivated.

Influence of researcher

Marshall and Rossman (1999) highlight the importance to be aware and reflect on the influence the facilitator might have had on the research. Especially in action research, researchers should continuously examine their biases, and how these have affected their research, therefore a self-observation seems highly critical (Flick, 2006). Furthermore, they should examine how their actions have influenced the research outcomes (Herr & Anderson, 2005; Ritchie, Lewis, Nicholls, Ormston, & others, 2013). These will be discussed in this section.

Beliefs and values of the facilitator

In this section, I discuss how my initial beliefs and values have influenced the study approach and research outcomes. At first, my belief was that the “Action Approach” would work better, since people would find it very difficult to think about the future in Argentina. Due to the work of Hofstede (Hofstede et al., 2010), my own experience of the turbulent political and economic life in Argentina and it seemed unrealistic for people in Argentina to prefer long term planning taking uncertainties into account. I’ll reflect now how my initial

assumption may have affected the final outcome, that indeed the “Action Approach” seemed to function more appropriately than the ‘Scenario Approach”. One could argue that I steered towards this outcome myself. To limit my own bias and steering, I arranged an additional notekeeper (who was not aware of my hypothesis), and I cooperated together with the Student Sabrina Couvin. Her thesis aim was to have good outcomes of both workshops and also had a social activist approach. Since I wanted to support a good working relation with Sabrina, and also I wanted to empower all participants in both workshops, I tried my entire best to teach the participants about ADM. Furthermore, I wrote down my biases during the process and discussed these in honest conversations with Sabrina. Furthermore, I very critically analysed the reasons why the “action Approach” seemed to be more successful, with the entire team and by using the different research methods. The surprising outcome was that cultural influence seemed to be less critical than I initially expected. In this way, I believe I successfully prevented my own steering for a particular research outcome.

Furthermore, I expected a very dynamic group, after being present at earlier participatory work on the Parana Delta. Therefore, we decided to set-up relative small workshops with a maximum of 15 participants. Also, I expected people to have heated arguments with each other, which I had seen in other workshops, and therefore we spent time on rules and regulations in order to promote a relaxed workshop flow. I also expected participants to be motived, and for this reason, I included many games since I thought participants would react enthusiastically. In most of the workshops, participants seemed to like this, while in the last workshop I overestimated the enthusiasm of the group. I also expected participants to attend the workshops due to their interest in water management in the Netherlands, and therefore I stressed the usage of DAPP for the Dutch Delta Plan.

During the establishment of the set-up of the work most participants were positive about participating in the workshops. However, some seemed to have a different vision on our professional quality as woman engineers. Therefore, I expected that this could be a problem during the workshops, however luckily it did not seem a real issue, and even though maybe at times we were taken less serious by some men, we did not encounter any direct sexism.

Influencing actions of the researcher

Different influencing actions on the research outcomes can be found by the researchers. In appendix R.4 I have described all the influences of the researchers. I’ll describe the main point here. Both Sabrina and I pushed the participants to make the pathways. In the first workshop, the facilitators seemed very dominant in having the participants place the actions in a sequence. In the second workshop, the facilitators were very dominant in the selection of the actions. In the third workshop, the facilitators pushed the participants to place the actions in a sequence. For this reason, action 1 and action 2 was created. In the fourth workshop, the participants were also pushed to put the actions in a sequence; however, they did not listen too. Overall, it is essential to be aware that the dynamic elements in all pathways are highly influenced by the facilitators. However, in both cases, the facilitators seemed to push equally. However, we aimed to have participants themselves formulate actions and come up with solutions. For example, when participants asked me how the Dutch approach worked. I explained to them that by participating in the workshop, they would learn the Dutch approach, they could learn the process from me, but they themselves had to create the idea.

Maybe relevant to note as well, earlier participatory work by other ADM organizations seemed to play a role, and make participants already sceptical on the use of ADM at the beginning of the workshop, it was also challenging to invite suitable participants for the workshops due to this earlier experience.

Changes in workshop formats

Several changes were made to the workshops that might have influenced the results of the study, an overview of all the changes in the workshops can be found in Appendix R.1. The change that seems to have had the most impact is highlighted here. The particular exercise on Opportunities and vulnerabilities was taken out after the second workshop. In the last two workshops, opportunities and vulnerabilities were discussed instead during exercise of the system description. However, since no special attention was given to making use of the current opportunities, participants were less encouraged to think off solutions to make use of all current potentials of the Delta. Furthermore, specific vulnerabilities might have been missed. I believe leaving a specific exercise regarding vulnerabilities and opportunities out, was needed for the one-day workshops since a lot of vulnerabilities and opportunities were presented, which were not useful for the policy regarding dykes. Therefore, the vulnerabilities and opportunities highlighted in the first two workshops were actually not used at all in the pathway developments. Therefore, this change did not seem to influence the comparison between the workshops. However, in a more extended workshop, especially with more computational support, I would advise them because they could help to create ideas on the development possible benefits to using in the Delta, or additional vulnerabilities to take into account.

Ethical considerations

As McNiff and Whitehead (2009) highlight, it is vital to reflect on ethical consideration in social research. In this section, an ethical reflection is presented. Also, I discuss questions that trouble me after this research regarding this study and action research in general. I hope by giving a valid reflection, to be able to use these thoughts for their future work for myself and the readers of this thesis.

My first thought relates to the fact that I am already pre-supposed that the “Action Approach” would function better than the “Scenario Approach”. This turned out to be the case, and the participants that participated in the “Action Approach” seem much more empowered to use ADM, than in the “Scenario Approach” in their future work. I really believe in the value of ADM for the participants, and I might have discouraged participants to use the method. On the other hand, if I did not perform this research, the “Scenario Approach” would have been applied in Argentina and other participatory cases over the world for ADM planning. But we would have never known that the “Action Approach” would be more suitable. Also, it would have been necessary to test the usage for this adapted approach, because in literature ‘DAPP’ suggested first to investigate scenarios, and I could not have made another decision. Or, if the “Action Approach” would have been applied, due to the idea of cultural influence, the approach might have been applied wrong. the I still feel concerned with the fact that some participants are less likely to use ADM in the future.

Secondly, is it ethical to teach people a methodology, give them the feeling of empowerment, without a final project after that? Initially, I thought an ADM study would follow up on my work. However, this is not clear right now. On the other hand, the empowerment of the participants seems to construct several bottom-up approaches in the Delta already.

Thirdly, I assume that the main reason for participants to participate in the workshop was to ‘learn about the Dutch approach’. However, there does not seem to be one Dutch approach. I did not want to spend too much time explaining this, but should this not be made clear to the participants? I did tell honestly in by means of the invitation and in the workshops that were using DAPP, which was used in the Dutch Delta Plan.

Furthermore, the participants participated in the research in order to be empowered to teach ADM for their work. As discussed in the section on action research (8.1.3), it was not my core purpose to empower the participants. As actions research suggests if the research had to be set-up together with the population, in order to empower them to use the method

afterwards, maybe I ought to set-up my study more as training. However, due to the strict timetables of my participants, I was already satisfied that I could organize full day workshops.

As a final thought, does it even make sense to push participants to think long term, if they can barely survive in the short term? Of course, a long term plan is necessary in order to face future threats. However, the system in Argentina seems just to works very different. When a policy window opens up, it seems useful to take full advantage of this policy window and immediately take strong action, since the subject is on the political attention. Who am I to teach participants that it is better to wait taking action when actually it is against their own interest? Of course, one could argue that actually DAPP helps to keeps options open and prevent lock-in. However, in the framework taking full advantage of a policy window, even though it might limit to reach the objectives defined in the end, does not seem to be possible.

As could be seen after this discussion on the ethical dimension, not a hard critic can be given. I also discussed ethical implication upfront with supervisors and the Argentinean student. Still, I believe an ethical reflection in DAPP research is very valuable. Therefore, a possible suggestion would be to do an in-depth ethical analysis before the research, and evaluate which alternative design options are available for the research.

Threats to validity research methods

In this section, an overview is given which threats to validity could be found per research method impacting the main results.

Threats to validity Triangulation

The general understood aim of triangulation is that it can be used to investigate the convergence of the different data sources and the related conclusions (Decrop, 2013), leading to a validation of information, as suggested by several researchers (Campbell & Fiske, 1959; Jick, 1979; Patton, 2002, Yin, 2011). They claim that triangulation can improve the validation of the results by collecting different types of data. Ritchie and Lewis (2003) present two leading schools of critics to this claim. The school of ontology[1] criticizes triangulation that there is not one perspective of the world and trying to argue this by using multiple sources gives a wrong perception of reality (see for example Fielding & Fielding, 1986) . On the other hand by epistemologists[2] is argued that all methods have specific characteristics in terms of data they gather, making a valid comparison of the results unlikely. Both of these schools use triangulation merely to use different data sources to include a variety of visions and extending the understanding; they do not purely assume that the flaws of one method can be compensated by others (Ritchie & Lewis, 2003).

The epistemological argument, that methods have specific characteristics making a comparison on the data unlikely, could be seen. For example, the critical incidents and the pathways were situated in such a different format and gave a different type of insights that it is difficult to see them as comparable data sources. Also, the pathways only answered criteria regarding the quality of the pathways and the timing of the tipping points, while observation was also associated with the atmosphere and learning of the possibility. Furthermore, the methods are not independent of each other. For example, the observer describes the atmosphere in the workshops and the comments that participants make, while the outcomes of the workshop also depend on the atmosphere in the workshop. Also, when participants are able to construct suitable pathways, the atmosphere in the workshop may be better. In order to limit this issue, it was aimed to separate the role of observer and facilitator as much as possible so that the methods would not influence each other. However, in practice, as described earlier, this was not always possible. Another issue is that the observation and critical incidents analysed the workshops with the same input. However, the observation was done during the workshop and critical incidents with the entire workshop team after the workshop. Therefore, the methods giver different insights at times, but the methods can also be seen as almost similar sometimes.

Reflecting on the epistemological argument, it seems to be important in the data analysis to see how the methods influenced each other or have overlap. In this way, the same data will not count double. However, since in my case I reflected well in the results how the data sources had an overlap, and all data sources seem to highlight the same conclusion. Therefore, the insights of the different data sources can give greater confidence in my conclusion, as suggested by (Modell, 2009).

The ontological argument regarding the existence of multiple realities seemed more difficult to reflect on due to the epistemological set-up of this research. However, clear

[1] Within social research, ontology concerns itself with the being of the social world. The main important questions of concern are: Does one single common shared social reality exist or is the social system constructed by a variety of beliefs and realities of the world (Ritchie & Lewis, 2003)?

[2] Within social research, epistemology concerns itself with how learning and knowledge takes place in the social world. Important questions of concern are how can we know about reality and what is the foundation of the knowledge system we have (Ritchie & Lewis, 2003)?

different perceptions could be seen of the participants when constructing the water system, the vision, the threats and vulnerabilities. This is the core of the related MSc.. Thesis for the MSc.. Water management. This may promote the claim that if already not one entire system understanding can be made, how the different data methods can evaluate one system. However, it was not the aim of this research to investigate the system, as of the MSc., Water management; the aim here was to compare the methods. Therefore, I believe that the insights brought by the different data sources will all be valuable for the comparison.

Moreover, Jick (1979) shows the often poor application of the method in which only specific results of the methods are presented, but not detailed version including for example intensity, dynamics etc. of an observation. In this study, it is aimed to limit this issue by written a detailed data report per research method. Since in actual research practices scholars have to take a more flexible approach (Modell, 2009). Finally, methodological critics on the method can be found that it seems almost impossible to reproduce the study if so many methods are simultaneously applied (Jick, 1979) . However, this critique can be made for every case study, and therefore does not seem relevant. By describing all the methods in the methodology, and adding a detailed appendix on all the methods, reproducibility of the study is aimed to be shown in this work.

Based on all these critiques triangulation is less seen as a validation method, however more as a strategy to justify and receive underpinning knowledge (Flick, 2006). However, this discussion regarding epistemological and ontological arguments, if triangulation can increase the validity of the study, does not seem to play an active role in this study. All the methods seemed to give interesting insights for the comparison of the two approaches. However, to prevent double counting, I clearly highlighted the overlap between the methods in the results section. I presented detailed data reports on the research method, in order to set up good and sound research.

Threats to validity Comparison Pathways

Regarding the comparison of pathways also limitations can be found. Firstly, often motivations of participants for decisions on pathways were not clear; it is possible to pathways which I considered by the criteria as illogical, might have made perfect sense for the participants or in the situation. Criteria constructed might not have been suitable for Argentina, or I might have misunderstood the participants when constructing the pathways with them. Furthermore, a high influence of the results by the facilitators could be found; it is difficult to understand how strong the influence was of the facilitators. In order to address these issues, I discussed the pathways together with Sabrina after the workshop, and a report was written (in Appendix R.2), to address all the influences of the pathways. Results of pathways, with a strong facilitation influence, are addressed and taken into account in the final conclusion of the work.

Threats to validity Observations

Several limitations can be found in the method of observation that may have affected the research outcomes; these limitations are associated with the validity and reliability of the method. The validity of the method relates to if a method reflects the concept for which it had been designed to measure and if an error arises when implementing the measure in the research process (Bryman, 2016). Reliability expresses if results are interpreted correctly. The influence these limitations had on the research outcome will be discussed below.

Regarding the validation criteria ‘fit to design’, the observation was useful to understand the reaction from the participants on the method, regarding their discussions on the use of the method for future use, and record their discussion on the pathways. Even though it was

not possible to grasp all information; it seems that the main issues could be answered by means of observation. A weakness of the method is that the 'natural' behaviour might be replaced by 'strategic' behaviour of the participants due to the presence of the observer(Winstanley, 2010). However, the influence of observation presence seemed to be limited on the group, in relation that the facilitator had.

Regarding the second validation criteria of correct implementation, Flick (2006) highlights to reflect on how much the observation should be revealed to those that are observed. In the beginning, I mentioned I was investigating how to adapt ADM for the Parana Delta, and I made notes during the workshop. Only in the last workshop, the participants seemed to be more aware of the fact that they were observed, and asked why I was filling in smileys. I politely tried to explain that I was trying to see how they were reacting, to understand which aspects the method should be adapted. However, possibly this would have disturbed the atmosphere in the workshop. Also, participants mentioned that they did not want to give actions as outcomes since they were afraid that these would be published and this would impact the Argentinean politics. Furthermore, in the first and second workshop participants asked in a discussion regarding partners in the delta and problems, if the audio tape could be turned off.

Regarding the reliability, the observation may be subjective and mistakenly assigning the way a person is behaving to the situation (Winstanley, 2010). This is aimed to be addressed by having two observers, combining the observation forms, and discussing the observations afterwards with the facilitator: inter-observer consistency (Bryman, 2016). Also, observations were done over the entire workshop to understand better the social system: intra-observer consistency (Bryman, 2016). However, it sometimes could be confusing if participants were tired or did not like the workshop. It was aimed to write down their behaviour as neutral as possible.

Overall, the aspects mentioned regarding the validation and reliability do not seem to influence the results of the main question for comparing 'Approach Scenario" with "Approach Action" significantly.

Threats to validity Surveys

Two different main limitations of the survey can be found: the non-response and socially wanted answers. As shown in the results chapter a high non-response could be found for the "Scenario Approach." As suggested in the results Due to the strong non-response the comparison of results of the surveys is less valuable, making its contents difficult to use in the analysis. However, the non-response seems to give a valuable insight that the participants did not seem satisfied after the workshop, possibly frustrated and that they did not fill in the survey. Many participants did not want to hand in the survey after the workshop, but they promised to send it afterwards. Showing that the respondents were much more willing to give feedback after the "Action Approach".

Furthermore, many experts participated in the workshops, which already showed an interest in the methodology by coming to the workshop. Also, many participants seemed to know each other and seemed to want to collaborate further with the Dutch. They might give socially wanted answers or might want to give themselves the idea that their time was well spent (van Vliet et al., 2012). According to some studies, individuals are only partly aware of their own perspective and how it changes over time (van Vliet et al., 2012). However, similar to the work of van Vliet et al. (2012) it is likely that the impact of this low awareness will be more or less the same in all workshops and will thus have limited impact on the overall analysis as conducted here.

The first discussion point of non-response seems to suggest that the non-response can be used as an argument that the workshop should not use as a dominant data source in conclusion, but that it also seems to show that people were more satisfied with the "action

Approach" due to their additional time given to the researchers for feedback. The second point of socially wanted answers seems to have limited effect on the research.

Threats to validity Critical incidents

Regarding the usage of critical incidents different limitations of the use of the method can be found; these are summarized the table below. Also, it is explained how these limitations are handled.

Firstly, The method does not address the issues of personality, keeping Hofstede's (1991) definition of culture in mind as collective programming (Witteveen & Enserink, 2007). This issue was addressed by writing different notes on how personality might have influenced the results in the observation. In this way, a cross-validation could be made. Secondly, a drawback is that critical incidents theory (CIT) relies on observers to recognize, remember, and report these incidents accurately (Witteveen & Enserink, 2007). This is addressed by immediately after the workshop describing the critical incidents with the entire team. However when other participants drove with us back in the car, this could not be done, and up to a few days later, the reflection could be made. However, after the workshop observers and facilitators were extremely tired, they get up very early, and the workshop was highly intensive. This might have given a worse quality of results. For this reason, the critical incidents were evaluated a few days later again. Furthermore, sometimes the incidents could be evaluated based on societal motivations, but also maybe the participants acted in a certain way since the facilitation was not good enough. Therefore, for each of the incidents is described if the influence could be based on the characteristics of the group or the system, or if the facilitation played a significant role. Afterwards, in a meeting with the Argentinean supervisor who had experience in workshops in Argentina, the influence of the facilitators was discussed on the incidents. In the final presentation of the critical incidents this critique is mentioned. Finally, Since I'm Dutch and evaluate the application of a Dutch method, the incidents are interpreted from my Dutch perspective (Witteveen & Enserink, 2007). It might be that by the participants of the workshops entire other critical incidents would be highlighted. However, by discussing these incidents with the Argentinean supervisor and the workshop team the influence of these incidnets could be limited.

As could be seen a solution was implemented for each of the criques on the incidents, and therefore the incidents seem to be valuable to be used for making insights on the main question and conclusion.

B5: Suggestions for participatory ADM

Given the detailed analysis throughout the thesis, next to making conclusions on the main research question other conclusions can be made as well regarding DAPP or ADM usage in the Parana Delta. These will be highlighted in the following chapter. Based on each research methods notes were made regarding aspects relevant for DAPP. For simplicity, instead of highlighting the results per research method, the points of discussion of DAPP are presented here together based on the entire research. Furthermore, for each discussion point, literature is sought to reflect on the occurrence of the discussion point in other studies as well. Afterwards, a reflection is given for the usage of DAPP in the Parana Delta.

In this section Discussion points for DAPP, based on the results of observation, critical incidents, surveys and workshop outcomes are discussed. These are summarized below.

Static short term actions

The first point of discussion relates to the choice of actions of the participants. The participants seemed to find it difficult in both cases to relate to and use dynamic, adaptive solutions with long term strategies. Even though, as shown in the results section, in the 'Action Approach', the selected actions were more adaptive and different strategies could be differentiated, also there more static solutions were proposed.

Firstly, many actions were related to short term implementation. The participants showed that the current system is already not functioning well. The participants preferred to spend the resources on an improvement of the current system. However, they were mostly suggesting preparatory actions as additional research, zoning, the instalment of an early warning system etc. They preferred to use the did not seem to give a possibility to include these actions. ADM seems to be focused on providing strategies in order to reach long-term objectives, given certain uncertainties. However, in the Parana Delta, the current system is not functioning correctly. This implies that the actions that are suggested are related to improving the current situation. The participants prioritize the actions to the actions which need to be implemented most urgently, and which actions they can wait a few years. However, with sufficient funding, they would immediately implement these actions. in DAPP (Marjolijn Haasnoot et al., n.d.) is assessed when the status quo is not functioning properly anymore. However, what if the current situation is already not functioning well enough? The approach does not seem to give attention to this problem. The DAPP framework does not give a possibility to set out preparatory actions in time based on urgency. This aspect is addressed in adaptive management; it tries to analyse how the primary challenge is forming knowledge for future implementations, while also having successful short term outcomes based on current knowledge (Allan & Stankey, 2009). While, with DAPP due to the high orientation of the future

(Timmermans et al., 2015), it already seems to imply a well functioning current system (Andrew Warren, 2018, personal communication).

Secondly, different adaptive strategies were very much pushed by the facilitators, and the participants only seemed to accept these when they were continually pointed out that they had to keep uncertainties in mind. The participants disregarded all long term dynamic actions as increasing of the dykes, room for the river, which are large structural decisions. In such types of strategies, ADM would have value. Often they were principally against the creation of dykes, even though they highlighted that individual levels farmers would construct these. Room for the river and floating houses did not seem to be applicable here. New adaptive strategies were not suggested by the participants. In some cases, the participants accepted the proposed strategies, once the facilitators pointed out the need to consider uncertainties. In order cases, the participants said the facilitators could write them out, but they would not consider them in reality. It is difficult to assess at this point if the strategies indeed were not well for the Delta, that participants simply had difficulties in accessing the long term future or that the methodology was to difficult.

Regarding the difficulties to access long term futures it might be explained by culture dimensions (Hofstede et al., 2010), however in the similar study in Sweden (Carstens et al., 2019) it was also found that participants preferred static actions, and they used uncertainties to justify their short term actions, instead of using it to explore the decision space. Also, (Wise et al., 2014) show that the actions that are implemented in ADM approaches are mostly focused on incremental change and less on large societal change. Carstens et al., (2019) give an explanation for this that the participants preferred static solutions since they did not see possibilities for enforcing static solutions in their plan. This aspect was not mentioned by the participants.

However, the other explanation of Carstens et al., (2019) that the methodology was found relative complex due to the limitation methodological knowledge it would be difficult to highlight in an everyday application. Also, Bosomworth et al., (2017) highlight that the simplicity of the pathways approach will be lost due to it complex development of numerous actions, with different drivers and uncertainties in the application of a real life situation. As I have tried to argue in the previous chapter, the ‘Action Approach’ would function better due to its learning effects, but possibly the methodology is in both cases too complex.

Finally, Participants mentioned that they are used to make short term plans since with a new government all the regulations and plans will change (every four years). For this reason, they do responsive planning. Also, after an emergency more money is available. Is it wise to make plan the actions so long term for the Parana Delta, if the next government will make a new plan? Is it not more useful to roughly think about the long term, but go more in detail in the short term actions. Since for responsive actions, money is available. As the participants highlighted, tomorrow the government of Argentina can completely change, and also the funding issue is a real problem. Notably, unstable governmental structures do not seem to guarantee a successful continuation of the project. This was also seen as one of the main barriers to implementation by (Aguiar et al., 2018) for local adaptation in Europe. As

Timmermans et al. (2015) show that DAPP is least focused on the present, as the other theoretical foundations of ADM., the approach is highly orientated on the future. In this way, a short term orientation of culture does seem to play a role. However my point of discussion is here, does it seem to play a role as the way the participants think themselves, or is it the political system which with they have to live? Of course, the two are related, but the type of participatory work that needs to be organized will depend on this question.

Objective formulation

Participants seemed to have significant issues and trouble in formulating key performance indicators (KPI's) and quantifying these. The same issue was found by (Carstens et al., 2019) in their application for Swedish medium scale towns. They found it challenging to formulate the main goals and criteria that were both specific, but agreeable for the participants (Carstens et al., 2019). (Bosomworth et al., 2017; Wise et al., 2014) show that among others, the presence of relatively limited and uncontested goals is a limitation of DAPP.

In order to specify the objectives for the KPI's first a vision of the Delta was created. Participants mentioned that they found it difficult to make a vision since in Argentina so many things can go wrong, that they did not have the feeling they could create a future for the Delta they wanted to have. Also, the participants have a feeling that they have limited power for changing the system. However, in the evaluation of the workshop participants also mentioned that participating in the workshop empowered that to change the system themselves, while until them due to the turbulent political and economic dynamics in Argentina, affecting the lives of many people, they had the feeling they could not be in control themselves.

Then, in the development of objectives based on this vision, participants had great difficulties in developing these. Wise et al. (2014) criticizes the pathway approach to focus only on context with unambiguous goals, and not able to handle a more complex context of multiple conflicting objectives. Such a context can be found in the Paraná Delta. However, it might also be explained by the fear of some participants that this research would influence further development in the Delta, and therefore they only wanted to make a well-considered decision. Or possibly culture played a role, and participants had difficulties in framing long term objectives. Furthermore, participants wanted to change objectives also during later stages of the process, this is also highlighted by (M. Zandvoort et al., 2017), that in the Portugees participative study a constant debate took place regarding the redefinition of the objectives.

Many uncertainties

Most studies that are found for the application of ADM in workshop format only handle a limited amount of uncertainties on the tipping point axes (see for example Marjolijn Haasnoot et al., 2013). However, in the Parana Delta, many uncertainties can be found both regarding the technical system and the social system. For the technical system, the following main uncertainties are highlighted: Influence of Sudestada, the frequency of Sudestada, the height of Sudestada, increase/decrease in rainfall Delta, Increase/Decrease flow Parana and the Influence river Uruguay. Furthermore, little knowledge exists of for example the influence of the dykes, the sediments etc. For the social system, the main uncertainties can be found as well as the government presence in the Delta, the price of soy, wood, houses, the creation of infrastructure, the popularity of the Delta to live, tourism, the social conflict that can occur,

the change of livestock to agriculture, the price of a manhour in order to construct dykes can be seen. All these uncertainties influence different scenarios. However, in the workshop the scenarios were build up of 2 axes; however, in reality, the scenarios are much diverse. Moreover, the social-economic component in the scenarios, describing a pressure for economic growth in the Delta seemed to confuse the participants a lot, since socio-economic development also depends on endogenous variables as the number of dykes, affecting the wood prices.

Most importantly, for the overarching tipping point condition in the Delta, was very difficult to determine. While the tipping point condition influences the actions to take to achieve the long term objectives. This is also highlighted by (Chris Zevenbergen et al., 2018) since in their study to Bangladesh they highlight that much more uncertainties can be found, and in the Dutch context only a limited range of uncertainties can be found. Therefore, they advise adapting the framework to embrace a variety of uncertainties. Also, (Wise et al., 2014)

Decision trees may form a solution in handling the high amount of uncertainties in a workshop format. By using the decision tree schematic (Ray & Brown, 2015), in which by suggesting different decision steps uncertainty of climate may be addressed at first by going to a tree of detailed modelled steps, suggesting the formulation of different models, and as a final step the inclusion of an ex-post scenario elaboration, followed by a methodology of decision making under uncertainty (Ray & Brown, 2015). Also, ideas could be found in decision tree induction, Classification and Regression Trees (CART) (Breiman, Friedman, Olshen, & Stone, 1984), these could help to focus on the relevant or limited uncertainties.

Who is the actor?

For the implementation of the Delta Plan in the Netherlands one governmental authority 'the Delta commission' can be found (Deltacommissaris, 2018). However, the Parana Delta consists of 18 municipalities and 3 provinces. These have much different legislation. A limited amount of planning instruments are present, and the general basin authority lacks all power. The delta is a bit wild west. Farmers take individual actions as building dykes. This means that all actions are individually done in the Delta; the government has minimal control. This can also imply that some actions might harm other individuals how these people should be compensated if not one clear authority exists. The DAPP framework seems to suggest one main actor making decisions, while the reality of the Parana Delta is that of many actors that are in conflict with each other.

This argument can also be traced back to the literature. Timmermans et al. (2015) show that DAPP is more unicentric than the polycentric approaches to transition management and adaptive management. In which numerous interdependent stakeholders are considered, instead of one single decision maker. Furthermore, it gives less attention to the process of decision making than the other approaches presented in the literature study of Timmermans et al. (2015). This is also shown by Wise et al. (2014) and (Bosomworth et al., 2017), that most pathway approaches assume a clear decision maker and enabling governance.

It seems that in the complex delta as of the Parana the relative unicentric framework of DAPP seems to have some limitations**.** Several adaptations to the framework are proposed to

address these issues. Rosenzweig et al. (2011) have developed an approach of flexible adaptation pathways, which has high similarities with DAPP, but also a strong focus on the scientist's stakeholder process. The, for example, it describes how to include decision makers from various levels and how to include uncertainties to the general public. In this was small actions could take place, as well as large transformative actions of global change. Also, transition management highlights that the system main contains multiple domains, levels and actors, and focuses on a transition including all these domains by including a transition area (Loorbach, 2010; Loorbach & Rotmans, 2010). These concepts be might be useful in the case of the Parana Delta. Wise et al. (2014) show that in adaptation pathways have been focused on simplistic thinking of a mono identified decision maker. However, they highlight that in reality the context is much more complex and various actors can play a role. These actors can have vested interests, might constrain other actions. In the Parana Delta clearly, vested interests of several actors could be seen in their high dominance in the planning of the Delta, even the participation of this study did not seem to be welcomed. But even though these actors are not part of a governmental organization, they seem dominant in the steering of the decision-making process. An alternative to the adaptive pathways could be 'pathway thinking' which might enable to investigate next to the implications of climate change also change due to drivers and other actors responses . However, this approach seems much more complicated in my view for local participants to handle but could form a value for academics working on the Parana Delta. On a more higher level, In order to address the issue of such a complex socio-cultural and institutional system van der Brugge & Roosjen (2015) add additional dimensions in the analysis of the strategies to highlight the different actions of the different actors and their position to each other. Furthermore, they highlight how institutions would change in different scenarios.

Refreshing seems to be the study of (Murphy et al., 2017) in which is highlighted that ADM should not be seen as an end product but as a process, but part of a pathway of social change in an actual socio-ecological landscape. They highlight that social-change is poorly theorized in pathway approaches. Notably, in the context of Parana Delta this seems to be interesting since many different development efforts are taking place, top-down, bottom-up, as a chaotic transforming network. Also, this study can be found in this turbulent social change system. I believe it would be a great value if ADM would try to position itself in the organic change that is already happening inside the system. For example, by participating in the workshops, some stakeholders will already apply ADM to their case areas. (Murphy et al., 2017) propose a situated pathways approach taking into consideration how cultural and political dynamics animate diverse trajectories of change over time. The work especially seems interesting for communities were existing livelihoods are unlikely to be maintained (Murphy et al., 2017). Since the vulnerable communities of the Delta, in this case, may not be sufficiently be protected in the general DAPP framework.

Not a separate system

The case study turned out to not be a separated system. It was connected to the rest of the Parana Delta by means of natural processes, due to the growth of the Delta and its proximity to the city of Buenos Aires, due to the migration of its inhabitants and the influence of the

surrounding communities to the continent and due to international wood prices to the broader international area. It was difficult to firstly select therefore a defined case, and also find solutions for this case during the workshops. Notably, the complex legal environment turned out to be an issue. However, this is not only the case in the more turbulent context in Argentina, but it was also highlighted by Wise et al., (2014) in their overview of different applications, and by Carstens et al. (2019) in their Swedish case study. My case and these other examples, clearly highlight that adaptation are not separable of its surrounding context, and other legal and sectorial constraints also play a role. Local adaptation is influenced by other interventions, of multiple scales and multiple times (C. Zevenbergen, Veerbeek, Gersonius, & Van Herk, 2008).

As could be shown the different findings of this research, could be confronted with literature, and many new interesting insights could be found. This might give new interesting suggestions for future research.