



Mekong Delta Plan



Long-term vision and strategy
for a safe, prosperous and sustainable delta

The Socialist Republic of Vietnam and the Kingdom of the Netherlands have signed a Strategic Partnership Arrangement on Climate Change Adaptation and Water Management (October 2010). The Mekong Delta Plan has been produced under this arrangement.

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Preface to the Mekong Delta Plan

The Mekong Delta stands at crossroads.

In the past decades, the Mekong Delta successfully developed into the granary of the country and turned Vietnam into one of the leading rice exporters globally. Recognising the need for higher income generating possibilities in the agricultural sector, in 2000 the Vietnamese government introduced a policy on agricultural diversification which shifted production from rice mono-culture to a more diversified rice-based farming system which includes aquaculture, fruits and horticulture. In recent years, the region has been committed to official government development objectives for the Mekong Delta in becoming a balanced multi-sector economy with increasing urbanisation and industrialisation. However, despite all efforts, industrial development in the Mekong Delta falls behind and actual developments are deviating from existing government policies aimed at high-tech agricultural development and full exploitation of the competitive advantages of the region.

Due to its geographical situation, the Mekong Delta is likely to be severely affected by the adverse impacts of climate change. Peak flows and river floods are set to increase in the wet season. Decreases in dry season flow may lead to serious fresh water shortages. The sea level will rise and saltwater intrusion will further increase, subjecting large areas of the coastal delta to a brackish environment. Transboundary developments may further aggravate the stress on land and water resources.

Socio-economic developments determine to a large extent the ever-increasing pressure on the delta's land and water resources, even more than climate change. Developing an appropriate strategy to mitigate and adapt to these changes has become crucial. The Government of Vietnam has since long recognized the vital role of water as a key natural resource for the development of the Mekong Delta. In 2008, the National Target Program respond to Climate Change (NTP) was issued with the main strategic objective to assess climate change impacts on sectors and regions, and to develop feasible action plans to effectively respond to climate change in the short- as well as the long-term. It is this task that is also at the heart of the Vietnamese – Netherlands cooperation on the Mekong Delta Plan.

The premise for the Mekong Delta Plan is to contribute to realising and maintaining a prosperous delta, both economically and socially, in which its population can thrive in a vigorous and dynamic economy that is founded on sustainable use of its natural resources, and well adapted to changes in water resources and climate. It spells out what uncertainties and challenges confront the delta from now to 2050, and from 2050 towards 2100, and presents a clear long-term vision towards Agro-Business Industrialisation as a promising future strategy. Taking into account the existing government policies and the institutional framework, it is recognised that the orientation for the agricultural sector in the delta needs to shift from a focus on production towards a focus on added value by improving the product-value chain, involving public-private partnerships and introducing market-based mechanisms. The Mekong Delta Plan includes 'no-regret' and priority measures, as well as measures that can be deferred towards the longer-term that Vietnam could adopt to ensure a safe, prosperous and both economically and environmentally sustainable and climate proof future for the delta region.

The Mekong Delta Plan is presented as a reference document for Government agencies and organisations at all levels. As such it provides a tool to support the review, coordination and integration of present and future master plans as well as a guideline towards implementation. Its findings are also important for the international development partners, universities and research institutes, potential domestic and foreign private investors as well as for a broader audience of individuals and organisations committed to the sustainable development of the Mekong Delta.

December 2013



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1 Introduction

Deltas, some of the largest sedimentary deposits in the world, are widely recognised as highly vulnerable to the impacts of climate change, particularly sea-level rise and changes in runoff, as well as being subject to stresses imposed by human modification of catchment and delta plain land use. Most deltas are already undergoing natural subsidence that results in accelerated rates of relative sea-level rise above the global average. Many are impacted by the effects of water extraction and diversion, as well as declining sediment input as a consequence of entrapment in dams. Delta plains, particularly those in Asia, are densely populated and large numbers of people are at risk as a result of external terrestrial influences like river floods, sediment starvation and external marine influences like storm surges and erosion¹. The Mekong Delta ranks amongst the top 5 deltas in the world most likely to be severely affected in terms of climate change. The development of an appropriate strategy to mitigate and adapt to these changes has therefore become crucial for future generations in the Mekong Delta. This requires a willingness to address strategic socio-economic planning and spatial and water resources management in a collaborative and holistic way.

1.1 Vietnam - Netherlands cooperation on a Mekong Delta Plan

It is this challenge that is at the heart of the Vietnamese – Netherlands cooperation in the Mekong Delta. The government of Vietnam has since long recognised the vital role of water as a key natural resource for the economic and social development of the delta. In the recent years, major programs have been initiated to improve the performance of the water system. Inspired by the recent (2008) experiences in the Netherlands, the Government of Vietnam expressed the strong intention to work towards a Mekong Delta Plan for a safe, prosperous and both economically and environmentally sustainable and climate proof development of the Mekong Delta.

The Kingdom of the Netherlands and the Socialist Republic of Vietnam have a strong history of cooperation in the field of water and coastal zone management. One important example in development of the Mekong Delta has been the Mekong Master Plan (Nedeco) in 1993.

In October 2009, the Vietnamese MARD, MoNRE and the Dutch MIE² signed a Memorandum of Understanding (MoU) for cooperation until 2015. Participants agree to broaden the existing cooperation in the field of integrated river basin management and coastal zone management between the Socialist Republic of Vietnam and the Netherlands, into a long-term cooperation based on equality and mutual benefit. Parties agreed on concentrating their cooperation at the Mekong Delta and the Vietnam Southern Key Economic Zone (SKEZ).

In January 2010 the MoU was followed by a formal request from the Government of Vietnam for assistance of the Netherlands in developing a Delta Plan for the Mekong Delta. In the Strategic Partnership Arrangement between The Government of the Socialist Republic of Viet Nam and The Government of the Netherlands on Climate Change Adaptation and Water Management (October 2010) the two countries explicitly agreed to "closely cooperate on developing an integrated long-term Mekong Delta Plan, to respond to the consequences of climate change and to ensure the sustainable socio-economic development".



Strategic Partnership Arrangement
between
The Government of the Socialist Republic of Viet Nam
and
The Government of the Netherlands
on
Climate Change Adaptation and Water Management

¹ Intergovernmental Panel on Climate Change (IPCC, 2007) Assessment reports 10 Asia Working Group 2, Impacts, Adaptation and Vulnerability

² Ministry of Agriculture and Regional Development (MARD), Ministry of Natural Resources and Environment (MoNRE) and the Ministry of Transport, Public Works and Water Management now the Ministry of Infrastructure and Environment (MIE)

1.2 From sectoral master planning to strategic integrated delta planning

The Dutch developed their first Delta Plan after the 1953 flood disaster in the south western delta of the Netherlands. The Dutch responded with a firm plan with a wide range of concrete measures for coastal protection, water availability and water quality in view of the future economic development of the country. Based on the experience with the Dutch Delta Plan 1953, the Dutch have assisted Vietnam in making the Mekong Delta Master Plan in 1993 (Nedeco), which has been a successful instrument in a period of economic progress in the Mekong Delta.



Figure 1-1 Dutch Delta Plan 1953 and the 1993 Mekong Delta Master Plan

In 2008 it became clear that climate change is forcing itself upon the Netherlands: a reality that cannot be ignored in light of the country's vulnerability to flooding. The predicted sea level rise and greater fluctuations in river discharge compelled the Netherlands to look far into the future, to widen the scope and to anticipate on developments further ahead. The government appointed a 'new' Delta Committee with the mandate to formulate a vision on the long-term protection of the Dutch delta. The mandate was much broader than that of the first Delta Committee. Just after the 1953 flood disaster, the Committee's primary concern was a reliable flood protection by hydraulic engineering works. Anno 2008, maintaining a high flood protection standard remains important, however the challenge is in developing a balanced programme with combined structural and non-structural measures. And also in creating the necessary institutional arrangements, in mobilising and securing the funding needed for implementing and in strengthening the administrative coordination decision making by the competent authorities.

"If we want to be well prepared for the expected consequences of climate change, we shall have to strengthen our flood defences and change the way our country is managed, both physically and administratively. Our Committee's mandate is therefore unusual: we have been asked to come up with recommendations, not because a disaster has occurred, but rather to avoid it. The nature of the advice requested is also unusual: to present an integrated vision for the Netherlands for centuries to come." (Dutch Delta Committee, 2008)

The Dutch Delta Plan 2008 is by no means a master plan similar to the Delta Plan 1953, as the 2008 Delta Commission's goals were:

1. To present a long-term vision and coherent, integrated advice to keep the Netherlands safe from floods and effectively deal with the consequences of climate change up to 2100;
2. To share among all relevant decision makers a strong sense of urgency that measures and action will be needed on the short-term to address the challenges of the longer-term;
3. To ensure that the strategic advice and key recommendations would be adopted and translated into a long-term *Delta Program*.

Likewise, the Mekong Delta Plan 2013 will not be similar to the previous 1993 master plan. The Mekong Delta Plan aims to be a strategic advice concerning the integrated long-term development of the Mekong Delta.



Figure 1-2 The Dutch Delta Plan 2008 and the Mekong Delta Plan

Similar to the Dutch Delta Plan 2008, *existing* knowledge will be extensively used for the production of a sound Mekong Delta Plan. The relevant knowledge concerns a wide range of disciplines that relate to land use, natural (water) resources management, social and economic developments affecting land and water use, climate change, developments more upstream in the river basin and scenario planning. The need for integration of decision making is reflected in the approach for the Mekong Delta Plan: all involved sectoral ministries, provincial and municipal governments; experts with different backgrounds and national and international stakeholders are consulted. Consent is sought on the development direction to be pursued.

In 2008 the Dutch Delta Committee advised the government on very fundamental issues for the next decades. The advice comprised both physical and governance measures and the securing of financing:

1. Continuation and intensification of flood protection measures and raising of flood protection standards;
2. Major measures to ensure fresh water supply;
3. Development of a comprehensive, coherent and long-term Delta Program;
4. Establishment of a Delta Act (to create the necessary institutional arrangements);
5. Setup of a Delta Fund (to mobilise and secure the funding needed to implement the program);
6. Appoint a Delta Commissioner (to coordinate the Delta Program).

Dutch government and parliament have positively responded to the advice. The Delta Act went into force on 1 January 2012. A Delta Commissioner was appointed in 2010. Currently, the Delta Commissioner is preparing the Delta Program 2014, i.e. the political decisions that will shape national water policy in the years to come.

In establishing the Mekong Delta Plan, similar issues will be important in the formulation of a sound strategy. These issues will have to be elaborated in a subsequent operational phase (set-up 2014) in which the strategy needs to be detailed and implemented.

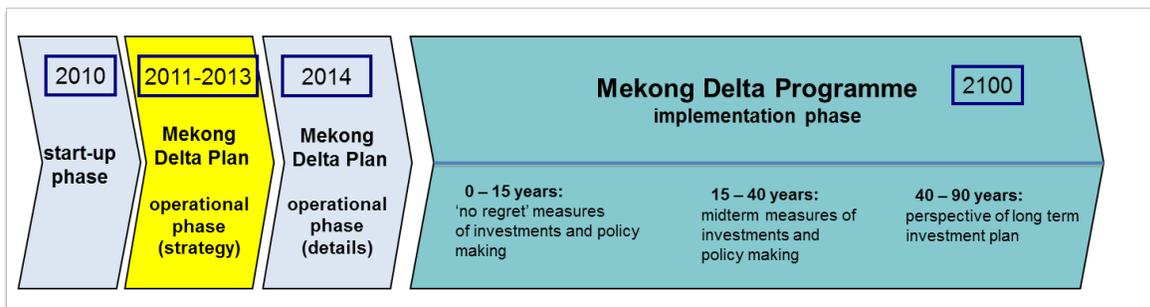


Figure 1-3 Planning schedule for the Mekong Delta Plan and the following Mekong Delta Program



2 Approach for making the Mekong Delta Plan

2.1 Mekong Delta Plan has extraordinary position in planning system Vietnam

The Mekong Delta Plan aims to develop a long-term strategic vision towards a safe, prosperous and sustainable delta, including policy recommendations and ways of solutions. As such, the Mekong Delta Plan is an reference document for the Vietnamese government in reviewing and where necessary revise its socio-economic development planning, spatial planning and sectoral master planning for the Mekong Delta as well as a guide future decision making, legislation and investments in the Mekong Delta. The Mekong Delta Plan is not a master plan. It is also not a social-economic development plan or regional target program. The Mekong Delta Plan has no formal status in the Vietnamese administrative system other than providing strategic advice to the Government of Vietnam. In this sense, this Mekong Delta Plan document stands for the start of a *continuous planning process* for the Mekong

Box 2-1 Mekong Delta Plan in Vietnamese

It is argued that Mekong Delta Plan can best be translated into Vietnamese either as "Kế hoạch đồng bằng sông Cửu Long" or as "Quy hoạch đồng bằng sông Cửu Long". MoNRE has chosen *Kế hoạch* as the best translation. Considering pros and cons, the main conclusion is that the Mekong Delta Plan is something new in the Vietnamese planning system, doesn't exactly fit the current definitions for plan(ning). Therefore the Mekong Delta Plan should be regarded and assessed on the merits that it brings as a new approach.

Delta in which an expert analysis of the delta leads to a long-term vision on how the delta may best develop.

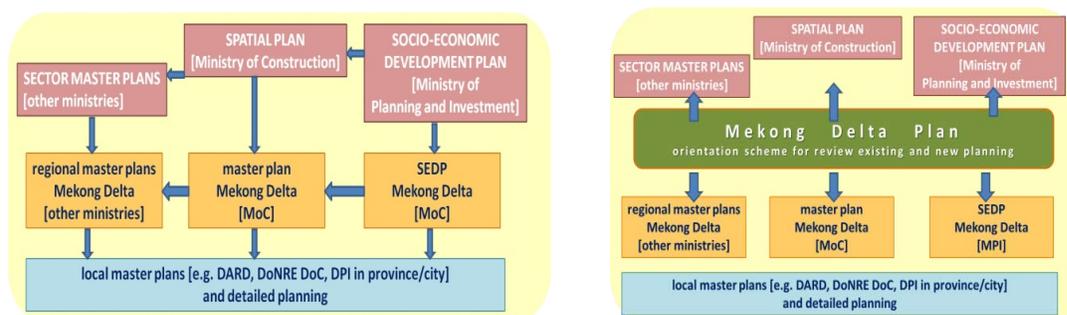


Figure 2-1 Present way of master planning. The Mekong Delta Plan is the start of a long-term planning process; as such it will serve as an orientation scheme for revision of existing and making new flexible (master) plans, taking into account potential autonomous, desired and undesired long-term developments. The above image does not necessarily propose the formal position of the MDP. As a strategic – key – advice to the Prime Minister, the adoption of the MDP approach should have implications on all master plans for the Mekong Delta.

The Mekong Delta Plan is based on existing knowledge of and expertise on the state of the delta and has translated this into a range of strengths, weaknesses, opportunities and threats facing the Mekong Delta. The Mekong Delta Plan has applied the tool of scenario planning to look ahead into possible futures, taking into account (and building on) the fact that the future is not certain and cannot be exactly determined. Using different scenarios, the Mekong Delta Plan identifies a desired future, a commonly shared and supported, strategic long-term vision on the Mekong Delta. This vision constitutes the main reference for exploring possible solutions and measures that can be taken (short-term, no-regret as well as mid- and longer-term). This methodology to develop the Mekong Delta Plan is further explained in the paragraphs below.

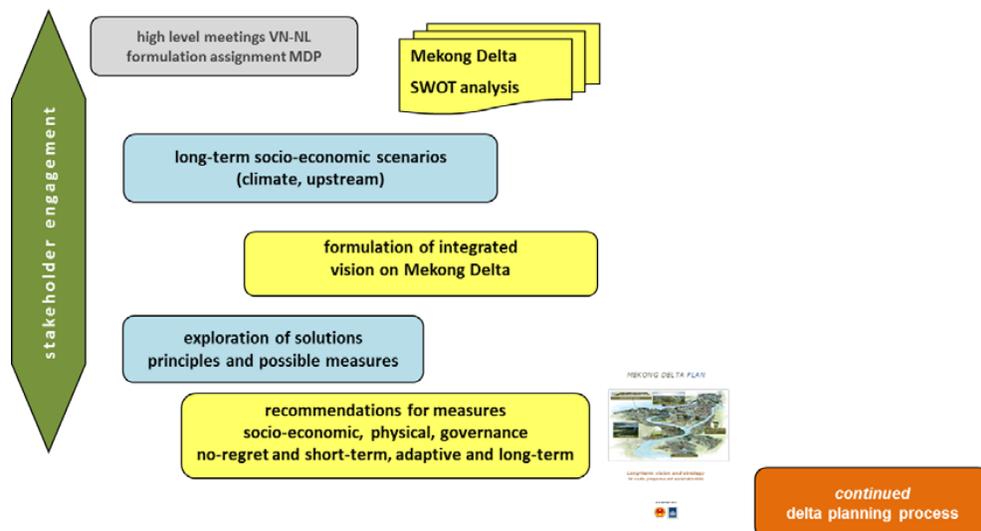


Figure 2-2 After Vietnam and the Netherlands agreed in the high level meetings (2010/2011) to make a Mekong Delta Plan, the process of making a Mekong Delta Plan includes the main steps as indicated in the above figure.

2.2 Current state of the delta, strengths, weaknesses, opportunities and threats

The process of making a Mekong Delta Plan has started with an *expert* assessment of the current state of the delta using the abundant existing data. Many data are already available. In the context of preparing the high level meetings [Figure 2-2] the Southern Institute for Water Resources Planning (SIWRP), the Mekong Delta Development Research Institute and Climate Change Research Institute of Cần Thơ University (DRAGON-CTU), the Division of Water Resources Planning and Investigation for the South of Vietnam (DWRPIS) and the Sub-institute of Hydrometeorology and Environment of South Vietnam (SIHYMETE) have composed a set of relevant data. Deltares has reported this in "Towards a Mekong Delta Plan, Synthesis of water sector assessment" (February 2011). This is a more or less comprehensive, overall assessment of the Mekong Delta. This report describes primarily the strengths, weaknesses and threats of the delta.

The delta finds its strengths in the rich natural and human resources that are the foundations for a successful agricultural policy. Where the location of the delta is an advantage, its low level is also a weakness in terms of vulnerability to flooding and salinisation. The intensification of agriculture, increasingly leads to strains on the water resources base and shows a growing need for more, truly integrated planning. Water quality and fresh water supply are major problems. Moreover, climatic change and upstream developments have increasing impact on the water resources system of the delta.

Where the agricultural policy has been successful, the demographic, social and economic development shows that the delta has comparative advantages over other regions of Vietnam. But, the delta has also pronounced comparative disadvantages, which results in a weaker base for urbanisation, industrialisation and hence in out-migration. The competitiveness and prosperity of the delta depend very much on the efficiency and effectiveness of investments for flood protection, salinity control, water quality and fresh water supply.

These strengths, weaknesses and threats will be summarised in chapter 3 of this document. In the process of making the Mekong Delta Plan this phase results in a common, shared assessment of the delta's qualities and vulnerabilities. This result forms the base for seeking the best opportunities for a safe, prosperous and sustainable delta.

2.3 Long-term scenarios describe potential directions of delta development

2.3.1 Socio-economic scenarios and land-water-use scenarios

From the analysis of the Mekong Delta it is found that the socio-economic development plays a very important role. Moreover, the economical and agricultural production policy has great impact on the conditions for land and water use. On the other hand, economic and social factors, demographic developments, climate change and changes in the upstream river basin can be influenced, but are by no means fully controllable, even if all policies are right in place. If current practice is that policies are not in line, this incoherence may lead to

evolution of a less desired scenario. Also more external factors will largely influence the socio-economic development that will in reality take place. Less desirable scenarios may then occur.

Of course, predictions of future developments have a high degree of uncertainty, but many leads are available to give a coherent description of alternative possible *and* plausible future development directions in the delta: scenarios. These scenarios serve as a basis for action.

This Mekong Delta Plan will describe two basic scenarios that are more or less based on continuation of existing economic and agricultural policy and two other scenarios that include a more successful redirection to a more economically efficient use of natural resources. In that sense these scenarios cover a range of plausible developments from rather pessimistic through likely to optimistic.

The scenario that will eventually develop is uncertain, but can be directed to a certain extent. It depends largely on the success of spatial planning and land and water resources management, effectiveness of government incentives and policies. Policies can be more or less successful, control on spatial planning may succeed partially, efforts to make land use and water use more sustainable may be very effective to reduce flood hazards, or have little impact. Industries may occupy fertile areas and require high flood protection investments or be concentrated in more suitable regions etc.

In each potential scenario there is a different impact on land and water use developments and each scenario has a different capacity of flexible response to climate change and other uncertain developments.

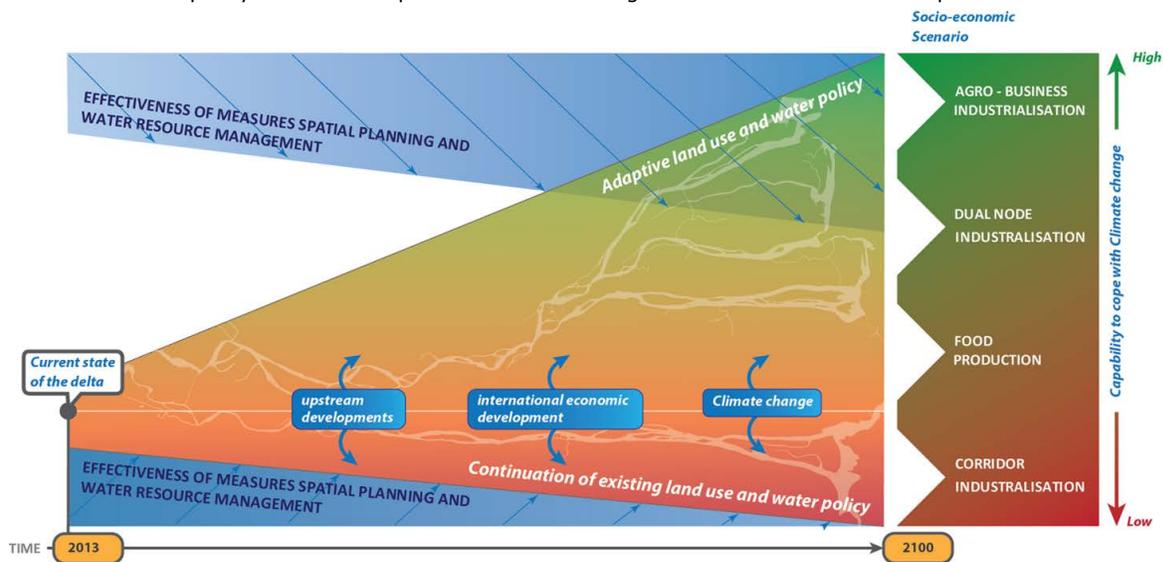
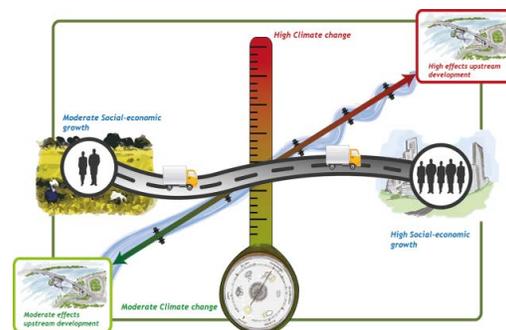


Figure 2-3 Socio-economic scenarios, implying land and water use development scenarios in a delta plan approach. Starting from the current state of the delta, it is investigated in two scenarios where current practice would lead to in the long term and how the outcome would score if tested to dealing with climate change and upstream developments. In two more scenarios it is also investigated how adjustment of current practice would perform. The scenario that will eventually evolve depends on one hand largely on the successfulness of the measures in spatial planning and water resources management and on the other hand also on external, less manageable social and economic and developments. The outcome cannot be exactly calculated: prospering economic capacity to finance high costs for land and water resources management adds to the capability of adequate response to climate change; the right socio-economic policy and adaptive and sustainable policies as well.

Governments need to explore different possible future scenarios to determine which development should be pursued for a safe, prosperous and sustainable development of the delta. It helps identifying which policies for water resource management and spatial planning need to be pursued and what flexibility is needed if the outcome of these policies is less than desired. Decisions for short-term investments can be made with good motivation for the long-term. No-regret measures are efficient and effective in all potential scenarios and flexibility can be kept for future developments, so that options are open to respond when future changes become more certain and clearer.



2.3.2 Climate change scenarios

Climate change has been studied extensively, at global, regional and national scales. Because the large uncertainties in future climate change often a scenario approach is used. Internationally there is to a certain extent good agreement on the effects of low, moderate and high climate scenarios. For shorter-term climate change projections the uncertainty is lower and it is well possible to base assumptions for projects close to a low climate scenario. MoNRE has done this for Vietnam. This can be a good approach to avoid upfront overinvestment in today's projects, when the eventual climate scenario is yet uncertain ("avoid regret measures"). For longer-term approaches, such as establishing a delta plan, it is important to be aware of the uncertainty in future climate. A useful way to include uncertainties in the planning process is the use of different scenarios. Rather than adopting a fixed value, the delta plan approach considers minimum and maximum developments, the ranges of expected sea level rise, of low discharges and of high discharges in order to assess ranges of measures to be taken. In the preparation of this delta plan this range has been established [see Table 2-1 below].

Table 2-1 Characteristics of climate change scenarios³

	moderate scenarios		high scenarios	
	2050	2100	2050	2100
increase wet season flow	no change	10%	0 – 10%	20 – 50%
increase wet season rainfall	0 – 5%	5 – 10%	10 – 20%	10 – 30%
dry season flow	+/- 5% (higher or lower)	5% higher or 15% lower	10 – 30% lower	30 – 60% lower
decrease dry season rainfall	0 – 10% less	5 – 15% less	10 – 20% less	20 – 40% less
increase salinity intrusion	slight	moderate	moderate	dramatic
sea level rise*	20 – 30 cm	57 - 73 cm	40 – 60 cm	78 – 95 cm

* Relative sea level rise is the sum of land subsidence and sea level rise, which could be higher than figures stated here, little information is available on land subsidence

2.3.3 Upstream developments

The Mekong Delta has a larger upstream part of the river outside its borders than within its own jurisdiction. Apart from climate change, future changes in discharge are affected by upstream developments such as land and water use, reservoir construction and flow management in the upstream countries. Also the impacts of flow management of upstream dams, the number of dams, deforestation, the degree of flood protection upstream, increased need for river transport are uncertain.

This implies good knowledge about minimum and maximum river flow, sediment flow, water quality entering into the Vietnamese part of the delta.

2.4 Integrated long-term vision and strategy

A vision on the desired development of the delta must be a natural and logical consequence from having developed possible and plausible scenarios, i.e. the potential developments for the (Mekong) delta. Based on the assessment of the performance of the four scenarios on the criteria safety, prosperity and sustainability, a desired direction of development to be pursued may be established and formulated as a "vision on the Mekong Delta". The vision will describe which elements will contribute to a safe, prosperous and sustainable future for the delta. This vision is long-term, order of 100 years ahead and the actions required to materialise this vision define the integrated overall strategy for the Mekong Delta.

In the case of the Mekong Delta the basic elements in the vision are:

- a. use of comparative advantages of the delta as a whole over the rest of Vietnam and use the comparative advantages of the Upper Delta, Middle Delta and Coastal Zone within the Mekong Delta;
- b. economic focus for distinguished regions in the delta;
- c. enhancement of economic perspective by turning depletion of natural resources into sustainable use of these resources;
- d. measures to cope with the dominant vulnerabilities of the delta: flooding, fresh water shortage, salinity;
- e. institutional arrangement to facilitate cross-border decision making and true integration of planning and measures.

³ Data provided and verified by MoNRE/SO

2.5 Exploration of solutions, principles and possible measures

With the long-term vision on the Mekong Delta in mind, the question arises: "what should be done today?" It is trusted that in this "back-casting" approach more specific, but also more creative options open up to move step by step towards realisation of the desired future for the delta. This in contrast to a forecasting model in which today's problems are projected into the nearer future with the effect of using a more limited range of possible measures.

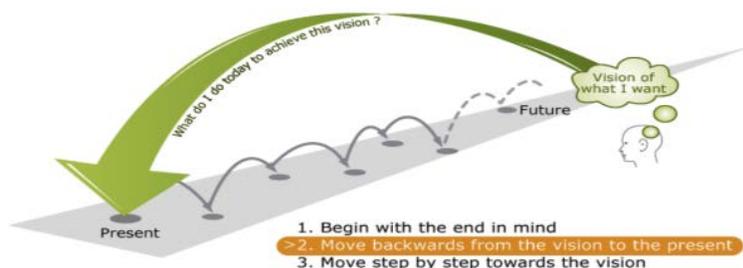


Figure 2-4 Back-casting model, deciding on first steps, no-regret measures (probably including continuation of existing projects) keeping in mind the end, but especially the flexibility

Referring to the analysis of the delta's vulnerabilities and its strengths and opportunities, exploration of the possible measures will follow three lines of control:

- a. flood control (i.e. flood protection and control for irrigation);
- b. fresh water control (includes availability and quality);
- c. salinity control (i.e. protection where fresh water is required and adaptation to saline water related economy).

Packages of principle and possible measures will be developed for the delta as a whole and for the distinguished regions (Upper Delta, Middle Delta, Coastal Zone).

Within this package distinctions are being made:

- no-regret measures and priority measures; these fit in the development paths of most of the four scenarios; they need implementation in the short- or mid-term;
- formulation of "avoid regret measures";
- mid- to long-term measures, that can still be postponed, for which further research and investigation is required and for which the need is probably yet uncertain;
- "last resort" measures, that are only necessary in case of extreme climate change, land subsidence or upstream developments.

Distinguishing these types of measures helps in avoiding overinvestment and in a flexible adaptation to foreseen and unforeseen developments.

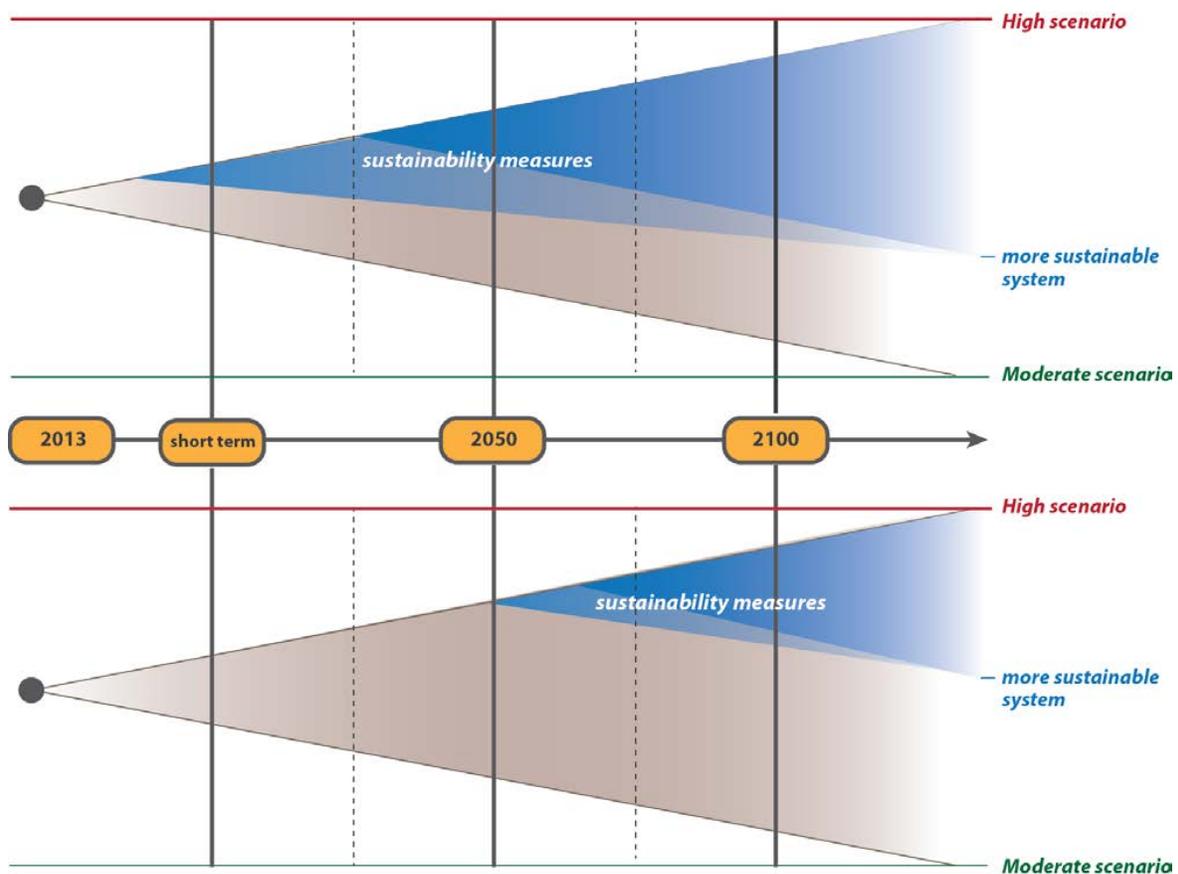


Figure 2-5 In a high climate scenario more water resources management measures will be required to manage flood protection, water supply etc. In the delta plan approach measures will be proposed that e.g. a) conserve the naturally present flood protection (mangroves, retention in Upper Delta) b) contribute to a redundant system (economically attractive alternatives to third rice crop for conserving retention or economically attractive and sustainable alternatives for present shrimp farming reducing fresh water demand and contributing to mangrove system). The lifetime of existing infrastructure or new measures will thus be prolonged. The required volume, scale of the measures will be smaller, less expensive.

An important element in this adaptive approach is the drive to prolong the lifetime of realised measures, of earlier investments and second to postpone investments in new measures, while keeping (or raising) the standards for control of floods, fresh water and salinity [see Figure 2-5].

2.6 From vision on the delta to active implementation of new policies

It is obvious that a vision with "safe, prosperous and sustainable" as its core, primarily aims at largely integrated measures. This implies: short-term action and long-term perspective, cross-boundary decision making: geographical boundaries of countries, provinces and municipalities, but also jurisdiction boundaries of ministries and their respective organisations. Financial structures need to be set for an investment climate that is in line with the desired development scenario for the Mekong Delta.

This requires review of existing policies, programmes, master plans, possibly leading to intensification where appropriate or adjustments required. Legislation needs to enable further development and stimulate the process of adaptation. An important next step after formulation of the vision and strategy in the MDP is to start a process creating administrative or governance conditions to really use the MDP as an orientation scheme for making truly integrated decisions on how the delta management can become adaptive, how investments can be steered to no-regret measures and to a higher value economy. [see paragraph 5.4].

2.7 Stakeholder engagement in developing the Mekong Delta Plan

The process of establishing a Mekong Delta Plan includes a number of steps that mention "shared analysis" or "commonly shared vision". The Mekong Delta Plan will advise on review and revision of policies, cross-border/sector, integrated decision making etc. Also, measures will affect the operational field of many stakeholders at the level of authorities as well as at the level of private organisations, industries and e.g. individual farmers or cooperations. Where governments have the responsibility to create good long-term boundary conditions for a safe environment, private organisations need to be attracted to invest in profitable and sustainable business.

Consequently this requires engagement of relevant stakeholders:

1. involvement of experts and specialists from different sectors with a bird's-eye view across the sectors;
2. decision makers of local, provincial and national authorities;
3. representatives from organisations for e.g. industry, fishery, transport, agri- and aquaculture.

In the context of Vietnam involvement of international organisations like World Bank, ADB, UNDP and different non-governmental organisations are stakeholders in the sense that they have a good understanding of integrated development and that they are capable of influencing projects in the delta in conformity with a delta plan approach. End users, urban and rural (farmers) need some kind of representation to involve these stakeholders and make them heard, not only in the process of making the Mekong Delta Plan, but especially in the program phase [Figure 1-3].



3 Current state of the delta: great potential *and* vulnerability

Preceding the establishment of the Mekong Delta Plan a synthesis report⁴ of information of the delta has been produced. In the first stage of the Mekong Delta Plan the project team and reference groups have analysed this information, reviewed and updated data and formulated trends and leads for strategies to cope with potential development scenarios⁵. The main issues have been summarised and are being presented in this chapter.

3.1 The Mekong Delta

3.1.1 Geographical situation

The Vietnamese part of the Mekong Delta (or the Nine Dragon river delta after its nine estuaries, *Đồng Bằng Sông Cửu Long*) is the region in the far south of Vietnam. The delta roughly forms a triangle of 3.9 million ha stretching from Mỹ Tho in the east to Châu Đốc and Hà Tiên in the northwest, down to Cà Mau at the southernmost tip of Vietnam. More upstream the delta stretches out to the division into the two branches Bassac (Hậu) and Mekong (Tiền) near Phnom Penh (1.6 million ha more). Administratively the delta is divided in 13 provinces, the city of Cần Thơ could be regarded as the centre of the delta

The Mekong River discharges into the East Sea and through a network of canals also into the Gulf of Thailand or West Sea. Hồ Chí Minh City is the most important gateway just outside of the delta, although

high floods of the Mekong causes discharge through the Vàm Cỏ, passing Hồ Chí Minh City. The delta is very flat, the elevation at Châu Đốc is about 3 to 4 m and the average elevation of the delta is about 0.8 m above mean sea level. The wet season brings high river discharges through the two main branches Bassac/Hậu and Mekong/Tiền (80-85%). A smaller, but still significant part of the discharge is overland (15-20%). Large parts (about 50%) of the delta get seasonally flooded up to 3 m depth, mainly the Plain of Reeds and the Long Xuyên Quadrangle. This affects the lives of more than 2 million people. Low river flow in the dry season causes salt water intrusion in the coastal regions of the delta, affecting over 1.4 million ha. The coastline has a length of some 600 km, mostly with relatively low sea dykes and mangroves.



Figure 3-1 Topography of Mekong Delta

3.1.2 Successful economic development in a complex environment

With around 17 million people⁶ (20% of the Vietnamese population) the Mekong Delta is, like many deltas, densely populated. In 2012, only around 25% is urbanised compared to the national average of 32%, leaving some 75% of the population rural. Still, actual conditions in the Mekong Delta are far from benign for its inhabitants. The delta has its enormous flooding problems, increasing salinity, drainage of naturally occurring acid sulphate soils, with high levels of potentially toxic aluminium and poor phosphorous availability. Uneven seasonal distribution of rainfall causes temporary drought conditions in the central and eastern parts of the delta. In spite of these adverse conditions, the delta being endowed with highly fertile soils and abundant fresh water enables highly productive agriculture and fishery. Large parts are used for rice cultivation, highly productive shrimp farms, fruit orchards and vegetable crops. The delta accounts for half of the nation's rice production and contributes to Vietnam's place among the top three rice exporters in the world in tonnes behind Thailand and switching ranking with India⁷.

⁴ Towards a Mekong Delta Plan, Synthesis of Water Sector Assessment February 2011

⁵ Appendices to MDP0.2, MDEC Conference My Tho, 5 December 2012

⁶ GSO, census 2009: country's population: 88.777 million people, Mekong Delta: 17.191 million people in 2009 and 17.39 million in 2012

⁷ Food and Agriculture Organisation (FAO), Rice Market Monitor 2013

The per capita income in the Mekong Delta averaged in 2008 around 14 million VND (about 730 US\$) Although growing, it is slower compared to the national average; until 2002, the average income of the Mekong Delta was slightly higher than the national average, since 2008 it is considerably less⁸.

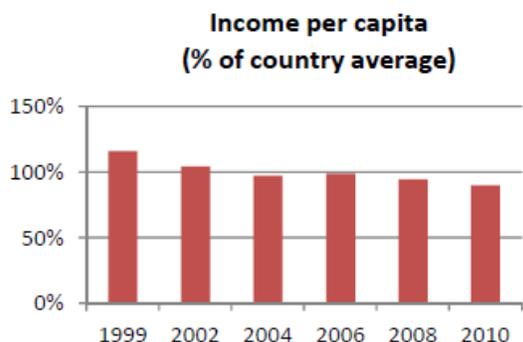


Figure 3-2 GDP in Mekong Delta sinks below average

The difference between the highest and lowest income groups increased from 6.5 times in 2004 to 7.5 times in 2008. The percentage of poor households has declined considerably, but is especially in remote and border areas still fairly high, reaching 20-25%. GDP growth has been around 10% a year between 2002 and 2012, also thanks to the contribution of industrial growth. The share of the Mekong Delta in the national GDP is 18% and around 10% in industrial production.

The 1986 economic reforms policy of *Đổi Mới* has had a major influence on the socio-economic development of the delta. This shift, along with policies to remove obstacles for development gave

proper direction to investments to improve the water infrastructure, especially for irrigation development. These improvements have significantly contributed to a breakthrough in economic development of the delta. Salinity control projects in coastal areas and reclamation of acid soils greatly enlarged suitable cropping areas. Technological developments played a key role, once the appropriate mix of innovations with investments in infrastructure [see Box 3-1] was implemented. For instance, although already available in the 1970s, the high yielding rice varieties only started to be effectively used after improvements in irrigation, drainage and flood control were implemented on a large scale. These improvements in water management, the implementation of technical advances and policy reforms supported the delta's rice production to rise from 4.5 million tons in 1976 to 24.6 million tons in 2012 of which 8 million for export⁹.

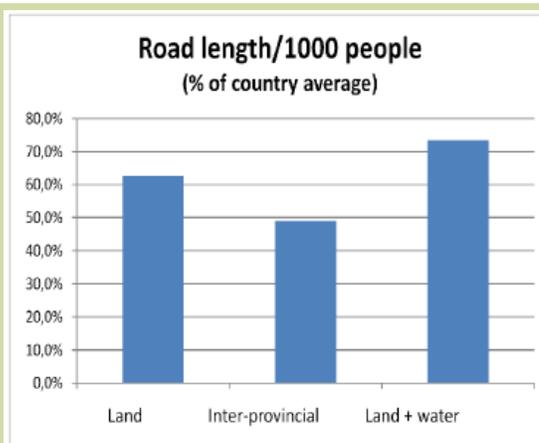
Box 3-1 Infrastructure development

Infrastructure investments are a key driver for economic growth. Limitations pose high risks on severe flood damages and casualties. Also, inadequate infrastructure is an enormous push factor for private investment.

The current state of the road traffic system in the delta is much weaker compared to other regions in Vietnam, seriously constraining the commercialisation of the agri-food-industrial business. Especially the inter-provincial roads have insufficient capacity to serve the economic development¹⁰. The delta has a potentially very advantageous waterways network, which is by far not sufficiently utilised and in serious degradation, resulting in soaring transportation costs, which hampers investments. Also, a large port system for direct export of agricultural products is missing.

Focal provinces for rice and catfish processing such as An Giang, Dong Thap, Kien Giang are insufficiently connected¹¹. Furthermore, urban infrastructure lacks drainage capacity and suffers from sanitation issues.

Current master plans anticipate on huge investments in the roads and waterway network, with emphasis on upgrading and constructing two north-south and two east-west axes (one from HCMC – Cà Mau) and upgrading coastal and rural roads. Also the feasibility for a railway connection between Cần Thơ – HCMC is being studied. Key will be to examine realistic future traffic forecasts (different scenarios), and identifying which network/corridors would need priority to facilitate the desired long-term vision.



⁸ Dr. Vo Hung Dung (VCCI) - Graph: General Statistics Office. Vietnam Household Living Standard Survey 2010

⁹ MARD- UNISDR Conference, Geneva 2013

¹⁰ Graph: GSO, the transportation infrastructure of the MKD, 2010

¹¹ Dr. Dang Kim Son (MARD)

Box 3-2 Industrial and urban development

Urbanisation has changed and will be changing the spatial structure of the Mekong Delta. In line with the anticipated industrial development and acceleration of urbanisation, the land area for industries and urban areas has increased at the expense of agricultural land. However, due to a lack of harmonised planning and competition among provinces, industrial zones have developed rapidly in a scattered manner. Many on highly fertile ground. Due to lack of capital investment, capacity exceeds production and only 30-40% of the industrial plants is currently occupied. At the same time, future development objectives anticipate on a further increase of urban land to 350,000 ha in 2050 and land for concentrated industries to 40,000-50,000 ha in 2050 (SIWRP). Real estate development around Cần Thơ shows a similar trend. An overcapacity of expensive housing is being built in the area, while there is a desperate need for affordable housing.

Question is how feasible and attainable current developments and future master plans are, bearing in mind the land-use pressures and the objectives of the agricultural sector. To guide future developments in a sustainable way, integrated spatial planning approach between all sectors is essential. In this way, allocation of plants can be more in compliance with the competitive advantages of each location, and conflicting less with high-value agricultural land, and units would be better able to join forces to be competitive on the domestic and international market. Also, to guide the urbanisation process, proper urban planning will be essential to enable affordable housing and job opportunities, and to prevent slum developments. Adequate urban infrastructure, including sufficient drainage, will be vital to this.

At the same time the population of the delta has shown a remarkable adaptive capacity to cope with difficult conditions and rapid changes. Traditionally people are used to live with the floods, showing resilience towards extreme floods, while benefiting from the moderate floods that bring fertility to the fields and sustain a rich fishery. The unprecedented growth of aquaculture – for instance brackish water aquaculture production quadrupled over a period from 2001 to 2008 – also shows the capacity of the people to seize an opportunity provided by market conditions and technology.

3.2 Exploration and analysis of existing problems and drivers of change

On top of the hydrological and physical problems of the Mekong Delta due to its geographical situation as described above, the future will intensify the challenges to make this delta safe, prosperous and sustainable. Besides the evident trends in society, such as industrial development and population growth, change of land use, intensified need for the delta's natural resources and climate change will certainly have significant impacts on the physical conditions of the delta. In combination with changes in river flow due to upstream developments in the riparian countries of the Mekong River, these impacts will cause profound difficulties in the life and work of the inhabitants. Exploration of the character and impact of these changes is required to formulate a strategy of dealing with them.

3.2.1 Random spatial development and industrialisation

The projection of population size in current master plans for the delta for the year 2050 is from the present 17 million up to around 30 million in master plans for the delta, although lower growth figures are already being accepted. The trend in industrialisation and urbanisation is growth, taking more land out of agricultural production. At the same time more people need to be provided with food and fresh water. Ongoing industrialisation will also take up more space and increase the demand for water as well as the production of wastewater. Both trends will increase the need for proper spatial planning, efficient water supply, investments in water treatment and stringent enforcement of environmental legislation.

The current trend deviates from the predictions in the master plans. More recent policy population growth estimates range from 19.5 million¹² in 2034 to 30 million¹³ by 2050, which is anticipated to be facilitated in urban areas. Urbanisation is forecasted to increase to 34% in 2020 and to 40-50% by 2050. However, recent figures show that there is a net out-migration: immigration rate is 1.5 ‰, the emigration rate estimates range between 5 and 6.5 ‰.

Growing industrial and urban development is leading to spatial conflicts. Although the Mekong Delta is defined as a focal area for agricultural production at national scale, the huge competition between provinces and cities to attract industry for their economic growth has caused that thousands of hectares along the Mekong and Bassac rivers - which have been classified as first class agricultural soils and which should have been reserved for agricultural production - have been (or are planned to be) turned into industrial zones. Nevertheless, presently on average just 30 – 40 % of the industrial zones have actually been occupied by enterprises, due to the lack of basic planning studies and cooperation between municipalities and provinces.

¹² New forecasts (2012/13) GSO, population projection for Vietnam 2009 - 2049

¹³ Older forecasts in sector master plans (2012), Review of Sector Mekong Delta Master Plans, March 2013

At least as important is that the Mekong Delta has a comparative disadvantage to other regions in Vietnam as it comes to attractiveness for industrial investments. Poor transport facilities are an important factor, Hồ Chí Minh City is a strong pull factor for skilled labour, reflected in the net migration figures for the delta.

3.2.2 Flood protection

There is a trend in decrease of the flood retention area in the wet season: dyke raising to enable triple instead of double crop rice take room from the Mekong River. Even in the Upper Delta the river regime is influenced by sea level. Reduction of the retention and sea level rise eventually increase the flood levels in the Middle Delta in the long term.



Figure 3-3 Large areas in the Upper Delta in the Plain of Reeds and the Long Xuyên Quadrangle still flood in the wet season, double rice crops fit in this flood system. Triple rice in the Upper Delta requires flood protection taking retention area from the river system

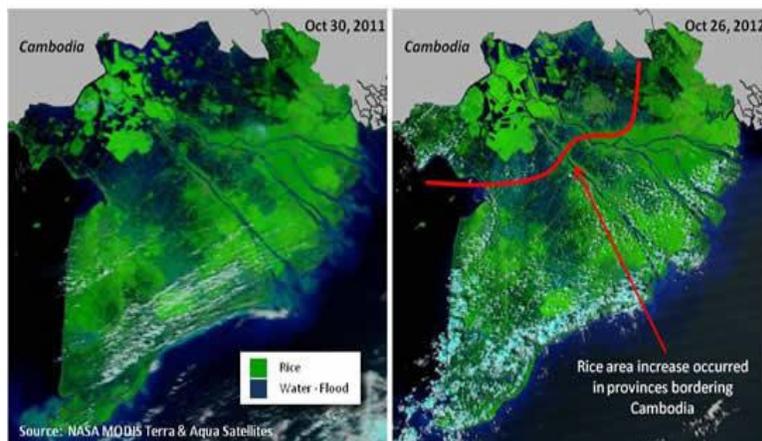


Figure 3-4 Increase of triple crop rice in one year. This is a long-term trend, eventually resulting into large scale loss of flood retention area.

This situation is illustrated by Figure 3-4. One single rice field or one single year of lost retention area has a small hydraulic effect on river water levels; accumulated losses of retention in the long run cause an upward trend on river water levels. In the middle and lower parts of the delta there is a higher growth of industry and urbanisation. Reduced retention area and sea level rise increase the vulnerability to flooding in these areas leading to an increased need for capital intensive measures for flood protection. The extra income of a third rice crop needs to be weighed to decreased yield of the first two crops, loss of fertile sedimentation, costs of fertiliser, increased costs of flood protection and other economic prospects for the wet season.

Maintenance of existing structures and safeguarding the integrity of the flood control system is generally problematic. Room for river, in terms of dedicated space for river water storage and discharge is ever decreasing (compare e.g. Figure 3-4), the condition of flood defence structures vary from well-maintained, to a very bad state. Legal and illegal sand mining leads to changes in the structure of the river bed and serious bank erosion, affecting the water and sediment transport capacity of the river and causing costly damage to infrastructure.



Figure 3-5 Bank erosion

3.2.3 Salinity

The brackish water environment in the Coastal Zone is gaining importance, not only by its – growing – presence, but also by the growing importance of economic adaptation to this initially unfavourable situation. Measures to create a – clear – border line between brackish and fresh water environment are yet

underdeveloped. Furthermore, a rise in sea level will increase salinity levels in the delta's river branches and its water network. A sea level rise of one metre would increase the area of 4 g/l salinity with 334,000 ha in relation to the benchmark year of 2004, a rise of 25%. Deep salinity intrusion is occurring already during dry seasons, giving rise to significant crop losses. Its extent and frequency is likely to increase due to climate change, giving rise to even higher and more frequent economic losses.

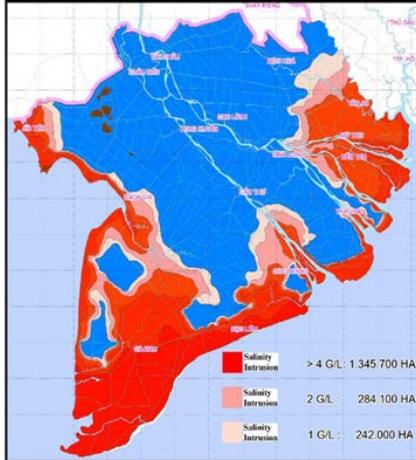


Figure 3-6 In the – still – dynamic system of the Mekong Delta the saline-brackish border is not a fixed line with lower salinity more inland. The southern estuaries of the Hậu and the Tiền still "push" the saline water towards the sea. The branches with lower flow suffer from further salt intrusion. This aggravates over time [see Figure 3-7]

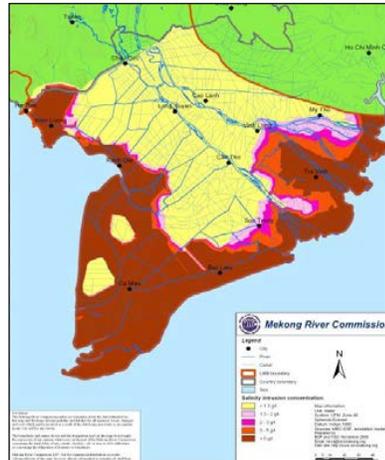


Figure 3-7 Salinity intrusion extent in 2024 under B2 climate change, 20 cm sea level rise and LMB-20 year development plan scenarios.
Source: MRC, 2011

3.2.4 Water quality and water supply

Despite the great advances in socio-economic development, Mekong Delta still faces a range of problems in their daily lives. Safe water supply is guaranteed only to 60-65% of the urban population and for the rural population this percentage is considerably lower. Water supply in the rural areas is based on surface water, groundwater and rainwater. Supply from surface water encounters two major problems: high salinity and potential aluminium contamination.

Untreated wastewater discharges, industrial pollution and limited sanitary facilities cause local problems of water quality and create health risks in combination with insufficient water supply. Shortage of funds for maintenance leads to reductions in overall capacity of irrigation systems. Existing water infrastructure is said to operate far below the design capacity. Drainage capacity is insufficient in many areas during periods of heavy rainfall and high river discharges, causing floodwaters to recede late. Many canals have not yet been equipped with sluices to prevent salt water intrusion. And where such sluices do exist, there is sometimes a conflict between the fresh water needs for agriculture and salt water needs for brackish water shrimp farming.

Rapid population growth and intensive agricultural and aquaculture development over the past decades have

Box 3-3 Groundwater depletion in the Coastal Zone

In the Coastal Zone dry season fresh water surface flows are limited. This to the extent that increasingly groundwater is being used from deep phreatic aquifers (ca. 110 m) as an additional source of fresh water. Both to control salinity levels in shrimp farming and enable the diversification of production into vegetables and homestead production (both in rice and shrimp areas). Already today, water pressures drop by 2-5 m in the dry season, forcing farmers to lower their centrifugal pumps into the wells to enable continued pumping as water levels drop to 15-20 m below the surface. There are strong indications that ancient (Pleistocene) deep water layers are being depleted that are not (or very limited) replenished from Mekong flood waters. This raises the concern that present groundwater use is already depleting a limited aquifer, and that further intensification of this groundwater use in future is unsustainable.



significantly reduced the natural values in the delta. Many wetlands such as mangroves, ponds, lakes, lagoons and wet grasslands are threatened by extinction through the concessions for irrigation, forest plantations, salt ponds, industrial development zones and shrimp farms. Furthermore, overexploitation of the natural resources is a major threat for the health of ecosystems.

3.2.5 Ecosystems preservation in the delta

The ecological status of the delta has been dwindling vast and constantly with its transformation into an intensified agricultural production domain over the last decades. Progressive land and water reclamation, agricultural intensification, as well as negative ecological impacts of warfare, have significantly reduced the natural forests, wetlands and other natural habitats of the delta. The closest of a "successful" merger between nature and intensive agricultural use, characterised by diversification of crop/fish culture and multiple use of land and water resources is the fruit garden cultivation system in the eastern Middle Delta. Apart from its economic value, this agricultural diversified system, when maintained with its high diversity of trees, plants and fish, is a good example of man-made ecosystem. Due to its scenic beauty and diverse flora and fauna, it has proven attractive for tourism. It is thus well worth to preserve this area (economically and ecologically) and make sure that the diverse and multiple use character of the system is maintained and supported – also in the future of more market oriented fruit production and commercialisation.

Mangroves have been deteriorating through various factors, and the Coastal Zone is now characterised by intensive monoculture shrimp farming, salinisation of fresh water zones, aggravated by extensive use of groundwater. The reduction of the tidal coastal zone due to coastal protection works at the outer shores is further deteriorating the coastal mangroves, and conducive to aggravated coastal erosion. The preservation of coastal mangrove forests, and its gradual regeneration and expansion, form a critical ecological function for the delta – not only in terms of ecology and biodiversity, but also in terms of enabling a natural wastewater treatment capacity for the aquaculture sector and coastal defence capacity. To reverse coastal erosion, and enable the sustainable integration of aquaculture and mangrove systems, with a dynamic saline-brackish water circulation, it is therefore recommended to adopt a dual coastal zone management strategy. With the outer zone explicitly focused on the creation of a healthy brackish/saline zone with and integration and restoration of mangroves in combination with poly-aquaculture. Existing mangrove forests should be preserved with priority to enable this strategy to be implemented and make also in the future optimal use of the natural resources the delta has to offer.

With the fresh water flooding zones, the preservation of existing malleuca forest should likewise receive priority. They are not only small patches of natural ecological value; they also provide scope for unique natural resources and production systems such as the integrated malleuca-snake head fish-rice systems that can still be encountered in small patches of upper Cà Mau and the Upper Delta. Also in the Upper Delta, the small still existing patches of traditional floating rice production systems should be preserved with priority. Both in its own right as a cultural and crop-genetic heritage site, as well as providing potentials to access high-value specialty international rice markets, that can provide high economic returns to farmers. These existing flood-based land and water use systems are also critical to provide the experience and genetic resources to make further developments in innovative flood-based agricultural systems.

3.2.6 Climate change

Climate is already changing in the delta. The Mekong Delta ranks amongst the top 5 deltas in the world most likely to be severely affected in terms of climate change¹⁴. Despite a limited record of meteorological and hydrological data in the Mekong Delta, trends in temperature, rainfall and sea level are noticeable. From 1970 to 2007 the average temperature rose 0.6°C and rainfall increased 94 mm. Predictions of climate change in Vietnam are carried out by the Vietnam National Institute of Meteorology, Hydrology and Environment (IMHEN), which has developed three scenarios for the

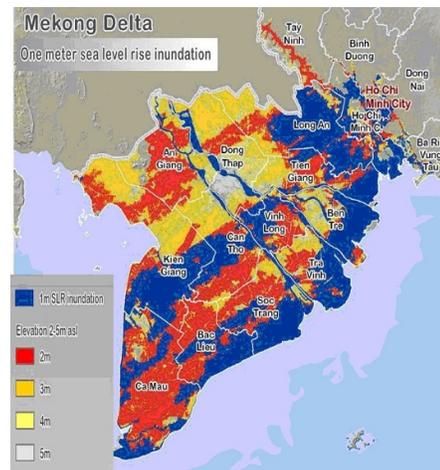


Figure 3-8 In the high climate change scenario (with 95 cm of sea level rise) the survival of large parts of the delta are at stake. Major measures are required to ensure the coastal defence and safe river discharge.

¹⁴ Intergovernmental Panel on Climate Change (IPCC, 2007) Assessment reports 10 Asia Working Group 2, Impacts, Adaptation and Vulnerability

country: Low emission (B1), Average (B2) and High emission (A2). In all scenarios rainfall tends to decrease in the dry season and to increase in the wet season. Together with the temperature rise and changing rainfall patterns, sea level rise is expected to have a huge impact on the physical conditions of the Mekong Delta, leading to a range of effects on people, their health, livelihood and prosperity. In the flat areas of the delta, the predicted sea level rise can result in large areas of permanent and more frequently inundated coastal plains. Depending on the scenario the percentage of inundated delta ranges from 12.8 – 37.8%. Rice production will be affected through excessive flooding in the tidally inundated areas and longer flood periods in the central part of the delta. These adverse impacts could affect all three cropping seasons. The assumed figures for future climate change scenarios have been summarised in Table 2-1.

3.2.7 Land subsidence and groundwater extraction

A less acknowledged factor, but often at least as important as climate change, is land subsidence, due to sustained, long-term drainage and groundwater extraction. Very little data are available, but 1 to 2 cm/year is a common figure. Recent studies for the Cà Mau region confirm these figures¹⁵. Land subsidence has a strong relationship to groundwater extraction. Figures for Cần Thơ range from 0.30 – 0.70 m/yr already 10 years ago¹⁶. Deeper well, more than 100 m, extract (very old) groundwater that is not replenished at all. The relation between water supply, groundwater extraction, land subsidence and flood protection is not well known in its integrated context.

The combination of land subsidence and sea level rise is referred to as relative sea level rise. In its accumulation an extreme sea level rise of 95 centimetres could be far worse in terms of relative sea level rise. This would make a sound coastal protection of the whole delta necessary: dyke or dyke-mangrove systems, closure of a number of Mekong River branches and major measures to retain water in the delta, enhanced river discharge and direct flood protection by river dykes.

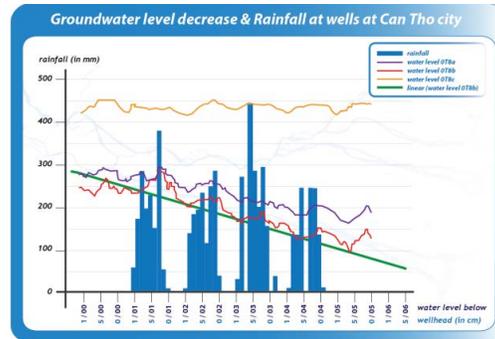


Figure 3-9 Groundwater extraction

3.2.8 Upstream developments

Upstream development (mainly dams, reservoirs, deforestation, large scale irrigations schemes, urbanisation, upstream flood protection and other forms of land use change) will have direct impact on the river discharge, both in the wet and the dry season. To date, impacts of upstream development activities (e.g. dams in Figure 3-10) on Mekong flows lack substantial quantification.

The effects of the dams for the delta may be positive:

- mitigation of peak flows in the wet season or
- upstream buffering for fresh water supply in the dry season,

or they may be negative:

- faster runoff;
- decreased retention;
- withholding fresh water for own use;
- reduced flow in dry season resulting in more salt intrusion downstream;
- pollution;
- blocked fish migration;
- reduced sediment and deposition.

Upstream flow changes will impact the required flood protection and fresh water supply measures in the delta. Altering the Mekong discharge characteristics has therefore direct implications to the current water issues.



Figure 3-10 Dams in the Mekong as an example of upstream developments

¹⁵ MARD Phase 1 Research Study: Assessment of land loss Cà Mau, Norwegian Geotechnical Institute, Land loss study for the Cà Mau Province, Vietnam. Presented by Kjell Karlsrud on 17-6-2013 in Cần Thơ.

¹⁶ Bonn and Bochum University

3.3 Strains in the development of the delta¹⁷

Today, the valuable human, land and water resources of the Mekong Delta are fully utilised by Vietnam's society to harness its economic potential.

As outlined in the above chapters, these uses are not static – changes in land and water use are continuously taking place driven by economic opportunities, demographic developments and policy interventions. Sector's individual weights on human, land and water use are shifting, remarkable gains in intensification and productivity have taken place. However, this has not been achieved without significant impacts.

3.3.1 Strains in the socio-economic development

Despite these huge advancements, the delta's macro-economic structure deviates markedly from the national average. This structure and state of development has a strong base in the unique strengths of the delta, but urbanisation and industrialisation lag behind official government development objectives. At present, the primary sector remains the most dominant (GDP share of 41% compared to the national average of 20%¹⁸). At this pace, the projected decline of this share to 31% by 2020 will not be achieved.

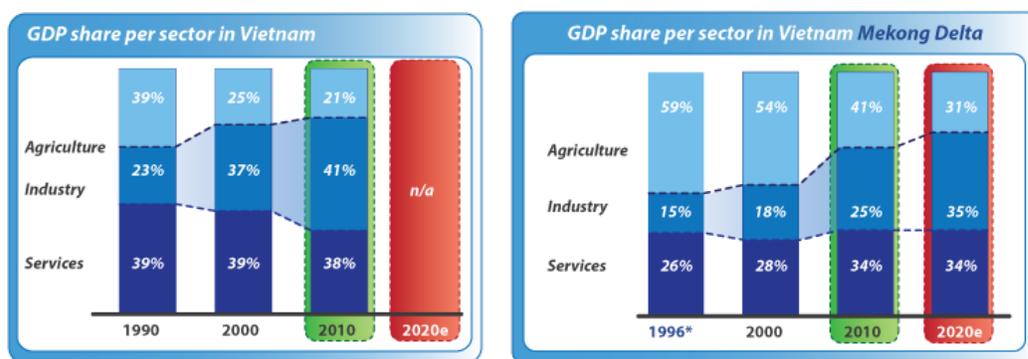


Figure 3-11 Current and projected GDP share per sector in Vietnam (left) and Mekong Delta

The investment climate of the Mekong Delta is perceived as less attractive, and neighbouring provinces north and east of Hồ Chí Minh City are able to capitalise more from its proximity to the city than the Mekong Delta. The Mekong Delta is mainly suffering from¹⁹:

- insufficient infrastructure and transportation links, leading to high transportation costs;
- decentralisation of decision making on public investments has contributed to competition between provinces and cities, leading to sub-optimal decisions;
- the vulnerable and flood-prone natural system is reality, many investors perceive the delta as risky and prone to flooding and thus, less attractive for investments;
- low education levels which translates in a shortage of qualified labour force;
- a high out-migration of human capital, mostly to Hồ Chí Minh City;
- the tight control over "food security" and other institutional barriers that constrain farmers to diversify their agricultural production and
- the institutional mechanisms for more integrated planning are insufficiently enforced.

The current rice-dominance of the economy is hampering human capacity building, as it requires less skills and resources compared to other economic sectors such as aquaculture fruit culture, horticulture or industry. The agricultural restructuring has not taken place, no remarkable changes in farming techniques have been carried out to increase productivity. Also in the process industry, the majority of companies focus on processing raw agricultural products with low added value²⁰. The existing value chains of rice and aquaculture are constraining the livelihoods of farmers, leaving low margins for the farmers. Currently, the Mekong Delta is a processing area where most commodities and input materials (fuel, fertiliser, agro-chemicals, equipment) for production are imported²¹.

¹⁷ Mostly described in the Appendices to MDP0.2, MDEC, December 2012

¹⁸ Statistical yearbooks of Vietnam, GSO and Local Statistical Yearbooks (MD)

¹⁹ The Mekong Delta System, 2012

²⁰ Dr. Võ Hùng Dũng (VCCI)

²¹ Prof. Ho Long Phi (National University of HCMC)

3.3.2 Strains on the water resources base

The successful intensification of agriculture is increasingly leading to strains on the water resources base of the delta in terms of:

- growing population, urbanisation and industrialisation leading to a demand for higher flood protection and intensified use of water resources;
- protecting traditional flood plains against seasonal flooding through permanent dykes for the intensification of triple rice farming in the Upper Delta takes retention areas impacting downstream flood protection negatively;
- coping with increasingly fresh water supply constraints during the dry season, in particular in Coastal Zone and Middle Delta;
- an expanding brackish water environment along the coast that alters the land (and water) division between brackish aquaculture and fresh agriculture; unsustainable shrimp farming using fresh groundwater and suffering from significant production loss;
- abundant use of groundwater leading to subsidence and depletion of resources;
- aggravation of flooding and drought problems through climate change, upstream developments and land subsidence.

Box 3-4 Sustainability of shrimp farming

The present intensive monoculture of shrimp is putting a lot of strains on the water and production system. Current production levels are severely hampered by low water quality problems that result in:

- one yield of shrimp where two yield per year are potentially possible;
- frequent stock/yield failure due to overstocking of shrimp ponds in low water quality environments;
- these stock failures greatly depress the income levels of small scale pond owners, and frequently lead to large indebtedness.

The water quality issue is governed by two aspects:

- higher than optimal salinity levels make the shrimp more susceptible to diseases;
- high stocking rates and intensive feeding, with low pond refreshment rates, lead to pollution.

These issues need to be addressed in the short to midterm. In order to increase the sustainability of brackish aquaculture, a number of combined measure are needed:

- increase the fresh water influx, especially during the dry season, into the brackish zone, in order to enhance the refreshment and salinity control rates of aquaculture systems, but ensuring that brackish water remains available;
- convert the present monoculture of shrimp farming into poly culture systems of multiple species (fish and crucea) which will significantly diminish the (solid) waste loads of aquaculture on the water system;
- stimulate the waste water treatment of aquaculture, potentially with the regeneration of mangrove forest on waste ponds acting as helophyte filters.

There are, however, a number of constraints that impose difficulties in establishing this desired sustainable state for brackish aquaculture. Fresh water supply during the dry season is increasingly becoming scarce and set to further decrease with climate change. Whereas poly-culture systems in brackish aquaculture have established good economic returns, and global market certification demands for aquaculture products favour sustainable production practices, the small holder context of shrimp aquaculture in the Mekong Delta hampers these transitions in the short term.

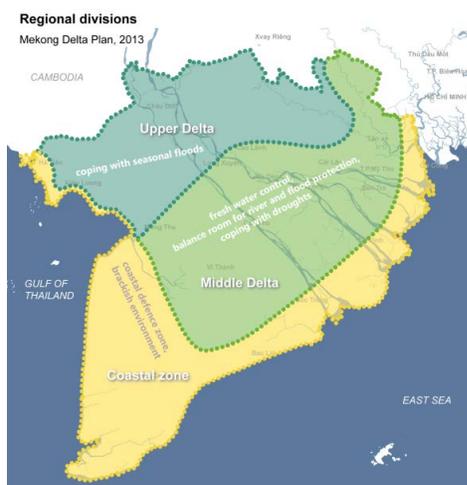


Figure 3-12 Upper, Middle, Coastal delta

The climate change effects, compounded by upstream developments, will amplify the hydrological effects and changes in the Mekong Delta. These effects and resulting strains, as today, are geographically bounded, providing specific opportunities and constraints across for land and water use and economic development in the Upper, Middle and Coastal delta. For climate change adaption these differing hydrological regimes pose specific challenges for the optimal alignment of land and water use adaptation, economic development strategy and water management measures. Three hydrological zones can be distinguished as:

- 1) Upper Delta, coping with increased seasonal fluvial floods and enhancing the water retention capacity through adapted land and water use (e.g. living with floods);
- 2) Middle Delta - coping with dry season fresh water shortages and droughts and securing fresh water supply;
- 3) Coastal Delta — coping with brackish water and salinity intrusion (e.g. living with brackish water) and sustainable coastal protection [see Figure 3-12].

These hydrological changes will progress and evolve over time, and require a strategic anticipation today to align their future land, water and economic use.

3.3.3 Economically sustainable infrastructural measures

Comprehensive infrastructural measures, like dykes, polders, conveyance channels, (temporary) closure of the estuaries and water retention capacity are required for a safe delta and to enhance sustained economic development. These measures require huge capital outlay and investment. Where strains on the water resources base tend to further amplify over time, keeping up with the progressive effects may come to the point that the required investments become economically unsustainable. A sound sustained economic development is required to keep these measures economically affordable; alternatively or at least additionally, better control over land and water use systems of the delta contributes to control over the amplifying effects of growth and climate change on the water resources base.

3.4 Responses and seizing opportunities

Evidently, these drivers of change do not cause isolated impacts. Instead, there will be complex interactions that could result in cumulative and non-linear impacts on the human-environment system of the delta. Possibly also some positive effects may outweigh negative effects, but it is safe to say that the overall impacts of these changes will surely require an active management response. On one hand, the economic development determines the impact on land and water use, on the other hand the desired land and water use system should therefore influence the desired economic development. Sound and sustained economic development is a basis for control over the delta's resources and its vulnerabilities, but the reverse is equally true.

Partly these responses consist of measures, policies and plans that are already under study or implementation. For instance the improvements of the water supply system and salinity barriers along canals are urgently needed now and continue to require upgrading to solve future fresh water demands.

Besides the so-called no-regret measures and actions also more fundamental strategic decisions are needed in the near future on how to meet the combined impacts of all these changes. An

example of a radical intervention in water-related infrastructure is a plan to construct large salinity barriers across the main estuaries. A fundamentally different strategy would call for adapting to the changing salinities by radically shifting cropping patterns to more salt-tolerant crops such as shrimp and fish culture.

Adapted water use systems can thrive productively and sustainably in the changing water regimes of seasonal floods, water scarcity and brackish environment. This strategy requires investments in the economic development of adaptive land and water use systems that are specifically targeted to innovation, diversification and intensification of flood-based, water-saving and brackish production systems. The Mekong Delta seems particularly conducive to such a strategy as the water and land use has been highly dynamic over the past decades (re. rise in aquaculture) and the strains on the water resources are highly spatially concentrated. Also this strategy requires considerable investments, but directed towards economic development and innovation as a basis of generating new economic growth. The inherent risk hereby is that the anticipated economic development and growth does not take off, and the changes in water regime remain constraints for production and economic growth.

But many questions remain to be answered before such decisions can be made. For instance, in view of sea level rise and flood risks a potential response would be to opt for full flood control. However, this would deny people the present benefits of the floods and would completely eliminate the accumulation of silts brought in by the floods, annihilating aggradations of the soils and causing the delta to sink relative to the sea level. More

Box 3-5 Mekong Delta Waterways Project – Increasing water conveyance and storage capacities.

Presently, the Ministry of Transport (MoT) is carrying out the Mekong Waterways Project, with the aim of revitalising the canal network in the Mekong Delta to enhance the shipping capacity throughout the delta, thereby facilitating transportation and further drive economic growth. The project will enlarge waterways and canal networks to increase shipping capacity (as well upgrade sluices and locks), with specific emphasis on providing three primary shipping corridors across the delta from east (Hô Chí Minh City) to west (the northern, central and southern corridors). Additional benefits of these infrastructure investments are that the conveyance capacities of these corridors will be significantly increased. Thus providing additional water conveyance capacity from the Bassac and Mekong branches into the delta during the dry season (although north-south conveyance may still be restricted, and the southern corridor will be subjected to salt intrusion in the lower stretches of the branches). In the wet season, the revitalised network will also increase water storage and conveyance capacity for excess flood waters, thus alleviating the flood risks. Although to what extent will need to be carefully assessed.

detailed measurements of actual sedimentation patterns, compaction rates and sea level changes are needed to get a more quantitative insight in these processes.

Hence, more research, studies and projections are needed both in the magnitudes of change as well as in the efficiency and side-impacts of all possible alternative measures. But equally important are mechanisms to work together to formulate plans and implement measures in a coherent and harmonious way. This requires sound planning and good governance.

3.5 Planning and governance

Vietnam has wide experience in preparing plans for economic sectors. The central government has initiated a number of studies to deal with planning challenges and collect sectoral data (agriculture, construction, aquaculture, water resources planning). Increasingly, the interdisciplinary nature of the issues and interests of various stakeholders create difficulties in information exchange, matching sectoral interests. Consequently, truly integrated spatial planning remains difficult. Not only multiple ministries, agencies and planning branches are involved but also multiple levels of government (central, provincial, district, city and local people's committees). The Master Plan for Socio-Economic Development until 2020 for the Mekong Delta plays a very important role and should be the foundation for other sectoral plans. However, this master plan has not yet been approved by the government. It is evident that spatial planning is strongly determined by (central) socio-economic planning.

Water governance in the Mekong Delta has been improving over the years to meet the needs for managing its dynamic development. There is a well-defined legal framework for water management (i.e. the Law on Water Resources) and a network of institutions for water management. Besides the various ministries, there are both national and international river basin organisations (i.e. the Mekong River Commission). Furthermore there are research and education institutes, public and private companies, dealing with water infrastructure. On the ground there are many irrigation management organisations at grassroots level.

Despite this dense network of institutions and organised stakeholders there are still many challenges for the government at all levels to improve land and water governance, resulting in sector master plans that do not show coordination and integration [4]. There are overlaps in responsibilities and tasks, leading sometimes to conflicts between and among the agencies. There is weak collaboration among sectors and the various administrative layers. Provinces have a relatively large autonomy, which sometimes result in sub-optimal solutions at the larger delta scale. And finally, human resources in water management are relatively poorly developed compared to the country's standard, both quantitatively and qualitatively.



4 Potential socio-economic development scenarios in the delta

4.1 Policies and scenarios for the Mekong Delta for dealing with uncertainties

The different ministries, sectors have established their policies for the Mekong Delta and concretised them into their sector master plans. World, national and regional economy may go up and down in the near and further future. Climate change may heavily impact the conditions in the Mekong Delta. We have seen in the review of the master plans [4] that sector policies are not well in line. Of course, there is great effort in coordinating and integrating different policies and get them in line. Still, it remains uncertain to what extent this coordination and integration will be successful and to what extent external influence from world economy and climatic change will positively or negatively impact the delta's development, even if all policies are well in line.

Given the present policies, desirable future developments and the strengths and opportunities of the delta, it is a realistic possibility that the delta could well grow into a very positive development scenario. Given the numerous bottlenecks, uncertainties in developments it remains – also – well possible that a less desired scenario will develop. The scenarios partly represent a continuation of current developments and policies, and partly a shift to a more effective use of land and water use policies.

Understanding that different outcomes are possible, regardless of the policy interaction, helps in assessing what strategy needs to be followed and how effective measures can be under deviating circumstances and outcomes? In this chapter the approach with different, plausible scenarios shows the need for an adaptive and flexible management of the delta. Thus, better choices can be made to prevent under- or overinvestments in measures for the development of the delta in each of the scenarios.

4.2 Past and existing policies

Due to the rich natural resources of the Mekong Delta, the primary focus of the region's economy has always been the agricultural sector. In recent years the region has been committed to official government development objectives for the Mekong Delta in becoming a balanced multi-sector economy with sufficient urbanisation and industrialisation. Although there are clear socio-economic development objectives and policies for the region, approved by the Prime Minister, actual developments are moving into a different direction.

From the American war land use has been – successfully – dominated by a food security policy: national self-sufficiency in terms of particularly rice and other food staples has been achieved. This food security policy is still deeply rooted in Vietnamese government policy. As a result of substantial policy reforms (notably since the *Đổi Mới*, 1986) the agricultural collectives gained more control over agricultural production. Investments in land reclamation and construction of irrigation and drainage systems took time. In the 1990-2000 period many farmers shifted from growing one crop of long-growth-duration traditional rice per year to two or even three crops of high-yielding rice varieties per year (rice intensification). On top of this food security policy the government introduced a rice-production for export policy. This rice-first policy turned Vietnam into one of the leading rice exporters globally.

The *Đổi Mới* has also induced a structural change, which was driven by a rapidly growing industrial sector since the mid-1990s. The most important industrial sector in the Mekong Delta is the food-related industry, especially the processing of food, the production of agricultural and aquaculture products and related industries in equipment and machinery. Besides that, textile industries and other low-technology manufacturing industries emerged. Despite all efforts, the industrial development in the Mekong Delta falls behind expectations formulated in development master plans²².

Recognising the need for further improving rice farmers' incomes and the importance of aquaculture and fruit production for sustainable development of the agricultural sector, in 2000 the Vietnamese government introduced a policy on agricultural diversification. Accordingly, driven by salinisation and enabled by the *Đổi Mới* policy, many farmers have shifted their production from rice monoculture to a more diversified rice-based farming system which includes aquaculture (catfish and shrimp farming), fruits and/or vegetables and leads to higher income generation possibilities

Still, institutional barriers and tight control on agricultural production (notably rice) hamper the progress in agricultural productivity and profitability. The economic prosperity of a predominantly rural society depends very much on the added value of the farmers' production and reduction of their transaction costs. Thus, it is recognised that the agricultural sector in the delta needs to modernise from focus on production to more added value and increase in scale.

²² Renaud, Kuenzer, *The Mekong Delta System*, Springer 2012, chapter 4

Understanding the dynamics of these policies and the future socio-economic development scenarios in which they may result is essential. These developments determine to a large extent the ever increasing pressure on the delta's land and water resources, even more than climate change.

4.3 Possible, plausible future scenarios

4.3.1 Population and economic growth

The socio-economic scenarios partly contain those drivers that will have a high impact on water management issues and are highly uncertain. The key drivers that will influence the future socio-economic structure are population growth and urbanisation, GDP growth and development of the agricultural, industrial and services sector. These elements form an integral part of the scenarios and will also have different outcomes per scenario. The current master plans project a population of over 30 million by 2050. This is a huge increase. A low(er) population growth seems to be lacking.

Box 4-1 Importance of scenarios, example population growth scenario

Taking into account different future outcomes is paramount for adequate decision making and prioritisation of investments. This can be well illustrated taking the example of the current population projections considered in the master plans. All master plans anticipate on an extraordinary population growth in the delta until 2050 (to 30 million people), which is in contradiction with current reality of *declining* growth rates and with forecasts for Vietnam as a whole. As low growth scenarios seem to be lacking for the Mekong Delta, we have developed these, based on the official Vietnam projections and current trends. In the low growth scenario, the Mekong Delta will not count 30 million but less than 15 million inhabitants in 2050. Obviously, if this materialises, it will drastically alter investment needs and priorities laid down in the master plans such as demand for industrial and residential areas and capital intensive climate adaptation intervention.

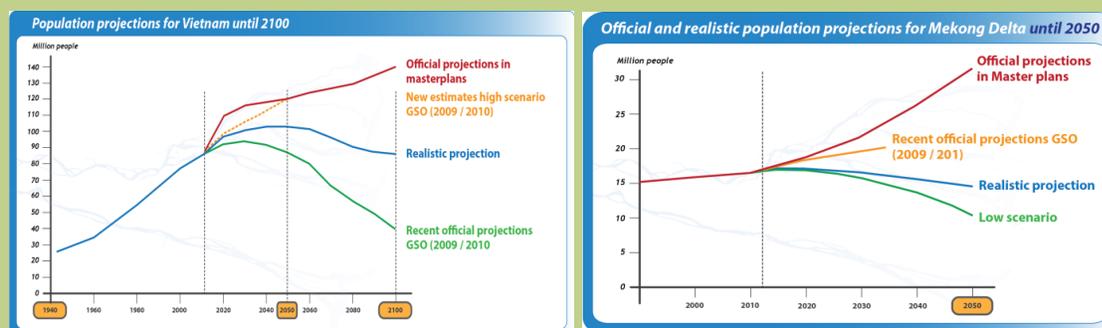


Figure 4-1 Predictions for population growth seem to be fixed in sector master plans, meanwhile already adjusted by the 2009 census (GSO); in reality population growth depends on many social and economic factors, different scenarios are possible.

The table below presents *plausible* high and low extremes of socio-economic outcomes for the near and longer term for the Mekong Delta. This table is based on UN projections for Vietnam, current growth trends and GDP growth forecasts of the IMF. The high scenarios are based on the current projections in the master plans

Table 4-1 Characteristics of high and low socio-economic outlook in the Mekong Delta²³

	moderate outlook			high outlook		
	2025	2050	2100	2025	2050	2100
Population¹	18 million	15 million	7 - 8 million	20 million	30 million	40 million
urbanisation	28%	30%	<40%	36%	45%	>60%
GDP growth²	2 - 3%	<2%		4-6%	>4%	
% share GDP industrial sector	20 - 25%	<30%		35 - 40%	>40%	

²³ UN (population growth projections available until 2100) and IMF projections for Vietnam (high and low GDP data for Vietnam available until 2018, for SEA until 2025)

Currently, it is unknown whether the Mekong Delta will develop more in line with the high-growth or low-growth outlooks, however, the outcome will have clear implications on the demand for residential areas, demand for economic zones, port and transportation development and transportation related economic activities. Although many forces behind these outcomes are out of the control of decision makers, some key driving forces can be influenced and altered if taken the appropriate actions. This is mainly related to effective land and water use policy implementations.

4.3.2 Four scenarios for potential socio-economic developments in the delta

To anticipate on similar growth as the national targets, the current master plans emphasise on the urgency and prioritisation of the Mekong economy advancement through a diversified industrial development. The Socio-Economic Master Plan lists a diversified manufacturing structure as drivers for economic growth, such as energy, textiles, footwear and the mechanical industry. A clear focus on the delta's comparative advantage, its rich agricultural land and resources enabling a high-value agro-processing industry, is missing.

The sector master plans insufficiently reflect on how the anticipated acceleration of such a fully diversified industrial and service economy can be accomplished [4]. Current signs are indicating that this strategy is less effective, as mainly the food processing industries are performing well in the Mekong Delta. Occupancy rates at industrial parks in the Mekong region remains low, at 37%, compared to the national average of 57%²⁴. An extraordinary favourable economic climate would be needed to enable an effective diversified industrialisation.

Therefore a clear strategic decision is needed on what type of industrial development is attainable and desirable in the delta: *a fully diversified industrial development* or *an industrialisation that builds upon the agricultural competitive advantage of the delta*. This is one of the key drivers that will shape the future of the delta and in which strategic choices can be made.

Although the master plans explicitly target a restricted area for economic development, the Focal Economic Zone (FEZ), the day to day practice is a spatially dispersed and fragmented development of industrial and urban activities, with competition on growth objectives between provinces. Also, many industrial activities are emerging in an undesirable corridor between Cần Thơ and Hồ Chí Minh City, following the improved transportation network and economic pull factor of Hồ Chí Minh City.

A "build-it-and-they-will-come" philosophy has proven to be ineffective, as growth is driven by a market. Thus, a mere investment in infrastructure, urban and industrial zones by itself is unlikely to attract the required growth. Moreover, tensions arise from the infrastructural investments that are required to support this approach. Adequate policy is required to reinforce spatial specialisation, which will lead to higher overall returns. The entire delta should gain on this, provisioned that the generated yield in one part of the delta is also invested in further development of other parts. At the same time potential future land-use conflicts arise due to the safeguarding of agricultural land for rice cultivation and land (34%) to be used for urbanisation and industrialisation.

Box 4-2 Low occupancy in industrial and urban development

Urbanisation has changed and will be changing the spatial structure of the Mekong Delta. In line with the anticipated industrial development and acceleration of urbanisation, the land area for industries and urban areas has increased at the expense of agricultural land. However, due to a lack of harmonised planning and competition among provinces, industrial zones have developed rapidly in a scattered manner. Many on highly fertile ground. Due to lack of capital investment, capacity exceeds production and only 30-40% of the industrial plants is currently occupied. At the same time, future development objectives anticipate on a further increase of urban land to 350,000 ha in 2050 and land for concentrated industries to 40,000-50,000 ha in 2050 (SIWRP). Real estate development around Cần Thơ shows a similar trend. An overcapacity of expensive housing is being built in the area, while there is a desperate need for affordable housing²⁵.

Question is how feasible and attainable current developments and future master plans are, bearing in mind the land-use pressures and the objectives of the agricultural sector. To guide future developments in a sustainable way, integrated spatial planning approach between all sectors is essential. In this way, allocation of plants can be more in compliance with the competitive advantages of each location, and conflicting less with high-value agricultural land, and units would be better able to join forces to be competitive on the domestic and international market. Also, to guide the urbanisation process, proper urban planning will be essential to enable affordable housing and job opportunities, and to prevent slum developments. Adequate urban infrastructure, including sufficient drainage, will be vital to this.

Effective and coordinated, inter-sectoral adoption of land and water use policies will be essential to overcome these potential conflicts and to effectively coordinate spatial diversification within the delta. Analysis of the different master plans has identified this as another major driver for the future of the delta for which strategic

²⁴ Vietnam News, Mekong Delta Economic Cooperation conference, Vinh Long 25/26 November 2013

²⁵ SIWRP

decisions need to be made: *the extent to which coordinated and effective implementation of land-use and water policies will be in place.*

Given the past and recent socio-economic developments of the delta, and the national economy of Vietnam, the development of the delta stands at a crossroads. At present and thanks to its dedicated development over the last three decades, the Mekong Delta is characterised by its agro-based economy; serving the nation as its rice bowl (and corner stone of national food security policy) as well as primary provider of food-based export revenue. The national economy of Vietnam, however, is undergoing a transformation into an industrial and services based economy with an increased export orientation on goods and services. In the Mekong Delta this transformation of the economy has not taken off yet, but is increasingly emerging at the forefront of provincial planning as an engine of economic growth and prosperity for the delta. Thus, for the future, the question is whether the delta should follow the national economic development strategy or opt for an innovation and reinvigoration of its comparative advantage and established success of an agricultural based economy.

Another fundamental aspect of future developments in the delta that will have implications for the capacity and measures for climate change adaptation is the degree to which economic and infrastructural developments can be spatially coordinated and optimised, or will be spatially evolving through localised economic responses. In case of the former, resources utilisation and adaptation measures can be spatially directed and economically pro-actively optimised. In case of the latter, adaptation measures become responsive to economic developments with the inherent risk of becoming costly due to impact mitigation.

Based on these two main driving forces of socio-economic development *i) agro-based versus industrial development* and *ii) effective implementation of land-use and water policies*, four spatial development scenarios have been designed. This has been captured in a four-quadrant matrix. These scenarios represent plausible outcomes based on global and regional developments, master plan objectives, the natural system and its limitations, institutional barriers and past and current trends. Two scenarios depict positive economic developments for the delta with pro-active planning and optimisation of resources and measures, which distinctive in their degree and type of industrialisation of the economy. The two other scenarios depict intensification of current economic development trends in the delta (one primarily agricultural, the other primarily industrial) that are not spatially (and in their resource utilisation) optimised, and hence will induce higher adaptations costs and measure to sustain and maintain in the future of climate change.

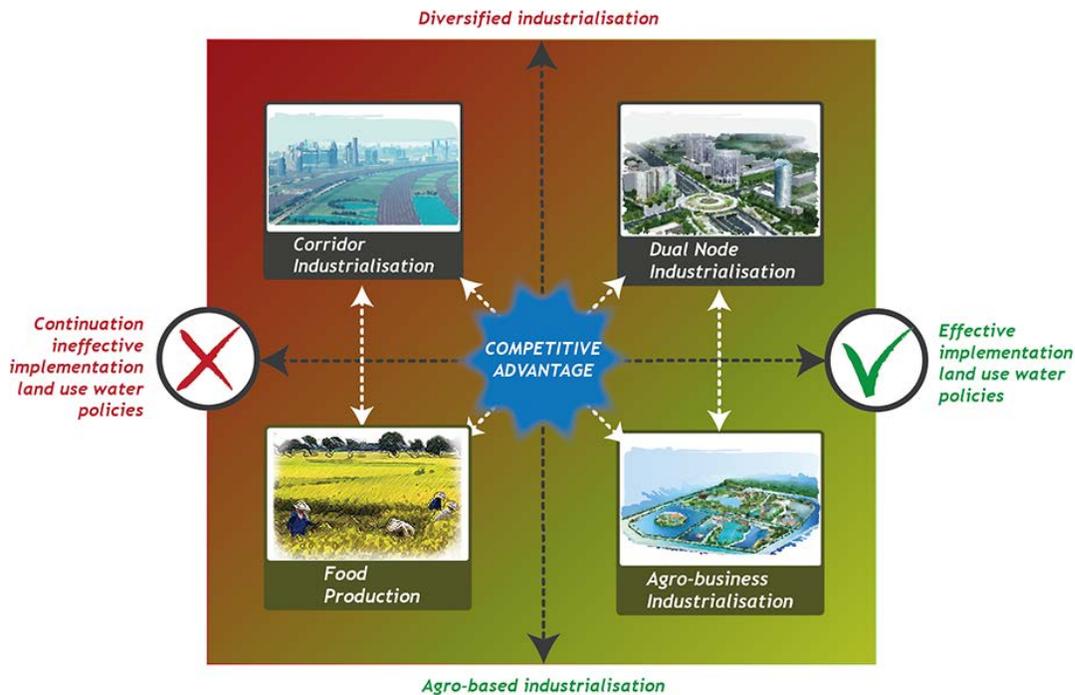


Figure 4-2 Four possible development scenarios with key drivers of policy implementation and economic diversification

Corridor Industrialisation scenario

Mekong Delta Plan, 2013

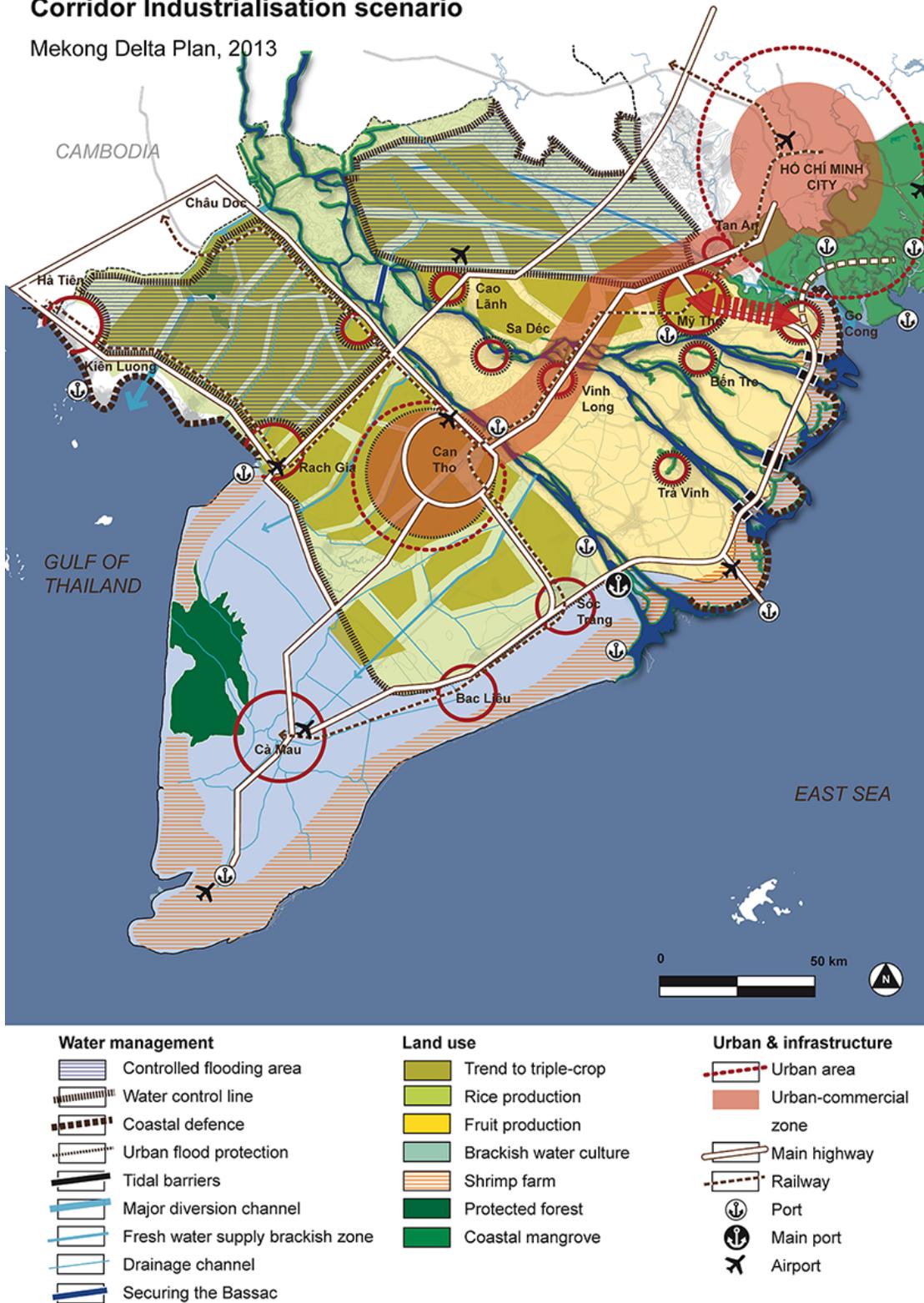


Figure 4-3 Potential development scenario with diversified industry in the HCMC – Can Tho corridor; assumes continued accumulation of industry and by consequence loss of fertile area for agriculture (fruit)

4.3.3 Corridor Industrialisation scenario

In this scenario, a favourable economic climate and expansion restrictions in the Hồ Chí Minh City area push economic activities – non-agro-business industries – further into the delta, creating an urban and industrial concentration in the Hồ Chí Minh City – Cần Thơ corridor. This colonisation and transformation of the economic structure of the corridor divides the delta's economy into two zones: an industrialised metropolis in a highly fertile and flood-prone area and a rural hinterland struggling to keep up pace. The governance environment is unable to redirect the urban-industrial development through effective spatial planning arrangements, further resulting in a fragmented industrialising hinterland, characterised by fierce competition and stagnating growth. Urban planning is ineffective, leading to a mismatch between developed real estate and the need for affordable housing. The premise of this scenario is that the comparative advantage of the different land characteristics of the delta is not respected, resulting in a loss of prime agricultural and productive land to urbanisation and industrialisation with subsequent high investments for flood protection and water supply requirements. The subsequent inefficient scaling process leads to higher income inequalities with a GDP growth under pressure in the long run.

This scenario is disconnected with the other scenarios by the fact that once industrialisation and urbanisation expands into the corridor, it becomes near impossible to recuperate the affected land and water resources for an agro-based economy.

Population growth - Population will further increase in the corridor area. Expected population by 2020 is around 20 million people. In the long run (2050+), working population will decrease due to migration to more effective growth areas less prone to natural hazards.

Economic growth – High global economic growth scenario. GDP growth in both agricultural sector and corridor metropolis lags behind expectations due to inefficient use of the land resources. High inequality between corridor and rural hinterland.



Figure 4-4 Development pathways of the socio-economic drivers for the Corridor Industrialisation scenario

Food Production scenario

Mekong Delta Plan, 2013

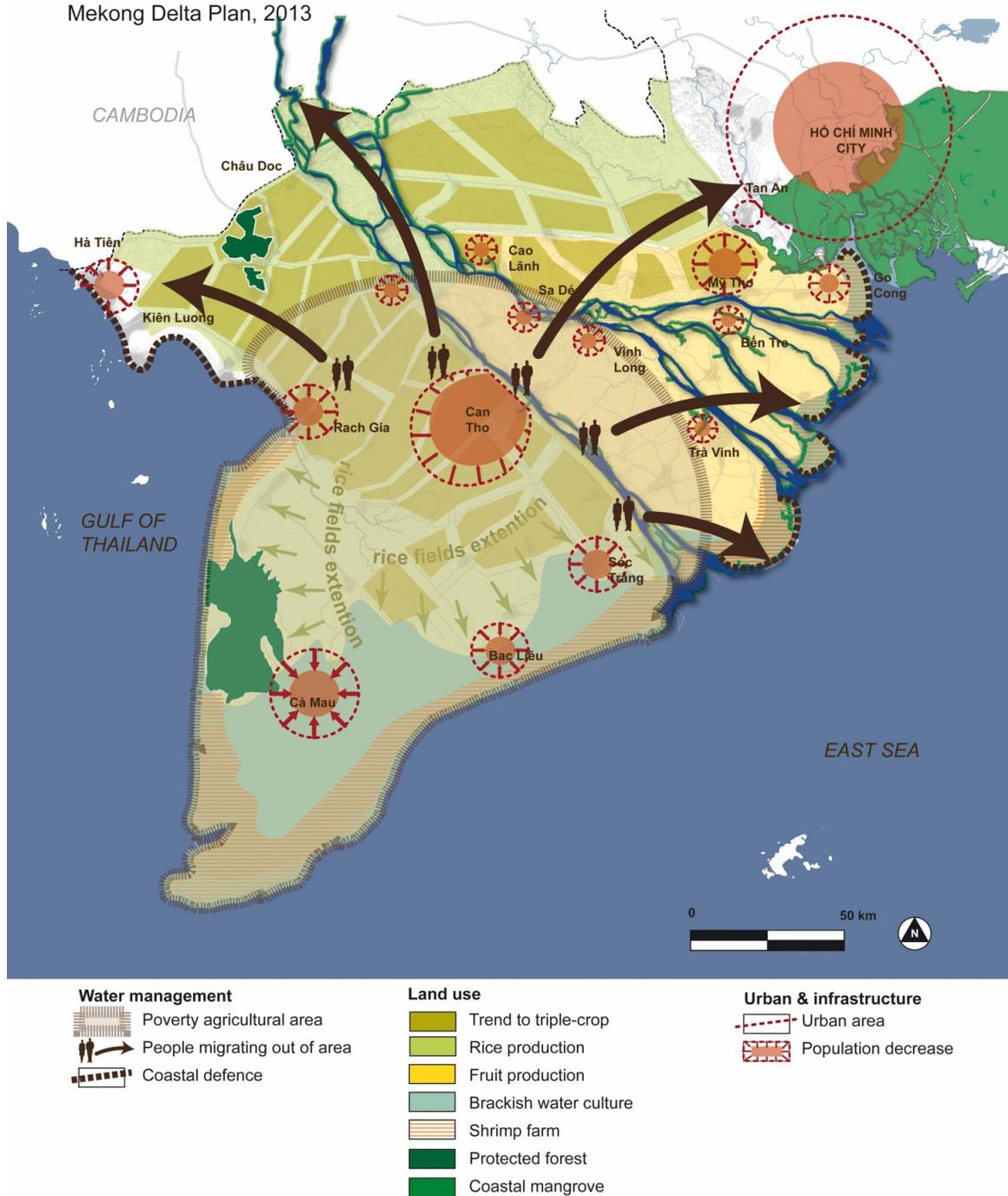


Figure 4-5 Agriculturally based economic development scenario assuming a continued focus on food supply security

4.3.4 Food Production scenario

In this scenario, the delta is not able to materialise its anticipated economic transition process. This is caused by an unfavourable global and national economic climate, and in the course of rebounding economic growth, a failure to re-direct the industrial and services based economic growth trends towards the delta. As a result,

pressures continue to mount on the delta to secure the interests of national food security and achieve or at least maintain increased production of food commodities (e.g. rice) and the general food basket (fish, fruits, vegetables). The economic structure remains largely agricultural, with a GDP growth far behind the national average. As a result, the population pressures on the rural resources base will continue to increase, thereby hampering the modernisation of the production base through resources consolidation and/or increasing income inequality (and potential poverty) among the rural population. Alleviation of these pressures can only come from a continued out-migration of the delta to neighbouring regions (dependent on continued favourable economic growth there), and further stagnation and eventual decline of population growth at the national scale.

Population growth – Population is expected to increase to around 19 million people by 2020 after which population will decline rapidly as a result of out-migration. Depopulation of the delta could also evolve at a much slower pace, if economic climate in neighbouring regions is less favourable.

Economic growth - Stagnating, this scenario is characterised by the lowest GDP growth of all assumed scenarios.



Figure 4-6 Development pathways of the socio-economic drivers for the Food Production scenario

Agro-Business Industrialisation scenario

Mekong Delta Plan, 2013

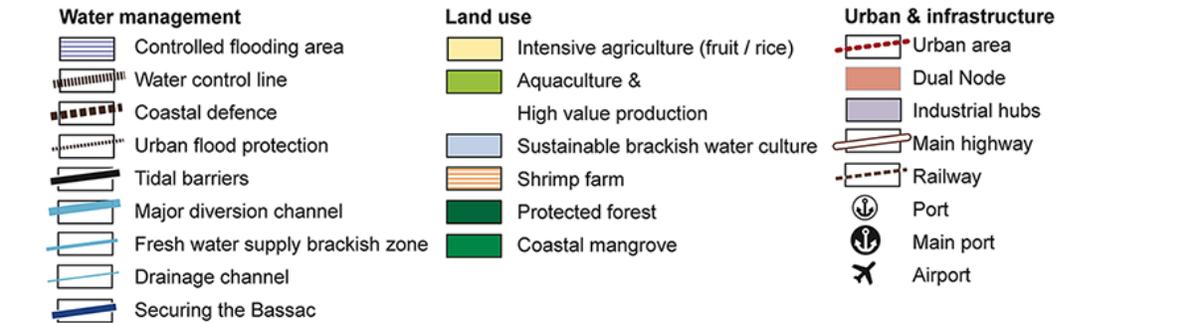
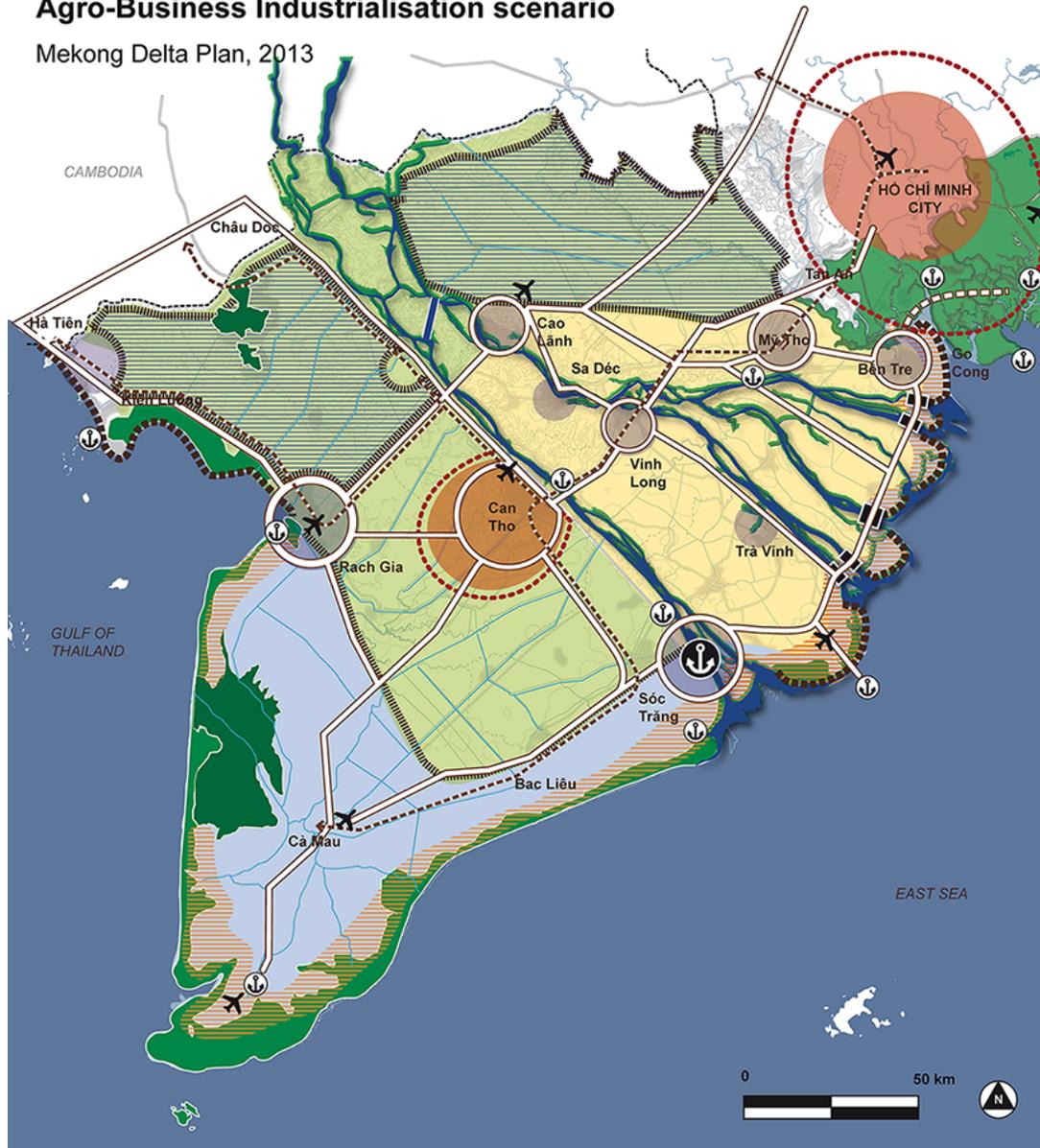


Figure 4-7 Agro-Business Industrialisation, economy scenario, assuming successful spatial planning and water resources management

4.3.5 Agro-Business Industrialisation scenario

In this scenario, the Mekong Delta develops into a regional hub specialised in high-value agriculture and agro-food products for export and domestic markets. Non-agro food industrial and tertiary sector activities, except for related services and industries such as logistics, machinery and equipment are directed outside the delta, enabling an economic development and GDP growth based on the region's agricultural niche advantages. This scenario represents a specialised economic growth model that deviates from the national average, but more closely reflects, and builds upon, the present agro-based economic structure and climate of the delta. Apart from concerted investments and policies to create an enabling economic climate for specialised agro-industrialised processing and export, this economic model will also require a turnaround of the agro-based production sectors. These latter, whether in aquaculture, fruits or commodities, will need to transform in modern, commercially oriented, production systems focused on high product quality that meet international and middle-class urban consumer standards. A continuation of declining rural population pressures and resources consolidation – as presently emerging in some areas of the delta – may thus form a favourable socio-economic environment to achieve this. This is especially true if and when a growing agro-industrialised sector will be able to absorb a production based labour force that is non-agricultural and growing steadily. Also this Agro-Business Industrialisation scenario depends highly on effective spatial planning and well-concerted investments in agro-industry, production and transport. Disappointing growth rates and trends may result into a "slipping-back" of this economic trajectory into a Food Production like scenario.

Population growth - The premise for this scenario is a decline of the rural population that migrates towards economic centres outside the delta. The expected population by 2050 is around 15 million.

Economic growth – Low to moderate global economic growth. Nevertheless, a stable GDP growth is achieved in the Delta through efficient high-value agriculture production.



Figure 4-8 Development pathways of the socio-economic drivers for the Agro-Business Industrialisation scenario

4.3.6 Dual Node Industrialisation scenario

In this scenario, the delta develops into a thriving diversified economy, where high-value agro-food business prospers, congruent with secondary and tertiary sector activities in designated economic zones. The global economic climate is highly favourable with seamless global trade, and the region is characterised by an impeccable integrated and coordinated spatial planning. Main urban-industry expansion is directed towards two nodes: around Hồ Chí Minh City and west of Cần Thơ. Fragmentation of industrial zones is limited and the delta is characterised by large-scale specialised agro-business co-operations and enterprises. Boosted by the highly favourable economic climate, high-value agro-food business prospers, congruent with thriving and high-value secondary and tertiary sector activities in designated economic zones. Total output and productivity increase significantly. The wealthier consumer base enforces the emphasis on food safety standards and a nutritious and varied offer. At the same time, global trade dynamics decrease the need for self-supportiveness over food security. An efficient infrastructure network – including port and waterway developments in the west – connects the hinterland to the mainports, facilitating further growth of the delta. Land and water pressures are high, but dealt with in an effective and coherent manner, leading to efficient use of all resources and preservation of ecosystems. The core drivers of this scenario are both a very favourable economic climate and a clear and targeted overarching vision for the entire Mekong Delta and beyond – to make sure that developments are not conflicting with development trajectories of the adjacent regions.

Population growth - Growth in the secondary and tertiary sector will act as a pull-factor on the delta, resulting in a high population growth to maybe even as much as 30 million by 2050 after which the population growth will decrease slightly due to lower birth rates of the wealthier population.

Economic growth - This scenario has the highest GDP growth, attained in the services and diversified industrial sector and fostered by impeccable infrastructure connections.



Figure 4-9 Development pathways of the socio-economic drivers for Dual Node Industrialisation scenario

Dual Node Industrialisation scenario

Mekong Delta Plan, 2013

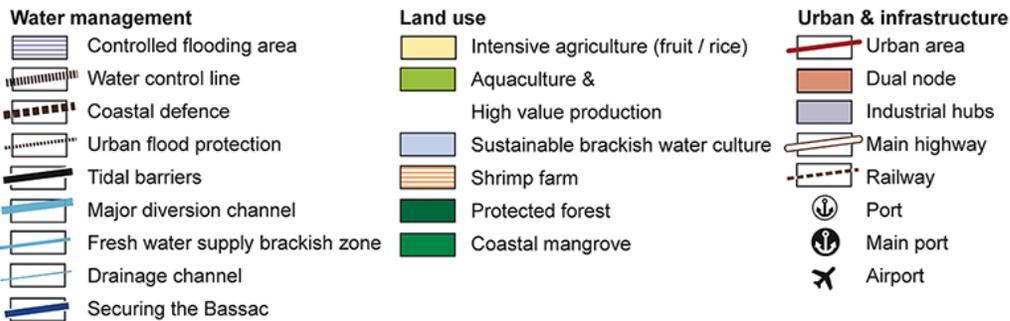
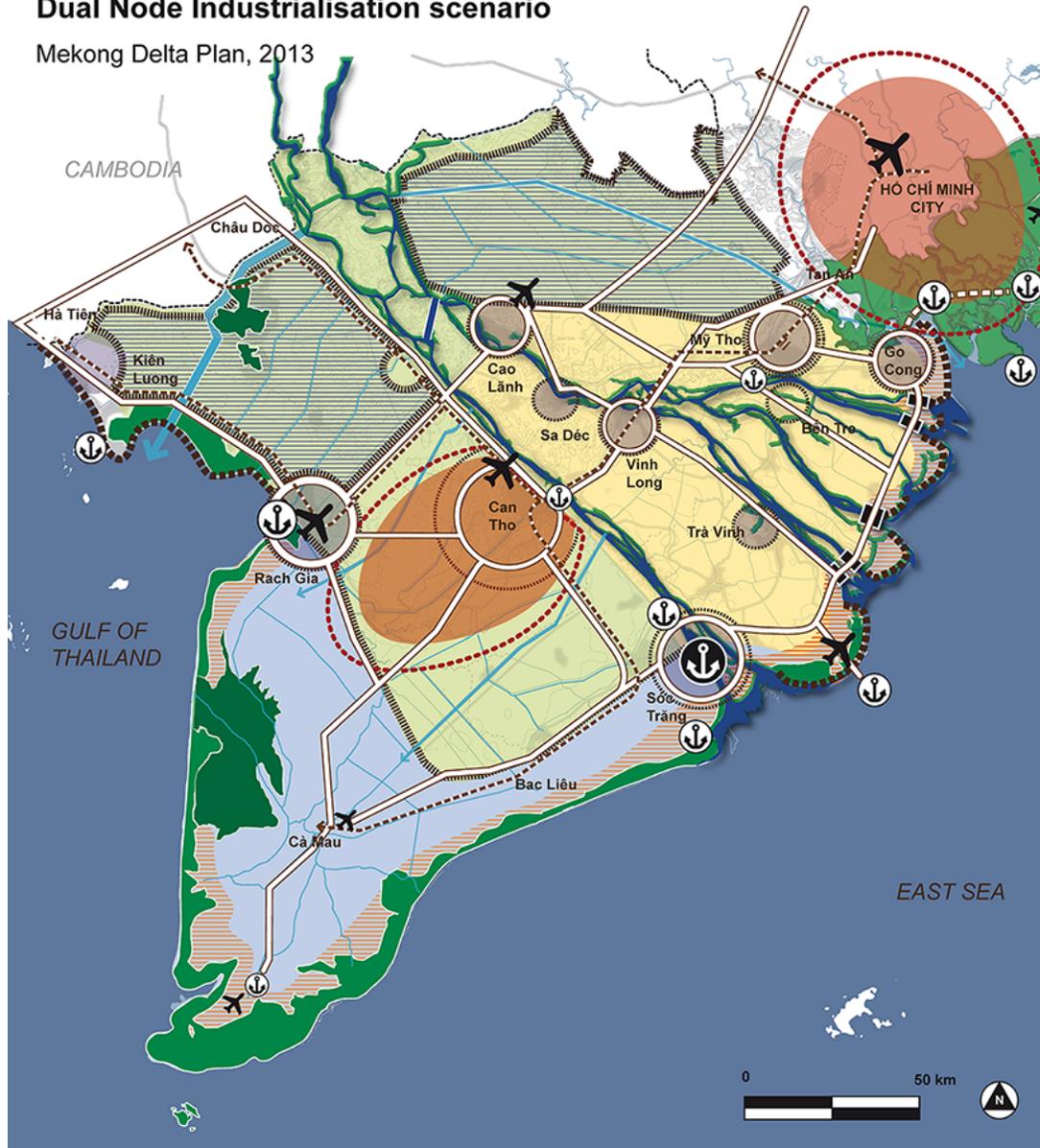


Figure 4-10 The Dual Node Industrialisation scenario assumes effective land-use planning of Hồ Chí Minh City and preservation of valuable fertile soils for agriculture and fruit culture between Hồ Chí Minh City and Cần Thơ. West of Cần Thơ agriculturally unfavourable soils is used for industrial development.

4.4 Food Security perspective changes in economic growth scenarios

The agricultural development of the Mekong Delta, and in specific the impressive growth in rice cultivation and production, has been the result of concerted pursuit of national food security policy that has transformed Vietnam from a food deficit country into a major exporter of food commodities. However, with continued economic growth, and shifting economic development targets geared towards diversification and growth in particular for the industry and services sectors, the food security dimensions are bound to change profoundly – both for a national policy and the Vietnamese consumer base.

According to the FAO World Food Summit of 1996, food security is defined as:

Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

This definition has four dimensions to food security, with diverging implications for policy setting that can be stated as:

1. Enough food should be *physically available* for consumers;
2. People should have economic and physical *access* to food;
3. The food *utilisation* should be nutritious and healthy (food safety);
4. These three dimensions should be *stable* over time, providing food security throughout the year and lifespan of consumers.

In the FAO view on food security self-sufficiency is not required. Coming from a situation of national (physical) food deficiency only three decades ago, and confronted with high population growth, Vietnam has rightly put enormous efforts in achieving national food self-sufficiency, primarily by boosting its production of rice and other agricultural products. Obviously food security is so basic that it is part of all four scenarios.

With an increasing urban population, and a wealthier consumer base dependent on industrial and services sectors, the *economic access* to food and its *utilisation* become increasingly important – also from a national food security perspective. With economic development, the securing of a nutritious and varied food supply of good food quality and safety, that meets ever increasing richer dietary preferences of a wealthier consumer base (e.g. higher animal protein based food basket), becomes more and more important. Whilst the access of Vietnam to the world trade market has increased, the agricultural sector's access to international high-value consumer base and markets – as attested by the recent exponential growth of the aquaculture sector and export – will continue to increase the opportunities for an agro-industrialised based economic sector to reap economic value and drive economic growth.

These changing dynamics of the economic structure in Vietnam (in particular wealth and sectoral composition) and accompanying changes in food market demands (both national and international) thus warrant a reassessment of the food security policies and rural economic development strategy to be pursued in the Mekong Delta. Transforming agricultural and rural development towards high-value products and markets (e.g. fish, fruits, processed foods, etc.), as foreseen in the Agro-Business Industrialisation scenario, enables rural development policies for the Mekong to shift from food *availability* towards creating *economic access* among the rural and agronomic sector through increases in rural income. This entails a shift from assuring food availability towards establishing rural economic growth by reaping economic value across the value chain.

In the *Agro-Business Industrialisation* and *Dual-Node* scenarios this food security and economic growth strategies form the corner stone of rural development for the delta. Where in the *Dual-Node*, a more diverse development of (non-agro based) industry and services is anticipated, but where economic growth (and therewith *economic access* to food) is stimulated, and agricultural developments are increasingly responding to diversified and higher value food demands of domestic and international markets. In the *Corridor* Scenario, the loss of prime agricultural soils and high-value fruit production capacity due to Corridor Industrialisation is seen as an irreversible economic loss of assets for the delta, which is worth to avoid. Not only as it would represent a loss of potential development and economic value of agro-business development, it also increases the needs and costs of flood protection measures for the urbanised-industrialised corridor. In the Food Production scenario as defined here, the economic development and growth of the delta fails to materialise – with the consequence that *economic access* to food remains depressed, and the securing of food *availability* remains a prime strategy – both locally in the rural delta, as in the national food economy.

Rice production and *availability* have been the corner stone, and success, of Vietnam's food security policy of the last three decades. In the future outlook of the delta's development as presented in the four scenarios, this is bound to change. This is on the one hand informed by the opportunities for the delta to shift towards agro-economic development based on high-value food products (e.g. Agro-Business Industrialisation), and on the other hand the stabilisation of demographic growth of Vietnam, coupled with economic development, which is reducing the future demands for rice-staples. This does, however, not imply that there is no need for future rice production in the delta. The delta shall continue to be an important provider of rice for Vietnam, in order to secure both *availability* and *economic access* to food. But to promote economic development and *economic access* in rural areas, more value is to be obtained from focussing on high-value food (products) in domestic and international markets. Rice production can be stimulated in good areas (double in Upper Delta, and triple in Middle Delta), enabling upscaling to reap economies of scale in rice production for economic growth and diversification into high-value agro-business supplies for single and double cropping systems. The latter in particular for the upper delta, in order to retain a flood-based agricultural/fisheries season that can facilitate high-value fish/vegetable production and reduce flood protection measures in the Middle Delta.

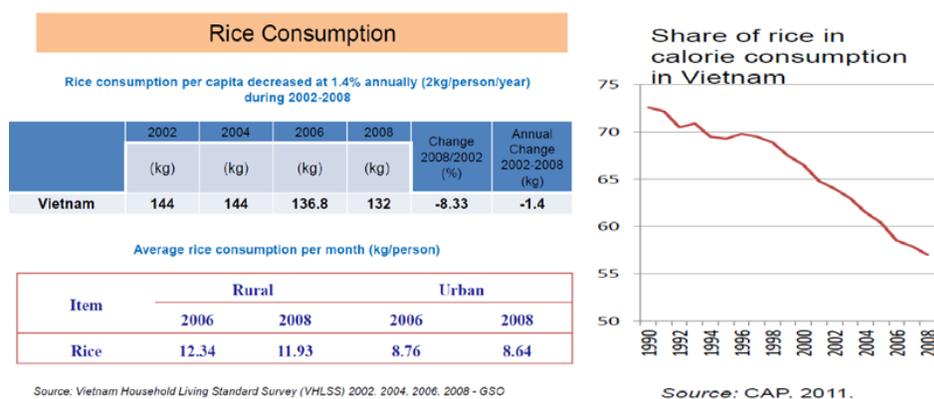


Figure 4-11 Availability of other food types causes reduction of rice consumption

4.5 Implications of economic scenarios for people, land use, water and economy

The main priorities for the delta are to develop into a safe, prosperous and sustainable region. Looking at the possible development trajectories of the Mekong Delta, they all have their specific advantages and disadvantages. An assessment of these development scenarios regarding these three key issues provides a view on the capability of dealing with changes in the economy and land water use situations [see Table 4-2].

Each of the scenarios may occur

A key note to be made of the assessment is on the plausibility per scenario that should not be disregarded. The development is not only the result of implementing and enforcing the right policies and institutions. Much will also depend on highly uncertain external developments such as the economic development of Hồ Chí Minh City and neighbouring countries, global trade and commodity prices, climate change and upstream developments. For this reason, an adaptive approach, that makes use of, and respects the specific opportunities and threats of the delta is recommendable above a more 'high-risk' – single-focus trajectory such as Dual Node - in which all drivers have to be in place and develop according to a set projection. This has a high risk of failures due to deviating outcomes of uncontrollable drivers [see also paragraph 5.4 Bottlenecks in the current agricultural value chain of the Mekong Delta].

Table 4-2 Assessment of potential scenarios developing in the Mekong Delta

				
SAFE				
Required safety level	medium: high economic value, high-value agriculture needs protection	high: due to large centralised industrialised/urbanised areas	low: small area of industrialisation / urbanisation and low economic value agriculture	very high: due to scattered industrialisation and urbanisation
Costs of flood protection	medium: concentrated protection and use of natural protection	high: centralised and planned industrialisation/urbanisation results in efficient protection	medium: not controlled land use demands diversity of measurements	very high: needed for attraction of industries. scattered pattern, high value to protect
Return on investment of safety level	high: due to medium costs and moderate sustainable income	very high: depends on external economic development	very low: due to high costs and low income	medium: depends on external economic development
Score safe	high	very high	very low	medium
PROSPEROUS				
Using competitive advantage	very high: use of natural resources	medium: other regions more competitive advantages	medium: competitive advantage not optimised	low: competitive advantages ignored.
Effective urbanisation and industrialisation	high: economic value delta supports high urbanisation ratio	very high: economic value delta very high	low: economic value of delta too low to support high level urbanisation	medium: at first an increase followed by decrease
Cost-effective infrastructure development	high: due controlled to spatial planning	very high: due to controlled spatial planning, higher urbanisation	very low: ineffective planning and use of infrastructure	low: ineffective planning of infrastructure
Score prosperous	high	very high	low	low
SUSTAINABLE				
Sufficient fresh water supply	high: lower demand, saline areas adapted	high: lower demand by industry	very low: contradicting land use in relation to environment	low: scattered pollution over the delta by industry
Water quality	high: new adaptive systems improve water quality	high: low use of surface water, industrial water centralised	very low: water use insufficient, many pollutants	low: scattered pollution over the delta by industry
Sustainable land use	high: land use adapted to its environment	high: structured spatial planning, risk on loss of high fertile agro-grounds	low: land use is not in conjunction with delta characteristics	very low: natural system not taken into account
Using natural flood defence	high: use of natural mangrove system	medium: some areas need structural protection	very low: coastal zone used for agriculture	low: many areas need structural protection
Coping with climate change	high: flexible land-use systems.	high: centralised areas, effective protection	very low: high risk of bad harvest	low: scattered high vulnerable areas
Coping with external economic developments	very high: less dependent on external factors	high: dependent on external success factors, variation activities needed	medium: less affected by external factors	very low: extreme dependent on external factors
Score sustainable	high	high	low	low

Another way of presenting the general scores of the scenarios in terms of safety, prosperity and sustainability is given in the figure below.

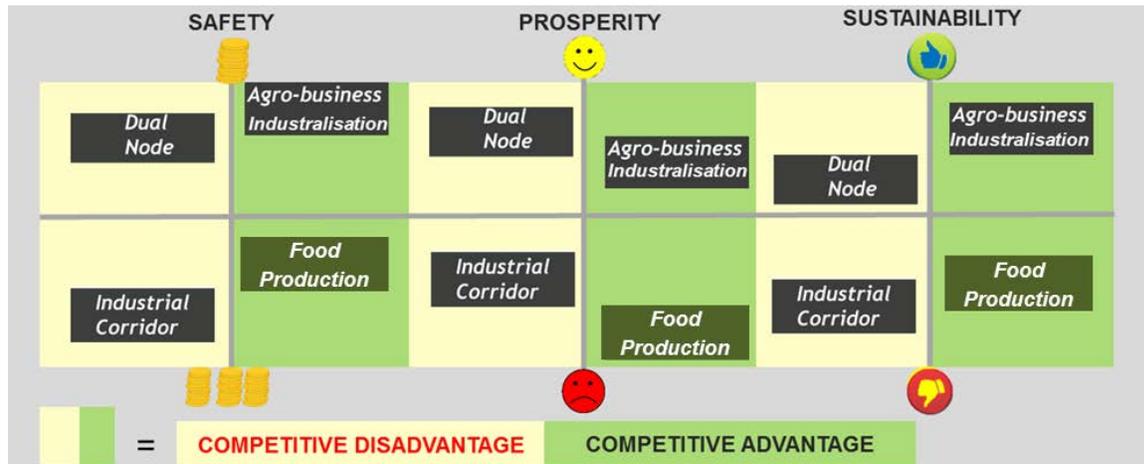


Figure 4-12 This figure illustrates the position of four scenarios in relation to the main objectives for the Mekong Delta: safe, prosperous and sustainable.

Both the Agro-Business Industrialisation and Dual Node Industrialisation scenarios make use of the opportunities and threats of the physical system of the Mekong Delta. In the Dual Node Industrialisation scenario, urban and industry activities are taking place on less-fertile area, hence are not competing with high-value agricultural activities. In both scenarios infrastructure development is essential and cost-efficient, as it connects the agricultural productive land with the larger economic clusters and markets. As a result of a much larger population and urban expansion on dry and acid land, the Dual Node Industrialisation scenario will be confronted (and thus will have to deal with) profound water scarcity and water quality issues. This will be much less in the Agro-Business Industrialisation scenario. A crucial difference between these two scenarios is their vulnerability to external shocks, in particular to economic growth. As the Agro-Business Industrialisation scenario specifically targets its core competitive advantage: its agricultural niche, growth is organically driven and is less vulnerable for stagnating (global) economic growth. Contrarily, the Dual Node Industrialisation scenario is distinguished for high economic growth; a highly diversified industrialisation with less focus on industrialisation from its core competitive advantage. This makes this scenario particularly vulnerable for external shocks such as declining (global/national) economic growth rates.

In all scenarios safety (flood and fresh water) can be acquired, but in the Corridor Industrialisation and Food Production scenarios the safety can be reached at unnecessarily or less affordable high costs. Prosperity and safety are very much connected factors: a high safety is required to attract industry and enhance a sustained economic prosperity and vice versa high prosperity in the delta makes the investments for safety affordable. The natural competitive advantage of the delta is in the sustainable use of its natural resources for agriculture. A focus on agri- and aquaculture is a very feasible option, creating conditions for industrialisation is essential for good economic development. In the Dual Node scenario, huge capital investments in infrastructure, flood protection and water supply and purification are necessary. This is only feasible if the Mekong Delta already has developed a solid structure of a high value adding production system.

4.6 Interconnectivity of the different scenarios

Each presented scenario evolves over different development pathways and will have different implications for the people living in the delta, the natural resources, its vulnerabilities and the economy. Thus, an economic development scenario becomes in physical terms also a land and water use scenario.

The socio-economic outcomes are both influenced by actual strategies adopted and by external circumstances such as climate change and the pace of global and regional economic growth. As the economic climate has its own supra-national dynamics and is largely out of the control of decision makers, an adaptive strategy towards sustainable growth is recommended.

Figure 4-13 shows the key drivers of the different scenarios. The left side, Food Production and Corridor Industrialisation, correspond with a continuation of current developments of the Mekong Delta, in which the spatial development and resources utilisation are locally evolved rather than spatially directed. The right side, Dual Node and Agro-Business Industrialisation correspond well with official government objectives and growth targets set for the delta but are highly dependent on an effective implementation of land and water use policies. The outcome will furthermore be determined by the global and regional economic climate. The top of the graph, Dual Node and Corridor Industrialisation represent growth trajectories that will only materialise and sustain in the long run if the global economic climate is highly favourable. The bottom of the graph represents outcomes that are plausible when the global economic growth is less strong or even stagnates.

As global economic growth develops exogenously and is thus impossible to influence, a single-focused anticipation on a Dual Node or Corridor Industrialisation type development is therefore risky. Instead, focussing on the core comparative advantage as pillar of economic growth will be more sustainable in the long run and allows easier adaptation to changing circumstances at a later stage.

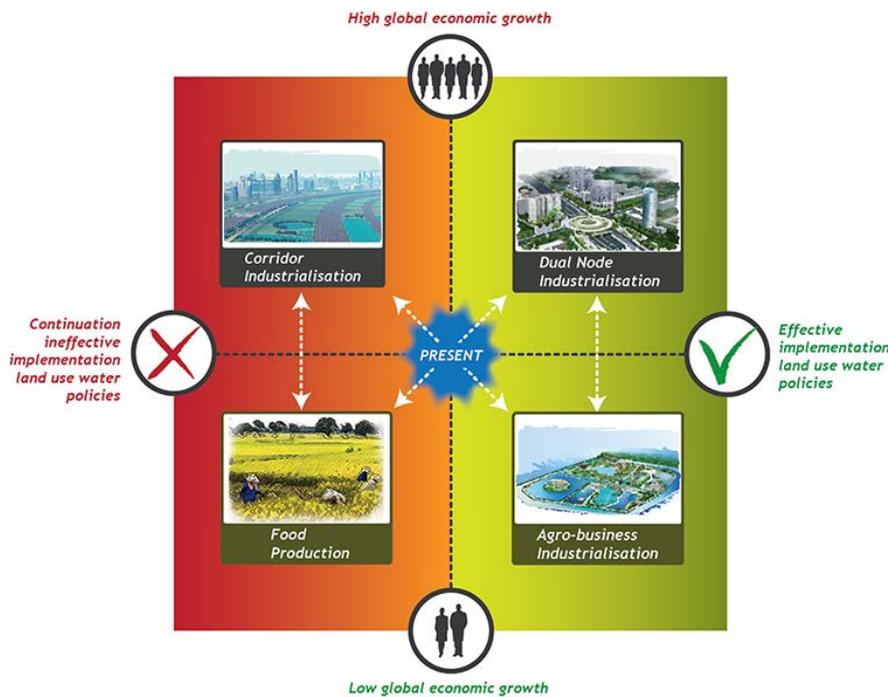


Figure 4-13 Potential socio-economic development paths in the Mekong Delta, depending on external economic climates and on effective implementation of land and water use policies

Scenarios over time

The scenarios presented as such form the basis for a socio-economic development vision and roadmap for the Mekong Delta within the context of land and water. As such, both the 'Food Production' and 'Corridor Industrialisation' scenario can be seen as an extension of current development and executed policies. Due to the history of Vietnam, major governmental focus has always been on food security objectives. In line with the objective of becoming a middle-income country, this shifted drastically at the end of the last century, when the transformation towards a multi-sectoral economic structure began. Then, as a result of the decline in food supply and resulting soaring food prices in 2008, the national government tightened control on the Mekong Delta region, putting emphasis on rigid regulations to guarantee food security, such as the protection of 3.8 million hectares of rice land. This has had serious implications on the livelihood of the regional farmers. In the past two years, as a result of recent huge surplus and resulting lower market prices, some first steps towards transforming this policy have been put into place. However, many institutions favouring protection of rice production have been implemented and will be difficult to change as well as the perspectives of the government²⁶.

²⁶ Dr. Vo Hung Dung (VCCI)

In the 'Food Production' scenario, the tight control over rice production remains intact or even intensifies due to global economic slowdown and resulting food commodity shortages. Furthermore, the 'Food Production' scenario is a result of unchanging institutional developments such as localised orientation, a lack of integrated regional policy (and enforcement) on designated economic hubs and no or suboptimal infrastructural investments. As such, no efficient subsystem of agro-hubs and producing hinterland is created leaving the hinterland poor and disconnected from markets. This will severely hamper the development of a high value added supply chain industry. To overcome this, different policies and concerted infrastructural investments will need to be taken in order to enable an agro-business like development. Moreover, the sustained focus on rice production, as provision of bulk supply of food-staples, provides a reduced economic margin for producers and the supply chain on which to base economic growth. Economic growth becomes then dependent on increasing margins through economies of scale (through large-scale commercial enterprises), which can only be achieved with a progressive depopulation of the rural areas. A continuation of a smallholder based rural economy will, in a rice based scenario; inevitably mean a progressive economic disparity between the delta and other industrialised regions of the country.

In the Agro-Business Industrialisation scenario emphasis is put on the market value of the agricultural products instead of on production quantities. Even with low global economic growth, the region is able to upscale the agricultural sector with high-value agricultural products for the domestic and international trade markets, enabling a higher GDP for the entire region. This is realised due to concerted efforts, such as a clear focus on its unique advantages instead of duplicating the industrialisation patterns of other provinces., The main difference compared to the Food Production scenario is that the Agro-Business Industrialisation scenario focuses on intense investments with a high technological component, on a well-structured organisation of agro-business hubs and producing hinterland and on market and trade development of value added product chains for agriculture. While the food security focuses on exploiting the comparative agricultural advantage (rice), the agro-business scenario aims to build a competitive advantage for the Delta, thereby building on a national competitive advantage.²⁷

The Dual Node scenario follows a multi-sectoral approach, focusing on rapid urbanisation and industrialisation, and building upon the natural advantages and the agricultural value added industrialisation. It corresponds well with the Mekong Delta economic development which has been approved by the Prime Minister in 2009 – though in this scenario it is smaller in size to avoid industrialisation in the upper flood plains and water scarce areas of Cà Mau – and is in line with the country-wide transformation objectives of accelerating growth of the industrial and services sector. However, it is highly unlikely that this development will be achieved in the near future, based on the current economic climate of the delta, with structure and growth lagging behind the national average. Rather, this scenario could be a logical sequence once the 'agro-business industrialisation' has a strong and solid basis. And even then, a highly favourable global economic climate will be a prerequisite to accomplish this growth model.

The Corridor Industrialisation scenario represents a continuation of current actual developments, with an organic urban and industrial growth along the improved transportation network (A1 highway) in the economic corridor of Cần Thơ and Hồ Chí Minh City. As local governments lack investment resources, they take advantage of existing corridor transport routes for development. Unfortunately, if this current development is not altered, the Mekong Delta has a high risk of evolving into a 'Corridor Industrialisation' like scenario, with industrialisation in an undesirable corridor with potential negative impacts and risks of losing the export base of prime agricultural land and fruits in the delta. It will also require primary investments in flood protection of new economic zones that is likely to upset the adaptation options for the wider delta.

The following graph illustrates the interrelationships of the different scenarios and their possible evolution over time towards another growth path. As described, the Dual Node should be seen as an extension of the ABI scenario, while further investments fostering the corridor scenario are contra-productive, as it will be very difficult to alter investments towards an Agro-Business Industrialisation or Dual Node growth model. When economic climate deteriorates this trajectory has a high risk of falling back into a Food Production like scenario.

²⁷ Dr. Vo Hung Dung (VCCI)

Timeline of scenarios

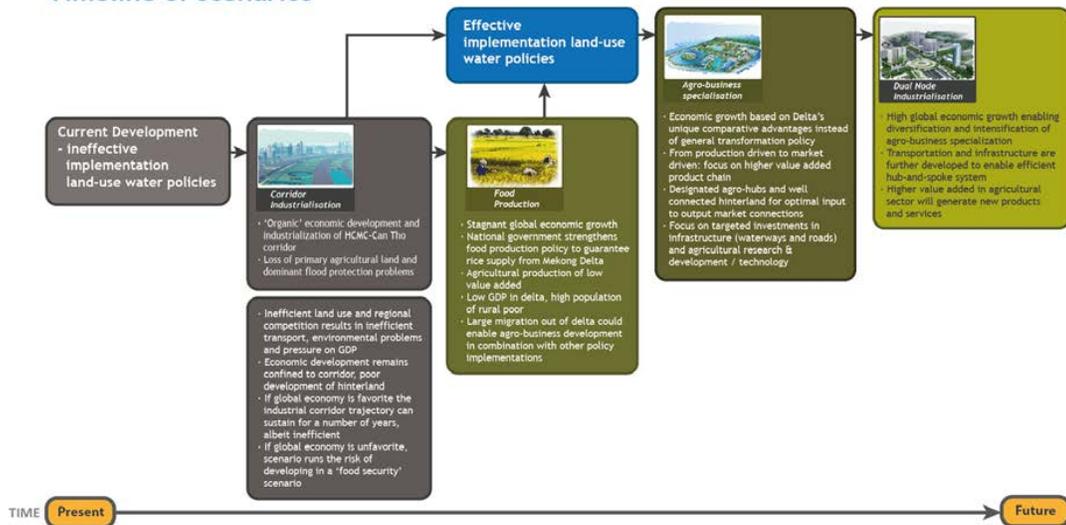


Figure 4-14 Scenarios in a timeline presentation



5 Long-term economic vision on living with water in the Delta

Chapters 3 and 4 provide an analysis of the current state of the delta and possible future developments. It goes without saying that all stakeholders pursue the best safe, prosperous and sustainable development in the delta. The Vietnamese government has formulated its intentions for "high tech agriculture". In this chapter this vision will be supported in terms of Agro-Business Industrialisation. This vision does not elaborate on all details for the Mekong Delta, but it addresses the main concrete issues for a delta development programme. The vision is a logical sequence of the scenario analysis and the delta's comparative advantages as outlined in chapter 3 and 4. From intelligent use of natural resources the optimum economic development is pursued for a prosperous and safe delta. The realisation of the vision requires action and the vision addresses the stakeholders and stresses the need for integration, collaboration and diversification.

5.1 Matching economic prosperity with the delta's comparative advantage

The four scenarios presented in chapter 4 represent four possible outcomes of socio-economic development that may take place in the Mekong Delta – each of which has its own particular bearing on the socio-economic development for the delta's population and economic structure, as well as the utilisation of the delta's land and water resources in light of climate change impacts. These scenarios set the stage for weighing strategic choices in policy decisions with regard to what are to be considered the preferred development objectives and outcomes for the delta in decades to come. Both from an economic development as well as a climate change adaptation perspective, a strategic choice for the stimulation and development of the Agro-Business Industrialisation scenario has clear advantages and benefits to offer for the delta and its population.

5.1.1 Economic growth and prosperity for a rural based economy

The predominantly rural economy of the delta has been well established and developed over the last three decades, primarily as a result of the dedicated investment and support (with emphasis on land and water reclamation) by the Government of Vietnam to steady rise in agricultural production and output. This has enabled the population and the country to attain self-sufficiency in food as well as to combat malnutrition and poverty [see paragraph 4.4 Food Security perspective changes in economic growth scenarios]. With the onset of the Đổi Mới policy, the agricultural development in the delta has received a further stimulus in that it has enabled sections of the sector (e.g. fruit and aquaculture) to respond to international market opportunities and engage in higher value markets.

At the national level, Vietnam's economy is developing rapidly towards a middle-income country with marked transformations in the nation's economic structure, in which the contribution of the industries and services sectors to GDP are overtaking that of agriculture. Demographically this is being matched by an accelerated urbanisation. Both of these trends are fully acknowledged and incorporated in the national economic development strategies of Vietnam.

At the level of the Mekong Delta, however, this economic transformation has not taken off to the extent of the national average, let alone of that of neighbouring Hồ Chí Minh City. The industry and services sectors are markedly less pronounced within the delta's GDP-share. Despite the introduction of dedicated (provincial) policies and targets, as well as industrial zones, the GDP fails to pick-up at national average speed. With the result, that the economy of the delta is still predominantly rural and agricultural, and economically dominated by agricultural output and value – both of which are still marked by smallholder enterprises and/or low value primary agricultural output (especially in rice). This is increasingly resulting in a socio-economic disparity between the delta and the national and Hồ Chí Minh City economies (as also reflected in the declining share of the delta's economy to the national GDP). With the attraction of higher social-economic growth perspectives in other regions of the country, the demographic development of the delta is already showing clear signs of (economic) outmigration.

With a dedicated support to (and strategic choice for) the Agro-Business Industrialisation economic development model, there is an opportunity to support and shape the future economic development of the delta in a delta specific and dedicated manner. This development can be steered on three principles that are presently favourable within the delta: i) it explicitly targets rural based economic development offering economic growth for a predominant rural economy, which is important to stem the current trend of economic-outmigration; ii) it provides for economic diversification and specialisation across the agricultural produce/product regions (e.g. brackish aquaculture, fresh aquaculture and flood based agriculture, rice, fruits and vegetables, etc.), which enables: iii) geographically bounded and produce/product specialised development of agro-based industries and services sector. An essential feature hereby is that the agricultural development is transformed into a value chain approach that is explicitly targeted at reaping the higher

economic values for processing, product development and international trade within the delta's economic structure, thereby transforming the agricultural growth policy from increasing productivity per hectare to increasing economic value per hectare, or economic value per person. Enabling thus the delta to recoup its prominent share to national GDP, and become an economic magnet – for its population and highly educated workforce of neighbouring regions.

5.1.2 Suitable and adaptable to dynamic land and water resources base

Also from the perspective of the highly dynamic, but potentially valuably, land and water resources base that characterise the delta (today and in the future of climate change impact), the agro-business based industrialisation development model has distinct advantages to offer. The land and water resources of the delta are characterised by a rich diversity, as well as valuable production potential, that have enabled the rich and diverse agricultural produce base – e.g. rice, fruits and vegetables and brackish and fresh aquaculture. With the onset of climate change, the impacts on the water resources base of the delta are set to further accentuate these dynamics and differences in resources base – e.g. an extensive brackish zone and increased salinity intrusion in the coastal zones, higher and more pronounced seasonal fresh flood regimes in the upper delta, and more dynamic excesses between (rainfall induced) inundation and (dry spell induced) drought seasons in the middle delta. Rather than to try to stem and contain these dynamic changes, the ABI development model provides the opportunity to: i) support and stimulate a diversified and specialised high-value agricultural sector(s) that is specifically geared towards the resources utilisation (e.g. brackish aquaculture, flood-based agriculture and fresh aquaculture, fruits etc.) and; ii) establish a thriving agro-based research, development and innovation capacity that enhances the future adaptability of agricultural production systems to the changing resources dynamics.

They key feature of the Agro-Business Industrialisation scenario from a biophysical perspective, however, is that in comparison with the other scenarios it makes optimum use of the land and water resources base of the delta in view of the projected climate change impacts. For the Coastal Zone it makes the strategic choice to full-heartedly embrace the brackish Coastal Zone, and invest in a sustainable and high-value brackish aquaculture specialisation. Allowing for high-value aquaculture economic growth and sector specialisation, while reducing the needs for infrastructural coastal defence and salinity intrusions works by letting saline water intrude into an integrated aquaculture-mangrove coastal estuary. Likewise, it purposely targets the seasonal flood-based agriculture in the Upper Delta (also with regard to reducing the flood and erosion risks for the Middle Delta and Cần Thơ), and targeting higher value agricultural intensification and innovation based on double rice and flood based aquaculture/horticulture. The fertile fruit zone in the mid-eastern delta is likewise purposely conserved, to be further developed into higher value fruit-based food products. In comparison with the other scenarios, the strategic choice is thus made to optimise the agricultural use of resources to the changing, dynamic and diverse setting of the delta, and invest in economic value generation of agricultural based production and services systems.

5.1.3 Use of specific human and land and water resources in the Mekong Delta

The long-term vision of the Mekong Delta accommodates for the prime assets and values of the delta. Its main targets are socio-economic enhancement, safety and sustainability. It is an attractive area to live, study, work, invest and recreate. Sustainability is a key pillar with efficient use of water and natural resources of the delta. Land use and spatial planning is adapted to, and fully profits from its natural characteristics. Cần Thơ (and westward expansion) is the economic heart of the delta, a thriving regional hub of goods, services and knowledge that is well-connected to Hồ Chí Minh City and the villages and smaller cities in the delta, linking input with output markets. Main economic output is generated around this mainport in industries closely related to the natural resources of the delta and interrelated industries and service sectors. As such, the targeted transition towards industrialisation and services is accomplished by using the agricultural competitive advantages of the Mekong Delta.

Given the relative high costs of land and water and changing nutrition patterns in Vietnam and the region, the focus will transfer from low (rice) to high-value agricultural products, such as fruits and vegetables and sustainable aquaculture. This is further fostered by the rapidly changing competitive position of Vietnam with regard to rice producing countries, such as Cambodia, Myanmar and Lao. The high-value diversified agricultural products and services are covered over the full value chain, from growing to processing to markets. This is enabled through an effective investment in the transportation system, fully utilising the natural assets of the many waterways of the Mekong and through expansion of port facilities.

The added value generated in the agro-industrial hub system is invested to develop the rural areas in the Mekong Delta. Investments are targeted at high technological agricultural research, rural development and farmer education. Sufficient employment in the secondary and tertiary sector is provided, mainly within economic sectors that fit the physical delta characteristics well, such as food- processing industries, logistics,

agro-education, research and development in agro-technology, maritime activities and concrete aggregates (sand, gravel).

Box 5-1 Landless and land consolidation dynamics

Increasing land and water resources utilisation, dynamic changes - driven by market responses - in production systems (e.g. shrimp/fish, fruits and vegetables) have resulted in a dynamic and changing land and resources allocation among the rural population of the Mekong Delta. Economic growth and transformation - both within the delta, and adjacent industrial areas - are strong pull factors in transforming livelihood strategies from rural/agricultural production to a services/industry based livelihood. On the other hand, market opportunities are strong drivers in consolidating land and water resources to achieve economies of scale and attractive profit margins in agriculture/aquaculture production systems. The latter can be seen as a positive development opportunity that permits taking advantage of highly productive, efficient and both economic and resources sustainable production systems, that depend largely on the economies of scale to take advantage of high investment costs and high-value international market opportunities.

Such transformations of the rural economy, however, also have a potential downside in that re-allocation of the resources base leads to inequalities - in access to resources as well as economic development. Signs of increasing inequality are already prevalent in the Mekong Delta, where the rate of landless households increased from an estimated 14% in 1993 to 24% in 2004 (Ravallion and Walle, 2008). From a macro-economic perspective this is not necessarily a problem, as long as the economic transformation can keep up pace with rural transformation and absorb these new available workforce in growing industry and services sectors. But as the relative growth of both industry and services in the Mekong Delta is still lagging behind the national average, attractive livelihood alternatives within the delta for this growing pool of landless is becoming problematic.

On a more positive note, a successful growth of industry and services sectors (within the delta, and in adjoining regions), may free up land and water resources for further and continued consolidation and modernisation of production systems. Either by direct sale of land and water assets or, by leasing arrangements of an increasing pool of absentee landowners of their assets in agricultural production companies. The success of such rural and economic transformation, however, depends on the success of the economic transformation and the degree to which it can provide for alternative economic means of living.

Both urbanisation and mobility are encouraged and facilitated, as urbanisation enables a more efficient provision of services and social infrastructure. A coherent spatial urban planning accommodates for the needs of the migrating rural work force by providing affordable housing around Cần Thơ and other smaller cities. A varied nutritious diet and sufficient fresh water is available for the growing middle-income inhabitants, as well as for the agricultural, industrial, environment and transportation sector. The opportunities of water are utilised, pricing is rationalised gradually to reflect costs and shortages are adequately maintained and awareness raising of efficient use of water is incentivised.

In the long-term vision, the different land characteristics of the delta are well respected. The industrial and commercial activities are spatially concentrated and located in hubs where there is a clear comparative advantage for these activities. Hence fertile and rich agricultural land is preserved and high investments to overcome flood risks and water scarcity can be averted.

Box 5-2 Investing in infrastructure

One of the critical pillars for economic growth and prosperity of an economy is extensive and efficient infrastructure, according to the World Economic Forum that issues the Global Competitiveness Report annually. Well-developed infrastructure reduces the effect of distance, connecting farmers at low cost to national and international markets. In addition, the quality and extensiveness of infrastructure networks significantly impact economic growth and reduce income inequalities and poverty in a variety of ways. A well-developed transport and communications infrastructure network is a prerequisite for the access of less-developed communities to core economic activities and services. Effective modes of transport - including quality roads, railroads, ports, and air transport - enable entrepreneurs to get their goods and services to market in a secure and timely manner and facilitate the movement of workers to the most suitable jobs²⁸.

In the Provincial Competitiveness Index (PCI) investigation, businesses indicate that infrastructure is the number one constraining factor of the Mekong Delta. In 2009 the share of the GDP in the Mekong Delta ranked third in the country, but the overall rate of asphalted road was the second lowest while the average electricity price ranked the second highest. The share of GDP is decreasing rapidly, mainly due to poor infrastructural connections. About 36% of firms in the Mekong Delta reported having damaged products due to the poor road conditions and the average loss value for every business was about VND 25 million/year²⁹. The businesses also suffered an average loss of 7.2 working days due to inaccessible roads as a result of floods and natural disasters. Although waterways are an advantage of the region, the opportunities of waterway transportation are hampered due to traffic jams and blockings. Enhancements of the waterway transportation routes are paramount for enhancing international trade with Cambodia and for general development of the agro-business industrialisation infrastructural requirements³⁰.

5.2 Agro-Business Industrialisation matches the comparative advantage of the Mekong Delta

5.2.1 Vision Agro-Business Industrialisation

The adaptation strategy in both scope and timing determines largely which economic development will eventually evolve in the delta. Considering the physical system and richness of the delta, a shift to a modern agro-business specialisation with associated food-processing industries would seem the most viable and sustainable in the long run. This agro-based growth model comprises activities of related economic sectors that fit the physical delta characteristics well, such as maritime activities, transportation and concrete aggregates (sand, gravel). In the short run, it might be necessary to facilitate the released rural workforce in low-skilled industrial activities outside the agro-industry in certain economic zones in the delta, but this would only be a temporal development as these activities are better tailored in other provinces. Also, to accommodate for seasonal fluctuations of the agricultural production³¹, certain light industrial activities might supplement Agro-Business Industrialisation, but connection with the agro-business is always recommended.

In view of environmental problems and manageable climate change impacts pursuing a strategy that is targeted at developing the core Agro-Business Industry based specialisation is considered to offer the best perspectives for the Mekong Delta. It fits and utilises the typical natural features of the delta (low lands, waterways, fertile soils and generally abundant availability of fresh water) providing an excellent basis for a long-term vision on future sustainable economic growth and spatial arrangements. This development direction fits best the demographic and economic structure of the delta, which markedly differs from the country as a whole and from neighbouring regions.

- I. Agro-Business Industry represents an economically sustained development, evolution and modernisation of the present agro-based delta economy; it can meet the growing national and international demands for high-value agro-based products;
- II. Agro-Business Industry brings economic growth and wealth through an agro-specialised industrial and services sector;

²⁸ World Competitiveness Report, 2012-2013

²⁹ http://www.business-in-asia.com/comparison/pci_2008.html

³⁰ Dr. Võ Hùng Dũng (VCCI)

³¹ Prof. Hồ Long Phi (National University of HCMC)

- III. Agro-Business Industry bypasses unwanted competition between economic sectors and with other regions in the country;
- IV. The delta's unique natural resources of fertile land and water present the perfect base for an agro-based economy;
- V. An agro-based economy is well suited to adapt to the climate change challenges through development and alignment of targeted brackish, flood control and fresh water production systems.

Focus on its core comparative (and competitive) advantages enables a solid and sustainable organic growth path. Through coherent and coordinated investments in effective spatial and policy arrangements, it paves the way towards a further Dual Node Industrialisation, if the (external) economic climate accelerates. Agricultural modernisation plays a crucial role in the transition to sustainable growth. As the national economy urbanises and industrialises, nutrition requirements change. Safe, affordable and differentiated food supply becomes increasingly important for the growing middle-income class. At the same time, an agro-business transformation for the delta will bring the desired prosperity with a stable agricultural hinterland that is adopting modern technology and employs industry-supply inputs³².

Although the Dual Node Industrialisation vision is more in line with nation-wide official objectives for Vietnam, targeting an active strategy focusing on its core competitive advantage offers the best opportunities to adapt to uncertain future circumstances in the Mekong Delta. A development towards Agro-Business Industrialisation best fits the natural and physical characteristics and advantages of the delta with due care to nature and enables a further industrial and economic expansion.

Key to the Agro-Business Industrialisation development will be to increase the agricultural productivity and value by adopting high-tech agricultural practices in an ecological sustainable way, protecting the environment and mitigating climate change impacts. The Mekong Delta has an excellent advantage in agro-seafood processing and exporting and the region has the potential to further develop into an agro-seafood hub for the regional international market (Thailand, Cambodia and Laos). An example can be taken from the Dutch flower industry³³ [see 5.3.1].

5.2.2 Prime Minister's Decisions on "high tech agriculture"

Box 5-3 Agro-Business Industrialisation matches with Vietnam's desired course

The preference for an Agro-Business Industrialisation scenario to evolve is very much in line with the Prime Minister Decision on December 17, 2012, approving the Program on high-tech agriculture development through 2020 for Vietnam.

<p>THE PRIME MINISTER SOCIALIST REPUBLIC OF VIET NAM Independence - Freedom - Happiness No.1895/QĐ-TTg Hanoi, December 17, 2012</p> <p>DECISION</p> <p>APPROVING THE AGRICULTURE DEVELOPMENT PROGRAM OF HI-TECH APPLICATION OF THE NATIONAL PROGRAM OF HI-TECH DEVELOPMENT THROUGH 2020</p> <p>THE PRIME MINISTER</p> <p><i>Pursuant to the Law on Organization of the Government dated December 25, 2001; Pursuant to the Law on High Technologies dated November 13, 2008;</i></p> <p><i>Pursuant to Decision No.2457/QĐ-TTg dated December 31, 2010 of the Prime Minister approving the national program of high-tech development through 2020;</i></p> <p><i>At the proposal of the Minister of Agriculture and Rural Development,</i></p> <p>DECIDES:</p> <p>Article 1. To approve the agriculture development program of hi-tech application of the national program of hi-tech development through 2020 (hereinafter referred to as the Program) with the following principal contents:</p>	<p>I. OBJECTIVES</p> <p>1. Promote the development and effective application of high technology in the agricultural sector; contribute to build a comprehensively-developed agriculture in the direction of modernization, large-scale commodity production, high productivity, quality, efficiency and high competitiveness, achievement of an annual growth rate of over 3.5%; and assure firmly national food and foodstuff security in both short and long terms.</p> <p>2. By 2015</p> <ul style="list-style-type: none"> - Initially develop the high technologies on the List of high-technology prioritized for investment, development, and advanced technologies in agriculture to create and put into production <p>1 - 2 new varieties for each staple plant, livestock or aquatic animal of high yield, good quality, outstanding resistance; 2 - 3 advanced technological processes in each sector; 2 - 3 kinds of biological products ; 2 - 3 kinds of animal feed; 1 - 2 kits; 1 - 2 vaccines; 1 - 2 kinds of new supplies, machinery and/or equipment for agricultural production;</p> <ul style="list-style-type: none"> - Step-by-step apply high technology, advanced technology to produce some of agricultural products of high yield, quality, economic efficiency and safety; increase the proportion of hi-tech applied agricultural production obtained about 15% of total value of national agricultural production; - Establish and develop at least 80 hi-tech applied agricultural enterprises in the key economic provinces; build 3-5 agricultural area 	<p>of hi-tech application in a number of agro-ecological areas and 1 - 2 agricultural high-tech applied area in every key economic province.</p> <p>3. The period 2016 - 2020</p> <ul style="list-style-type: none"> - Promote development of the high technologies on the List of high technology prioritized for investment, development, and advanced technologies in agriculture to create and put into production 2 - 3 new varieties for each staple plant, livestock or aquatic animal of high yield, good quality, outstanding resistance; 3 - 4 processes of advanced technology in each sector; 3 - 4 kinds of biological products ; 3 - 4 kinds of animal feed; 2 - 3 kits; 2 - 3 vaccines; 2 - 3 kinds of supplies, machinery and/or equipment for agricultural production; - Promote application of high technology, the advanced technology to produce the agricultural products of high yield, quality, safety and high competitiveness; increase the proportion of hi-tech applied agricultural production obtained about 35% of total value of national agricultural production; - Establish and develop about 200 hi-tech applied agricultural enterprises in the key economic provinces; build more 1-2 agricultural hi-tech applied area in a number of agro-ecological areas and 2 - 3 agricultural high-tech applied area in every key economic province.
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³² Modernisation of Agriculture and long-term Growth, Yang and Zhu, 2008

³³ Dr. Tô Văn Trường (former director of SIWRP)

Box 5-4

It also follows the Prime Minister decision on socio-economic development of the Mekong Delta through 2020 (July 19, 2012), in particular the following paragraphs:

2. To bring into the fullest play the potential and advantages of localities in the region, especially advantages in agricultural production, aquaculture and marine economy; to step up economic restructuring and growth model renewal along the line of in-depth development; to sustainably develop the delta and coastal areas.

3. To develop a synchronous and eco-friendly system of urban centers and residential areas and a system of technical and social infrastructure facilities in close relation with rice fields, orchards, rivers, sea areas and islands.

5. To focus on training and developing human resources, especially high-quality ones, so as to meet market demands, combining human resource development with scientific and technological development and application.

6. To pursue sustainable development, combining socio-economic development with economical use of natural resources and protection of the eco-environment; to adopt solutions to proactively prevent and respond to climate change and sea level rise; to closely combine socio-economic development with assurance of national defense and security and maintenance of political stability and social order and safety.

IV. DEVELOPMENT ORIENTATIONS FOR DIFFERENT SECTORS

1. Agriculture, forestry and fisheries:

To develop the Mekong River delta into a key agricultural development region, focusing on large-scale production of high-quality and competitive commodities, with rice and aquatic products as two national strategic exports. To form large-scale specialized production areas in combination with hi-tech application and new-countryside development; to further

restructure agricultural production along the market orientation. To strive for an annual agricultural growth rate of 5.2% during 2011-2015 and 4.9% during 2016-2020.

Box 5-5 Targets for the Mekong Delta in line with agro-business industrialisation vision

Recent objectives (2013) stated by the South-Western Steering Committee are supporting an Agro-Business Industrialisation type development for the region.

"With regards to agriculture, the Mekong Delta is to further diversify its products, strengthen intensive farming, establish areas specialising in particular plant varieties like rice, fruit and short-time industrial trees. Natural materials for industries and animal feed will also be heavily developed.

Aquaculture, a strength of the region, will have due attention paid to its expansion. The region will invest in developing the irrigation system and protecting ecosystems, especially the coastal salt-marshes in the Đồng Tháp Mười, Long Xuyên Quadrangle, west of Hậu River and Cà Mau peninsula.

Small and medium-sized industries will be efficiently developed. The industrial sector will soon exploit the gas potential of the Southwest sea area, aimed at developing gas-electricity-nitrogen fertiliser industry. Additionally, industrial clusters, sea transport, agriculture and aquaculture processing, engineering industry and construction material production will also be developed. Cần Thơ city is considered the centre for these efforts.

In the services sector, the Mekong Delta provinces will pour appropriate investments into developing trade and tourism, especially eco-tourism. Among others, Phú Quốc Island in King Giang province could be transformed into a tourist hub"



Agro-business Industrialisation



5.3 Tempting examples for Agro-Business Industrialisation

This paragraph shows challenging examples for economic growth of a delta rich in natural resources. The Netherlands show good examples of farmers, producers of agricultural products to join forces, reduce transaction cost, increase the production scale and add value.

This outlook is tempting for the Mekong Delta. Using its specific potential, making a shift from individual to cooperative farming enabled by well-aimed government regulations, agro-business and industrialisation can well take off. Paragraph 5.3.5 describes the perspectives in the aquaculture sector.

5.3.1 Holland as world's leading supplier of flowers, plants and trees

The Dutch horticulture sector³⁴ is an international market leader in flowers, plants, bulbs and reproductive material and the number three exporter in nutritional horticulture products. It forms the heart of an international network for floriculture, bulbs, and decorative trees as well as fruit and vegetables. The country's important logistical hubs – such as the Port of Rotterdam and Amsterdam Airport Schiphol – its proximity to Europe's 500 million consumers, plus the development of high-quality production methods have enabled the Dutch horticulture cluster to become strong. The Dutch have created efficient supply chains that are able to deliver flowers in New York that have been cut the very same day in the Netherlands.



Dutch horticulture is concentrated in six clusters, called Greenports, where businesses and research institutes work closely together on production, research and development, logistics, infrastructure, and exports. Horticulture makes a significant contribution to the country's prosperity, through the considerable volumes and sheer quality of production, as well as via technological innovations. The Dutch approach to innovation and research and development is rather unique: companies, research institutes and governments work together on innovation projects and programmes in the so-called Golden triangle. Prime examples of innovations include intelligent greenhouses that can float on water, moving platforms, robots, innovative lighting, water- and waste-recycling, and greenhouses that generate more energy than they consume and thus contribute to a reduction in CO₂. Dutch greenhouses cover an area of over than 60 km², constituting a city of glass - and with a relatively low impact on the environment. The focus is on concepts and technologies that facilitate energy-efficiency and adaptability to climate change. The Netherlands leads in green genomics, which aims to achieve better yields, sustainable and safe production, resistance to diseases, or taste/design changes. Plant Research International and the Technological Top Institute Green Genomics lead the field.

Facts and Figures

- In 2011, total horticultural production amounted to €8.6 billion. Exports (including re-exports) amounted to €16.2 billion. Horticulture accounts for 39% of Dutch agricultural production. The share of horticulture in the total Dutch exports in 2010 was 4% (share of agricultural exports 34%)
- The Netherlands has an exceptionally large share of the world trade in horticultural products, at 24%. In trade in floricultural products worldwide, the Netherlands is dominant with a share of 50%. In bulbs, the share is even 80%.
- The Dutch produce 4.32 billion tulip bulbs each year, some 53% of which (2.3 billion) are grown into cut flowers. Of these, 1.3 billion (or 57%) are sold in the Netherlands as cut flowers and the remainder is exported: 630 million bulbs in Europe and 370 million outside Europe.
- For the fourth year in a row, the Netherlands is the world's biggest exporter (in value) of fresh vegetables. The Netherlands exported 4.6 billion kilos of vegetables in 2010, with a market value of € 4.2 billion. A little-know fact is that the Netherlands is the world's top producer of onions.

³⁴ Dutch Horticulture Board, Flora Holland, Greenports Nederland, LEI, Plantum, Bloembollencentrum, HBAG

- The Dutch are the world's largest exporter of seeds: the exports of seeds amounted to € 1.5 billion, growing 5% each year.
- The world's largest auction company for cut flowers and plants is Dutch. It has 4,100 employees and sales of about € 4 billion in 2010. Each day it sells 34.5 million flowers and 2.3 million plants and conducts 120,000 transactions using 46 clocks.

5.3.2 Westland vegetable farmers moving up in the value chain

Westland in South-Holland Province in the Netherlands has been flood prone for ages. Floods created coastal creeks which silted up slowly. Hence habitation became possible. Beyond there, people started to live on land protected by dykes and on hillocks. Dykes served as the road connection between villages. Originally there was agriculture and cattle-breeding. Since the 16th century, people started horticulture. Mild temperatures at the coast offered a conducive, natural environment. The excellent connections by water to transport products from the land to the market contributed considerably to the competitiveness of the Westland. In the 19th century horticulture started to scale up, the Westland became the centre for grape cultivation. Demand for fruits and vegetables was rising with growing cities as the Hague and Rotterdam in the vicinity. Export became more important, with half of the grape harvest being exported to the UK. At the end 19th century a regional railway was developed to connect with the national network to be able to ship out the goods quicker and more efficiently. The agriculture crisis in 1880 made entrepreneurs move to other sale methods (auctioning) and cultivations, introducing the use of greenhouses for the cultivation of vegetables and fruits. Nowadays the Westland is a prosperous and innovative region, in particular because of the fast growing agribusiness over the last decades. The region excels in developing new techniques to have horticulture companies functioning better, which in itself has become an important export product, beside the horticulture products. While the amount of glass houses is decreasing, the added value is increasing through innovations in process and cultivation. This adds to the almost 25% contribution of the horticulture sector to the surplus of the balance of payment in the Netherlands.

5.3.3 Managing the value chain in cooperation; from grass to glass

FrieslandCampina is one of the world's largest dairy companies and has a cooperative tradition stretching back more than 140 years. Via Zuivelcoöperatie (Dairy Co-operation) FrieslandCampina U.A. the member dairy farmers in the Netherlands, Germany and Belgium own 100% of Royal FrieslandCampina N.V. All the member dairy farmers are independent entrepreneurs. Their competence and professionalism helps FrieslandCampina guarantee quality, safety and sustainability. On behalf of its member dairy farmers, FrieslandCampina strives for growth and value creation.

FrieslandCampina has a long history in the dairy sector. Together with the Cooperative's member dairy farmers, FrieslandCampina commands and controls the entire milk production chain from milk to end product – from grass to glass. This guarantees the quality, safety and sustainability of the products. FrieslandCampina distinguishes itself through the entrepreneurship of its member dairy farmers, the optimal conditions for dairy farming in Western Europe and the high-quality processing of milk into a wide range of products. In addition, its expertise in the field of milking, milk production and products, the short supply lines and the market positions are characteristic of the Company.

Nowadays FrieslandCampina is a cooperation of nearly 20,000 member dairy farmers. They have offices in 28 countries with 20,000 employees. FrieslandCampina exports to over 100 countries, reaching 10 billion consumers and more than € 10 billion revenue.

5.3.4 A cooperative for finance and risk alleviation

Rabobank Group is a Dutch, international financial service provider based on cooperative principles. An Allfinanz market leader in the Netherlands, with internationally a focus on food and agro-business.

This diverse and leading financial group began in the late nineteenth century as a collection of small Dutch agricultural co-operative banks. Their motto is: "We know better than anyone that we can accomplish more together than alone". This knowledge is grounded in the fact that the roots of the bank lie in the cooperative: what farmers couldn't achieve on their own, they could achieve together. Members joined forces within the cooperative so they could bear the risks collectively and get through the good times and bad together. This cooperation enabled everyone to become full participants in the economy. The cooperatives lent money in a fair manner. Members received assistance at crucial moments. This form of cooperative self-help proved to be effective. In cooperation more was achieved than alone.

The idea of Raiffeisen served as the inspiration for the establishment of agricultural cooperative banks in the Netherlands. Friedrich Wilhelm Raiffeisen founded the first agricultural cooperative bank in Germany in 1864. As a rural mayor he witnessed first-hand the poverty some suffered within the farming community. He set up a charitable foundation in order to provide relief. However, he gradually came to the conclusion that self-help

was more beneficial than charity in order to bring about lasting improvements. This led him to transform his charitable organisation into a farmers' cooperative bank in 1864. This 'Heddesdorfer Darlehnskassen-Verein' collected the savings from the rural population so as to be able to fulfil the local need for credit. The fundamental principles of the cooperatives were: self-help, self-responsibility and self-management.

From the late 1890s there were many followers of the Raiffeisen cooperative movement in the Netherlands. One of the first was the priest Gerlacus van den Elsen. He initiated a number of local agricultural cooperative banks in the southern part of the Netherlands. His mission was both exalted and down-to-earth. In his own words: 'To fend off usury, to stand by the farmer in his time of need, and also to encourage thriftiness, charity, industriousness and moderation.'

The first cooperative banks were founded on the initiative of clerics and local notables, such as mayors, entrepreneurs and teachers. Sometimes the initiators were also wealthy farmers who took action for the benefit of their less successful colleagues. While the driving force was idealistic, the working method was firmly grounded on pragmatic business principles. This is reflected in the guiding principles of the first cooperative banks:

- share alike and unlimited liability of the members
- an unpaid management
- reserving profits for further growth
- a field of operation limited to the local area
- association with a cooperative central bank, while retaining local independence

These business elements behind the idealistic philosophy were primarily responsible for the successful development of the agricultural cooperative banks. Two central cooperative organisations, which were both founded in 1898 and existed alongside each other for three quarters of a century, merged to one organisation in 1972: the Coöperatieve Centrale Raiffeisen-Boerenleenbank. It became generally known as Rabobank due to the first two letters of both banks. The city of Amsterdam became the legal domicile. The new centralised bank was given the name Rabobank Nederland in 1980.

The cooperative philosophy has always remained the foundation of Rabobank: by working together you reinforce both each other's strength and your own strength. This idea constitutes both the essence of existence and the vision for the future. The customers of the Local Member Rabobanks form the foundation of the Rabobank Group. Customers can demonstrate their involvement with their bank through membership. Members take advantage of a number of banking and non-banking benefits. But the most distinctive characteristic of membership is that members are able to join in the thought and discussion process concerning their bank's policy. The members monitor and influence the bank's course. They bring the outside world inside and promote the bank's external orientation; *'We are open to the opinions of those for whom our services are important. Customers who give shape to their involvement with the bank through membership gain a voice with respect to our course and the way in which we contribute to the achievement of their ambitions.'*

5.3.5 Agro-business perspective for aquaculture in the Mekong Delta

Capturing value up the international value chain

The aquaculture sector (both brackish and fresh) is a high-value sector targeting export markets at the global and regional level. To achieve and maintain good access and good value of this high-value perishable product that is increasingly subjected to quality control and sustainable practices standards and certifications, an agro-business value chain approach is required. The farming and production of aquaculture produce form herein only one, although primary, aspect of the agribusiness value chain. As has become evident in the shrimp and pangasius sectors of Vietnam, an agribusiness sector (and chain) comprising of research and development, feed and stock suppliers, processing and marketing plants, dedicated transportation sector and services, finance and quality control services are all essential components of the chain, and hence sector.

Hatcheries and stock supply

The importance of research and development is best illustrated by the critical role the research in Cần Thơ and Research Institutes for Aquaculture (RIA 2) has played in the development of hatchery techniques for *Pangasianodon Hypophthalmus* (tra catfish) and *Pangasius Bocourti* (basa catfish). This has enabled the breeding and cultivation of these pangasius species – as opposed to their catching at natural hatching and pawning grounds – which has been instrumental for the sector's take-off and export orientation. Hatcheries supplying year round fingerlings to the cultivation sector have now become a critical element of the supply chain, with state owned hatcheries providing for 20% the sector's requirement, and the remaining 80% supplied by private hatcheries. Quality control issues, in particular with regard to fingerling health and breeding techniques are still rife, especially in the private sector, with high mortality rates among fingerlings

and juveniles depressing margins of both hatcheries and raisers. Continued research and development and investments and developments in breeding/hatchery techniques, as pursued in the state owned hatcheries, is thus essential to further reinvigorate the pangasius sector – in particular by integrating the private hatchery producers into agribusiness value chain and raise their quality and production standards.

Within the shrimp sector, Vietnamese hatcheries are currently capable of providing for 59% of Black Tiger Prawns and 47% of Pacific White Shrimp demand in Vietnam. The remaining stock is imported from Thailand, China and the USA. Relative shortages in supply, depressing margins, and difficult to control supply chains dominated by middlemen hampering quality control and traceability are prominent issues that require continued investment and development to improve the alignment of shrimp hatcheries and shrimp raisers to ensure the sector's future and continued compliance with international certification and trade standards.

Feed supply

With the intensification and export orientation of both shrimp and pangasius farming, the dependence of the sector on industrial feed inputs has risen manifold (from nil in 1995 to 90% in 2011 for the latter). In the shrimp sector, the industrial feed supply is dominated by foreign companies (that hold a 60% market share), and depends for 50% on the import of feed components, as the domestic sector cannot supply the current demand. This is estimated to result in a 10-15% higher price for industrial feed in Vietnam, as compared to neighbouring countries, which is further depressing the margins for producers. There is thus ample scope to further increase the domestic share of both production of raw materials and processing of industrial feed for the aquaculture sector, and attain a closer integration of the agribusiness chains within the delta. Continued research and development efforts and investments have a further role to play in this chain by providing further impetus to waste management and water quality control through optimisation of feed input management and cultivation techniques.

Processing and export

The processing and export industries and services have held pace with the exponential growth and export orientation of the aquaculture sector, with up to 90% of produce volume destined for export. Direct producer-processor supply linkages, however, are still limited to ca. 25% of produce volume, with the remaining 75% volume supplied through intermediate traders. Also in the processing-export chain intermediate traders play an important role, with registered export companies outweighing processing plants with a ratio of 3:1. Though initially conducive and characteristic of a vibrant and dynamic processing and services sector that is able to exponentially grow (in volume and outreach), this limited vertical integration in the value chain increases the transaction costs for quality control and product certification that is required to secure the access to high-value international markets and retailers. Not surprisingly, the certified export segment is increasingly stimulating increased vertical integration of the aquaculture value chain through securement of direct supply contracts across the producer-processor-retailer chains. This is especially prevalent in the pangasius sector, and, in the continued absence of producers' affiliations/cooperatives, favours the integration of large-scale producers in certified markets chains.

Whereas intermediate traders have played a critical role in the establishment of an extensive production base among small holder shrimp and fish farmers -- through the provision of multiple services as financing, transportation, market access and feed/stock/input services -- they are unlikely to be conducive for stimulating investments and developments in improving the quality and sustainability of production. As long as there is a wide (smallholder dominated) producers' base available, and opportunities to differentiate between certified and non-certified market access, their primary interest will lie in minimizing transaction costs and optimising margins.

Research and development and technological innovations

Research and development in new aquaculture techniques provide important impulses for improving the sustainability or resources utilisation and food quality standards in aquaculture. This sector has many possibilities and promising innovations.

- i) Developments and commercial uptake of poly-culture systems that are designed around the culture of multiple species (fish and crustacea) in connected water basins through water and suspended feed/organic matter is cycled, before it is drained into a mangrove/coastal estuary where the water is recycled through the natural treatment capacity of the mangrove forests.
- ii) Developments in bio-flock aquaculture systems, that are designed to minimise the water intake and refreshment rate of pond-culture through optimisation of the algae/bacteria management in ponds to

achieve the best in-situ recycling of suspended nutrients and carbon in bio-flocks that act as additional feed.

- iii) Developments in aquaponics, that are based on the recycling of (fresh) waste water of aquaculture into hydroponic based horticulture, where the nutrients load of aquaculture is recycled for horticulture, and the organic waste of horticulture can be applied as feed supplements in aquaculture. Developments in brackish/saline-based hydroponics are still futuristic, but may become opportune when a shift is made from fresh produce production to the production of food/pharmaceutical/cosmetic agro-based supplements.

Whereas the poly-culture systems require investments in organisational management and spatial planning to ensure an optimal alignment of poly-culture based ponds, water cycles and an adequate regenerative mangrove area exposed to see water exchange, the bio flock and aquaponics systems are technology and management intensive. Both require thus substantive transformations to occur within the aquaculture sector that need to be achieved by good market and value chain integration of producers and processors/retailers. The latter to provide an economic incentive and security for pond owners to invest in increased sustainability and food quality standards.

Government support

Government support has been crucial in the field of research and development and trade negotiations and product certification services for the aquaculture sector. In particular the research and development capacity build at Cần Thơ University and the government's own run Research Institutes for Aquaculture (RIA1-3), has been instrumental in the development of breeding and hatchery technologies for pangasius. The state owned, and state run hatcheries in this sector occupy a critical segment of this agro-business value chain, where private capacity seems limited in lieu of market demand. Likewise, the joining of Vietnam to the WTO, and subsequent trade negotiations on aquaculture products and certification, have been instrumental in enabling the exponential growth in high-value exports of the shrimp and pangasius sectors of the last decade. This is also supported through government provided services in product certification and certification standards. The Đổi Mới policy has, in its turn, stimulated the growth in processing industries and trade services, international and in particular of intermediate traders.

Vertically integrating the agro-business value chain

Whereas all the segments of the value chain of aquaculture are present and established in Vietnam and the Mekong Delta, they are still by and large segregated entities glued by dynamic trade and services alignments. Limited capacities in breeding and hatcheries, domestic development and production of feed, investments in technology development and uptake, and establishment of economies of scales to reduce transaction costs, are some of the most prominent limitations and bottlenecks of the aquaculture sector today that delimit its capacity to reap higher economic values within the domestic chain. The Government of Vietnam (GoV) is active and supportive in this chain by investing in, and providing for, direct services – notably research and development, state operated breeding and hatcheries, and trade regulation and certification support services.

To provide a new impetus to the further innovation and development of the sector and its value chain it is, however, imperative that the private sector (e.g. industries (supply and processing)) and services (trade, finance and logistics) take a more active role in RandD, financing and product development and marketing services. This requires a further vertical integration of the value chain, in which direct linkages are established between suppliers-producers-processors-traders/retailers and service providers, so that investments and developments of private partners can be secured, valorised and reaped within the entire value chain. At present this vertical integration, and establishment of a conducive investment environment, is primarily impeded by the smallholder based producers-base which -- through its characteristics of an extensive production base consisting of high number of producers and low product volumes per producer -- is not favourable for the establishment of close and tight linkages and contracts across the chain in which private investments can be brought to fruition. Notable few exceptions are found primarily in the pangasius chain, which are then based upon the integration of large-scale commercial raising farms within the chain.

To stimulate the vertical integration of the aquaculture agro-business value chain and the active investment of private parties, the Government of Vietnam will need to shift its strategic policy and investment support to the sector towards the integration of the large smallholder production base in the chain. This will require flanking policy, institutional and regulatory reforms that enable smallholder producers to cooperate and integrate their production within the chain – e.g. establishment of cooperatives, producers' affiliations, joint-stock companies etc. that can effectively reduce transactions costs and aggregate production volume towards

suppliers, processors and trade service providers. The provision of services (capacity building) and a conducive regulatory environment (contracts, cooperation regulations) specifically targeted at producers' integration should hereby be seen as an absolute priority. This will need to be paired with investments in favourable infrastructural developments – in particular waterways and management that account for sustainable water quality intake, disposal and treatment requirements of producer conglomerates, as well as transport, energy services. Investments in education and research and development should remain prominent, whereas investments and developments in technology, supply base and product development should be placed within the agro-business chain, possibly through public-private partnerships (PPP) and private investments. This entails a strategic shift of government policy support and the private sector towards the establishment of healthy and sustainable producers base and its integration into the value chain.

Potentials for agro-business value chain in animal husbandry.

The animal husbandry sector (poultry, pigs, cattle, dairy) possesses a similar basic structure of the value chain as the aquaculture sector with tight linkages between feed (culture, processing and trade), animal breeding, animal raising, and food processing and trade. This provides ample opportunities to add and generate value for different segments in the value chain. With the increasing wealth and urbanisation in Vietnam, and the accompanying changing dietary preferences of the domestic consumer base, it can be foreseen that the consumer demand for animal protein based foods will increase sharply over the next decades. This will increase the potential and opportunities for this sector to scale up its productivity within an integrated value chain approach. But, in comparison with the aquaculture sector, the animal husbandry has still a more fundamental transformation to make as it is still dominated by smallholder and mixed farming practices – e.g. animals are raised in small numbers and in conjunction with other agricultural practices. For an integrated value chain approach, specialised farms, producers and traders will need to emerge first before commercial contracts and private investments are to be attracted.

5.4 Bottlenecks in the current agricultural value chain of the Mekong Delta

5.4.1 Vertical integration of suppliers, farmers, processors, traders and retailers

As outlined in paragraph 5.2.2 the objectives and impacts of a thriving Agro-Business Industrialisation are well shared within policies for agricultural modernisation and agricultural developments for the Mekong Delta. This is emphasised for adoption of modern technology and breeds/varieties, attainment and securement of high quality, potential high-value outputs and exports. These form essential characteristics of an economic well-thriving agro-business value chain.

Within an Agro-Business Industrialisation model however, one thrives for the active participation and investments of private sector parties in the different value chains to drive the innovations and developments in technology, product processing and marketing. In order to achieve this, there should be tight vertical integration among suppliers, farmers, processors and retailers – typically through established supply contracts – by which the economic value can be gained and re-invested. For farmers this is critical to the extent that it enables them to secure access to higher value markets, higher income and provide stability and security of market access to warrant further investments in their production process (technology, breeds/varieties, quality). Likewise, for agro-business companies (suppliers, processors, retailers) a vertical integration along the value chain provides them with the security and incentive to invest in research and development and the production chain (from supply to market) in their quest continued product development and market security.

A continued focus on the development technology, mechanisation and seeds and breeds to further increase and improve the productivity, quality and sustainability of the agricultural production in the Mekong is certainly needed – especially towards high product quality and value that can secure access to high-value markets. But in an Agro-Business Industrialisation model this should be the result of developments, innovations and investments of agro-business enterprises in their value chain, which can disperse innovation to farmers directly through their supply-chains (contracts); this is *not* a direct leading role for government and its agencies or only to a limited extent.

Within the current agricultural setting of the Mekong Delta the major bottleneck for the fruitful establishment of vertically integrated value chains is the large smallholder based production setting. This is currently hampering the integration of producers in the value chain through the establishment of direct contracts and trade-production relations between farmers and enterprises. The huge transaction costs associated with the servicing of large groups of smallholder producers currently hamper the value chain in both directions:

- For producers in obtaining direct access to good supplies (high quality inputs and technology) and therefore to high-value markets – the latter being critical to obtain higher economic margins, market security and warrant investments in the production process.
- For traders and suppliers it is difficult and costly to reach producers, which hampers investment of the chain enterprises in development of new technologies, processing services, and product-market development.

5.4.2 Farmer product and production associations

Thus, there is at present a critical need to provide for a better integration of smallholder producers in the value chain, through the promotion and establishment of affiliations, cooperatives, joint stock companies, etc. among farmers. These will become essential in the securing of direct contracts with suppliers, processors and traders/retailers by making effective use of economies of scale through pooling of smallholders and providing an effective access point of larger volumes of trade (and products) for the value chain and its different enterprises. Farmer product and production associations may thus secure access to higher value market segments, as well as good input and supply services. Whereas for the agro-business enterprises (feed, supplies, processing, retailing) it becomes more attractive to settle and invest in production capacity near large production entities and areas – giving further impetus to the agro-based services and industries sectors. A geographical production concentration, as foreseen in the Agro-Business Industrialisation scenario with distinctive regions for (brackish and fresh) aquaculture, rice, fruits and vegetables across the delta, will further favour attractive agro-business settlement and investment, once value chains are established and integrated [re. Westland, see 5.3.2].

In the continued absence of producer associations, value chain development (and its affiliated agro-based industries and services) will be limited and naturally verge towards larger-scale producers. From socio-economic perspective this will feed disparity in socio-economic rural development between larger producers with access to higher value chains and smallholders without.

5.4.3 Government role in the value chain

It is questionable if the *national* self-sufficiency policy for food should lead to too much focus on food production in the *delta region*, where a successful industrialisation step is required. One of the basic ideas behind the Food Production scenario is that, in absence of successful industrialisation, too much on just food production in the Mekong Delta may remain, where a strategy to combine agriculture and industrialisation is more promising in economic terms.

The issue becomes *what* the Government of Vietnam can undertake to stimulate the establishment of vertically integrated value chains along agricultural products in the Mekong Delta, as to realise the settlement of agro-based industries and services in the delta and incite their investments through public-private partnerships (PPP) in the sector. A critical aspect is that the government adopts a modernised integrated development approach and focuses on the value chain. In analogy this cross sector approach resembles the integrative approach in the fields of land and water resources management and climate change. This approach cuts across the sectors affecting each segment in the value chain – e.g. agriculture, land and water resources management, rural development, planning and investment (industries and services), education and transportation. In the implementation of this policy specific needs and bottlenecks along the chains of the product/marketing process must be addressed.

Stimulus needs to be cross sector and address all segments, particularly farmers

Most critical in this approach is direct stimulus to the establishment of farmer affiliations and associations: reforms and developments in regulations (legislative status of association and contract registration); direct support services in formation, registration and capacity building; credit supply. Preferably in conjunction with PPP agreements with enterprises of the targeted value chain, with specific focus on contract negotiations and establishment along the suppliers-farmer associations-processors-market chain and attracting industries and services investments in the links. Chain specific requirements, such as specific land and water resources management needs for quality production, transportation, industrial development and its energy, water and waste management requirements are then subsequent specific needs and requirements that can be addressed by (local) governments in their respective fields of planning and investment. This goes along with active stimulation of conglomeration of value chain (product) specific industries and services covering the links and steps into agro-business like parks, provides further stimulus to cooperation, co-innovation and co-investment in the value chain. The latter being an element that can be further stimulated by government through targeted (chain/product specific) education and establishment of PPP based research and development facilities.

Aquaculture and rice can be exemplary in setting the approach

Regional “chain-specialisation” (aquaculture (fresh and brackish), rice, fruits, vegetables, animal husbandry, ecotourism and specialty products) will allow for geographically centred and specific developments of agriculture and associated industries and services, minimizing economic competition among provinces and regions.

As outlined in paragraph 5.3.5 above, within the aquaculture sector the components of the value chain, as well as its distinct enterprises, are already present within the delta to some and also varying degree. The present lack of this sector’s vertical integration along suppliers (feed, breeders, hatcheries, technology) – producer associations – processors – market hampers its further development into a well-established agro-business value chain. Production innovation and sustainability with a targeted focus on product quality (and its certification requirements), as well as efficiency gains in resources utilisation and economies of scale, are there to be made through a better integration and cooperation of the different entities along the value chain. A targeted and integrated value chain approach, that addresses the specific needs and bottlenecks across each of the linkages, in specific producer cooperation and integration, is now required to bring the sector into its next development phase of product and market development and innovation, rather than (opportunistic) response.

Also the rice supply chains –both for the domestic and international market- are not yet oriented towards a high product quality with higher value. In order to upgrade the supply chain, marketing and rice breeds will need to be improved; currently most Vietnamese rice is undifferentiated, and hardly any Vietnamese brands are known in international markets. The bulk of the rice produced domestically is divided into standard quality lots. As a result, Vietnamese rice is graded as inferior to rice from Thailand and even Cambodia and Laos on international markets. Also here, the smallholder based production and lack of farmer affiliations form a big impediment for the agro-business sector to engage with and invest in high quality oriented rice production, processing and marketing. Whereas the domestic success of aromatic Sóc Trăng rice variety (ST39) show here ample scope and potential to further explore these opportunities for favourable agro-based economic development of the delta.

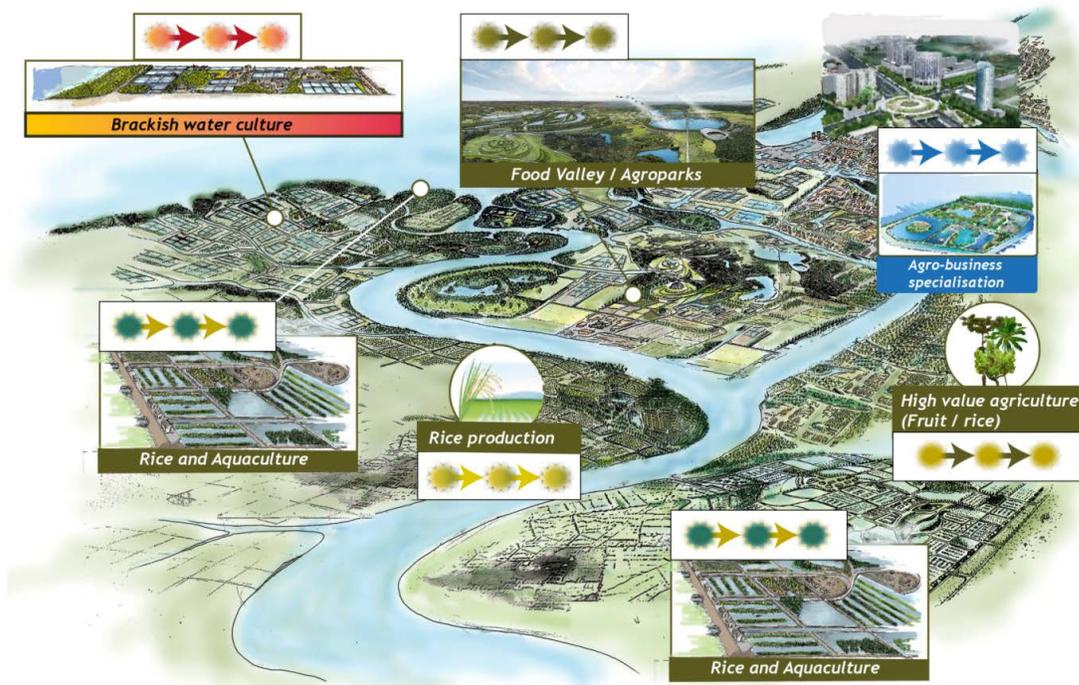


Figure 5-1 Value chains are geographically bound, regions within the delta have each their own comparative advantage

"The value of the value chain"

A favourable and conducive value chain structure, which would fit well in the Agro-Business Industrialisation scenario, is depicted in Figure 5-2. Enterprises have a central role and are able to do thorough domestic and international market research on demand and product development. Based on the different comparative advantages of the region, different areas are designated to produce different products. Cooperatives or groups are formed to enable technological enhancements and to educate and train farmers on different production processes to produce higher value products. Different facilities are needed in order for the enterprises to process the raw material into quality products, and to differentiate the products through branding before they are launched into the markets³⁵. A major governmental policy enabling such a value chain would be to offer financing of the entire supply chain by providing credit through enterprises participating in contract farming with farmer groups.

Figure 5-2 represents in fact the core of the vision on Agro-Business Industrialisation for one "value chain" aquaculture. In the heart of the desired economic development, the farmers (producers) play a key role. A great number of individual, but non-organised farmers are capable of great production, but at high transaction costs. Every farmer provides for his own supply, transport, machinery etc. Organisation of producers in cooperatives [see e.g. paragraphs 5.3.1 and 5.3.2] opens possibilities for significant reduction of transaction costs, but more important, it makes them an important partner in trade and innovation. Collectively they will be able to have themselves represented by skilled experts. Research and development institutes, producers of technological equipment, providers of feed, wholesalers of agricultural produce can make dedicated contracts for supply and innovation in the entire production process.

This will create an intrinsically innovative value chain with better conditions for each segment of the chain.

Moreover, apart from the private-private economic links in the chain, also the role of governments develops from a direct role in achieving production targets into a more supporting, stimulating or enabling role. Legislation must allow for organisation of the farmers, constraints for forming contracts and investments in the different segments need to be removed. Government can also play an important role in sustainable land and water management, by stimulating more sustainable shrimp farming, combining it with adaptation measures to a more saline environment and relate projects to coastal defence, particularly mangrove restoration in the case of aquaculture.

Major issues in land and water issues go across provincial (and national) boundaries. Still many of the value chain issues are nevertheless geographically bound. The aquaculture value chain belongs mostly to the Coastal Zone where it concerns brackish shrimp farming, but a similar value chain could e.g. develop further for fruit products in the Vinh Long area, for pangasius and for rice in combination with vegetables or rice in combination with fish farming in the Upper Delta [Figure 5-1].

The value chain describes mostly and preferably private enterprise. The role of government is obviously not in the enterprise, production or trade itself, but in facilitation of these economic activities. Apart from legislation to make these kinds of activities economically feasible and profitable, an important role for government is in the "arrows", connections of Figure 5-2, in transportation infrastructure: roads, airports, waterways and ports, but also in energy supply, cable and data information infrastructure. At least as important is the role of the government in the – sustainable – use of land and water resources. Where individual farmers, or individual provinces will, almost by definition, choose for suboptimum solutions, the organisation of farmers into cooperatives or the organisation of provinces into a region will enable government to have responsible and skilled counterparts to discuss and deal with the required modernisation and innovation in land and water management. Preventing too much dyking in combination stimulation of wet season vegetable or fish farming and sustainable shrimp farming in combination with mangrove restoration are in this respect exemplary.

³⁵ Prof. Võ Tòng Xuân, An Giang University

- ✓ ALL KINDS OF DEDICATED SERVICES OR SERVICE-INDUSTRY
1. ice-supply
 2. logistics (specialised transport, cooler trucks, ships, stocking, national, international)
 3. administration (contracts, trade)
 4. auctions
 5. banking, financing services
- but also:
- shared waste treatment plants
 - collective waste - raw material contracts
 - shared energy supply
 - shared advertisement
 - shared fairs/exhibitions, trade missions
 - shared certifications (certify cooperation, not each individual farmer or hatchery/breeder)

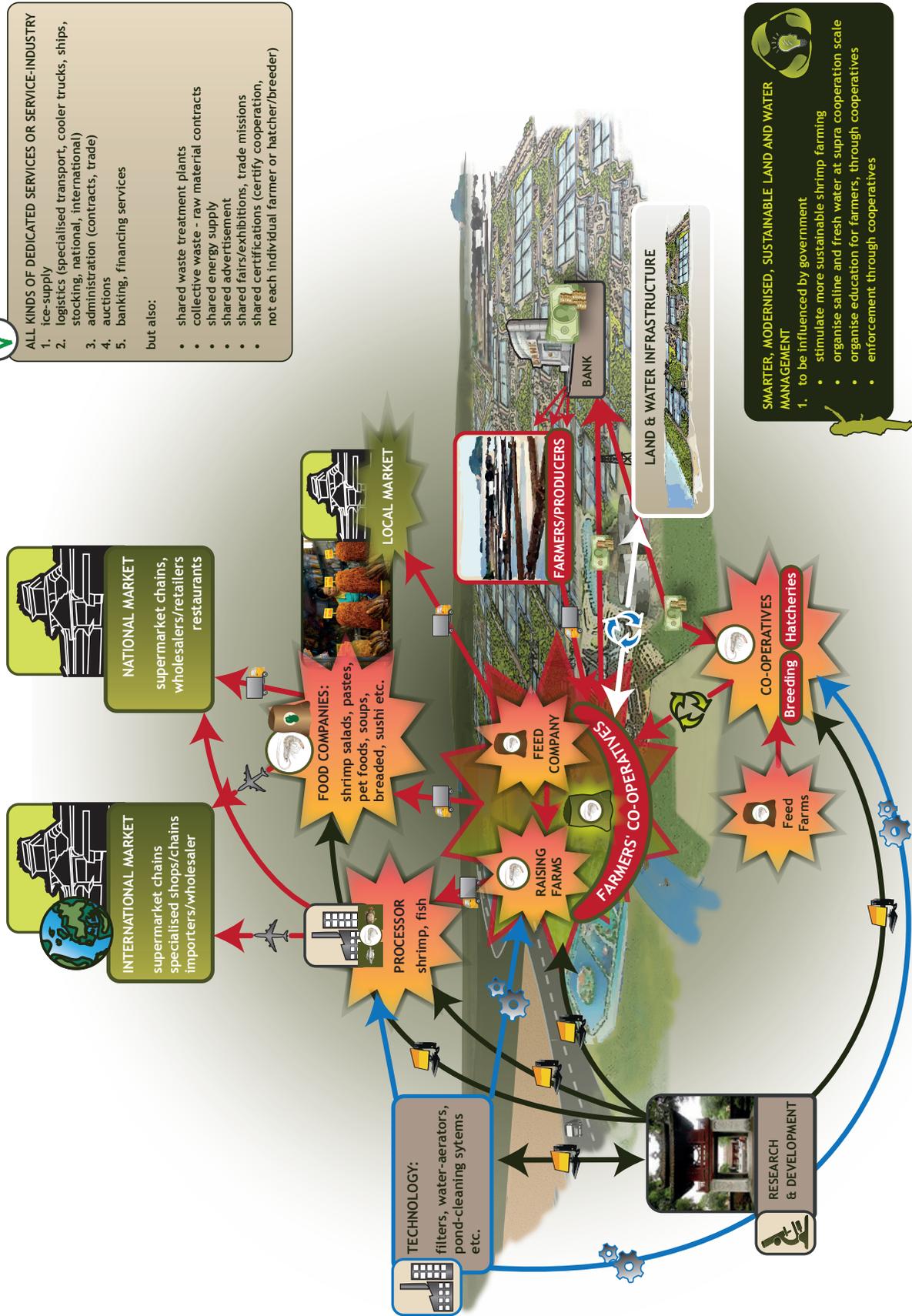


Figure 5-2 Desired value chain structure for the Agro-business industrialisation development³⁶

³⁶ Combination of information from Võ Tong Xuân (An Giang University) and Gerardo van Halsema (Wageningen University)

Box 5-6 Key-notes chapter 5 Policy changes for support of Agro-business industrialisation and value chain approach:

For the advancement of the agro-business industrialisation and value chain approach as the major drive of economic development and industrialisation, policy shifts are required that explicitly target the needs of a value chain approach:

- Agricultural growth policy needs to be transformed from increasing productivity per hectare to increasing **economic value per hectare** – or **economic value per person**. Enabling the delta to recoup its prominent share to national GDP, and become an economic magnet of growth. (Agricultural modernization and productivity gains will follow as a result of further market orientation and high-value product targeting)
- Agribusiness industrialisation thrives with the active **participation and investments of private sector enterprises** that invest in modernisation, product development and innovation, and economies of scale. This should be explicitly targeted and supported by agriculture, planning and investment, industrialisation and other policies through PPP.
- A **pre-condition** for successful agro-business industrialisation is the **vertical integration** of the product/produce value chain among suppliers, farmers, processor and retailer – typically through the establishment of long-term **supply contracts**.
- The **huge transaction costs** associated with the servicing of large groups of smallholder producers currently hampers the value chain in both directions:
 - For farmers/producers in obtaining direct access to good (and high quality) supplies and services (inputs, technology, certification), and therefore access to high-value markets – critical element in obtaining higher economic margins, market access security and warranties for investments in modernizing production process.
 - For traders, processors and suppliers it becomes logistically difficult and costly to reach and service individual smallholders, which hampers their investment in the development of new technologies, processing services and product-market development as they have no access to secured product supplies/markets.
- A **priority policy target** is therefore facilitating the establishment of **farmer product and production associations** (or cooperatives) as a means to secure the vertical integration of the value chain, and provide farmers and private enterprises with easier and securer access to each other's products and services, as well as the market.
- **Government support** needs to be **cross sector** and address all segments of the values chain, with specific focus on farmer integration:
 - Direct stimulus of farmer affiliations and cooperatives;
 - Development and reforms in regulations (legislative status and procedures of association/cooperatives, supply contract registrations);
 - Direct support services in formation, registration and capacity building for associations/cooperatives;
 - Credit supply facility for producer cooperatives and supply chain private sector;
 - Targeting PPP investments and co-innovations in the entire supply chain around supply-contracts (farmer-value chain);
 - Creating an enabling production and investment environment for the specific needs of the value chain:
 - Trade agreements/certification
 - Specific land and water management infrastructure for quality production;
 - Transportation and infrastructure;
 - Value chain specific agro-industrial parks (water, waste water, energy)
 - Research and Development institutes and facilities
- **Product specialisation and concentration** by value chains should actively promoted through creation of agro-business industrial hubs/zones, that are specialized around specific product value chains:
 - This stimulates cooperation, integration, co-innovation and co-investment among chain enterprises, as well as sharing/exchanging of resources (waste, infrastructure, services and human capacity);
 - Enables regional and geographical diversification and specialisation of agro-industrialization across the delta (e.g. brackish aquaculture, fresh aquaculture, fruits, rice, horticulture, etc), as an effective counter to regional competition in general industrialisation targets.



6 Improving institutional performance in the Mekong Delta

In chapter 5 and particularly in 5.4 it has been addressed where the bottlenecks for governance of the Mekong Delta are. This leads to recommendations for improvement of the institutional – governance – performance for the delta.

1. Pursuing a strategy to Agro-Business Industrialisation the governance in the Mekong Delta should focus on
 - a. a transition in agriculture/aquaculture and consequently
 - b. on more strategic guidance in planning, budgeting and project approval for all sectors in line with the desired development
2. Effective and sustainable land and water resources management that goes cross-border in all its aspects.

These three aspects for governing the Mekong Delta are very much inter-related, as is shown in Figure 5-1.

Starting with the original question for the MDP of how to go about the natural resources under climate change, solutions need to be developed integrating problems at basin level eventually. More important, it is recognised that the economic development plays a decisive role in the response of how to deal with the natural and human resources. This requires a transition to a new economy and therefore also a transition in governance with production targets to a more enabling administration, setting the right conditions. Finally this transition creates new administrative problems that need streamlining, transparency and stability in order to make the right planning and investment decisions or create conditions for well-directed private investments.

6.1 Focus on value chains in agro-business for effective governance and planning

6.1.1 Land and water issues require cross boundary solutions and overall delta management

The water resources management and climate change adaptation measures in the Mekong Delta require an integrated approach that cut across the different sectors, ministries and line-agencies. This approach goes across political and governance boundaries and mandates of the 13 individual provinces. The arrangements and measures for flood control, securing of adequate fresh water supplies in the dry season, salinity intrusion, regulation and management of an adequate and healthy brackish water zone for aquaculture, coastal defence, etc., are all typically measures that need to be considered at the delta level; in their impacts and influences they go beyond the boundaries of local governance and policy jurisdiction (district, province). E.g. restraining of seasonal flood regimes in the upper delta by construction of permanent dykes alters the peak flow regime of the river and its branches further downstream the delta, imposing additional costs and risks for flood and bank-erosion control downstream. Likewise, large-scale measures (e.g. coastal defence, fresh water storage capacity) benefit the population and land/water management in a much larger area than just the location where these measures have been implemented. This requires a careful weighing of costs and benefits against multiple interests, and coordination and integration of measures and policies. This is required to assure optimisation and cost-effectiveness, and avoid sunken costs that may emerge when measures and investments made at one province or locality become sub-optimal or obsolete by unforeseen measures taken elsewhere. This requires the establishment of an institutional governance entity that is mandated to take up this role, and direct, plan and financially approve, the water resources management and adaptation plans and measures for the delta. This should account for multiple stakes, interests of economic development in the delta and an overall beneficial outcome at the delta level. In the field of integrated water resources management (IWRM) such mandates are typically divulged to river basin organisations that, though not fully integrated across all sectors and departments, are mandated to influence and direct sector specific developments through the issuance of regulations and permits to all plans and developments impacting upon water resources (in quality and quantity).

6.1.2 The Mekong Delta requires much more than land and water management

As outlined in this Mekong Delta Plan however, the challenge for the Mekong Delta is of a larger magnitude. The socio-economic development in the delta and its distinctive provinces will take in the near to mid future have substantial impact on the type of measures to be taken to secure the desired and required land and water resources. *Vice versa*, certain measures and water management regimes may forestall future socio-economic developments to take place. The diverging and contrasting features/characteristics of the four scenarios presented are illustrative in this regard. This means that the Mekong Delta needs a coherent and

integrated planning for its socio-economic development, as well as for land and water resources utilisation and management.

6.1.3 Embedding an institutionalised integrative role in regional governance

This MDP provides a first qualitative and integrated assessment at strategic policy level. For the future development and adaptation of the Mekong Delta it becomes essential that such an integration and coordination role becomes institutionally embedded within the governance structure of Vietnam, and the delta as a region in particular. Ideally, this entails the establishment of legally mandated entity that is integrated and cross-sectoral in nature and capacity, and as such can act as a custodian of the MDP, its amendments and refinements, as well as subsequent elaboration into detailed programmes. In terms of mandate, one would wish to establish a "*Mekong Delta planning commission*" through which sectoral, departmental, provincial etc. plans (as well sectoral master plans) are reviewed and assessed on consistency and alignment with the overall strategy and development plan for the delta before approval. In cases of diverging development and plans that affect that principle outcomes and objectives as agreed upon in a government adopted MDP plan and programme, these are reverted to a re-assessment and revision (update) of the delta programme first to accommodate new insights, innovations and development objectives, and enable the commission to retain its role and mandate of coordination and integration at delta level.

This will greatly improve the orientation of the provinces towards each other as well as (jointly) towards national policy frames, notably towards relevant MARD-, MoNRE-, MoC- and MoT-policies and matters related to flooding, drought, salinity and water shortage. Through such meetings, the provinces will be able to view and jointly translate national policies in light of user functions such as agricultural and rural development, urban and infrastructural development, environmental and natural resource functions. Moreover, development of a better coordination at the scale of the Mekong Delta in Vietnam will also strengthen the international position of Vietnam in relation to the upstream countries along the international Mekong river basin.

The necessity of embedding of such an inter-provincial platform, ideally as a "Mekong Delta Planning Commission" in the planning system is essential. Its effectiveness depends on the ability of this commission to integrate and coordinate the mandates of all relevant authorities and the ability of these authorities to steer their mandates in the overall desired direction. Professionalisation of this commission and of the relevant authorities is more important than creating yet another authority. Essential is to guide stakeholder processes, to guide the process to powerful collectively supported choices, to guide provincial and local decision makers, to guide redistributions of property and (land)use rights, to control progress and take the right measures for effective operations. Hence authorities can keep their mandate [Box 6-1], but are bound to coordinate their planning and interventions through the commission. The latter should be equipped with the necessary powers, such as the ability to get information, develop its own knowledge base and enter into a dialogue with authorities on their shared responsibility in the basin.

Box 6-1 Mandate of a "Mekong Delta planning commission"

The mandate of the proposed planning commission is an important issue, when establishing a "coordinating and integrating administrative body" for the Mekong Delta region. Its coordinating "watchdog" function is essential. It could be argued that this should be a "commission", a "committee" or an "authority". It is essential that coordination and integration of decision making is somehow enforced, growing into a natural common practice of administrative coordination and integration. It is not the intention to create yet another authority that competes with existing sector or provincial authorities.

In fact this system already fits in the planning system [see Figure 2-1]. This MDP could give guidance as to how coordinate and integrate. At the same time the Mekong Delta has platforms for regional interaction.

Box 6-2 Role of the Delta Programme Commissioner in the Netherlands

In 2008, the Delta Commission, led by former minister Cees Veerman, established the Dutch Delta Plan in which he recommended a Delta Act. This Act was to include the appointment of a delta wide "director of the Delta Programme" the whole set of activities following the Delta Plan.

The Delta Commissioner acts as a government commissioner with staff. It should be noted that the Netherlands is a small country, not larger than the delta itself; in that sense it is a regional function. He is positioned at the centre of the administrative field of the Delta Programme. He advises all the government executives involved and may participate in the meetings of the advisory council of the Council of Ministers as an adviser. His tasks (including his staff) are co-ordinated in one ministry.

The Delta Programme Commissioner steers the Delta Programme in terms of cohesion (integration) and progress. He aims to create and maintain a support base for the measures and the Programme that benefits the delta as a whole among all the administrative tiers involved. If the programme gets hampered he will propose to government that authorities enforce their power to prevent stagnation of the programme. His focus is not just on the government but on all the parties involved including civil society.

The Delta Programme Commissioner's aims at designing an integrated, coherent and generally supported package of measures for the Delta Programme that is ultimately approved by Parliament. In this way, the Parliament determines the scope of the Delta Programme Commissioner's activities. The Delta Programme Commissioner monitors progress and implementation of the Delta Programme and advises Government in view of the state budget.

Consultation with the decentralised authorities and stakeholders involved is an important instrument in the work of the Delta Programme Commissioner, as is having access to information. The importance of these two components has been included in the Delta Act. This guarantees that at the administrative level, regular coordination takes place about, for example, the progress of projects and about proposals for the Delta Programme. Furthermore, the Act gives the Delta Programme Commissioner the authority, if necessary, to request information that must be supplied to the relevant ministers within the framework of the statutory obligation to provide information. Wherever possible, the Delta Programme Commissioner makes use of existing reports, information channels and consultation structures between the authorities concerned.

The Netherlands has dedicated this specific role to a new established entity in the form of the Delta Programme Commissioner [see Box 6-2], leaving the authorities in place, but enforcing collaboration in between sectors, ministries, administrative levels and seeking private partners. In Vietnam this needs to be ascertained whether to establish a new entity or reinforce and re-equip existing institutions to take up this daunting task. The SWSC plays currently a government advisory task that lies closest in nature and scope, and is well rooted with provincial governments and stakeholders. For such a renewed role and mandate, it would require further strengthening and capacitating with permanent planning and assessment officers drawn from across the sectors and government departments. Once established however, such a planning commission could act as an effective funnel and catalyst for government planning, ODA and FDI in the delta. It would also strengthen and partner with the VNMRC, whereby the delta program is brought forward and secured as Vietnam's national interests in the MRC.

6.1.4 Targeting support towards Agro-Business Industrialisation

Chapter 5.4 discusses the issues that need to be addressed to make the shift towards Agro-Business Industrialisation. This requires a shift of government focus, not only to act across sectors, but also address the segments in the value chain. Important is that the government creates an environment that enables private investments to contribute to a growing (agro-) economy. Essential factor in this is that the producers, the farmers get access to markets and that suppliers and processors get access to farmers. Government needs to support the forming of farmers' affiliations and associations, to make them an even match as a counterpart for other segments, notably suppliers and processors in the value chain.

In order to make the shift towards a high-value agriculture-industrialised economy, the social and physical infrastructure needs to be transformed. Not only to keep the people in the region and absorb the rural work force, but also to attract people and businesses that can add value. The cities in the Mekong Delta play an important role in creating this attractive living environment, providing job and career opportunities and high standards of health and education. Paramount is the physical connection between the cities and people and products in the rural area. Connecting infrastructure that facilitates growth in the desired direction requires more concerted action between national, regional and local levels and similarly between sectors, government, people and businesses with a clear value chain focus. Concerted action that is based on a joint vision: Agro-Business Industrialisation, in combination with a coordinated investment planning, spatial planning and water use.

Box 6-3 Value chain in Indonesia

Twenty global and local companies work together with ministries and provincial governments to introduce more sustainable production methods for seven target commodities (cocoa, corn, dairy products, palm oil, potato, rice and soy) to protect natural resources, improve food security and livelihoods of smallholders. A secretariat has been established which coordinates the activities. Pilot activities have been carried out and showed increase in productivity (30% for dairy, 10-20% for rice) as well as farmer incomes (12% for dairy, a target of 38% for cocoa). The palm oil working group has reduced carbon emissions by 20%.

(Source: World Economic Forum: Putting the New Vision for Agriculture into Action: A Transformation is Happening).

Such an enabling environment includes a strong role for provincial and local government agencies. Not so much to set targets and implement policies. But more a role to actively market the Mekong Delta as the incubator of innovative and sustainable agriculture, to be taken up together with representatives from industry. This constitutes a significant shift of focus, from government as a planning and implementing machinery towards a government as a marketing agent and facilitator of business and innovation. It will take time to make that shift. International experiences and practices can help, serve as a source of inspiration and provide examples of how to facilitate, support and stimulate innovative agricultural business development. Show cases, examples of successful concerted action in public-public and public-private partnerships will enhance developments in this direction.

Box 6-4 Becoming efficient in agriculture; public intervention in the Netherlands

The Netherlands possesses the most efficient agricultural sector in the European Union: with only 1.6% of its active population, this small country produces 8% of the EU's agricultural output, and rivals with France at the international level for second place behind the USA among agro-exporting countries.

This high performance originates in Dutch agricultural history, since the coastal regions of the country have been at the forefront of agricultural development in Western Europe for more than three centuries. Also, the Dutch success is the fruit of its agricultural policy, which has been focused since the fifties not only on the most developed regions but also on the disadvantaged inland regions in order to offset the differences in terms of development and to use the country's agricultural resources to their fullest.

Cornerstones of this policy throughout the years 1) support of the traditionally family run small farms; 2) initiating and support of agriculture research, education and widespread training; 3) supporting the development of cooperative ways to meet supply needs, to process raw farm goods and to provide agriculture loans; the government subsidised the establishment of agricultural mutual saving banks; and 4) integrated development of rural land (merging plots, construction of new farm buildings, improvement of infrastructures), that took into account three quarters of farmland until 2000, according to a plan that gave priority to the least favoured regions.

These regions are those in which the highest increases of productivity could be expected, thereby ensuring optimal use of the large amounts of public funds invested. In fact, in the coastal polder regions, the first drainage programs began in the 10th century and were initially carried out by the farmers themselves.

(Source: an interventionist agricultural policy intended to reduce regional inequalities, S. Devienne)

6.1.5 Streamlining planning and finance

In order to achieve a more sustainable development of the Mekong Delta and the agro-business chains, long-term planning of investments needs to be adaptive to changes of the socio-economic scenery and the water resources dynamics. In other words: given the challenges facing the Mekong Delta, investment planning will need to be more adaptive, taking future certainties, but also uncertainties into account.

This requires first a more strategic guidance in planning, budgeting and project approval, supported by a uniform and coherent system of cost-benefit analysis to prioritise projects according to the degree they contribute to the sustainable socio-economic development of the delta. This added value to the country should become decisive in public investments, Box 6-5 presents examples of guidelines for appraisal as being used in the Netherlands.

Box 6-5 Guidelines for the appraisal of investment projects

In the Netherlands, all infrastructure investment projects, including those in the Delta Program, are based on a Cost Benefit Analysis in line with guidelines of the Central Planning Agency (CPB) and the EU. The first step for the appraisal of investment projects is a qualitative discussion of the socio-economic context and the objectives of the investment. This discussion should include consideration of the relationship between the objectives and socio-economic development priorities. Next is the clear identification of the project, meaning that the object is a self-sufficient unit of analysis, i.e. no essential feature or component is left out of the scope of the appraisal; indirect and network effects are going to be adequately covered (e.g. changes in urban patterns) and whose costs and benefits are going to be considered. The third step is the study of the feasibility of the project together with alternative options. A typical feasibility analysis should ascertain that the local context is favourable to the project (e.g. there are no physical, social or institutional binding constraints), the demand for services in the future will be adequate (long run forecasts), appropriate technology is available, the utilisation rate of the infrastructure will not reveal excessive spare capacity, personnel skills and management will be available, justification of the project design (scale, location, etc.) against alternative scenarios.

The next three steps (4-6) comprise the financial analysis, economic analysis and risk assessment. A system of accounting tables should show cash inflows and outflows related to total investment costs; total operating costs and revenues; financial return on the investment costs; sources of finance; financial sustainability; financial return on national capital. The economic (Cost-Benefit) Analysis requires an investigation of a project's net impact on economic welfare. This is done in five steps: 1) observed prices or public tariffs are converted into shadow prices that reflect social opportunity; 2) externalities are taken into account and given a monetary value; 3) indirect effects are included if relevant (i.e. not already captured by shadow prices); 4) costs and benefits are discounted with a real social discount rate; and 5) calculation of economic performance indicators: economic net present value (ENPV), economic rate of return (ERR) and the benefit-cost (B/C) ratio. Finally, the project appraisal document must include an assessment of the project risks, notably sensitivity analysis; assumption of a probability distribution for each critical variable; calculation of the distribution of the performance indicators (typically FNPV and ENPV); discussion of results and acceptable levels of risk; discussion of ways to mitigate risks.

Even though significant progress has been made in the past years, the process of investment planning is still not very transparent and unpredictable for people and businesses. Increased transparency in investment planning will help decision makers to set more demand and market driven goals, targets and expectations that would increase the effectiveness of investments and projects. Public disclosure of information can mitigate market inefficiencies and provide easier access to capital markets and better terms for government financing.

Box 6-6 The importance of transparency

Vietnam has come a long way in the last 15 years in promoting the public availability of data and information. However, progress has been slower due to the absence of a generalised law on access to information. In the meantime, the impact of weak transparency has been costly for Vietnam. It is one of the core drivers of corruption and misallocation of public funds, especially in the area of land management. Moreover, investments are lagging behind, as investors, exporters, importers, foreign exchange dealers, banks, enterprises and farmers need clarity and information to make optimal investment decisions. And the public needs information to be able to understand and support, exert influence over these decisions and raise their voice in case of external effects of these decisions (e.g. discharging untreated waste water in rivers and canals).

Strengthening the process of project identification, prioritisation and approval by strengthening tools, methodologies and use of sound cost-benefit analysis as well increasing transparency will greatly improve the speed and effectiveness of investment planning.

Improving the management of government resources in order to enable a more effective and transparent delivery of infrastructure and socio-economic services will require a longer-term agenda. It entails significant strengthening of managerial skills and accountability in the planning, construction, rehabilitation and provision of infrastructure and social services at both national as well as provincial levels. To attract effective private co-funding in agro-business chains, it will be essential to provide stability in planning (e.g. factories can be secure in location and access to farmers/produce) and investments are carried out transparently and speedily.

Given that Official Development Assistance (ODA) money will slowly be trimmed down, public private partnerships may become a valuable alternative delivery model to complement public sector investments. In itself it does provide a selection model that prioritises the projects that produce the most value for money

Box 6-7 Strengthening the framework for public-private partnerships

Vietnam is adopting PPP as a way of developing and improving public infrastructure. As well as providing an additional source for capital investment in the short-term, PPP is a means to facilitate private investment in the provision of new and refurbished public infrastructure. For the Government of Vietnam, specific objectives for its policy on PPP include developing better value for money, more reliable, public services by deploying private sector skills in risk management, project planning and the use of new technologies; enhancing the employment generation potential and diversity of the economy; acting as a catalyst for the implementation of the 10 Year Social-Economic Development Strategy, the 5 Year Socio-Economic Plan, and the Annual Sector Master Plans; and improving the management of government resources in order to enable efficient and cost-effective delivery of infrastructure and socio-economic services.

The current ambitions and efforts to strengthen the framework for public-private partnerships in the provision of infrastructure services could prove very beneficial for the development of the Mekong Delta towards a agro-business-based economy, supported by infrastructure to increase the resilience of the delta. It could lure private sector to invest in co-operation with the government. In other words: more transparency in investment planning and decision making would help the Mekong Delta to mobilise significantly higher resources in the international market and at a much lower cost.

6.2 Recovering costs and ear-marking funding for water governance

In the future, water governance in the Mekong Delta will not be able to rely on international funds. Once a river basin organisation is established, a system will be needed through which it can build up financial funds. It should get sufficient budget from internal sources within the country. One system is based on cost recovery through a profit principle. This means that those who have an interest in water governance and profit from it, also pay for it. Such an option should be based on equal and fair distribution of risks, benefits and costs. Another system is based on cost recovery through a solidarity principle. This means that the costs of water governance are recovered from the national budget or provincial budgets. For the shorter term, a stronger degree of coordination between the different donors could pave the way: a multi-donor Mekong Delta Fund and Program could be set-up to assist the Government of Vietnam to gradually develop the foreseen basin organisation and – already – gear infrastructure investments towards the realisation of the vision for the Mekong Delta.

6.3 Knowledge, towards joint fact finding

Relevant (provincial and district) authorities need to have better access to relevant (water, land use, environmental, etc.) data and information to guide planning, decision making and licensing. Currently, data and information are insufficiently available, or scattered among many different (over 200) relevant research institutes as well as the more than 19 multilateral and 26 bilateral international donor agencies. Moreover, at regional level, these data and information need to be applied to develop basin-wide (surface and ground) water regime models that guide operational decision making and licensing. Only when these are in place, will the relevant authorities become more capable to effectively manage, operate, maintain and enforce the rules and policies for land and water in the Mekong Delta.

The availability and accessibility of data and information need attention. Sufficient data, data rights, access to data are crucial for the success of cooperation and coordination between the Mekong Delta provinces as well as between regional and national government agencies. A joint knowledge agenda would be a first step in the right direction. On the long-term, the Government of Vietnam could consider to merge different research institutes in one Mekong Delta Institute that will bring together all relevant knowledge and data in support of a more institutionalised management at the entire basin level.

6.4 Further integrating water legislation

The most relevant legislation governing the exploitation and use of water resources in Vietnam and the Mekong Delta are: the Law on Water Resources (2012), Law on Dykes, Law on Environment Protection, Law on Biodiversity, Land Law, Law on Inland Water Navigation, Decree 120/2008 on River Basins, Decree 149/2004 on Licensing, Decree 112/2008 on Reservoirs. An important step has been taken with the enactment of the (new, revised) Law on Water Resources (17/2012/QH13) which strengthens in particular the system of licensing of the use of water. The new Law clearly stipulates the rights and duties of water extraction and use. It assigns the Ministry of Natural Resources and Environment (MoNRE) as well as the Provincial People's Committee to carry out the granting, renewing, adjusting, suspending and revoking of

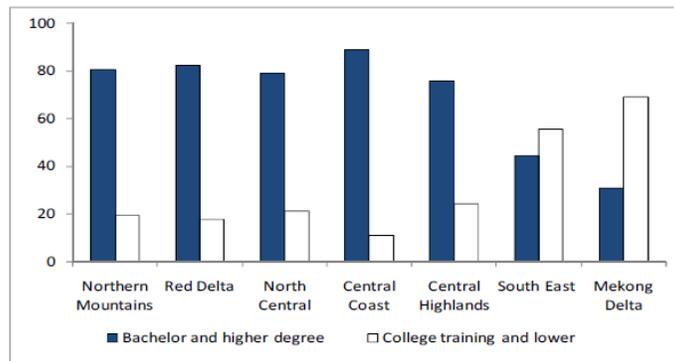
licenses on water resources. In the future, additional efforts to further integrate water legislation would contribute to more consistency and transparency in water resources management.

Box 6-8 Integrated water legislation in the Netherlands

The Netherlands may serve as an example here. It integrated its water legislation into one single (integrated) water law in 2009, bringing together a wide range of legislation on water quality management and flood protection, surface and groundwater management, water use and services. It is now the single piece of legislation defining authorities, responsibilities and instruments for managing water resources in an integrated manner. But there is a large number of additional Decrees, Decisions and Ordinances from a wide range of ministries as well as provincial regulations providing policy, guidelines and other implementing arrangements for water management.

6.5 Capacity building at provincial and local levels

Service provision and the operation and maintenance of water infrastructure (notably the repair of dykes and canals) are typically allocated at provincial and district levels. However, even though provinces have received significant more powers as part of recent decentralisation efforts (and increasingly are partners for development projects), their human capacity to master the challenges remains limited. The situation at District and Commune levels is even worse. Whereas the state management of MONRE constitutes a total of approximately 35% staff with Masters (or PhD) degrees; at the provincial and district levels little over 1% of staff has more than a BA/BSc degree. Moreover, although more than 1000 students graduate from the Water Resources University every year, these curricula do have a technical, engineering focus. The so-called soft and management skills are basically neglected.



Qualification in irrigation management in different regions in Vietnam (2007)

Box 6-9 Practical assistance and support from Dutch Water Boards

In continuation of the Netherlands support to the HCMC Steering Centre for Urban Flood Control (SCFC), five Dutch Water Boards have agreed to regularly send in their top experts in the field of water resources planning, project (cycle) management, operation and maintenance, tendering and supervision, to work closely with the SCFC experts on their concrete, day-to-day operations and challenges. Such a cooperative arrangement could also be beneficial to the Departments of Natural Resources and Environment (DoNREs) and Departments of Agriculture and Rural Development (DARDs) of the Mekong Delta. Preferably one that would cover all provinces of the Mekong Delta and stimulating joint learning and cooperation between the provinces.

Most of the mid-level officials in Vietnam hold bachelor degrees from mono-disciplinary universities, which are still the majority of universities in Vietnam. Their main weaknesses are:

- narrow focused study field, while their position required much broader knowledge and perspective
- lack of important skills; like team-work, IT (e.g. GIS and decision support systems), analytical skill and interdisciplinary research methods, project economics.
- hardly critical thinking and no problem-based approaches as the consequence of theory biased study programs, this is also caused by top-down decision making environment, in which they use to work.

In order to cope with the shortage in number and quality of officials, each province in the Mekong Delta formulated plans for human resources development. Planning, economics and climate change adaptation are on top of the list in most of provinces. The Netherlands financed NICHE program aims to train and educate more professional staff in these fields by strengthening the capacity of the Vietnam National University in Hồ Chí Minh City (VNU-HCM). But clearly the VNU-HCMC will not be able to meet the total demand for more qualified staff by itself. Moreover, with increasing demand for well educated professionals the present higher education system is still unable to produce the number of graduates needed to sustain Vietnam’s economic and social development. This also applies for the higher education institutions providing water and agricultural

programmes and delivering professionals in the different fields related to water management and food production in line with the long-term vision for the development of the Mekong Delta.

6.6 Foreign policy for the upstream issues affecting the delta

Due to its geographical situation at the end of the Mekong river, the Vietnam Mekong Delta is depends heavily on the upstream development and measures taken in riparian countries of the Mekong and impacts of climate change on the whole river basin. The most important issues in this respect are:

- dry season flow of the Mekong river entering the VMD;
- potential restriction on fish migration and its impact on natural fish stocks within the VMD;
- sediment load and deposition of the Mekong river;
- peak flow hydrograph during the flood season entering the VMD (both through overland flow and river discharge).

Essentially, with more than 10 major dams projected in the main stream of the Mekong, the hydrological effects depend largely on the – combined – operation of the dams. The hydrological impacts of climate change may either be amplified or attenuated.

With new dams, the sediment load for the Mekong Delta will further decrease. Along with less flooding in the Delta, the natural rising of the Delta will gradually stop. In the short to mid-term, it is therefore important to optimise and maximise the natural sedimentation as an adaptation to sea level rise, using the river's sediment as long as possible.

To enable the mitigation of environmental impacts and guide and manage the potential impacts of future developments on reallocation of the water and natural resources (e.g. silt, fish) it is essential that Vietnam conducts an active foreign policy on the above mentioned issues.

Vice versa, positive economic developments in the upstream countries form great opportunities for the delta to become the gateway of an economically flourishing hinterland.

The 1995 Mekong River Agreement could further develop into more intensified collaboration. With growing possibilities in an expanding economy, more options will become available to deal with potentially negative impacts for the delta due to upstream developments. The role of the Mekong River Commission is important, and potentially decisive in the long-term. Having a platform to discuss the management of the river basin as a whole is invaluable. Good examples for successful international cooperation of border crossing river are the Indus (India-Pakistan) and the Rhine (Switzerland, Germany, France, Netherlands), the water directives used in the European Union show good coordination of river management among countries.

Box 6-10 Institutionalisation of regional delta management

Assuming that the status of Mekong Delta Plan as a strategy will be confirmed, its status needs to be communicated in all relevant ministries and regional bodies. In the present context [see 5.4 and 6], it is not likely that a development to Agro-Business Industrialisation will successfully take off. It is therefore that this development be enhanced, stimulated and monitored, if necessary adjusted. Actors need to be put in place, producers need to get organised and government needs to adjust regulations, legislation and focus to facilitate in all segments of the value chain, sectoral integration and geographical specialisation. New policies create also new administrative problems that need streamlining.

1 Establishing process for realisation of the strategy, putting actors in place

- 1.1 intensification of collaboration platform for the Mekong Delta region with sufficient mandate;
- 1.2 appoint "custodian" of the strategy for the delta with sufficient authority;
- 1.3 review most important sector master plans
- 1.4 proceed, intensify projects that fit MDP approach;
- 1.5 revise projects that fit partially or not;
- 1.6 create "delta-institute" or better merge important existing research institutes to create joint fact finding and undisputed data base;
- 1.7 find pilot projects and showcases to test and evaluate the new approach.

2 Targeting support towards Agro-Business Industrialisation;

- 2.1 shift government focus to cross sector, cross boundary and address segments in the value chain;
- 2.2 enables private investments to contribute to a growing (agro-) economy;
- 2.3 essential support for producers'/farmers' affiliations and associations to create an even match with suppliers and producers
 - 2.3.1 Review of agriculture and land use policies: longer tenure periods than the present maximum (20 years) and raising land use ceilings (present 2-3 ha/household) contribute to more optimal business size and stability³⁷;
 - 2.3.2 increase committed contracting with domestic and international market;
 - 2.3.3 strengthening and establishing cooperative buying / selling (export) organisations
 - 2.3.4 legislation to enhance formation of associations, loans, financing.
- 2.4 Shift from state enterprise policy to facilitating private entrepreneurship
 - 2.4.1 investments along the food chain – "from land until consumer";
 - 2.4.2 stimulate PPP-constructions
- 2.5 Create a good financial investment climate

Investing and finance

- 2.5.1 improving financial capabilities by making enough credits (microloans or microcredits) available for medium and small sized enterprises to be able to make the shift from rice crop to other crops and downstream processing businesses (for example establishment of a cooperative / mutual saving bank or co-operation to attract agriculture loans).
- 2.5.2 create an attractive investment climate for (foreign) innovative enterprises and institutes to establish in the Mekong Delta, connect with Vietnamese industry.
- 2.5.3 high-value Agriculture Development Fund (funded by public and private sources along the production chain) (might be in particular for pro-poor / remote communities in the delta) with the aim of farmers moving up in the value chain
- 2.5.4 crops / Project Production Inputs Fund to establish group revolving funds
- 2.5.5 self-generated savings from group savings and credit schemes
- 2.5.6 cooperative insurance organisations / programs

Business organisation

- 2.5.7 strengthen and establishing cooperatives in fields as (a) information /data exchange, (b) processing plants (raw goods) and storage facilities, (c) irrigation infrastructure / operation.
- 2.5.8 support /cooperation scaling up in land use for certain subsectors / crops.
- 2.5.9 nucleus farmer approach to demonstrate technology and / or best farming practices, also to shift away from sole rice cultivation (integrated crop, fertilizer, pest and water management strategies, possibly in cooperation with traders, crop diversification, lower input techniques, crop rotation mix farming models, etc.), aim is close integration of production to agro-processing / storage and market access to ensure that productivity and profitability of agricultural production improves.
- 2.5.10 develop (vertical) partnerships between farmers / and their suppliers / traders seeds / fertilizers, producers, joint risk taking on production, facilitating programs.

Sector organisation

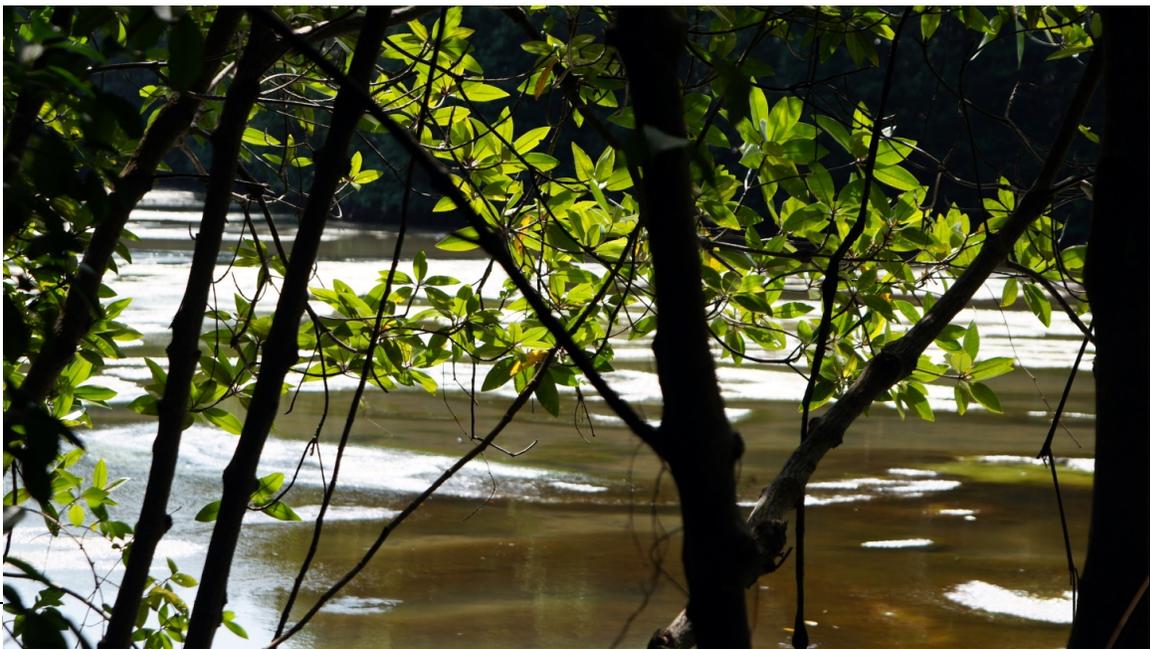
- 2.5.11 establishing trade and product organizations / associations with aiming at developing the sector by being a spokesman for the sector, introduction of professional business strategies and efficiency, financing research, pursuing cooperative initiatives, marketing and information, hygiene / quality certification, etc.

- 2.6 Streamlining administrative procedures and product appraisal

3 Establish active role donor coordination with help of MDP

4 Strengthen active foreign policy to upstream countries and MRC an VN-MRC, using MDP

³⁷ Natural Resources Management, Vietnam Development Report 2011



7 Sustainability and flood management measures

7.1 Problems in handling natural resources accounting for different scenarios

This chapter deals with the problems of mainly land and water management in the delta. This chapter attempts to describe several sets, types of measures that need to be considered to solve persistent and typical deltaic problems in the Mekong area. The approach is based on scenarios as laid out in chapter 3 and 4. A general idea is presented for the timeline, but first it should be considered that a scenario may evolve sooner or later, also requiring measures sooner or later and a shorter or longer lifetime (or higher or lower costs) of the measures that will be actually carried out [see also Figure 2-5].

Control over the natural resources land and water to benefit economy and reduce damage

Given the desired development scenario and the actual vulnerability of the delta, the Mekong Delta Plan proposes three distinct sets of measures.

- controlling seasonal river flooding in Upper Delta and shift in agriculture;
- a flood safe Middle Delta and solving fresh water supply, also lower in the delta;
- economic adaptation to salinity in the Coastal Zone in view of continued coastal flood protection water intrusion.

If climate change would become really extreme, also more extreme measures would be needed. This chapter touches on types of extreme measures in the mid to long term "waiting" for extreme changes to happen (or not); this waiting time must be used for further research and possible innovative alternative solutions.

The future development is strewn with uncertainties: in terms of the extremity of possible climate change, in terms of developments to take place in the upstream Mekong and last but not least in terms of the economic development to emerge within the delta. In view of these uncertainties and the long-term impact of infrastructural measures this Mekong Delta Plan distinguishes between "no-regret" measures (fits all scenarios), priority measures (short-term) and more structural measures to be deferred to the mid and long term.

Strategic issues in the delta

The delta's natural resources in terms of land and water form the base for the delta's economic power. Its geographical situation causes the delta's great vulnerability, potentially increasing through climate change or upstream developments. Demands on land and water management change. These are strategic issues that relate to an integrated vision of the future of how economic development, climate change and water management may fruitfully interact over the delta. Given the uncertainties in the future evolvement of socio-economic development in the delta, hydrological impacts of climate change and potential attenuation of upstream developments need to be treated cautionary and flexible in their design and approach.

Proposed measures stand for strategic problems needing further investigation and resolution

A primary focus is given to "no-regret" and "priority" measures to be taken in the short- to mid-term (2050) that enable: i) the adaptation of land and water use to the short-term climate change impacts, with emphasis on increasing the sustainable land and water use; and ii) are flexible enough in their structuring of water management and hydrological features to permit differential socio-economic development of the delta's economy in the mid- to long-term.

For the mid- to long-term (2100), additional measures are presented that are specifically designed to prepare the delta to cope with, and adapt to, the more extreme impacts of climate change. By necessity these are more structural and large-scale in nature, requiring careful valuation, planning and capital outlay. The outcome of which will be further subjected to renewed insights in the short- to mid-term depending on the actual evolvement of the delta's economy over the next decades, the severity of climate change to occur, upstream developments in the Mekong Basin, and future developments in water and agriculture technologies.

It is explicitly not the intention of the MDP-process to come up and present *the* solution for the strategic issues. In this stage, the process is aimed at putting these issues in the context they need to treat them in a truly integrated manner. It is either an already going process to investigate solutions, or the investigation and planning needs to start in a next phase, sooner or later.

Table 7-1

Land and water management recommendations for the Mekong Delta. The years 2050 and 2100 indicate medium- and long-term. Depending on the relative sea level rise (including the land subsidence factor) and climate change with respect to wet season floods and low dry season flows, the recommended measures may need to be taken sooner. Also the success of spatial planning and land- and water-use management influences the timing.

Upper-Middle Delta: Flood based agriculture and flood relief measures			
①	2050 "no-regret"	<p>Controlled Flooding. Agricultural land-use planning in Upper Delta and modernisation of flood-based agricultural production systems (flood water retention, diversification of fish and vegetables) induce sedimentation.</p> <p>Flood protection measures for urban and industrial development in the Middle Delta. Rural flood protection along flood retention areas.</p>	Food Production Agro-Business Industrialisation Dual Node Industrialisation
②	"priority" and no-regret 2050 2100	<p>Flood protection: local urban and rural in combination with room for river.</p> <p>Reinforcement and upgrading of flood (reversed drainage) protection system and spatial urban planning for urban water retention (urban waterscapes) to enhance gravity urban drainage.</p> <p>Scenario and strategy development for flood protection Middle Delta: landfill, manageable dyke lengths, primary-secondary systems, room for river.</p> <p>Continuous securing flood protection.</p> <p>With extreme climate change upgrade to urban / industrial polders with pumped drainage capacity.</p>	Food Production Agro-Business Industrialisation Dual Node Industrialisation 2050 in case of no controlled flooding
③	2100 "priority"	<p>Major Flood Diversion. With extreme climate change and peak flood increases, construction of east and west diversion canals, to keep urban polders (flood protection) feasible and cost-effective in the Middle Delta.</p> <p>Spatial planning reservation for Major Flood Diversion. Flood Diversion requires adequate spatial reservation to avoid regret and extreme costs for future flood protection.</p>	2050 in case of no controlled flooding

Middle Delta: Industrial, urban and rural flood safety, secure fresh water supply			
④	2050 2100 "priority"	<p>Radical shift from groundwater supply to supply from surface water to prevent land subsidence. Investments in open water supply facilities instead of groundwater extraction. Land subsidence reduction for more sustainable flood protection.</p> <p>Bassac/Hậu ↔ Mekong/Tiền Link. Secure flow diversion to the Bassac Branch at the bifurcation ensuring dry season fresh water flow to the Western Delta (Cà Mau peninsula).</p> <p>Spatial planning reservation for Link Canal. The Link Canal requires adequate spatial reservation to avoid regret and extreme costs for fresh water supply.</p>	Food Production Agro-Business Industrialisation Dual Node Industrialisation (less needed) Corridor Industrialisation (less needed)
⑤	2100	<p>Flow control of fresh and salt water in the estuaries during the dry season. Under extreme climate change and extreme reduction of the dry season river flows, temporary control of the river branches at their mouths to: a) prevent pronounced salinity intrusion; b) create a fresh water storage capacity in the river.</p> <p>First to be implemented in the east branches. Keep Bassac Branch open as long as possible.</p>	

Coastal Zone: Brackish water economy and advanced coastal protection	
2050 "no-regret" ⑥	<p>Dual Zone Coastal Management. Brackish economy and dynamic shorelines. Modernisation and increased sustainability of aquaculture by adopting poly-culture based systems aligned with mangrove regeneration in the outer coastline. Mangrove regeneration and sedimentation along outer coast line as reinforcement of sea-shore.</p> <p>Movement of hard-protective sea-dyke to inner-core zone.</p>
2050 "priority" and "no-regret" ⑦	<p>Fresh water management along the coast. Preservation of the ancient phreatic groundwater table along the coast is a priority by halting its use in agriculture and aquaculture. Limited use for rural water supply only. Combatting of land subsidence, by a) halting groundwater depletion and b) foster a brackish-aquatic environment. Use groundwater for drinking water alone.</p> <p>Local fresh water harvesting and storage in sandy areas for limited high-value agricultural use and diversification.</p> <p>Investment in saline high-value agriculture (derivatives for food, cosmetic, medicine and energy) based on salt tolerant crops, sea-weeds and algae. In the short-term investment in Research and Development..</p>
2100	
2050	<p>Reinforcement of coastal defence. For non-Dual Zone Coastal Management areas, sea-defence structures (dykes) need to be revamped to keep up with sea level rise. Especially north-west coast, and Eastern Delta (Mekong Branch). The routing of the dykes needs to be in line with Dual Zone Coastal Management.</p> <p>Unlinking road system from dyke system. Flexibility in dyke trajectories is required to allow for natural cost effective coastal flood defence strategies. The road function impedes the flexibility for the dyke.</p> <p>Under extreme sea level rise, coastal defence system is upgraded to accommodate rising flood risks. This includes reinforcement of inner protection dykes.</p>
2100	
⑧	
	<p>Food Production Agro-Business Industrialisation Dual Node Industrialisation Corridor Industrialisation</p> <p>Food Production Agro-Business Industrialisation Dual Node Industrialisation Corridor Industrialisation</p> <p>Agro-Business Industrialisation</p> <p>All scenarios</p>

Table 7-2 Overall measures

Overall measures	
"no-regret" ⑨	<p>Water transport. Linking Cần Thơ and surrounding industrial zones to Hồ Chí Minh City and the sea. Facilitation of industrialisation and bulk transport by development of harbour facilities in a well-designed scheme. Improvement of unique abundance of inland waterways. Needs further investigation and elaboration.</p>
"no-regret" ⑩	<p>Research and investigation programme [see 6.3]. Coherent data collection, joint fact finding and open sources, coherent research to develop programmes and plans for decision within the framework of an integrated development of the delta.</p>
	<p>All scenarios</p> <p>All scenarios</p>

Overall measures	
11	<p>"priority"</p> <p>Integrated Governance and Planning [see chapter 6]. Mechanisms, financial and political, are put in place to come to an effective coordination and integration of planning across sectors, and across governance domains, at national and provincial level, to come to a congruent planning and implementation in the future. Risks of irreversible non-optimal developments (e.g. Corridor Industrialisation) and negative cost-effect impacts of uncoordinated measures (e.g. urban flood protection and controlled flooding) need to be confronted.</p> <p>Well balanced foreign policy [see 6.6] with upstream countries in order to manage the impact of upstream developments for the lower Mekong.</p>
12	<p>"priority", "no-regret" mid-term</p> <p>All scenarios</p>

7.2 Upper Delta – Flood based agriculture and flood relief measures

7.2.1 ① Controlled Flooding – coupling double rice crop and fish farming

Given the current agricultural state of the delta's economy, and the moderate projected increase of wet season flows due to climate change (10% or even higher increase for high climate change scenario in 2050), the adoption, continuation and implementation of the controlled flooding practices in the Upper Delta is regarded to be a **"priority"** and **"no-regret"** measure to be taken in short to mid term (2050).



Vision 2100 | Controlled Flooding

Mekong Delta Plan, 2013

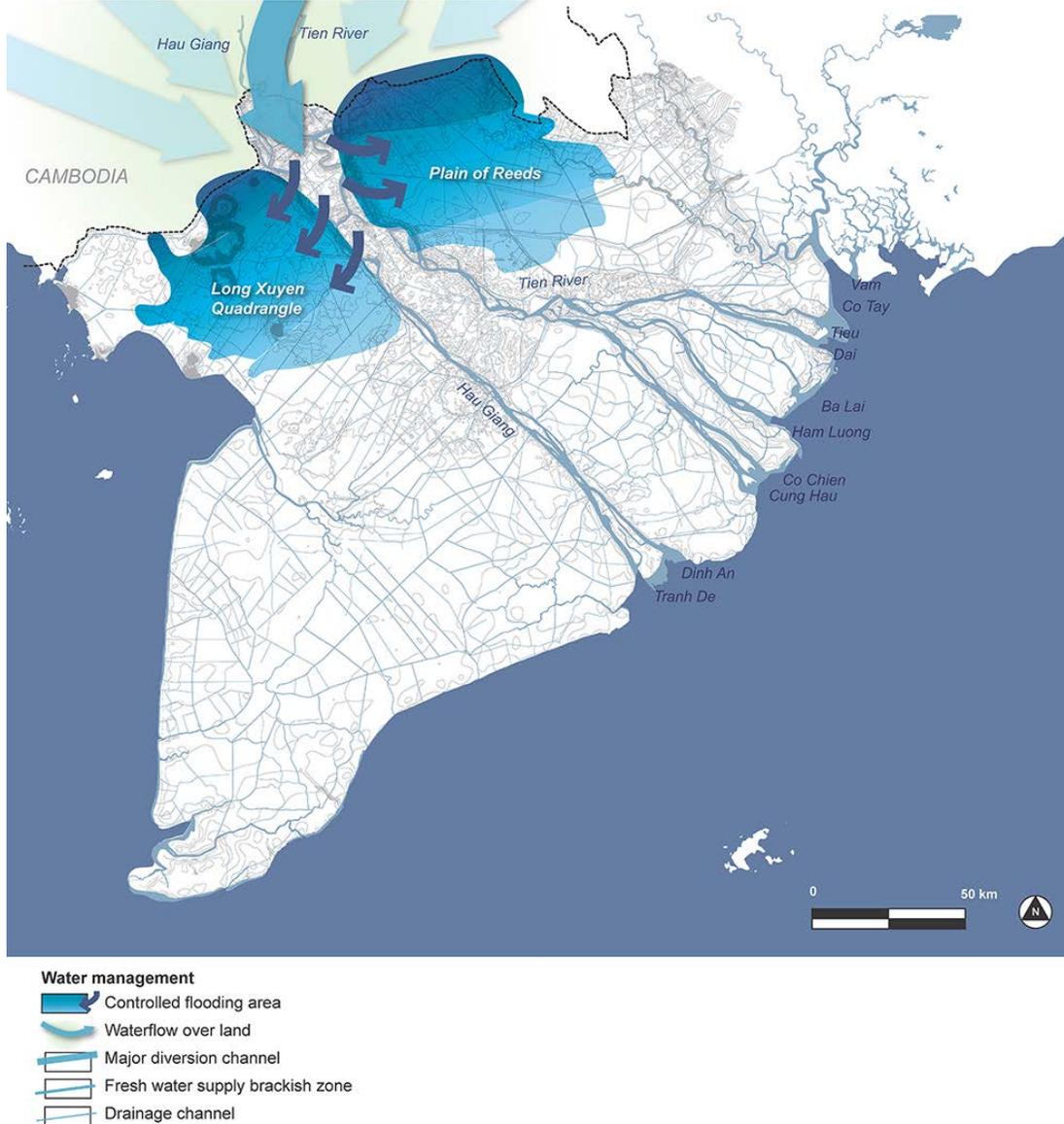


Figure 7-1 Schematic presentation of preserving and maintaining controlled flooding potential in the Upper Delta, despite a tendency of reclaiming flood retention for triple-crop rice. By lack of discharge capacity in the river channels itself, the water is retained and flows over land in an ingenious cascade system downstream.

The hydrological effects are beneficial for reduced flood risks, and by that cost aversion, for the middle-range of the delta, as well as the environment and ecosystems of the Upper Delta. In addition, the economic impacts are positive for the Food Production, Agro-Business Industrialisation and Dual Node Industrialisation economic scenarios.

This measure also fits the current state and practices of land and water use in the Upper Delta, although it signifies a clear departure of the triple-rice policies and increasing practices – in particular for the natural flood plain areas of the Long Xuyên Quadrangle and Plain of Reeds. Where this may initially

cause a (limited) loss of rice production, a controlled and actively managed (both in space and flood capture/release) controlled flooding practice has additional benefits to offer to offset the losses in rice production: i) post-flood rice crops tend to return higher yields due to soil fertility increases; ii) active silt accumulation in the delta may offset subsidence; iii) it enables diversification (fish and vegetables), modernisation and sustainable agricultural production systems that return higher value products and meet changing food demands of an increasing middle-income urban population (in and outside the delta); iv) smart spatial and controlled flooding strategy may reduce the cost for rural flood protection in the future.

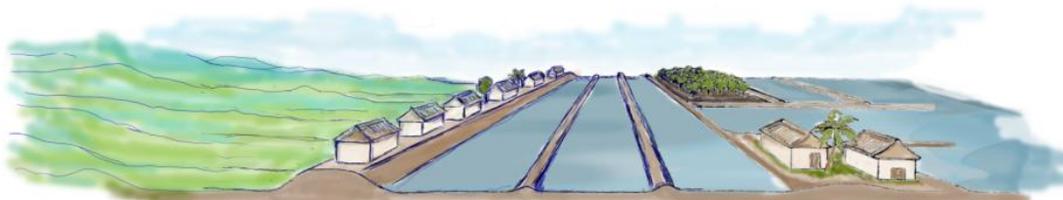


Figure 7-2 Inundated rice paddies in the wet season (Upper Delta) offer controlled retention of river floods after two crops.



Figure 7-3 Controlled flooding in the Upper Delta, using the inundated paddies for fish farming in the wet season or "floating vegetables", offering an attractive economic proposition.

Finally, this meets the socio-economic conditions of three out of four scenarios. Even for the Dual Node Industrialisation scenario, a reduced flood risk in the Middle Delta is highly effective and economically beneficial while a more diversified and higher value agricultural production in the Upper Delta will better meet the demands on increased urban population.

To support this strategy, investments will be needed to support the development of active and purposely controlled flooding production systems that actively retain the flood waters, and adapt and diversify their production system with fresh aquaculture and (irrigated or recession based) vegetable cultivation. Priority should be given to initiate such modernisations in flood-based agriculture to enable up-scaling towards the mid-term, and to assess the potential additional benefits that can be attained from retaining the flood water for reuse later in the season.

7.2.2 @ Urban and rural flood protection, room for river

Localised urban flood protection and inundation measures (specifically Cần Thơ) are to be considered a **"priority" and "no-regret" measure with phased planning** to be taken in the short- to mid-term (2050). A dual approach of providing adequate protection against flooding (overflow) and inundation (reversed drainage) through dykes, flap gates and land subsidence control, and provision of temporal (rain) water retention capacity (spatial planning!) within urban centres (urban waterscapes) to allow for low-tide urban water drainage, is proposed. In a wider scope, there is a strong tendency to allow for "overall" (urban and rural) flood protection in the Middle Delta. Creating a system with many and potentially growing number of ring dykes around – expanding – cities first, smaller towns later and then villages may result in an unmanageable length of dykes, requiring ever increasing costs for maintenance and upgrading. Dyking of the area as a whole affects the space that the river needs for lateral storage and flow in a negative sense. Reliable modelling of river flow in different scenarios is a very high priority to find the right strategy for successful spatial management here and avoid negative consequences of a sector or just local approach.

Embankments provide a minimum protection against (river) flood-induced inundation. Adequate storm water retention capacity maximises the time span in which urban water drainage can be accomplished without installation of – expensive – pumping stations. In the present context of urban development and hydrological regime, these measures can still be taken at a relative low cost, using gravity-based urban drainage. The control of land subsidence is an important factor here: the switch from uncontrolled groundwater extraction for fresh water supply needs a radical shift to surface water supply. Coordinated investments for surface water intake and treatment are required to offer a good alternative for groundwater supply. With increasing urban development (especially in a Dual Node Industrialisation scenario), additional localised structural measures will have to be taken to protect a larger area – and this may grow with urban expansion over time, resulting in a disproportionate growth of – upfront – investments.

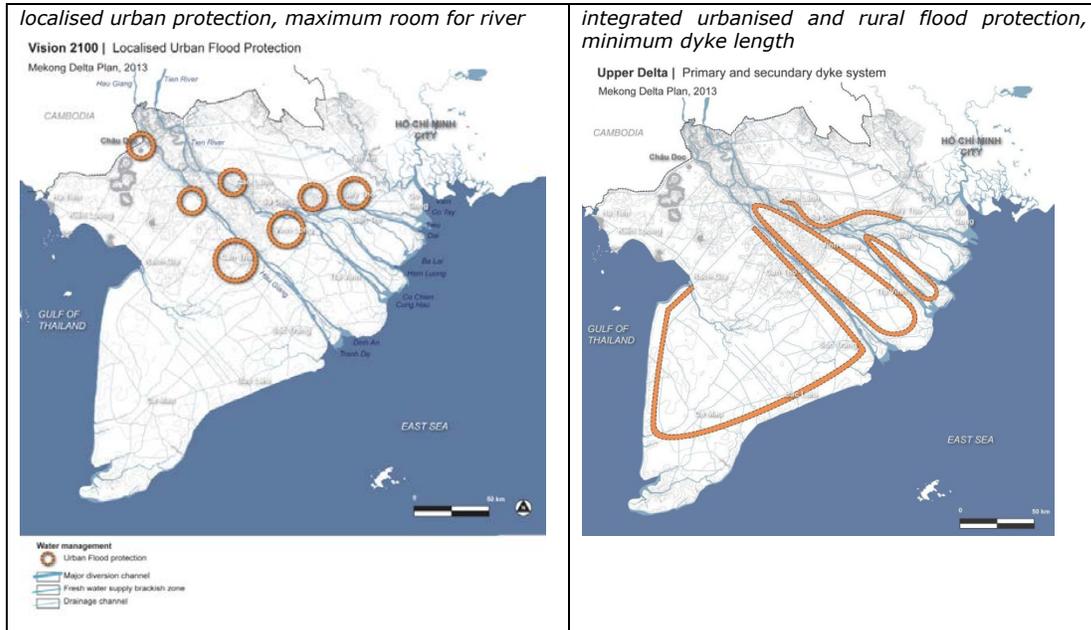


Figure 7-4 Schematic presentation of Urban and Rural Flood Protection. Two extreme options. The principle is to keep sufficient room for river flow and give manageable and affordable flood protection in urbanised and industrialised zones. Agreement on modelling and protection strategy needs to be part of immediate follow-up for this Mekong Delta Plan

With increasing sea level rise of up to 95 cm in the high scenario in the mid- to long term - 2100, revamped localised protection measures may need to be paired with pumped drainage facilities (e.g. creation of urban polders). In the case of extreme sea level rise in the long-term, additional coastal protection measures may need to be taken to protect Cần Thơ from flooding/inundation [see also paragraph 7.4 Coastal Zone].

Also in this case, this priority measure provides a positive economic impact for the Food Production, Agro-Business Industrialisation and Dual Node Industrialisation scenarios, and becomes as such a no-regret measure that can be further developed and adapted over time. In case the Controlled Flooding measures [paragraph 7.2.1] fail to be implemented and the upstream conversion to triple-rice crop systems continues unabated, the infrastructural measures (dykes and pumps) required for the protection of Cần Thơ, as well as associated investment and operation costs, will sharply increase in the short- to mid-term. Thus, it is recommended to bring these more extreme adaptation measures forward in time in order to accommodate economically potential land-use changes, rather than for the purpose of dealing with climate change.

7.2.3 ③ Major Flood Diversion

The "Major Flood Diversion" is essentially a structural adaptation measure for extreme climate change, which can be postponed to the **mid- to long-term plans (2100)**. However the spatial reservation for these measures is a **"priority"**. The Long Xuyên Quadrangle and Đồng Tháp Mười (Plain of Reeds) already fulfil an important role in flood alleviation for the Upper and Middle Delta.

In terms of absolute flows, the wet season discharge would significantly rise under conditions of extreme climate change in the long-term. Secondly, human activities like depriving the Mekong from its – large – flood plains by poldering for more rice crops, urbanisation and industrialisation. The latter is not directly an increase of the flow, but sets higher demand to flood protection in the Upper and Middle Delta. In the future controlled operation of the multiple dams more upstream aiming at damping of the river flow may actually abate these hydrological impacts further downstream in the delta.

Upgrading the cascade system for flood alleviation of the Hậu River, solving the problems of the more closed Plain of Reeds or creating eventually a bypass system requires high investments, tough spatial planning and still a lot of research and investigation of how, if and when this needs to be realised. A critical issue is the possible negative influence on the sediment distribution and morphological behaviour of the Mekong branches. This would result in loss of a natural adaptation capacity, which is critical in the coastal defence strategy.

The primary aim of bypassing the floods is to lower the peak flows in the Middle Delta, facilitating local urban flood protection measures or dyke rings around urban centres there. The actual need for bypassing a certain percentage of the discharge may be determined in the mid to long-term by the degree of flow peak increase in the Middle Delta (due to absolute increase in peak discharge and/or progressive restriction of the upper delta flood plains) and the extent of urbanisation and flood protection requirements taking place in the Middle Delta.

Important is that the bypassing floods requires prolonged enforcement of spatial planning in the most probable trajectory for the bypass canals. Uncontrolled spatial planning will either lead to high costs for resettlements to recreate space for extra river discharge or to disproportionate high investments for direct flood protection measures in the Middle Delta.

For the Food Production, Agro-Business Industrialisation and Dual Node Industrialisation scenarios there is no immediate need to provide this measure. The primary hydrological effect of the diversion measure is to lower the peak stage water levels in the middle reach of the delta, so as to enable the localised urban flood protection measures to be carried out at more feasible and lower cost levels. It may become necessary under extreme climate change (with high uncertainty), or in the case of a continued and progressive restriction of the Upper Delta flood plains (e.g. failure of controlled flooding strategy).

In the latter case, the cost of investment for by-pass channels should be added to the TEV (total economic value) assessment of triple rice policy and practices. Only in the case of the emergence of the corridor scenario and the associated exponential growth of urbanised centres in the middle reach of the delta, the need for the by-pass channels may be brought forward in timing. A strict cost-benefit analysis is needed to support a choice between local urban flood protection on a larger scale and required investments of diverting floodwaters, including mitigation of all environmental impacts.

Vision 2100 | Major Flood Diversion

Mekong Delta Plan, 2013

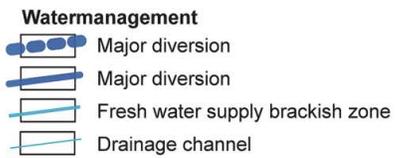
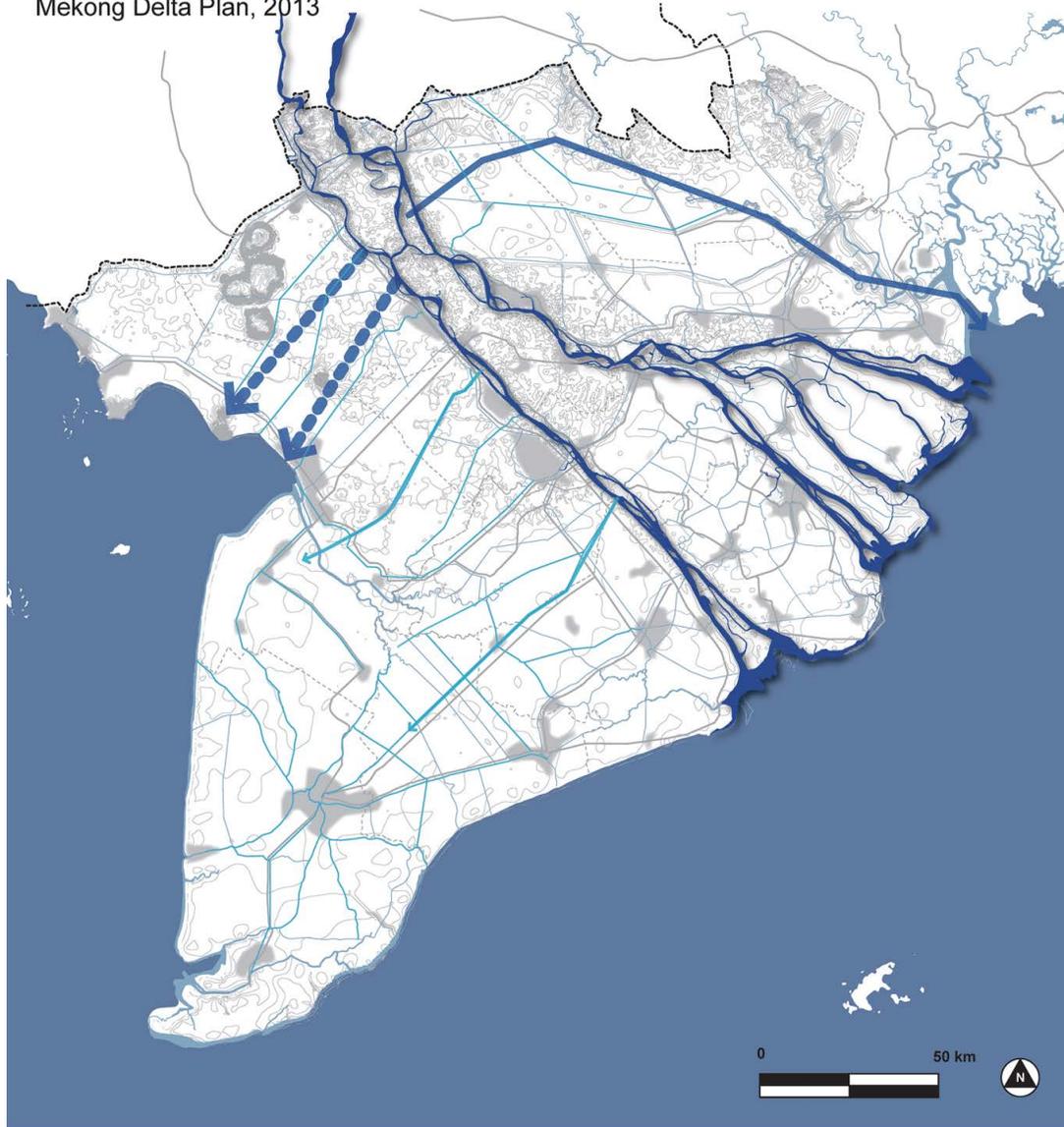


Figure 7-5 Schematic presentation of the principle that large scale additional discharge infrastructure may be required in the future to keep flooding measures in the Middle Delta in control. Systems of canals, dug rivers, cascades to bypass the Middle Delta from the border to either the West Sea (Gulf of Thailand) through the Long Xuyên Quadrangle or the East Sea through the Plain of Reeds and the Vàm Cỏ River. The exact location, dimension and design are still subject for research.

7.3 Middle Delta – Industrial and urban flood safety, secure fresh water supply

7.3.1 ④ Securing the Bassac-Mekong (Hậu-Tiền) flow division

Preliminary studies indicate that morphological changes, due to changes in the river hydrograph (peak and low) and sedimentation loads, may result in a substantial change of the flow division between the Bassac and Mekong branches. This is a process that can be further affected by sea level rise and ensuing changes in the flow gradient of the branches. At present the flow division between the two branches is roughly 50:50, neatly distributing the fresh water supplies over the east and west (Cà Mau) regions of the delta. Preliminary results indicate that changes in morphology are likely to affect the flow division in favour of the East Delta (Mekong branch). As it is primarily the Western Delta (Cà Mau peninsula) that is already feeling the pressures from fresh water shortages in the dry season, this change in flow division between the branches is undesirable. A priority measure for the mid- to long-term (2100) could thus become the restoration of the flow division between the Bassac and Mekong branches in order to secure the fresh water supplies to the Western Delta. This could be achieved with the construction of a Link Canal south of the natural bifurcation of the branches, to divert part of the flow from the Mekong back into the Bassac branch.

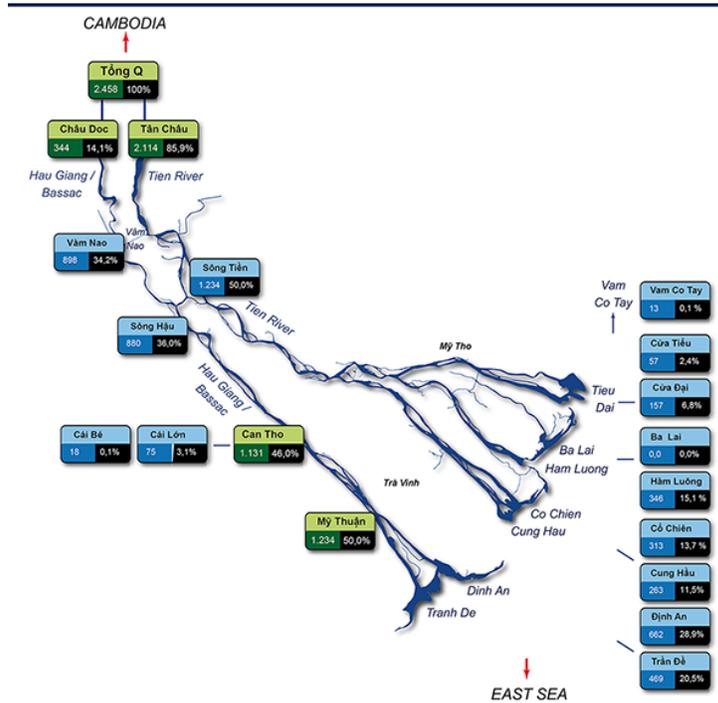
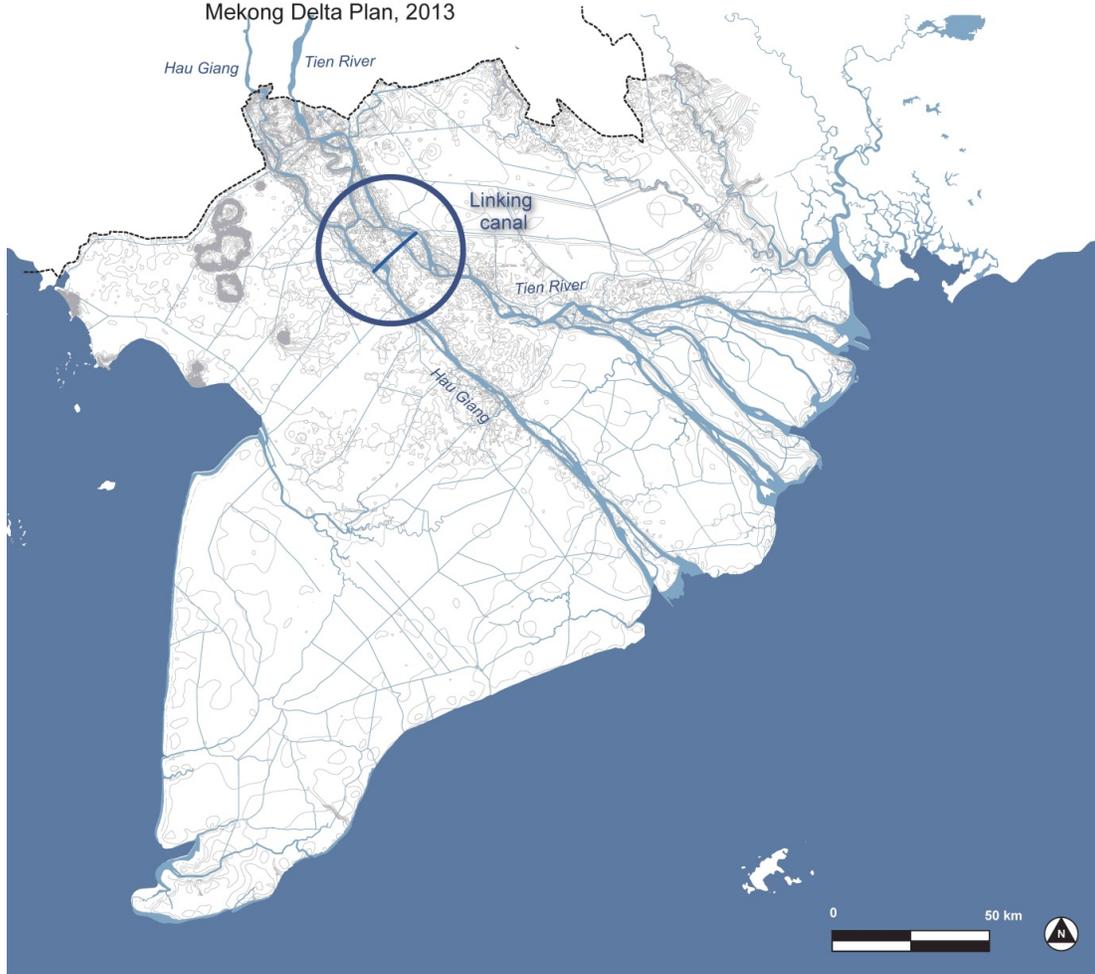


Figure 7-6 Example distribution of river discharges over the branches of the Mekong in April 2010 (dry season)

The need for this measure is however highly uncertain at this stage, but important to keep under continuous study and monitoring. The risks of occurrence are also subdued to the hydrograph effects of upstream developments. For the Food Production and Agro-Business Industrialisation development trajectories the securing of adequate fresh water flow in the Bassac and Cà Mau peninsula are of critical importance. In case the delta evolves along the Dual Node Industrialisation scenario with an extensive urbanisation in the middle Cà Mau (from Cần Thơ westwards), the fresh water requirements of the Western Delta may reduce sufficiently, thus not necessitating such reparation measures.

Vision 2100 | Ensuring flow and sediment partition between Hau and Tien river

Mekong Delta Plan, 2013



Water management

-  Securing the Bassac / Hau Giang
-  Major diversion channel
-  Fresh water supply brackish zone
-  Drainage channel

Figure 7-7 Principle of ensuring the division of water flow among the main branches of the Mekong. Creation of certainty on river and sediment flow is of major importance for effective and efficient investments in flood protection.

7.3.2 ⑤ Dry season control in river branches – preparing the delta for extreme events

Under extreme climate change scenarios, and unabated upstream hydrograph impacts, the delta may be subjected to severe reductions in dry season flow in the mid- to long-term (**2100**). This will severely affect the fresh water supply of the Middle Delta and agriculture (Central Cà Mau and the eastern fruit zone). This is further exacerbated by progressive salinity intrusion in the branches with extreme sea level rise. Measures to deal with this situation are temporary control of the water flow in the estuaries to i) protect the branches against salinity intrusion during the dry low flow season; and ii) provide a fresh water storage capacity within the river branches.

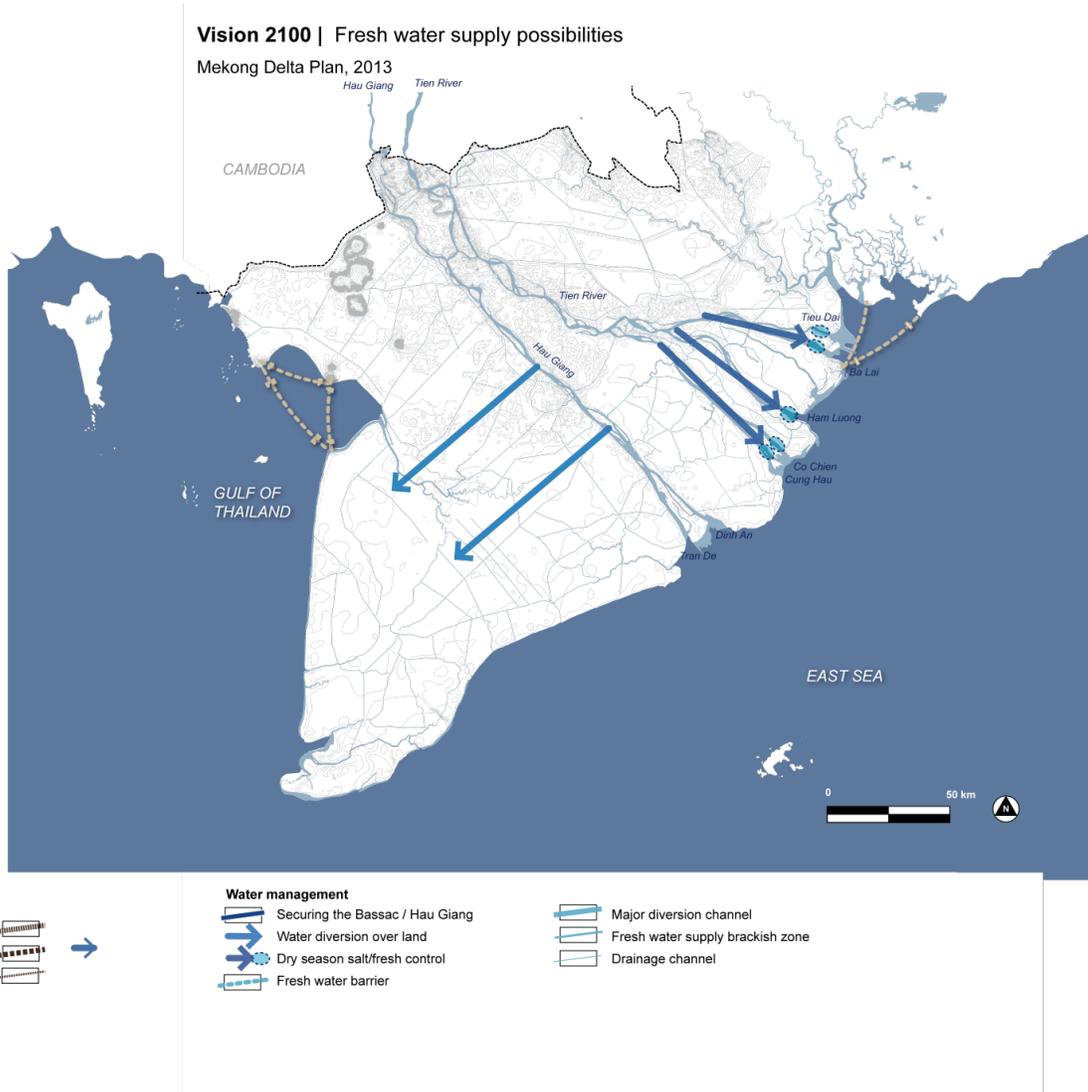


Figure 7-8 Principles for ensuring fresh water supply in the long-term during periods of low fresh water availability in the dry season; fresh water storage in large fresh water lakes behind closure dams and a number of estuary flow control structures. All these measures still require research, investigation and long-term planning.

Given the high degree of uncertainty (climate and upstream development impacts) for its need, and high disturbance impact on the general delta hydrology of these measures, this is a typical **"last-resort"** measure to be taken in extreme circumstances. The flow control of the branches may have disturbing effects on the hydrology (brackish-fresh interface) and morphology of the delta, which, once built, may have far reaching effects for the Coastal Zone, Middle and even Upper Delta, and its environment. Under extreme circumstances towards the long-term, temporary flow control in the branches should then be initiated in the eastern branches of the Mekong, in order to secure the high-productive and good quality soils of the Eastern Delta. This may provide sufficient protection and storage capacity for the Eastern Delta, allowing subsequent additional flow diversion from the Mekong to the Bassac (i.e. favouring flow diversion into the Bassac) to permit the Bassac to remain open.

Also for these measures, the development trajectories to evolve over the mid- to long-term will ultimately determine the requirements for their implementation. In the cases of the Dual Node Industrialisation and Corridor Industrialisation trajectories, the requirements for fresh water may have

significantly diminished to the extent that the measures above are not needed, or a scaled-down alternative becomes sufficient. Also for the Agro-Business Industrialisation and Food Production trajectories, the need for flow control in the branches will be highly influenced to the success and extent of agricultural innovations in brackish, saline and fresh water agricultures that still have decades to develop and establish (effectiveness of the coastal dual zone approach).

7.4 Coastal Zone – Brackish water economy and advanced coastal protection

7.4.1 ⑥ Dual Zone Coastal Management – living with saline water and dynamic shorelines

Investing in the sustainability and productivity of the brackish aquaculture based coastal zones and restoring of the dynamic shoreline reinforcement is to be considered an absolute **"priority"** and **"no-regret"** measure for the short- to mid-term (2050). The establishment of a sustainable brackish coastal environment is critical for the hydrological scenario of the delta in the short- to long-term (adapting to saline water intrusion and dry season reductions in fresh water supply), as well as sustaining and enabling a high-value agro-based economic (export) sector. The current coastal erosion has reached a critical stage. Restoration of the active and dynamic sedimentation and expansion of the delta's shorelines could minimise the investment costs for sea-defence structures (dykes) against sea level rise in the mid- to long-term.



Figure 7-9 Already proven concept for sustainable three step shrimp farming and mangrove restoration. First step is brackish water intake in which carnivore seabass is grown for consumption and cleaning of the water. Second step is (herbivore) tilapia farming to prepare the brackish water for shrimp farming in the third step. The effluent is discharged into the near shore to form a good base for restoration of mangrove.

This coastal strategy comprises a set of comprehensive measures that aligns the brackish aquaculture with environment and coastal reinforcement in an integrated manner. The present monoculture based brackish aquaculture practices are prone to water quality problems, disease and yield failure, which undermine the physical and economic sustainability as well as the export viability of the sector. This needs to be turned around by transforming the mono-based shrimp cultivation into a modern poly-culture based aquaculture system of multiple fish and shrimp species that thrive on each other's water discharge. This proven method has the capacity to sustainably improve the brackish water quality, reduce disease occurrences and yield losses, and diversify income. In addition it meets international certification standards of sustainability and quality, which enables producers to enter higher value markets. Along the coastal shores, this poly-culture system can be expanded by the addition of a "waste-water" disposal area on which mangroves can be actively planted and regenerated (feeding on nutrient rich brackish water). These new, and regenerated, mangrove areas in turn can and should be used to actively settle coastal sedimentation and use them as a natural coastal expansion and fortification system. To be effective, the outer (mangrove regenerated) shore line needs to be given room to settle (gentle coastal slopes/plains) and remain open to tidal inundation. To create this morphological condition the hard sea-defence dykes should be placed land inwards for protection of the inner core zone, thus creating an outer shore expansion and settlement zone. In particular along the Cà Mau peninsula there is thus still an opportunity to capture and settle sediment loads from the Mekong, supplemented with residues from aquaculture. Such an active expansion and sedimentation of a mangrove outer-shore will reduce the requirements (and associated investment costs) in the mid- to long-term for physical (hard) sea-defence structures (dykes), to be maintained slightly inland, and use the outer mangrove area as buffer protection zone.

Coastal Zone | Dual Zone Coastal Management - living with saline water

Mekong Delta Plan, 2013

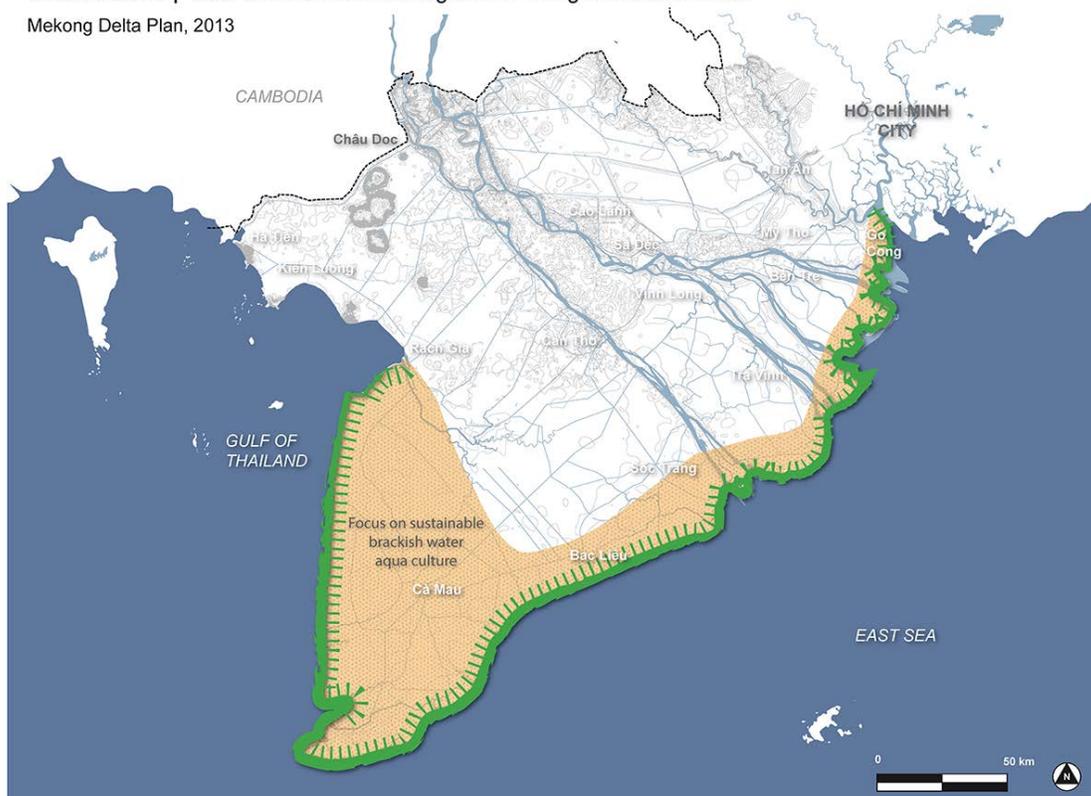


Figure 7-10 Schematic presentation of strategy for water resources management in the Coastal Zone of the Mekong Delta. The Dual Zone Coastal Management strategy assumes a wide Coastal Zone as a first line defence in which a new sustainable brackish water economy has developed. A triplet system of seabass-tilapia-shrimp would form the base of the aquaculture economy, also aiming at restoration of the mangrove coast. A second defence line of dykes would form the separation between the brackish and the fresh water economy and the flood safe defence line. The first defence line is supposed to grow, accrete with sea level rise, the second defence line will bring the high required safety level in the long-term.

Once the mangroves are planted and settled, this resources rich environment can be actively used and managed for additional income diversification – e.g. active seeding with crabs, molluscs and other species, fibres and other forest products. The conservation of mangroves, its management and sustainable exploitation lacks adequate legislation, rules and regulation. Still too many departments are involved with unclear responsibility and authority.

This Dual Zone Coastal Management strategy is a critical strategy to increase the sustainability (both physically and economically) of the brackish Coastal Zone, addressing some of the key issues it is facing now. This is critical to stem the current urge to move brackish shrimp farms further inland in a quest for good water quality into agricultural zones that may be kept fresh. The strategy also fits all four economic development trajectories, and is in particular enabling for the Agro-Business Industrialisation specialisation, with its focus on high quality and higher value aquaculture products.

7.4.2 Fresh water management along the coast

A critical issue (2050) arising in the Coastal Zone of the delta is the depletion of the phreatic ancient deep groundwater resources. Intensification of its exploitation has risen starkly over the last decade, driven by the widespread diversification of shrimp farmers into horticulture and, to a lesser extent, salinity control in shrimp farming. This is an unsustainable practice that needs to be halted. This scarce fresh water resource should for the short- to long-term be reserved for drinking water supply only. Its unabated use in agri- and aquaculture will lead to depletion of this scarce resource, as well as induce undesirable land subsidence. In the short- to mid-term a successful transformation of the brackish

aquaculture sector (strategy 6) should lead a reduced pressure on this resources base, as diversification and sustainability is thought within brackish aquaculture, rather than next to aquaculture.

In the mid- to long-term (**2100**) a **saline agriculture practice** for the Coastal Zone may become feasible, that is specialised and geared towards the production and processing of food, cosmetic and medical derivatives (half products), or even energy, that can be successfully and sustainably farmed within a brackish environment (e.g. saline environment plants, sea-weeds, algae). Though still in its early research and development stage, this type of 'new'-species based agriculture is promising for its capacity to target high-value, half-product, international market base. This strategy would fit well with Agro-Business Industrialisation development and enable the Coastal Zone to further lessen its dependency on fresh water and diversify its saline productivity base. In the short to mid term, it is thus worth to support research and development activities in this field, also within Vietnam.

For the coastal higher elevated sandy areas, investments and efforts need to be made to develop physical and economically feasible fresh water storage facilities (rainwater harvest / wet season surplus), to enable limited cultivation of high-value horticulture and fruits. This needs to be done in the short to mid term (**2050**) to decrease the dependency on limited groundwater supplies.

7.4.3 ⑧ Reinforcement of coastal defence

The Dual Zone Coastal Management strategy (6) will not be feasible to apply along the entire shoreline of the delta. For those areas that have no or limited capacity to accommodate a Dual Zone Coastal Management strategy (e.g. north-west shore line), the coastal defence infrastructure will have to keep pace with sea level rise. In particular for the mid- to long-term (**2100**) under extreme climate change, this may require major investments that need to be put in place timely. At these coastlines and along the major river estuaries, an active and green outer line should be kept in place as long as possible, so as to co-opt the natural sedimentation dynamics in shoreline and embankment reinforcement.

At many if not most places the sea dykes have been constructed too close to the actual shoreline. Large areas of mangroves have either been directly impacted and disappeared or their nutritional tidal plains have been affected to the extent of slow mangrove deterioration. Land use behind the dykes and the roads on the dykes impair a sustainable approach of rerouting of the coastal defence line.

Uncoupling of the road and dyke system and good natural coast (mangrove) management are therefore important measures to achieve an affordable and sustainable coastal defence.

7.5 Overall measures

7.5.1 ⑨ Transport for industrial economic competitiveness

In all scenarios industrialisation will benefit from a better logistic system. Good inland waterways and good harbour facilities near the coast are essential for competitiveness.

Some studies have already been carried out for a harbour near the *Trần Đề* estuary of the Bassac/Hậu river. Phasing, layout of the harbour, its facilities and its business case still requires significant research and cooperation between the provinces of the Mekong Delta. In the Dual Node Industrialisation scenario an industrial area west of Cần Thơ could need a port at the West Sea Coast. The feasibility of a bigger port here is yet difficult, since the – muddy – condition of this coast does not easily allow for deeper ships.

Dredging of the river to allow ships with a bigger draught up the river to Cần Thơ or possibly further needs to be part of the system. Inland waterways improvement, creation of waterways with few or no ship locks and a range of coastal or river feeder ports need consistent development in which combined forces of the provinces are essential to create a sufficiently large economic market.

The link by road between Cần Thơ and Hồ Chí Minh City is already being upgraded, the waterway connection requires upgrading in relation to a possible Cần Thơ – Trần Đề route.

In view of the vision and strategy of this Mekong Delta Plan it is recommended that planning of this type of infrastructure should be intensified and integrated in the strategy for the Mekong Delta.

7.5.2 ⑩ Research and investigation programme

Joint fact finding, coherent data collection and open sources, coherent research to develop programmes and plans for decision within the framework of an integrated development of the delta is of utmost important to make the right decisions for delta management [see paragraph 6.3].

7.5.3 ⑪ Integrated Governance and Planning.

This MDP has shown that integration of socio-economic aspects, land and water management as a sound base for sustained economic development, the planning and construction of other infrastructure, services, finances etcetera is of great importance to achieve prosperity in the delta. Chapter 6 addresses all these issues.

7.5.4 ⑫ Foreign policy and Mekong River Commission

The upstream developments form an external factor for behaviour of the Mekong River. These developments do not only affect the hydraulic behaviour of the river system, but determine also the possibilities for import and export of goods, water quality, fishery, water transport and other infrastructure. A dedicated foreign policy may contribute to a favourable economic development and sustainable river management [see also 6.6].





8 Roadmap for a Mekong Delta Programme

8.1 Development of the Mekong Delta Plan

This Mekong Delta Plan is based on the unique experience of the Netherlands in developing a long-term strategy for the Rhine-Meuse-Scheldt Delta. Partnering with MoNRE and MARD from January 2010 onwards, the MDP has been established to the present document, which is a milestone in a much longer process of programming the Mekong Delta. Originally the scope of the project was mostly aimed at the integration of land and water resources management in view of climatic change. In the process of establishing the vision on the delta, this scope needed adjustment and inclusion of social and economic developments. In that respect the MDP comprises a vision and a strategy with proposals for adjustment in governance and tuning, integrating measures in the different sectors. The main elements in this MDP are:

- integrated long-term vision (2100) and strategy for a safe, prosperous and sustainable development of the Mekong Delta in view of plausible socio-economic and climatic developments.
- recommendations on strengthening intergovernmental cooperation and institutional arrangements, legislation and financing options in order to create a transition in agriculture policy, adequate land and water management and rationalising sector investments by integrated planning and cost benefit analyses.
- coherent view on short term (2015-2025) priority and 'no-regret' measures.

In the process of making the Mekong Delta Plan MoNRE and the MDP-team have involved a good number of stakeholders and experts, regional and national. Thus, the vision on using the region's comparative advantage towards an Agro-Business Industrialisation development has encountered support and understanding for the required measures to make this vision come true. This direction has already been laid down in generic terms in earlier Prime Minister Decisions; there is however an apparent number of bottlenecks, seriously hampering this desired development. It has become clear that adoption of the vision and the strategy as laid down in the MDP requires reviewing the next national socio-economic development plan, sectoral master plans and related provincial development plans; incorporation of the strategy in these plans is an important next step. The major donor agencies have already indicated that the MDP constitutes a coherent approach for the delta and support this strategy.

8.2 The Mekong Delta stands at a crossroads

The Mekong Delta stands at a crossroads. Where focus on agricultural development has been very successful, the next step in its economic development is industrialisation, which has already started. The delta's comparative disadvantages and advantages lead more or less naturally to a specialisation in Agro-Business Industrialisation, which is generally acknowledged and confirmed in earlier Prime Minister's Decisions [see 5.2.2]. In order to achieve this future, the government of Vietnam, the 13 provinces, universities and research institutes as well as private stakeholders need to adjust their governing and working policies. Another important step is that the international financing institutions, multilateral and bilateral donors as well as other international stakeholders would acknowledge Vietnam's efforts in developing the Mekong Delta Plan as a shared framework for the coordinated and integrated socio-economic development of the Mekong Delta.

It is assumed that the MDP plays an important role in changing direction. The adoption of the MDP as an orientation scheme for a Delta Programme or Delta Framework should be the onset for making institutional arrangements in order to make such a framework and review the existing plans.

This chapter provides a general roadmap for implementing the recommendations of chapters 5, 6 and 7.

Box 8-1 Delta Programme in the Netherlands

Without flood defence systems, almost 60% of our country is vulnerable to flooding. Home to some nine million people, the area also represents two-thirds of our Gross National Product (recommendation from the Delta Committee 2008). That is why the Netherlands decided to do everything possible to prevent any future flood disaster, by setting up a Delta Programme, a Delta Programme Commissioner and a Delta Fund, enshrined in the Delta Act.

The *Delta Programme* is the Delta Plan for the 21st century. It stands for a safe and attractive Netherlands, now and tomorrow, where flood risk management and fresh water supplies are organised effectively. That is a key condition for the Netherlands' continued existence and a strong economy. All of the parties involved in the Delta Programme are working towards a robust Dutch delta, for which an innovative approach is paramount. This provides the Dutch water sector with opportunities to develop innovations in its home market, thereby creating a unique ensemble of three, i.e. the government, knowledge institutes and the business community, focusing on export and earning capacity.

The *Delta Programme Commissioner* directs the Delta Programme. Every year, he submits to the Government a proposal for specifying the Delta Programme. This is done in consultation with the relevant authorities, social organisations and the business community. The results are contained in the annual report that the Dutch House of Representatives receives on Budget Day. As in previous Delta Programme reports, this DP2013 includes the Delta Programme Commissioner's proposal and the Government's response.

The *Delta Fund* comprises resources for financing the measures and facilities of national importance that are needed for a safe delta and sufficient freshwater supplies. The Delta Fund was created in 2012, when the Delta Act came into effect. This third Delta Programme is the first of the Delta Programmes to contain an overview of all these measures. The first official Delta Fund budget will be sent to the Dutch parliament together with this report. The so-called experimental article in the Delta Act provides an essential opportunity for the Delta Fund, allowing the straightforward contribution of other resources to instance integrated plans.

In 2014, the Delta Programme will yield proposals on *Delta Decisions* from the Delta Programme Commissioner. The Cabinet and the Dutch House of Representatives will decide on these proposals. These Delta Decisions will provide direction for implementing measures launched after 2015, once the current programmes (such as the second Flood Protection Programme, Room for the River and Meuse Projects) are complete. Implementing the necessary measures requires public support and decisiveness. The Delta Programme seeks to achieve this by exploring and assessing possible measures in a transparent manner in order to be able to make choices. The previous Delta Programme report focused on tasking for flood risk management and freshwater supplies. This third report on the Delta Programme, DP2013, focuses on the possible ways of tackling these tasks. Over the next two years, less promising solutions will gradually be dropped based on unambiguous criteria, leaving only the most promising strategies. It has already been decided not to elaborate a number of strategies, as they are not useful for tasking in the Delta Programme.

The measures that seem necessary and advisable for flood risk management and fresh water supplies will be programmed in detail in implementation plans. As such, the Netherlands will have a 'new generation Delta Works' in place to work towards a robust Dutch delta in an effective and efficient manner.

8.3 Mekong Delta Programme

The Mekong Delta Plan constitutes a good orientation scheme for subsequent delta planning. The total of this subsequent delta planning could be formulated as a "Mekong Delta Programme" as *the* natural 'delta wide' follow-up.

Short-term follow-up after establishing vision and strategy (MDP)

The set-up of such a programme requires among others:

- appointment of a working secretariat with the responsibility to start preparations and make arrangements for the Mekong Delta Programme phase;

- design of a coherent plan of operations for a coordinating body, based on the assigned responsibility and mandate for strengthening integrated decision making, improving the quality of decisions (i.e. through joint fact-finding) as well as creating awareness and commitment
- translation of the MDP recommendations into generic and area specific sub-programs, with dedicated project teams;
- securing connections with and involvement of universities, research institutes, the private sector and other stakeholders;
- up to 2020, and alongside on-going programmes and projects, the emphasis of the Delta Program will be on preparing systematic delta management decisions;

Roadmap

In general terms the subsequent roadmap for activities beyond the Mekong Delta Plan looks like below.

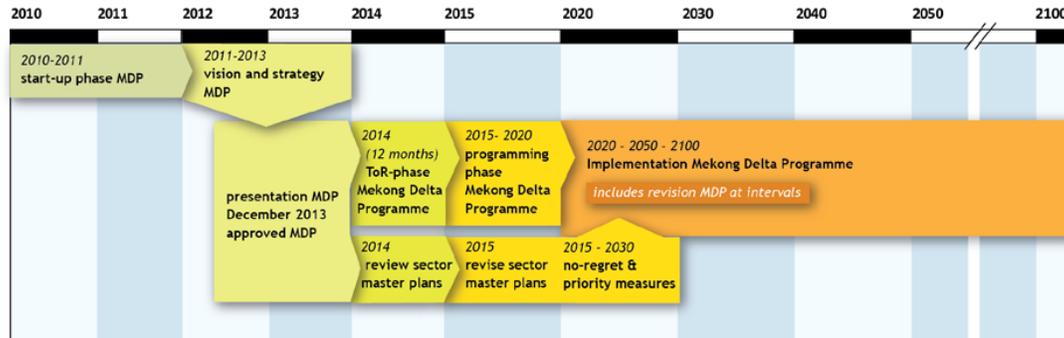


Figure 8-1 Roadmap for activities beyond the production of the Mekong Delta Plan

Terms of reference for Delta Programme

The Delta Programme or framework for the delta is the natural 'delta wide' follow-up of the MDP programme. The set-up takes time and is estimated at one year. All actors and stakeholders need to get in place and find their role. The government has a forerunner role and needs to appoint a forerunner, who will be acting as an ambassador for the Mekong Delta with staff. It needs to be decided where this forerunner and staff will be based, putting its coordinating, integrating task upfront.

Provinces, ministries, research institutes and the donor community are the principal partners. The position of unorganised stakeholder's group (e.g. producers, farmers) needs to be addressed.

8.4 Relation with actual sector master plans

Presently the development in the delta is determined by the Socio-economic Master Plan for the Mekong Delta and sectoral master plans. This MDP comprises a quick scan on existing sector master plans in which the compliance with the MDP strategy has been assessed [see Appendix Review of sector master plans]. An important finding is that the sector master planning has been successful in the delta's development so far. On the other hand in the desire to make a step into an Agro-Business Industrialisation direction the master plans lack coherence. Regionally diversified specialisation based on local comparative advantages and disadvantages is not yet part of the master planning. Standing at the crossroads [8.2], the Government of Vietnam and the Mekong Delta as a region being serious in pursuing the Agro-Business Industrialisation development in line with the MDP, must seek for a coherent approach in land and water use management. It is recommended that all sector master plans be thoroughly reviewed for which the above mentioned quick scan is just an initial step. Projects fitting in the MDP vision and strategy need to be continued with force and determination in order to solve today's urgent problems.

Other projects anticipated in the existing master plans may not fit the in the MDP-strategy and need to be revised. Moreover, new projects in several sectors stimulate and steer into the desired development within the framework of the Delta Programme. This comprises projects in all fields as is clear from chapters 5, 6 and 7.



REFERENCES

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Appendix Review of sector master plans

General review of master plans

In the context of the Mekong Delta Plan, the Ministry of Natural Resources and Environment has requested to review seven sector master plans and assess if these projects follow the lines of the recommendations in the Mekong Delta Plan approach. The review has been presented to MoNRE in April 2013, based on the final draft Mekong Delta Plan – Review of Sector Mekong Delta Master Plans, 29 March 2013.

- a) The system of master planning in the context of Vietnam’s development has contributed to rapid development in all sectors of the country;
- b) In general the SEDP for the Mekong Delta follows the national SEDP and is production target driven, the sector master plans generally follow this target; the targets are described as one fixed scenario;
- c) The targets for the Mekong Delta make limited use of the comparative advantages in natural resources in the Mekong Delta;
- d) The fixed targets leave little room for adaptations in line with actual economic analyses and developments; this is important since economic growth and population growth lag behind the predictions. Actual data show that investments in infrastructure, urban zones and industry are unlikely to be effective as other regions have comparative advantages over the delta in this respect;
- e) On one hand local initiatives are part of the master plans, on the other hand overall co-ordination and prioritisation are not part of the master plans (not within one master plan, nor among the master plans). Altogether the sum of master plans is unrealistic in terms of available financing and space;
- f) Spatial diversification within the Mekong Delta is disregarded, where the delta has obvious differences between the Upper Delta, the Middle Delta and the Coastal Zone.

A selection of the projects of these master plans will be assessed on their compatibility with the delta plan approach. This assessment should then lead to projects that fit, projects that need at least a review and probably revision, or even projects that need to be abandoned or better, replaced by new projects.

Table A-1 Reviewed sector master plans for the Mekong Delta

	Master Plan	no PM-decision	date	period
1	Socio-economic Development Master Plan for Mekong Delta	939/QĐ-TTg	19/7/2012	to 2020
2	Orientation, Mission and Plan for Transportation Infrastructure in Mekong Delta	638/QĐ-TTg	28/4/2012	to 2015, vision 2020
3	Transportation Development Master Plan for Special Economic Zones in Mekong Delta	11/2012/QĐ-TTg	10/2/2012	to 2020, vision 2030
4	Construction Master Plan for Mekong Delta	1581/QĐ-TTg	09/10/2009	to 2020, vision 2050
5	Master Plan of Drainage infrastructures for Mekong Delta toward 2020	2066/QĐ-TTg	12/11/2010	to 2020
6	Master Plan of water supply infrastructures for Mekong Delta toward 2020	2065/QĐ-TTg	12/11/2010	to 2020
7	Master Plan of water resources and irrigation systems for Mekong Delta in climate changes and sea level rise conditions	1397/QĐ-TTg	24/09/2012	to 2020, vision 2050

Specific quick scan of selected projects from the sectoral master plans

Following the general review of seven sectoral master plans, MoNRE requested a quick scan on the most important projects mentioned in the master plans. This scan gives an image of how projects in the master plans fit in the approach as proposed in the Mekong Delta Plan.

This scan has been carried out in a short period of time, with only the basic (meta)data of the projects. Very general conclusions could be given resulting in

1. projects seems to fit in the MDP approach
2. project is contrary to MDP approach

3. project needs to be reconsidered or at least reviewed, adjustments are probably required if the MDP approach would be leading, often with a recommendation for sound further investigation or even more fundamental research.

Projects that were assessed come from Mekong Delta sectoral master plans on Urban Drainage, Water Supply and Water Resources.

It should be stressed that this scan gives a first image. It is the objective of the Mekong Delta Plan to give directions for a strategy for the Mekong Delta and as a result, review of existing and guidance for new master plans could be carried out. See also chapter 2 about the Methodology of the Mekong Delta Plan and the position of the Mekong Delta Plan in the planning system of Vietnam.

Very distinct conclusions can be made on projects for wastewater treatment and drinking water supply with surface water as the main source. These projects tend to be no-regret measures.

A difficult issue to cope with is the short-term solution for fresh water supply and the long-term approach for a dual zone coastal management. Specific projects or programmes for a fundamental change in agriculture and aquaculture to a more sustainable approach have not been mentioned and thus not been assessed.

The list of projects and assessments can be found in Appendix Quick scan of sectoral master plan projects in the Mekong Delta on conformity with MDP approach on page 107.

With the provincial governments and two city administrations increasingly responsible for screening, appraising, selecting, and executing their own infrastructure projects and provinces increasingly in competition for scarce resources, it is more difficult to align infrastructure projects with strategic priorities of the nation as a whole. While Vietnam has Five Year Plans and separate sector Master Plans, industrial parks and Economic Zones, that establish economy-wide broad development priorities and action plans to implement those priorities, there seems to be limited connection between them. Too often, provinces work in relative isolation leading to fragmented, suboptimal infrastructure projects. Some of these projects have proven to be non-productive, most notably newly developed industrial (economic) zones.

The main conclusions from the review that was undertaken are:

- a) The system of master planning in the context of Vietnam's development has contributed to rapid development in all sectors of the country;
- b) In general the SEDP for the Mekong Delta follows the national SEDP and is production target driven, the sector master plans generally follow this target; the targets are described as one fixed scenario;
- c) The targets for the Mekong Delta make limited use of the comparative advantages in natural resources in the Mekong Delta;
- d) The fixed targets leave little room for adaptations in line with actual economic analyses and developments; this is important since economic growth and population growth lag behind the predictions. Actual data show that investments in infrastructure, urban zones and industry are unlikely to be effective as other regions have comparative advantages over the delta in this respect;
- e) On one hand local initiatives are part of the master plans, on the other hand overall co-ordination and prioritisation are not part of the master plans (not within one master plan, nor among the master plans). Altogether the sum of master plans is unrealistic in terms of available financing and space;
- f) Spatial diversification within the Mekong Delta is disregarded, where the delta has obvious differences between the Upper Delta, the Middle Delta and the Coastal Zone.

This review of sectoral master plans in the Mekong Delta draws the same conclusions as the Vietnam Development Report 2012 "Market Economy for a Middle Income Vietnam". Both highlight the lack of strategic guidance on current system of development planning, budgeting and approval processes. Vietnam's existing public investment regime can be best described as one in which the parts do not add up to the whole. In Vietnam's highly decentralised administrative structure, developing infrastructure is the responsibility of local governments. By putting its 62 provincial governments and two city administrations in charge of screening, appraising, selecting, and executing their own infrastructure projects, Vietnam has unleashed tremendous energy and competition among its local governments,

certainly a positive move. But, this has been done without connecting the infrastructure to the strategic priorities of the country (such as improving competitiveness) or using the market as a means of allocating resources.

Consequently, each province has worked in isolation to create fragmented, suboptimal infrastructure projects, many of which have become idle. If all the approved projects in Vietnam were built, the country would have one of the highest numbers of deep-sea ports, international airports and industrial parks in the world relative to the size of its economy. The report concludes that investment planning lacks credible strategic guidance that anchors government decisions and guides sector-level and province-level decision makers. While Vietnam has Five Year Plans and separate sector Master Plans, industrial parks and Economic Zones, that establish economy-wide broad development priorities and action plans to implement those priorities, there seems to be limited connection between them.

Following the general review of seven sectoral master plans, MoNRE requested a quick scan on the most important projects mentioned in the master plans. This scan gives an image of how projects in the master plans fit in the approach as proposed in the Mekong Delta Plan.

This scan has been carried out in a short period of time, with only the basic (meta)data of the projects. Very general conclusions could be given resulting in

1. projects seems to fit in the MDP approach (green colour)
2. project is contrary to MDP approach (red colour)
3. project needs to be reconsidered or at least reviewed, adjustments are probably required if the MDP approach would be leading (orange colour)

Projects that were assessed come from

- code 5 Mekong Delta Urban Drainage master plan
- code 6 Mekong Delta Water Supply master plan
- code 7 Mekong Delta Water Resources master plan in climate change and SRL conditions

It should be stressed that this scan gives a first image. It is the objective of the Mekong Delta Plan to give directions for a strategy for the Mekong Delta and as a result, review of existing and guidance for new master plans could be carried out. See also chapter 2 about the Methodology of the Mekong Delta Plan and the position of the Mekong Delta Plan in the planning system of Vietnam.

Quick scan of sectoral master plan projects in the Mekong Delta on conformity with MDP approach

Upper Delta 'no-regret' and priority measures			
Master Plan Projects	Project descriptions	Water quality	Remarks
5.1	Construction of 3 domestic wastewater treatment plants and collection sewer systems for Long Xuyên City with total capacities of 29,500 and 34,500 m ³ /day for years to 2015 and 2020 respectively. Implementation period: 2011 – 2020	all waste water treatment is important	
5.2	Construction of 3 domestic wastewater treatment plants and collection sewer systems for Rach Gia City with total capacities of 24,000 and 33,000 m ³ /day for years to 2015 and 2020 respectively. Implementation period: 2011 – 2020	all waste water treatment is important	
5.3	Construction of 1 industrial wastewater treatment plant and collection sewer system for Long Xuyên City with total capacities of 7,700 m ³ /day and 12,800 m ³ /day for years to 2015 and 2020 respectively. Implementation period: 2011 – 2020	all waste water treatment is important	
5.4	Construction of 2 domestic wastewater treatment plants and collection sewer systems for Rach Gia City with total capacities of 2,240 and 11,200 m ³ /day for years to 2015 and 2020 respectively. Implementation period: 2011 – 2020	all waste water treatment is important	
6.1	Upgrading Water Supply Plant Binh Duc with current capacity of 38,000 m ³ /day to 70,000 m ³ /day to supply water for the Long Xuyên City Implementation period: 2011 – 2015	information is that treatment is done on surface water	groundwater extraction would be red-coloured in MDP-term because of land subsidence
6.2	Upgrading Water Supply Plant of Châu Đốc Town, from current capacity of 16,000 m ³ /day to 20,000 m ³ /day. Implementation period: 2011 – 2015	information is that treatment is done on surface water	groundwater extraction would be red-coloured in MDP-term because of land subsidence
6.3	Upgrading Water Supply Plant of Rach Gia Town, from current capacity of 35,000 m ³ /day to 45,000 m ³ /day. Implementation period: 2011-2015	information is that treatment is done on surface water	groundwater extraction would be red-coloured in MDP-term because of land subsidence
6.4	Upgrading Water Supply of Ha Tiên, from current capacity of 8,000 m ³ /day, to 16,000 m ³ /day. Implementation period: 2011-2015	information is that treatment is done on surface water	groundwater extraction would be red-coloured in MDP-term because of land subsidence
6-5	Upgrading Water supply Plant of Phú Quốc Island, from current capacity of 5,000 m ³ /day to 15,000 m ³ /day Implementation period: 2011-2015		Phú Quốc is no part of MDP

Upper Delta 'no-regret' and priority measures		
Master Plan Projects	Project descriptions	Remarks
6.6	Pre-investment project on Water Supply Hậu River II which is proposed to be located at Chau Thanh District, An Giang Province. The Plant's capacity includes: phase I: 1,000,000 m /day, and phase II: 2,000,000 m /day. The plant will serve water supply for large area of focal economic zone in Mekong Delta, including Cần Thơ, An Giang, Kien Giang and Cà Mau, and parts of Bac Lieu and Hậu Giang provinces. Implementation period: 2016-2020	groundwater extraction would be red-coloured in MDP-term because of land subsidence
6.7	Pre-investment project on Water Supply Hậu River III which is proposed to be located at Châu Đốc, An Giang Province. The Plant's capacity includes: phase I: 200,000 m /day, and phase II: 500,000 m /day. The Plant will serve water supply for Kien Giang and An Giang provinces, concentrating for the urban areas along the border with Cambodia. Implementation period: 2016-2020	groundwater extraction would be red-coloured in MDP-term because of land subsidence
7.3	Water Control Works for Aquaculture in An Giang Province, Long Xuyên Quadrangle . Implementation period: 2012-2015.	water control works include small (low dykes), sluices (to get saline water) and pumping stations (freshwater supply), etc.
Water quality		
	information is that treatment is done on surface water	
	information is that treatment is done on surface water	
	possibly unsustainable use of fresh water, consider more sustainable aquaculture	
Upper Delta 'no-regret' and priority measures		
Master Plan Projects	Project descriptions	Remarks
7.1	Dam Chich Weir for controlled flooding along border with Cambodia, in Kien Giang province, Long Xuyên Quadrangle ; Implementation period: 2012 – 2015.	Retention areas + reconsidered triple rice growing project seems not to consider cross border approach or required retention capacity
7.2	Salinity Control Works along West Sea, in Kien Giang Province, Long Xuyên Quadrangle , including 6 sluice-gates (Ta Xang, Tam Ban, Song Kien, Ta Lua, Cau So 1 and Rach Gia) and lateral canal systems for salinity control and flood regulation Implementation period: 2012 – 2015.	adaptation to saline environment can economically be much more advantageous, project seems to be aimed at conservation of rice (compare coastal zone dual-zone coast management approach)

Upper Delta 'no-regret' and priority measures		
Master Plan Projects	Project descriptions	Remarks
7.4	Water Control System Bac Cai Tau Thuong for controlled flooding and irrigation and drainage in the area between two main branches (Tiền and Hậu Rivers) in An Giang province, including the Water Control system of North Vam Nao (phase 2) and dredging of Than Nong Canal. Implementation period: 2012 – 2015.	Controlled flooding is primarily based at keeping retention areas in the Upper Delta, enough floodable area in the wet season to reduce water levels.
7.5	Canals in the Area Between Tiền and Hậu Rivers , for irrigation and drainage in An Giang Province, including canals Vin Truong – An Giang, Moi and Cà Mau (Cho Moi district). Implementation period: 2012 – 2015	in general improvement of drainage and irrigation is not conflicting with MDP approach, where irrigation /drainage measures is aimed at increase of rice production through triple rice there is probably problem: it could be good in the present policy, but in MDP approach it is not good, because: 1. third rice does not give better crop and reduces quality of first crops 2. in economic terms 3. economically more attractive possibilities are better for prosperity AND for controlled flooding
7.6	Water Control system in the area between Vàm Cỏ Tay and Vàm Cỏ Dong Rivers (Canal 61 and Canal Rach Tram – My Binh) for fresh water supply, irrigation and drainage improvement, Long An province; Implementation period: 2012-2015.	idem
7.7	Water Control system on the Left Bank side of Tiền (Mekong) River in Long An and Tiền Giang Provinces for controlled flooding, salinity control, irrigation and drainage, including the water control works (sluices) and canals construction and improvements; Implementation period 2012-2015	idem
7.8	Flood Release Canal System to Tiền River including 5 canals improvement and excavation in Dong Thap province (Left bank side of Tiền River) for flood release, irrigation and drainage improvement. Implementation period: 2012-2015.	idem

Upper Delta 'no-regret' and priority measures			
Master Plan Projects	Project descriptions	Retention areas + reconsidered triple rice growing	
		Remarks	
7.9	Water Conveyance System Tiên River – Vàm Cỏ Tay River including the Canal Dong Tiên – Duong Van Duong – Lagrange and Canal My Hoa - An Phong – Bac Dong, for flood release, irrigation and drainage improvement in Long An, Dong Thap and Tiền Giang Provinces (Left bank side of Tiên River). Implementation period: 2012 – 2015.	idem	
7.10	Water Control Infrastructures to serve aquaculture in Dong Thap Province (Left bank side of Tiên River), Implementation period: 2012 – 2105.	idem	introduction of aquaculture could be good if sustainability well considered
7.11	Water Control system in the Vinh An Canal, including the small dyke and dredging of the canal for controlled flooding, irrigation and drainage improvement, in An Giang Province (Area between Tiên and Hậu Rivers). Implementation period: 2012 – 2015.	idem	
7.15	Flood Release Works along the Border with Cambodia, including 3 canals Song Trang-Ca Gua, Bat-79-Tan Thiet, and Bat Cu-Kenh T2, Long An province (Left bank side of Tiên River) for flood diversion from border. Implementation period: 2016-2020.	revision/review: cross-border approach seems not to be included	

Upper Delta 'no-regret' and priority measures		
Master Plan Projects	Project descriptions	Localised Urban Flood Protection
7.1 Dual Zone	<p>Water Control Works for controlled flooding, salinity control, irrigation and drainage in the Long Xuyên Quadrangle (Kien Giang and An Giang provinces), including:</p> <ul style="list-style-type: none"> - Upgrading and construction of 3 reservoirs in An Giang province for irrigation and water supply. - 5 sluice-gates on the main canals for flood and salinity control in Kien Giang and An Giang Province - Pumping stations for irrigation and drainage in An Giang - Dredging of widening of the main canals for flood water conveyance, drainage and irrigation in Kien Giang and An Giang province - Construction of ring dykes for Long Xuyên City and Châu Đốc Town for flood protection. <p>Implementation period 2016 – 2020</p>	<ul style="list-style-type: none"> • Construction of ring dykes for Long Xuyên City and Châu Đốc Town for flood protection fits in MDP approach • Improving water discharge fits in flood protection requirements
Master Plan Projects	Project descriptions	Space reservation + Research and Planning
7.13	<p>Flood Release Canals to the West Sea, including the dredging and widening of the 13 canals in the Long Xuyên Quadrangle (Kien Giang, An Giang and Cần Thơ) for flood release to west sea, improvement of irrigation and drainage. Implementation period: 2016 – 2020.</p>	<p>flood canal channel to West Sea is OK, spatial planning to important, stimulation of triple crop rice whilst reducing retention capacity is not OK In line with MDP approach for a mid and long term goal of flood diversion it is without serving triple rice crops</p>

Upper Delta 'no-regret' and priority measures		
Master Plan Projects	Project descriptions	Space reservation + Research and Planning
7.14	<p>Water Control System for Can Duoc – Can Guoc Area, Long An province (Left bank side of Tién River), including:</p> <ul style="list-style-type: none"> - Can Guoc River Dyke (salinity control with SLR) - 2 sluice-gates: Thanh Trung and Chanh Nhi (salinity control, irrigation and drainage) - Water control works on the canals Tri Yen – Rach Chanh, Cau Chua – Xom Luy (salinity control, IandD) and - Water Control works in Tan Chanh for aquaculture production (salinity control, IandD) - Water conveyance canal from Vàm Cỏ Dong to Can Duoc – Can Guoc - Water control works on Xom Bo – Can Duoc and Doi Ma – Mong Ga canals for salinity control and IandD <p>Implementation period: 2016-2020</p>	
7.16	<p>Canal Thap Muoi – Nguyen Van Tiep – Tong Doc Loc for flood release and water conveyance for irrigation and drainage between Tién River – Vàm Cỏ Tay River, in Long An, Dong Thap and Tién Giang provinces (Left bank side of Tién River),</p> <p>Implementation period: 2016 – 2020.</p>	<p>flood canal channel to West Sea is OK, spatial planning to important, stimulation of triple crop whilst reducing retention capacity is not OK</p> <p>In line with MDP approach for a mid and long term goal of flood diversion if it is without serving triple rice crop</p> <p>In line with MDP approach for a mid and long term goal of flood diversion if it is without serving triple rice crop</p>
7.17	<p>Canal system to release flood water to Tién River including 17 canals in the Dong Thap and Tién Giang provinces for the flood control, irrigation and drainage purposes.</p> <p>Implementation period: 2016 -2020</p>	
7.18	<p>Water Control Works (low dyke and dredging of on-farm canals) on the Vinh An main canal, An Giang Province (Left bank side of Tién River), for irrigation and drainage.</p> <p>Implementation period: 2016-2020</p>	
		<p>reverse or at least review: salinity control alternative is salinity adapt (MDP-Dual Zone approach); for MDP we have not established how the dual zone would be precisely, Can Duoc could be in the more saline area of the dual zone, where there is more focus on aquaculture instead of fighting against salinity to maintain rice or other produce.</p> <p>From the little information we cannot judge, but review would be good</p> <p>again: in MDP approach investments third crop (= loss of retention area) needs revision</p> <p>again: in MDP approach investments third crop (= loss of retention area) needs revision</p> <p>again: in MDP approach investments third crop (= loss of retention area) needs revision</p>

Middle Delta 'no-regret' and priority measures			
Master Plan Projects	Project descriptions	Water quality	Remarks
5.5	Construction of 4 domestic wastewater treatment plants and collection sewer systems for Cần Thơ City with total capacities of 60,000 and 86,000 m ³ /day for years to 2015 and 2020 respectively. Implementation period: 2011 – 2020	All waste water treatment is important	groundwater extraction would be red-coloured in MDP-term because of land subsidence
5.6	Construction of 10 industrial wastewater treatment plants and collection sewer systems for Cần Thơ City with total capacities of 64,000 and 197,600 m ³ /day for years to 2015 and 2020 respectively. Implementation period: 2011 – 2020	All waste water treatment is important	groundwater extraction would be red-coloured in MDP-term because of land subsidence
6.8	Upgrading Water Supply Plant Cần Thơ 2, from current capacity of 40,000 m ³ /day to 80,000 m ³ /day, Cần Thơ City Implementation period: 2011 – 2015.	if source is surface water, groundwater use needs to be revised in MDP-approach because of subsidence	groundwater extraction would be red-coloured in MDP-term because of land subsidence
6.9	Construction of Co Do Water Supply Plant, with capacity of 15,000 m ³ /day to supply water for Cần Thơ City. Implementation period: 2011 – 2015.	if source is surface water, groundwater use needs to be revised in MDP-approach because of subsidence	groundwater extraction would be red-coloured in MDP-term because of land subsidence
6.10	Pre-investment project on Water Supply Plant Hậu River I which is proposed to be located at Tân Thành, Cần Thơ City. The Plant's capacity includes two phases: phase 1: 500,000 m ³ /day and phase 2: 1,000,000 m ³ /day. The Plant will serve water supply for Cần Thơ City, Sóc Trăng province, west Bassac river corridor, and supplementary supply for north area of Bassac river in Ben Tre and Tra Vinh provinces. Implementation period: 2016-2020.	if source is surface water, groundwater use needs to be revised in MDP-approach because of subsidence	groundwater extraction would be red-coloured in MDP-term because of land subsidence

Middle Delta 'no-regret' and priority measures			
Master Plan Projects	Project descriptions	Upgrade existing fresh water supply system	Remarks
7.19	Water Control Structure Cluster Cai Lon – Cai Be in Cà Mau Peninsula (part belonging to the Middle Zone - MDP), including 9 canals irrigation and drainage improvements in Kiên Giang, Cần Thơ, Hậu Giang Provinces. Implementation period: 2012 – 2015	Need for fresh water supply to Cà Mau Peninsula	irrigation and drainage improvement is NO FIT , since Dual Zone would require more adaptation to saline environment

Middle Delta 'no-regret' and priority measures			
Master Plan Projects	Project descriptions	Upgrade existing fresh water supply system	Remarks
7.20	Hydraulic Works near West Sea, including 13 sluice-gates on the Upper U Minh (UMT) and 12 canals for forest fire fighting in the UMT forest, in Cà Mau Peninsula , Kien Giang province. Implementation period: 2012 -2015	Need for fresh water supply to Cà Mau Peninsula	MDP does not necessarily have an opinion on all projects
7.21	Sluice-gates along the West Sea Dyke (section from Cai Tau River to Kenh Hoi River Mouth, including 3 sluice-gates (Lung Danh, Rach Rong, Rach Trai) for the salinity control, irrigation and drainage in Cà Mau Province. Implementation period: 2012 – 2015.	Need for fresh water supply to Cà Mau	irrigation and drainage improvement is NO FIT, since Dual Zone would require more adaptation to saline environment
7.22	Cà Mau Peninsula Hydraulic Works Systems in the Cà Mau Peninsula of Bac Lieu, Sóc Trăng and Hậu Giang Provinces and Cần Thơ City, including: <ul style="list-style-type: none"> - 62 sluice-gates along the fresh-salt boundary of Quan Lo – Phung Hiep Area (Bac Lieu) for salinity control and drainage improvement. - Navigation Lock Ninh Quoi (Sóc Trăng – Bac Lieu) for navigation and salinity control and water supply. - Dredging of Ngang Canal (Cần Thơ) for irrigation and drainage - Hậu Giang 3 Sluice-gates for irrigation water supply and drainage facility. - Exploitation of the Vien Lang Alluvial Area (Hậu Giang) for the construction material supply. - Water Control system for 4 lowland districts of Sóc Trăng province. - Dredging of Xa No 2 canal (Hậu Giang) for irrigation and drainage. Implementation period: 2012 – 2015	Need for fresh water supply to Cà Mau Peninsula	Establishing/reinforcing a more inland salt-fresh boundary approach along the Quan Lo – Phung Hiep Area (Bac Lieu) fits to Dual Zone)) irrigation and drainage improvement could be NO FIT, since Dual Zone would require more adaptation to saline environment

Middle Delta 'no-regret' and priority measures			
Master Plan Projects	Project descriptions	Upgrade existing fresh water supply system	Remarks
7.24	<p>Water Control systems South Mang Thit (Area between two river Tiền and Hậu) in the Tra Vinh and Vinh Long Provinces, including:</p> <ul style="list-style-type: none"> - Secondary canals South Mang Thit (Tra Vinh) for irrigation and drainage - Sluice-gates Tan Dinh and Bong Bot (Tra Vinh) for salinity control and drainage; - Upgrading Sluice-gate Trem (Tra Vinh) for salinity control and drainage; - Dyke Route in Long Hoa-Hoa Minh Island (Tra Vinh) for salinity control - Dykes South Rach Tra Cu and Vam Lau-Bac Trang (Tra Vinh) for salinity control. - Water Control System Cai Von (Vinh Long) for flood control, irrigation and drainage - Water Control system May Phop – Nga Hậu (Vinh Long) for flood control, irrigation and drainage; - Water Control system Vung Liem River (Vinh Long) for flood control, irrigation and drainage; - Water Control system Tan Long-Tan An Hoi (Vinh Long) for flood control, irrigation and drainage; - Water Control system North Cau Ngang River (Vinh Long) for flood control, irrigation and drainage; - Water Control system South Cau Ngang River (Vinh Long) for flood control, irrigation and drainage; - Water Control system North Mang Thit River (Vinh Long) for flood control, irrigation and drainage. <p>Implementation period: 2012-2015</p>	<p>The measures contribute to the improvement of fresh water supply, but include also a lot of flood protection and irrigation works. Not all information readily available. Bottom line in the MDP approach is that retention capacity should be preserved.</p>	<p>It is OK with MDP short term plan strategy, but safety standards applied must be in line with a long-term vision of the whole effected/protected area</p>
7.25	<p>Water Control Works North Ben Tre, Area between Tiền and Ham Luong Rivers, Ben Tre province, including:</p> <ul style="list-style-type: none"> - 4 sluice-gates along the Tiền River (Cai Cau, Tan Dinh, Ca Nho and Dinh Trung) for salinity control and drainage - 3 sluice-gates along the Ham Luong River (Du nang, Cai Bong Muong Dao) for salinity control and drainage - Tiền River dyke and 11 sluices (culverts) under dyke for salinity control and drainage - Ham Luong River Dyke and 16 culverts (under dyke) for salinity control and drainage. <p>Implementation period: 2012 – 2015.</p>		<p>It is OK with MDP short term plan strategy, but safety standards applied must be in line with a long-term vision of the whole effected/protected area.</p>

Middle Delta 'no-regret' and priority measures			
Master Plan Projects	Project descriptions	Remarks	
7.27	Water Control System for aquaculture (concentrated cat fish farming) in Vinh Long Province Implementation period: 2012 – 2015	Upgrade existing fresh water supply system Improvement of fresh water supply	no special opinion MDP, a shift from only rice to economy with more added value is OK
7.28	Salinity Control Works inside Cà Mau Peninsula , including: - Water Control system O Mon-Xa No – Phase 2 for drainage and acidity flushing for Kien Giang, Cần Thơ and Hậu Giang Provinces - Xeo Can Canal for flood water release and irrigation and drainage for Kien Giang province. Implementation period: 2016-2020.	Improvement of fresh water supply	<ul style="list-style-type: none"> It is OK when only looking from middle delta perspective. It could be wrong when also considering coastal dual zone perspective. The need for strengthening of good overall water governance is foreseen.
7.29	Independent (small-scale) Water Control System in the Cà Mau Peninsula of the Hậu Giang, Bạc Liêu province and Cần Thơ City, including the river/canal dredging works, small pumping stations in Cần Thơ, small-scale water control systems and canal linings for the flood protection, salinity control, irrigation and drainage purposes. Implementation period: 2016-2020	Improvement of fresh water supply	<ul style="list-style-type: none"> It is OK when only looking from middle delta perspective. It could be wrong when also considering coastal dual zone perspective. The need for strengthening of good overall water governance is foreseen.
7.30	Salinity control system South Chac Bang for salinity control and drainage, including: - Sluice-gates Rach Cai Chanh - Sluice-gate Canh Den – Pho Sinh - Sluice-gate Phong Thanh Tay - Sluice-gate Kenh Xang-Huyen Su - Sluice-gate Tan Phong Implementation period: 2016 – 2020	Improvement of fresh water supply	<ul style="list-style-type: none"> It is OK when only looking from middle delta perspective. It could be wrong when also considering coastal dual zone perspective. The need for strengthening of good overall water governance is foreseen.

Middle Delta 'no-regret' and priority measures			
Master Plan Projects	Project descriptions	Upgrade existing fresh water supply system	Remarks
7.31	<p>Hydraulic Structures along the Bassac (Hậu) River in Sóc Trăng Province, including:</p> <ul style="list-style-type: none"> - 4 sluice-gates at Kênh Saintard, Rach Mop, Tra Quy and Tra Canh for salinity control and drainage facilitation - 7 canal systems for drainage improvement - Water control system for aquaculture in Lai Hoa – Hoa Nhat - Irrigation canals Long Phu – Tiep Nhat, and Nga Nam – Phu Loc. <p>Implementation period: 2016-2020</p>	Improvement of fresh water supply	Revise and review are needed depending how dual zone could be defined

Middle Delta 'no-regret' and priority measures			
Master Plan Projects	Project descriptions	River Control	Remarks
7.23	<p>Canals connecting Tiền and Hậu Rivers (Area between Tiền and Hậu Rivers of Vinh Long and Dong Thap provinces), including 5 canals (Muong Khai, Xa Tau-Soc Tro, Nhan Man-Tu Tai, Xeo Mat-Cai Von and Cấn Tho-Huyen Ham)</p> <p>Implementation period: 2012 - 2015</p>	Purpose of canals is to divert water from Tiền to Hậu making sure that after having canal water division will be 50-50% at each river. This will reduce flood of the Plain of Reeds, but may cause more flooding problem in the Hậu River, because of Hậu River's natural discharging capacity. Revise or at least review is needed.	This fits the ideas of the MDP approach. It is however a very challenging measure. At least review and thorough research is needed.

Middle Delta 'no-regret' and priority measures		
Master Plan Projects	Project descriptions	Localised Urban Flood Protection
7.26	Water Control systems in Area Between Tiên and Ham Luong Rivers , Ben Tre Province, for salinity control and drainage, including: <ul style="list-style-type: none"> - Water Control system Cai Quao - Ring dykes of Dong Nam Commune of Cho Lach district, and Hung Khanh Trung A of Mo Cay Bac district. Implementation period: 2012 – 2105.	
7.32	Hydraulic Works System South Mang Thit (Area between two main branches Tiên and Hậu Rivers) in Tra Vinh and Vinh Long Provinces, including: <ul style="list-style-type: none"> - Dykes at Tra Cu canal and Long Thanh – Phu Am Island (Tra Vinh 1) for salinity control taking into account SLR. - Sluice-gate Vung Liem for salinity control and drainage - 24 canals for irrigation and drainage - 7 water control systems for flood control, irrigation and drainage - Dyke along Mang Thi River for salinity control - Dyke along Co Chien River (Vung Liem district) to prevent the flooding by high river discharge and high tide - Dyke along Hậu River (from Binh Tan district to Tra On district, Vinh Long province) to prevent flooding by river discharge and high tide - 3 main sluice-gates at Bao Mon, Muong dieu and Rach Tra for salinity control and drainage. Implementation period: 2016-2020	It is OK with MDP short term plan strategy, but safety standards applied must be in line with a long-term vision of the whole effected/protected area.

Coastal zone 'no-regret' and priority measures		
Master Plan Projects	Project descriptions	Water quality
5.7	Construction of 3 domestic wastewater treatment plants and collection sewer systems for Cà Mau City with total capacities of 30,000 and 34,500 m /day for years to 2015 and 2020 respectively. Implementation period: 2011 – 2020.	All is wastewater treatment, so it is OK and important for the short term.
5.8	Construction of 4 industrial wastewater treatment plants and collection sewer systems for Cà Mau City with total capacities of 13,600 and 18,120 m /day for years to 2015 and 2020 respectively. Implementation period: 2011 – 2020.	All is wastewater treatment, so it is OK and important for the short term.

Coastal zone 'no-regret' and priority measures			
Master Plan Projects	Project descriptions	Water quality	Remarks
6.11	Upgrading Cà Mau Water Supply Plant, Cà Mau City, from current capacity of 28,000 m ³ /day to 50,000 m ³ /day. Implementation period: 2011-2015.	All is water supply, so it is OK and important for the short term.	Impacts may have on the upper delta and middle zone
Coastal zone 'no-regret' and priority measures			
Master Plan Projects	Project descriptions	Shift from mono-shrimp farming to poly-aquaculture	Mitigate groundwater use
7.33	Water Control Structure Cluster Cai Lon – Cai Be in Cà Mau Peninsula (part belonging to the Coastal Zone - MDP), including 4 sluice-gates (Cai Lon, Cai Be, Xeo Ro 1 and Xeo Ro 2) and 1 Sluice-gate combined with navigation lock (Xeo Ro) for the salinity control and irrigation and drainage in Kien Giang Province. Implementation period: 2012 – 2015	This is for both purposes, it is OK for a short term	
7.34	Sluice-gates along the West Sea Dyke (section from Cai Tau River to Kenh Hoi River Mouth, including 3 sluice-gates (Lung Danh, Rach Rong, Rach Trai) for the salinity control, irrigation and drainage in Cà Mau Province. Implementation period: 2012 – 2015	This is for both purposes, it is OK for a short term	
7.35	Hydraulic Works along the East Sea in the Cà Mau Peninsula of the Sóc Trăng province, including: - Dyke of Cu Lao Dung (Dung Island) - Sea dyke - 6 sluice-gates - Bridges (3) For salinity control, drainage and transport. Implementation period: 2012 – 2015.	This is for both purposes, it is OK for a short term	
7.36	Water Control systems for aquaculture productions in Cà Mau and Bac Lieu, including: - Tan Duyet Aquaculture farms in Dam Doi district, Cà Mau - Improvement of the water control system for aquaculture production in Sub-zone 3, South Cà Mau - Improvement of water control system for aquaculture in Long Dien Dong and Long Dien Tay areas. Implementation period: 2012-2015.	Need to review or revise in order to best use of the dual function coastal zone	

7.37	<p>Hydraulic Works Bao Dinh – Go Cong in Tiền Giang Province, including:</p> <ul style="list-style-type: none"> - Seadyke Go Cong I for salinity prevention and SLR - Seadyke Go Cong II (Cu Lao Phu Loi) for salinity prevention and SRL - Water Conveyance Canal Binh Phan – Go Cong for fresh water supply and irrigation and drainage - Salinity Control Dykes at Tiễn and Cua Tieu Rivers - Salinity Control Dykes at Vàm Cỏ Tay River. <p>Implementation period: 2012-2015</p>	<p>This is for both purposes: fresh water and sea defence; it seems OK for a short term vision. Location of the dykes must be carefully researched in order to maintain a sufficient coastal zone in front.</p>
7.38	<p>Water Control systems for aquaculture productions in Tra Vinh province (Area between Tiễn and Ham Luong Rivers), including:</p> <ul style="list-style-type: none"> - Water Control system for Aquaculture Area Tam Vu Lo (Cau Ngang District) - Water Control system for Aquaculture Area Dong Don. <p>Implementation period: 2012-2015</p>	<p>Need to review or revise in order to best use of the dual function coastal zone</p>
7.39	<p>Water Control System inside Cà Mau Peninsula, in Cà Mau and Kien Giang provinces for salinity control, drainage and disaster prevention, including:</p> <ul style="list-style-type: none"> - 12 water control system in the South Cà Mau Area for salinity control, drainage and freshwater keeping. - 2 water control systems in the North Cà Mau Area for salinity control, drainage and freshwater keeping. - 18 river dyke systems in Cà Mau province for salinity control and disaster mitigation - Canal KT1-An Ninh for flood release, irrigation and drainage. <p>Implementation period: 2016-2020</p>	<p>Need to review or revise in order to best use of the dual function coastal zone</p>

7.40	<p>Construction of 6 large tidal barriers, including:</p> <ul style="list-style-type: none"> - Cai Lon (390 m) - Cai Be (65m), - Vàm Cỏ (1,390 m), - Ham Luong (2,800 m), - Co Chien (1,470 m), and - Cung Hậu (1,680 m) 	<p>Closing of the river mouths must be carefully considered, main aspects are:</p> <ul style="list-style-type: none"> - Location: how far from the sea, this must be in line with the sea defence line in the MDP. - How open it will be - What is the main functions: sea defence, salt intrusion prevention; regulation of fresh water?? <p>These all specific measures need to be revised or at least reviewed under a long term goals.</p> <p>These structural measures are NOT included in the list of short-term projects of the PM Decision 1397/QĐ-TTg dated 25/9/2012 on approval of MD Water Resources Master Plan period 2012-2020 and vision to 2050 with the CC-SLR.</p>
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Acknowledgements and colophon



Acknowledgements

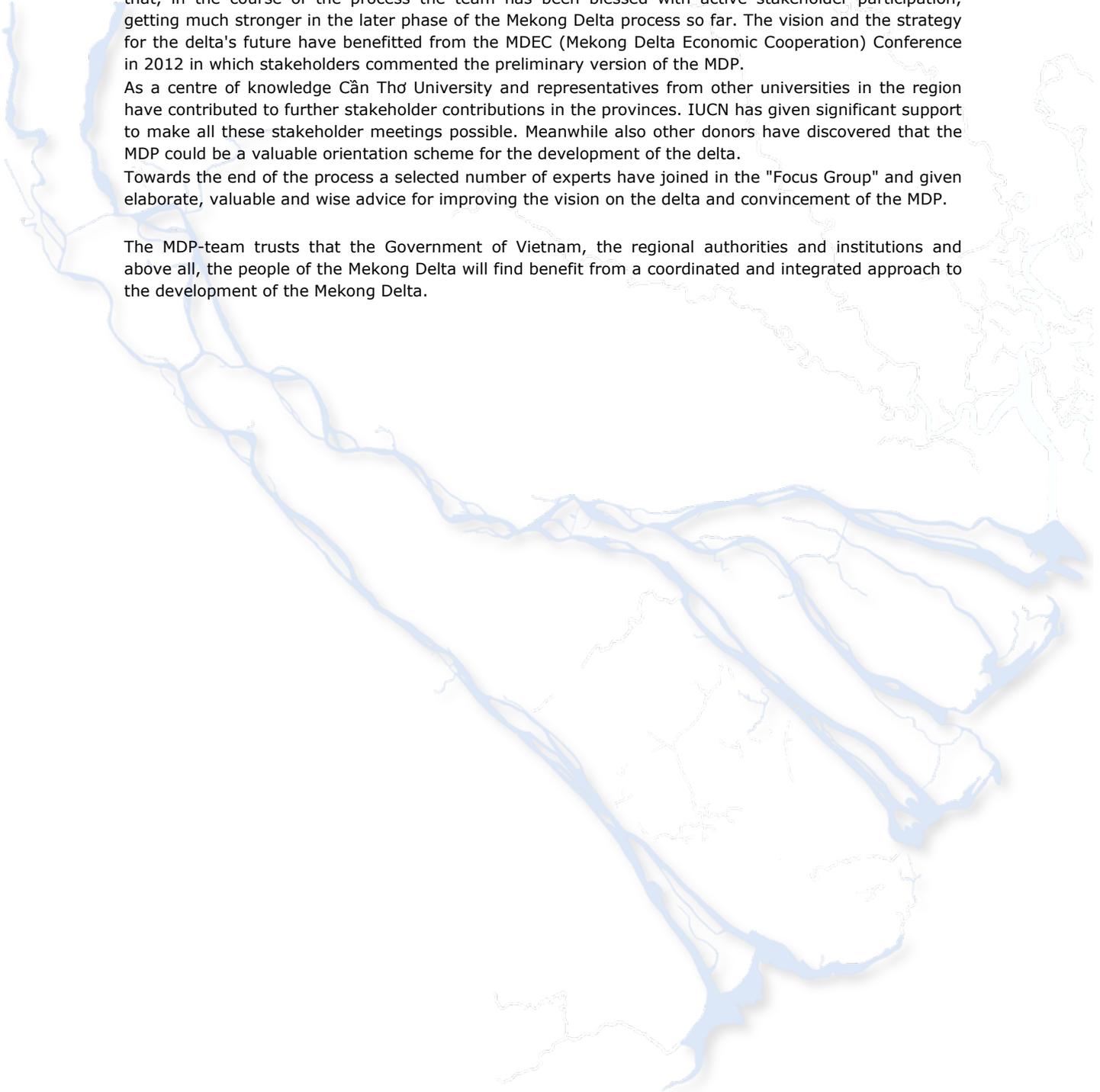
The production of this document would not have been possible without the dedicated effort of all partners and stakeholders involved. In all contacts the MDP-team has experienced that the delta lives, that people care for its current problems and are ambitious in seizing the opportunities for a safe, prosperous and sustainable development. In that sense the title on the front page is not just a policy, but it expresses the will of people caring for the delta.

In expressing the gratitude of the MDP-team it is virtually impossible to give all persons and organisations involved the appropriate attention. Naturally, the assigned partners MoNRE and MARD at the Vietnamese side and the Dutch counterparts have contributed to the best of their abilities. On top of that, in the course of the process the team has been blessed with active stakeholder participation, getting much stronger in the later phase of the Mekong Delta process so far. The vision and the strategy for the delta's future have benefitted from the MDEC (Mekong Delta Economic Cooperation) Conference in 2012 in which stakeholders commented the preliminary version of the MDP.

As a centre of knowledge Cần Thơ University and representatives from other universities in the region have contributed to further stakeholder contributions in the provinces. IUCN has given significant support to make all these stakeholder meetings possible. Meanwhile also other donors have discovered that the MDP could be a valuable orientation scheme for the development of the delta.

Towards the end of the process a selected number of experts have joined in the "Focus Group" and given elaborate, valuable and wise advice for improving the vision on the delta and convincement of the MDP.

The MDP-team trusts that the Government of Vietnam, the regional authorities and institutions and above all, the people of the Mekong Delta will find benefit from a coordinated and integrated approach to the development of the Mekong Delta.



Colophon



Mekong Delta Plan

**assignment
partners**

Partners for Water, Netherlands
Ministry of Infrastructure and Environment
Embassy of the Kingdom of the Netherlands, Hanoi
Ministry of Natural Resources and Environment
Ministry of Agriculture and Rural Development
consortium Royal HaskoningDHV, WUR,
Deltares, Rebel, Amersfoort, Netherlands

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