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List of Abbreviations

ADB – Asian Development Bank

AFO – Area Farmers' Organisations, Malaysia

AIP – Agriculture and Irrigation Programme

ASEAN – Association of Southeast Asian Nations

AWD – Alternate Wet and Dry Rice Management

BERNAS – Padiberas Nasional Bhd, Malaysia

BLKP – Agricultural Skills Training Division, Malaysia

CALFED – California Bay-Delta Programme

DARD – Department of Agriculture and Rural Development, Vietnam

DID – Department of Irrigation and Drainage, Malaysia

DoE – Department of Environment, Malaysia

DONRE – Department of National Resources and Environment, Vietnam

DWRM – Department of Water Resource Management, Vietnam

EPP – Entry Point Project

ETP – Economic Transformation Programme, Malaysia

FAMA – Federal Agricultural Marketing Authority, Malaysia

FAO – Food and Agriculture Organization of the United Nations

FOA/LPP – Farmers' Organisation Authority/ Lembaga Pertubuhan Peladang, Malaysia

FSP – Food Security Policy

IADA – Integrated Agricultural Development Authority, Malaysia

IMC – Irrigation Management Company

IME – Irrigation Management Enterprise

IMT – Irrigation Management Transfer

IRBM – Integrated River Basin Management

IRRI – International Rice Research Institute

IWAM – Integrated Water and Agricultural Management

IWM – Integrated Water Management

IWRM – Integrated Water Resources Management

IUCN – International Union for Conservation of Nature

KADA – Kemubu Agricultural Development Authority, Malaysia

KATS – Ministry of Water, Land and Natural Resources, Malaysia

LUAS – Lembaga Urus Air Selangor, Malaysia

MADA – Muda Agricultural Development Authority, Malaysia

MARD – Ministry of Agriculture and Rural Development, Vietnam

MESTECC – Ministry of Energy, Science, Technology, Environment and Climate Change, Malaysia

MOA – Ministry of Agriculture and Agro-based Industries, Malaysia

MONRE – Ministry of Natural Resources and Environment, Vietnam

MRC – Mekong River Commission

MSAN – Natural Water Resources Council, Malaysia

MyWP – Malaysian Water Partnership

NAFAS – National Farmers' Organisation, Malaysia

NAP 1-3 – National Agriculture Policy, Malaysia

NAP 4 – National Agrofood Policy, Malaysia

NGO – Non-Governmental Organisation

NKEA – National Key Economic Areas, Malaysia

NRE – Ministry of Natural Resources and Environment, Vietnam

NWRC – National Water Resources Council, Vietnam

NWRP – National Water Resources Policy, Malaysia

ODA – Official Development Assistance

O&M – Operation and Maintenance

PIM – Participatory Irrigation Management

PLKPK – National Agricultural Skills Training Programme, Malaysia

PPC – Provincial People's Committee, Vietnam

RBO – River Basin Organisation

SFO – State Farmers' Organisations, Malaysia

SRD – Centre for Sustainable Rural Development, Vietnam

UN/UNO – United Nations Organization

VEA – Vietnam Environment Administration

VNFU – Vietnam Farmers' Union

WFD – Water Framework Directive

WTO – World Trade Organisation

WUA/WUO – Water-user Organisation/Water-user Association

WWF – World Wide Fund for Nature

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1. Theory

1.1. Introduction

Balancing global food security and the constant demand for freshwater will be one of humanity's major challenges in the decades to come (HLPE 2015, 25). Securing freshwater resources, maintaining high water quality and managing freshwater effectively has great influence on people's daily livelihood, as freshwater has not only a major influence on sanitation and hygiene, but its availability also impacts on food security and therefore, the agricultural sector.

While the global population is estimated to be reaching 9.2 billion in 2040 (Roser and Ortiz-Ospina 2017), water supplies will be more and more contested, and water is considered as the major resource allowing for sustainable growth of the human population (Parolari, Katul, and Porporato 2015, 407). Freshwater in particular is essential for the survival of living beings (i.e. plants, animals and humans) – but, only 2.5% of the world's total water is freshwater and thus usable for agriculture, nutrition etc. (Perlman and USGS 2016). According to the United Nations (UN) Sustainable Development Goal 6 – Clean Water and Sanitation (UN 2017), water scarcity has already affected more than 40% of the world's population, and over 1.7 billion people live in areas where water use outpaces recharge. Additionally, instances of water scarcity are becoming more and more frequent, not only in regions that have already been prone to water scarcity but also in those with more temperate climates and rich water resources (Molle 2008, 217).

Availability of Freshwater

Many nations face a water table drawdown. As a consequence, freshwater is – more or less silently - treated as one of the future's most important resources. As it is closely connected to food security, a serious water crisis would thus have a great impact on the latter. However, this problem does not stem from a general scarcity of water (Molden et al. 2007, 39) but from mismanagement and unaligned governance responses such as conflicting interests on different levels of government or generalised policies, which do not work well on the local level in specific areas and do not consider farmers' needs. The quantity of water required for food production

is immense, and the way water is used in agriculture is one of the main contributors to ecosystem degradation and water scarcity. In fact, around 80% of diverted water – and often even more in developing countries – is used for farming (Molle 2008, 217). Additionally, there are many policies that – on the surface – seem to have nothing to do with water and agriculture but influence the sectors severely (Molden et al. 2007, 39). These problems seem to point to an artificially created water scarcity. Even more importantly, our attention should be drawn to how planning with this resource can have a tendency to override hydrologically and economically relevant criteria (Molle 2008, 217–18). Therefore, focusing on the governance of freshwater in the agricultural sector in general, and irrigated agriculture in particular, may provide great insight into one of the most relevant problems of our time. After all, we are all consumers of food and water.

Water Governance and East Asia

Following these assumptions, it is important to consider the role of water governance in irrigated agriculture; after all, "irrigated agriculture has a significant potential for food security and poverty reduction" and "farmers are [the] key actors in irrigated agriculture" as well as frequently the main target group of governmental policy making (Özerol and Bressers 2017, 45, 2017). This thesis therefore aims at contributing to the freshwater governance in irrigated agriculture research regarding countries in Southeast Asia.

Asia, as the world's driest continent, has an average per capita water availability of 6,380m^3 – less than half of the world's average – with countries such as Vietnam and China, which are under or close to water stress, but also exceptions like Malaysia, which is not considered to be water-stressed (Chellaney 2012, 143; Hezri and Dom 2017, 26). In addition, Asia features many arid or semi-arid areas which require intensive irrigation. This created, however, problems with soil-salinity and waterlogging as well as a decrease in yield growth. With 70% of the world's irrigated land located in Asia, and 74% of freshwater withdrawals for agriculture make water-efficient water governance on the Asian continent most important (Chellaney 2012, 146).

Against this backdrop, this thesis' analysis will focus on the country cases of Vietnam and Malaysia. The choice of countries is for illustrative reasons, and does not claim to be inclusive or be able to give a comprehensive overview over the state of irrigated agriculture in Southeast

Asia. However, as Vietnam is considered to be water-stressed and Malaysia not yet but facing the problem of water resources that "are increasingly coming under duress due to river pollution and water supply inefficiency" (Hezri and Dom 2017, 26), this paper aims at giving insight into the similarities and differences in water governance in irrigated agriculture. Not only do both countries differ greatly in their population-to-size ratio but also in their different political and economic systems. In 2016, Vietnam featured a population of 92.70 million and a surface area of 331.000 km^2 and Malaysia a population of 31.19 million and a surface area of 330.800 km^2. Additionally, Vietnam has a GDP of 205,28 billion USD, but agriculture contributes only 18% to GDP. Its GNI per capita is at 2100 USD making it a lower middle income country. Malaysia has a GDP of 296,54 billion USD of which agriculture has an even lower share of 9%, a GNI per capita of 9,860 USD and it is classified as an upper middle income country. (World Bank 2016a, 2016b) Further, Malaysia is a federal constitutional elective monarchy and the only federation in Southeast Asia, whereas Vietnam is a socialist one-party republic. While Vietnam has the higher share of agriculture, Malaysia's GNI is higher. Further, as stated by Mollinga (2010, 518), Vietnam has had a mainly domestically driven policy transformation, and are very selective in the application of global water policy frameworks, whereas Malaysia has not yet received much attention by international researchers in the sector of water governance at all.

Due to their topographic, economic and political diversity, Malaysia and Vietnam can give insight into the current state of water governance in irrigated agriculture in Southeast Asia.

The above made considerations lead to the following research question:

- *What are the similarities and differences in freshwater governance in the sector of irrigated agriculture in Malaysia and Vietnam?*

Particularly interesting is the dichotomy between research on developed vs. developing countries. There are numerous studies (Head 2010; Beierle and Cayford 2002a; Gunderson and Light 2006) regarding policy integration or water management in developed countries, whereas only few studies have been carried out for developing countries (Özerol, Bressers, and Coenen 2012, 59; Ioris 2009). This puts further pressure on the necessity of developing concepts which can also be applied to developing countries. Even though social and political contexts may be different to developed countries – e.g. an existing lack of institutional capacity or human resources – this should not be used as an excuse to disregard these countries and explore their current state of freshwater governance in irrigated agriculture.

Background of the Topic

Water itself is a complex issue. There are several different definitions for different kinds of water. Chapagain and Hoekstra (2008, 4) differentiate between green water (rain water), blue water (ground- and surface water), grey water (water as a product of pollution) and virtual water (water embodied in products). Brauch and Spring (2009, 175), by contrast, define blue water as drinking water and green water as water used in food production. However, since the former definition is most commonly used in academia and reports, this master's thesis will, when necessary, take up Chapagain and Hoekstra's approach.

Agriculture accounts for around 70% of the world's total water consumption, and with a growing world population, food production will have to increase by 50% by 2030. Otherwise, food security will be severely threatened. Moreover, the so-called 'green-revolution' has caused a great increase in food productivity through new irrigation technologies as well as high-yielding crop varieties since the 1960s. (Özerol and Bressers 2017) Simply put, "irrigation can be defined as the replacement or supplementation of rainwater with another source of water", with the objective of using the minimum amount of water required for plant growth through an irrigation system (Toriman and Mokhtar 2012, 361). Since both aspects stand in close relation to each other, water and agricultural governance make this field of research not only interesting from an academic's perspective, but also politically and economically relevant. The beginning of the 20th century marked the start of regular public investments in irrigation, contributing to what Molle, Mollinga, and Wester (2009, 330) call "state water bureaucracies". Effective freshwater governance is becoming a key issue in successfully achieving water and food security. Despite the fact that the effects of environmental change evoked by changes in irrigated agriculture are observed on a local level, the causes often originate from multiple higher levels in which resources are governed (Özerol and Bressers 2017, 46). Hence, water and food security is of growing importance not only on a domestic level, but also internationally. And it does not only have relevance on a national, but also on the local level.

Water governance is frequently considered a 'wicked problem' (Weber and Khademian 2008; Özerol, Bressers, and Coenen 2012; Head 2010, 2010, 2010; Bleischwitz, Johnson, and Dozler 2014). Wicked problems usually feature "multiple, overlapping, interconnected subsets of problems that cut across multiple policy domains and levels of government", thus making them unstructured and their "causes and effects extremely difficult to identify and model" (Weber

and Khademian 2008, 336). They, therefore, do not adhere to hierarchy or any authority structures across policy sectors, between organisations or political group interests. They are closely connected to other problems, such as economic development or sustainable development, and the attempt to solve them has consequences for other policy sectors as well. Their implications for politics and society at large can be drastic, not only due to the sheer number of participants and stakeholders from various backgrounds, but also due to the great variety of agendas involved. (Weber and Khademian 2008, 336)

1.2. State of the Art

1.2.1. Research on Water Governance and Agriculture

Integrative Approaches for Water Governance

Rogers and Hall (2003) define water governance as "the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society." Whereas Tropp (2007) states that current forms of governance focus "on process-oriented societal co-steering through, for example, formal and informal networks, partnerships and dialogue." There have been many works trying to find frameworks and explain the co-dependencies of water governance and land in regard to the principles provided by sustainable development. Among these are integrated water resource management (IWRM; e.g. Ioris 2009; Dukhovny, Sokolov, and Ziganshina 2013) and integrated water and agricultural management (IWAM; e.g. Fish, Ioris, and Watson 2010). These approaches have in common that they favour integration and a multi-disciplined take. They further signify the importance and urgency of finding approaches which are able to deal with cross-sectoral issues and a multitude of actors.

IWRM

Integrated water resources management (IWRM), defined by GWP (2019) as "a process which promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of ecosystems", offers a broad basis for a multitude of research

topics related to water governance. Its emphasis is on water management's integration of various sectors as well as spatial structure, put into the context of sustainable development (Petersen, Klauer, and Manstetten 2009, 2059) and can provide "a framework for addressing full basin development while ensuring that the interests of nations are protected" (Lawford et al. 2013, 608). Gain, Giupponi, and Benson (2015, 895) list six main dimensions of IWRM:

- integration and coordination between public policy and human activity;
- spatial scale of water management;
- accountability and transparency of governance mechanisms through decentralisation of decision-making;
- stakeholder participation;
- efficient and fair distribution of water resources;
- demand management.

Özerol and Newig (2008, 640) examine management practices in water management with particular focus on the measurement of success of public participation in Canada and the European Union as a means to better its effectiveness. Regarding IWRM, they note that "integrating social, economic, institutional as well as environmental aspects, integrated water resources management (IWRM) has emerged as a participatory approach for the coordination of water related resources." However, they also state that due to the complex nature of public participation and its varying aims and rationales, there are extreme shortcomings in most cases of public participation, which can all be attributed to their five established key constituents: scope of participants, communication, capacity building, timing and finances of the public participation process. They conclude that public participation processes in multi-level water policy mostly lack in communication practices with the public as well as their capacity building processes. Tropp (2007) focuses on IWRM and its transformative power for the management of water resources, suggesting that there needs to be a greater focus on the complexity of governance. He states that flexible as well as stable governance structures are needed that are able to mediate between conflicting parties in water use and take disadvantaged groups into consideration as well as a need to include actors outside the water sector to establish more inclusive water management networks. In contrast, Moss and Newig (2010) discuss environmental governance and water governance and its nested hierarchies in the national

political and administrative systems, whereas Thiel (2014) focuses on the relationship of institutional and geophysical setting in water governance.

Research on Water Governance and Irrigated Agriculture

Over the last years, however, there have been some works specifically acknowledging the inextricable linkage between water and agricultural governance, and the need to address issues surrounding it respectively. Several works deal only with water governance specifically. But there is only a limited amount of papers in academic literature dealing with water governance in irrigated agriculture. A combining approach to water governance and irrigated agriculture can be found in integrated water and agricultural management (IWAM). Fish, Ioris, and Watson (2010) examine the governance requirements for IWAM, pointing out that the fragmentation during the process of policy-making obstructs its successful implementation in both sectors, hindering the realisation of sustainable development. However, even though they also focus on the co-dependencies across sectors and favour an integrated approach to agriculture and water, they are yet unable to establish a comprehensive framework, due to institutional basis of water and agricultural management being too complex. A different approach is chosen by Dinar and Mody (2004), who examine water governance in irrigated agriculture with a focus on pricing mechanisms and other incentives as an effective tool to achieve efficient use of water. They come to the conclusion that, even though pricing water resources for farmers is becoming more accepted, the pricing mechanisms do often not follow on economic principles and is often insufficiently implemented. Mueller et al. (2012) assess the intensification prospects of closing yield gaps in agriculture. While analysing seventeen major crops, the find that merely 16% of "underachieving areas could close yield gaps by solely increasing irrigation." They further caution against an overuse of nutrients to minimise environmental impacts of intensification, but advocate the use of precision techniques, high-yielding hybrids, multifunctional landscape management, organic fertilisers etc. in order to mitigate environmental impacts. Araral and Wang (2013) discuss the importance of incentive structures as an important point of water governance. Whereas some authors focus on increasing water productivity (Bossio, Geheb, and Critchley 2010; Molden et al. 2010), other focus on the effects of irrigation on poverty (Lipton, Litchfield, and Faurès 2003). In contrast, Chartres (2014) follows an approach centred around food security and water scarcity in Asia, and their critical factors such as modernisation

schemes or irrigation for increased water productivity, techniques to improve efficiency as well as sustainable intensification of irrigated agriculture. They conclude that in-depth country analysis is needed to improve policy formulation and enhance water-use efficiency. On a more specific level, Lam (2006) focuses on the institutions needed for irrigation management and examines different institutional designs in Taiwan and Nepal. He comes to the conclusion that specialised institutions can help farmers to achieve better irrigation performance.

Studies by International Organisations, the Water-Energy-Food Nexus, and International Frameworks

In addition to current academic research, there have also been numerous studies conducted by international organisations (OECD 2011; FAO 2014; Unesco 2006), trying to give a holistic picture and assessment of the current state of water governance and agriculture. However, these assessments are mainly data collections and do not follow a replicable, academic framework, and focus heavily on sustainable development (e.g. OECD 2010; ESCAP 2009), water scarcity (e.g. Brown and Matlock 2011) or the overall development of water resources (WWAP 2012). Nevertheless, emerging from these studies has been the water-energy-food nexus approach, which has gained momentum in the last years and shows a growing awareness of the interconnectedness of resource management issues (WEF 2011; Bizikova et al. 2013; Hoff 2011; Andrews-Speed et al. 2012). The International Water Management Institute (Molden 2007) approaches water management in agriculture from a historic perspective, assesses challenges of water usage in the past, present and future, and gives recommendations for policy actions.

The development to implement integrated approaches, deal with cross-sectoral issues, and involve multiple actors has been established further with the European Union's Water Framework Directive (European Parliament 2000; *Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy*; WFD) and the Aarhus Convention[1], which deals with participatory mechanisms in environmental matters, and entered into force in 2001. Petersen, Klauer, and Manstetten (2009, 2064) state that the WFD, which came into force in 2000 with the objective to achieve

[1] The convention's full text can be found under: UNECE (1998), https://www.unece.org/fileadmin/DAM/env/pp/documents/cep43e.pdf.

"good status[2]" of all bodies of water by 2015, was designed in a way that increases and improves states' power, but also offers a new concept for integrated water management. Moreover, the WFD makes it clear that implementing governance processes in the field of environmental governance does not result in a leaner state and a reduction of actual government activity, but instead in an increase of government. Moss and Newig (2010) focus on levels of government in environmental governance and the challenges they are facing on a spatial scale. They point out that water regulations are re-ordered around the river basin in the WFD, and that this has enhanced modes of inclusive governance "suited to horizontal interplay between hydrological and political-administrative scales of operation and to vertical interplay within each of these scalar dimensions" (Moss and Newig 2010, 2).

1.2.2. Governance Analysis for Water Governance in Irrigated Agriculture – An Integrative Approach

Governance analysis focuses on policies as well as networks and actors and thus provides an approach that enables multifaceted and intersectional research, as demonstrated by the following statement about environmental governance by Kallis, Kiparsky, and Norgaard (2009, 635):

> Environmental governance refers to processes of negotiation, coordination and collaboration between state agencies, private actors and non-governmental organizations directed to the joint realization and implementation of a plan addressing an environmental problem. Governance processes are polycentric, heterarchic and self-organizing.

Governance analysis is frequently used in connection with environmental research (Evans 2012; Schreurs 2013, 2013). There are, however, multiple approaches to governance analysis, depending on the research's focus area.

One of the major issues of water governance in irrigated agriculture is to not only consider policies or institutions directly related to water or agriculture but to also adopt a cross-sectoral approach (Özerol, Bressers, and Coenen 2012, 60), which enables the incorporation of sectors not directly or less obviously related to water governance in irrigated agriculture. In contrast to

[2] The exact definition of what constitutes 'good status' can be found in the Official Journal of the European Communities European Parliament (2000, 38–51).

IWRM, which requires the examination of all water-user sectors, irrigated agriculture focuses exclusively on the aspect of land and water in agriculture. Özerol, Bressers, and Coenen (2012, 59) developed an approach that focuses on "interactions and tensions" among the policy sectors, and not, for instance, on the inclusion of all aspects of sustainable development.

Özerol and Bressers (2017, 46) conceptualise irrigated agriculture as two subsystems (the governance system and the agroecosystem), and aim at developing a model which combines farmers' decision-making and resource governance. They state that both systems influence agrarian and environmental changes and therefore make farmers the focal point of their research. Of these works, however, only Özerol, Bressers, and Coenen (2012) address the need for a framework which focuses specifically on the scales of water governance in irrigated agriculture and their alignment across sectors or have produced a framework which may accordingly provide meaningful application to countries in Southeast Asia. Hence, the approach, based on the governance model by Bressers and Kuks (2003) focuses not only on water governance in irrigated agriculture but also on cross-sectoral alignment.

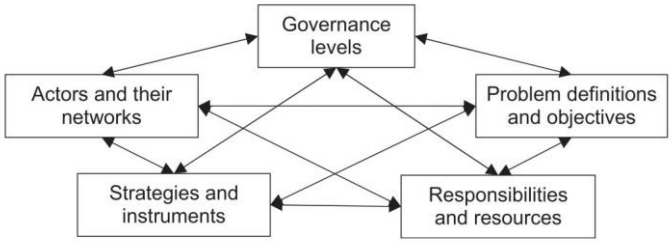
1.2.3. Governance Model and Cross-Sectoral Alignment for Irrigated Agriculture

Cross-sectoral alignment is the primary focus and also unique characteristic of the governance model and approach formulated by Özerol, Bressers, and Coenen (2012, 59). Based on IWRM principles but focused on irrigated agriculture, the authors propose cross-sectoral alignment as a means of analysis for "cross-sectoral issues in general, and the environmental impact of irrigated agriculture in particular" and define the concept as "the relative positioning of multiple policy sectors conducive to sustainable governance of natural resources" (Özerol, Bressers, and Coenen 2012, 59). This is based on the understanding that the governance of sectors does not happen at only one or several separate levels but results from constant interaction between levels with actors who may also act on different levels of government and are not necessarily confined to only one level, thus emphasising the multi-level governance nature of the approach (Bressers and Kuks 2003, 65). This definition can be broken down into three main points, the first being 'relative positioning'. Relative positioning indicates the different policy sectors' sub-systems of governance and their actors, levels, instruments and approaches. The second point – 'conduciveness' – refers to the somewhat normative position

this approach suggests. It is expected that the alignment of policy sectors brings about sustainable governance for natural resources through complementary and comparable positions within the governance sub-systems. The third point refers to the conduciveness, or contribution, of an alignment perspective to sustainable governance. (Özerol, Bressers, and Coenen 2012, 59)

In order to be able to analyse the alignment across sectors, Özerol, Bressers, and Coenen (2012, 59) construct a system which is based on and developed from the conceptual model of governance by Bressers and Kuks (2003). It displays five interrelated elements (Figure 1) that help demonstrate governance systems' many-sided nature. The authors suggest that with these five elements a governance pattern of a defined policy field can be adequately described.

Figure 1: Conceptual Model of Governance by Bressers and Kuks (2003)



Source: Özerol, Bressers, and Coenen 2012, 59.

Corresponding to these five elements, five questions are to be answered: Where? Who? What? How? With What?

Governance levels (*where*?) do not only refer to administration levels but also denote the multi-level character inherent to policy implementation. It questions which levels dominate policy and policy debates, and in which relation they stand, the relations between administrative levels of government, and how the interactions between the different administrative levels are arranged. (Bressers and Kuks 2003, 71, 74)

Similarly, the categories of *actors and policy networks* (*who?*), must also be considered since governance has a multi-actor aspect. Who can possibly participate and who is actually participating in the policy arena and in what position? Who is a stakeholder and who has user rights or other forms of relevant ownership? And how are the public, experts and politicians positioned to each other. (Bressers and Kuks 2003, 71, 74)

Problem definitions and objectives (*what?*) denote the multi-faceted character of governance with emphasis placed not only on objectives but also on possible problems. What is perceived as a problem? What are the perceived causes of this problem, and does it pose a problem only for single individuals or for the society at large? Which functions does a sector have? Is the problem new and does it have political salience? (Bressers and Kuks 2003, 71, 74)

Responsibilities and resources (*with what?*) take the multi-resource basis for policy implementation into account, as well as the (governmental as well as non-governmental) organisations involved into consideration. What are their responsibilities? Which authority do they possess and which resources are at their disposal. (Bressers and Kuks 2003, 71, 74)

Strategies and instruments (*how?*) consider the multi-instrumental character of strategies for policy implementation. Which instruments are used and which characteristics do they possess? What is the target group? Do the instruments provide flexibility? Are there incentives that encourage learning behaviour? Are resources for implementation available and how are costs and benefits distributed? Are changes in user rights and ownership accounted for? (Bressers and Kuks 2003, 71)

Through their interconnectedness, these five dimensions and the related questions can provide an extensive framework for the analysis of the alignment of various policy sectors. All five elements relate and give context to each other. In fact, they even "tend to adjust to each other if not affected by outside influences" (Bressers and Kuks 2003, 75).

Furthermore, Özerol, Bressers, and Coenen (2012, 59) propose three additional criteria for the analysis of cross-sectoral alignment. These are actor representation, issue boundaries and working procedures. Each of these criteria has relevant aspects – or categories – which relate to the different dimensions of the governance model (Table 1). In the following, it will be illustrated how these criteria are embedded in current academic theory, and how they relate to water governance in irrigated agriculture.

Table 1: Criteria of Cross-sectoral Alignment

Criterion	Related elements of the governance model
Actor representation	Levels, actors and resources
Issue boundaries	Problem definitions, objectives and instruments
Working procedures	Strategies, instruments, networks and responsibilities

Source: Özerol, Bressers, and Coenen 2012, 59.

1.2.3.1. Actor Representation

Organisation of Actors across Levels

Actor representation in natural resource governance has to take the multi-actor and the multi-level nature of governance into account (Özerol, Bressers, and Coenen 2012, 59). On the one hand, the most straightforward driver for the development of water resources is unified interests of all 'influential' actors (Molle 2008, 218), and on the other hand is the understanding that governance can be perceived as "the consequences of the interplay between attempts to intervene by all the actors involved" (Bressers and Kuks 2003, 65). Depending on the respective network of actors, the government can chose to assume a more prominent or a more minor and peripheral position (Bressers and Kuks 2003, 65). However, even though the above-mentioned 'influential actors' may refer to whoever is allowed to participate in planning processes, groups of actors can still unite and build coalitions to maximise the chances to promote their own interests (Molle 2008, 218). There is, nevertheless, an increasing recognition that it is not solely the government that decides the development of different sectors of society, but that this development is determined and created through the interactions of several actors (Bressers and Kuks 2003, 1).

Even though participatory processes are considered beneficial for the improvement of multi-level environmental governance, however, various challenges to participation in multi-level governance can be found. In order to find solutions, policy makers may seek out scientific knowledge and help, or, in order to enhance the legitimacy of governance, place great emphasis on either the roles of stakeholders, the public, or both. Scientific advice as well as civil society actors can be used to initiate and structure social and political arguments and debates, although there is a difference in nature and format of their evidence (Rauschmayer,

Paavola, and Wittmer 2009, 141). Participatory processes and actor representation are closely connected. Participation at various levels – either by citizens or stakeholders – describes the preparation and implementation of "collectively binding decisions" by means of involvement of "individuals or groups […] who are not part of the elected or appointed legal decision-making bodies" (Rauschmayer, Paavola, and Wittmer 2009, 142). Stakeholders must be involved in the given problem, having something 'at stake', hence the name. They get directly involved but may also be represented through other organisations, such as NGOs. Even though measuring participation is difficult due to the multi-level nature of governance, the participatory processes are essential, as they bolster legitimacy as well as effectiveness of governance solutions (Rauschmayer, Paavola, and Wittmer 2009, 142). However, the participation of different actors in decision-making processes does not only depend on their respective input but also – if not mainly – on their properties, such as information, power and objectives (Bressers and Kuks 2003, 67).

Ideally, all actors are to be represented at each level of governance. In reality, however, this is hardly achievable. Moreover, actor representation can also be liable to problems of collective action. Collective action, in turn, ties into the question whether an organisational structure is centralised or decentralised. Lai and Cistulli (2005, 2) define decentralisation as "a broad-based institutional process involving the transfer of authority and responsibility for public functions from the central government to other levels of governance". The World Bank (2013a) defines decentralisation as the transfer of "authority and responsibility of major government functions from central to sub-national governments – including local governments, civil society, and the private sector." Types of decentralisation include political, administrative, and fiscal. These are, however, not mutually exclusive. Decentralisation can give citizens the opportunity to influence decision-making processes and lead to collective action. Villages, communities, or individuals can be empowered by decentralisation, particularly if the most vulnerable groups (specifically social, ethnic, poor) are included in the process. However, decentralisation efforts can also lead to elite capture, corruption, and patronage politics. (World Bank 2013a) In regard to the decentralisation of irrigation, Garces-Restrepo, Vermillion, and Munoz (2007, 11) list five expectations (1) it reduces costs, staff requirements, and will increase productivity of systems in the long-run; (2) agricultural productivity and economic profitability of irrigation systems increase, while farmers can take direct influence on the management of irrigation systems; (3) farmers are motivated to pay (more) for the irrigation systems, because they are empowered

to take over authority over said systems; (4) accountability increases, because farmer or water-user organisations are interested in results and will thus produce more equitable water delivery; and (5) collective organisation in irrigation management can produce collective action in other areas as well, such as the group purchase of agricultural inputs. Nevertheless, decentralisation cannot be treated as the panacea of irrigated agriculture. Problems such as delays in funding, actors' resistance to decentralisation efforts, and last, the reluctance of central government to truly transfer power to local organisations can lead to failure (Zhou 2013, 78). This is the case, for example, if actors like the users of natural resources lack organisation on higher levels to collectively further their interests and thus fail to reach their goals (Özerol, Bressers, and Coenen 2012, 60). Furthermore, water management institutions are often most effective when they are managed and developed locally, as they have, for instance, a clearer understanding of the local physical boundaries and include all actors who have a concrete interest in the local water arrangements (Vaux 2011, 21–22).

Participation

An already addressed previously, an important part of actor representation consists of (public) participation. The management of water resources is relevant to many stakeholders' interests at all levels, including the public. Therefore, public participation is essential for effective water governance (Xie 2009, 55). However, participation often relates to democratic legitimacy and is thus normative in its demand. A high scalar level of collective decision-making can lead to lower possibilities for participation and thus, frequently, to greater conflicts among the stakeholders (Moss and Newig 2010, 3). Public participation, however, does not include "everyone". The public and stakeholders are often used as two distinctive terms referring to different forms of public participation. Stakeholder involvement usually denotes the involvement of interest groups in the discussion of policy problems, whereas public participation is understood as lay citizens' involvement in issues that occur at the local level. (Beierle and Cayford 2002b, 6)

Delli Priscoli (2004, 221) points out that in public participation, there are different potential fields of conflict, ethical concerns being one of the most frequent and important ones. They are mainly concerned with the allocation of costs and benefits – who gets what and who has to pay. Ethical tensions are frequently caused by old participation models that do not employ

public participation but a paternalistic approach, leaving either participants or communities dissatisfied, or both (Delli Priscoli 2004, 222). Furthermore, some kinds of environmental issues, such as technically very complex problems, or issues with broad ranges of interests, can be less favourable to public participation than others. This can happen especially in the case of difficult to achieve win-win situations, as the win of one interest group can mean a loss for another. (Beierle and Cayford 2002b, 36) There can be different aims and reasons for incorporating public participation in the (policy) planning process, although they are usually applied to improve either the effectiveness or legitimacy of decision-making, or both (Özerol and Newig 2008, 641). Moreover, there are some objectives that are commonly understood as legitimisation of public participation. Among them are an increase in public awareness, a better understanding of problem dimensions, an improved quality of decision-making by drawing on lay knowledge and (the appearance of) democratic legitimacy (Özerol and Newig 2008, 641). Likewise, it is important to keep in mind that participatory processes are generally considered a democratic instrument (see e.g.Delli Priscoli 2004). Even though their importance is regularly emphasised and discussed by many (Özerol and Newig 2008; Swyngedouw 2005; Kallis, Kiparsky, and Norgaard 2009; Beierle and Cayford 2002a; Delli Priscoli 1998), the scope in which public participation is used is thus likely to differ greatly across different political systems. Hence, public participation is not always able to achieve all of its ascribed goals or hoped-for benefits. What is more, many of these goals and benefits are difficult to measure. Additionally – and contrary to its name – public participation does not involve the public as a whole but only specific groups. The public and stakeholders are often used as two distinctive terms referring to different forms of public participation. Stakeholder involvement usually denotes the involvement of interest groups in the discussion of policy problems, whereas public participation is understood as lay citizens' involvement in issues that occur at the local level. (Beierle and Cayford 2002b, 6)

Özerol and Newig (2008, 641) attribute three main levels to public participation: information supply, which refers to authorities giving the public access to information; consultation, which means the public's – or a part of it – expression of opinion regarding the issue; and active involvement, which allows the public to actively participate in the discussion of issues. However, this last level requires rather intense interaction of actors, and may thus be limited to only a small number of actors. The establishment of effective communication between the public and authorities is one of the core points for successful public participation. However,

communication in public participation is often not conducted as a balanced two-way interaction. Instead, it favours the side of the authorities as the provider of information. In a best case scenario, the participants from the public should be compensated for their effort, both in terms of a reward and as an incentive for active participation. (Özerol and Newig 2008, 644)

The building of capacity of capacity is another dimension of public participation. Özerol and Newig (2008, 645) point out that active involvement of the public requires greater capacity than information supply and consultation, since a series of interactions can be expected. In contrast to this stands the simple provision of and response to information. Timing is regarded as another important factor for the success of public participation. Stakeholders should be involved as early as possible to achieve the best outcome possible, otherwise authorities will not be able to take full advantage of stakeholders' expertise and knowledge (Özerol and Newig 2008, 646). However, Özerol and Newig (2008, 651) point out that there are certain problems that occur regularly in public participation. The scope of participants suffers from an unclear definition of who is considered a stakeholder, and from unequally distributed opportunities. Communication can be unclear, using e.g. too difficult or highly technical language, or suffer from slow government responses. Capacity building may be hampered by a lack of knowledge on the public side, or simply a lack of institutional capacity. It can be problematic for the timing and financing of participation if the public is involved too late or if stakeholders are lacking financial support. According to the findings of Özerol and Newig (2008, 646), problems in communication and capacity building are the most common ones. The former, in particular, relates to issue boundaries as will be discussed later on.

Resources

Resources as part of actor representation asks about the distribution of power and resources. A certain actor or group of actors can have more power than another and thus dominate the policy process (Özerol, Bressers, and Coenen 2012, 60). In case a certain actor is dominant in shaping discourse and policy processes, objectives and problem focus can become part of this actor's aims and interests. A lack of representation or dominance of certain actors interferes with gaining a comprehensive picture and furthering progress in cross-sectoral issues (Özerol, Bressers, and Coenen 2012, 60). Besides, a single actor cannot fathom all available policy

options and choices because of limitations in experience, training, competence etc. To involve actors from different policy sectors can be beneficial to power and resource alignment. Going a step further, Molle, Mollinga, and Wester (2009, 336) point out that there are four categories of powerful actors which need to be considered – "politicians, construction companies, landed elites and development banks" – as they often engage in mutually beneficial favouritism. This collusion of different actors – e.g. of water business companies, politicians and banks – is identified as a synergetic relationship through which the flows of water, and thus power, are controlled and influenced; a relationship that commonly results in financial or political benefits and is shared by more or less all countries (Molle, Mollinga, and Wester 2009, 336). There are, however, several possible set-ups for actor networks and the way resources are dealt with. In the case of irrigation, for instance, landowners and farmers make up an important interest group. These 'associations' can result in competition among different groups, commonly between water and agricultural bureaucracies or ministries, which may result in a division of roles that is not necessarily beneficial. However, actors need not be divided in this way. According to Molle, Mollinga, and Wester (2009, 339), the example of Vietnam shows that responsibilities may as well be united under a single administrative body. Last, supra-national layers of governance can also impose concepts. These supra-national organisations can, at least in theory, override national strategies and enforce changes or adjustments in national water bureaucracies (see, for example, the EU Water Framework Directive) (Molle, Mollinga, and Wester 2009, 341).

1.2.3.2. Issue Boundaries

Problem Definitions and Objectives

The limitations of cross-sectoral issues need alignment in three major aspects: "the governance levels at which the issue is dealt with; the problem definition in terms of the nature and size of the issue; and the prioritisation of sectoral goals within multiple dimensions" (Özerol, Bressers, and Coenen 2012, 60). Cross-sectoral issues can occur and have consequences at every governance level. This means that the processes and interactions happening at each level have to be discussed in every policy sector. On the national level, for instance, agriculture can be seen as a means to reduce poverty and provide food security. However, the task of giving priority to certain aspects across sectors and dimensions can be challenging. The focus at the

national level is often economic development exclusively, and thus completely disregards social and environmental development elements. In consideration of a cross-sectoral alignment perspective, approaching development from such a one-dimensional angle, first, only touches the tip of the iceberg, and second, seriously impedes alignment and policy integration. As a result of the complex nature of political systems, however, it is rather unlikely that all possible or related policy sectors aim for the same goal or can be taken into consideration. (Özerol, Bressers, and Coenen 2012, 62)

Regarding the problem of alignment and issue boundaries, limiting argumentation and activities to certain levels while excluding or ignoring others is an indicator for low alignment. However, issue boundaries can be dealt with "by combining knowledge from multiple sectors, disciplines and data sources" (Özerol, Bressers, and Coenen 2012, 60). This means that shared knowledge bases, i.e. comprehensive databases, which are accessible from all sectors of policy, as well as one or more actors who are able to operate across policy sectors have the potential to advance cross-sectoral alignment in regard to issue boundaries. Furthermore, decentralisation has been an ongoing discussion in the governance sector. To achieve cross-sectoral alignment, a decentralised structure may be better suited as it also takes local stakeholders knowledge and interest into account (Chan 2009, 146).

Networks and Instruments

Networks and instruments deals with the theory behind networks. The first question one has to ask is "what constitutes a network?", as the term network is a rather broadly defined concept with recurring variables. Weber and Khademian (2008, 334) generally perceive a network as "defined by the enduring exchange relations established between organizations, individuals, and groups." These relationships can be straightforward, inter-organisational relationships between, for example, two government agencies. They may, however, also be much more complex, e.g. when formed across different sectors involving organisations, groups, and individuals.

Lejano and Ingram (2009, 653–55) examine collaborative networks based on the case of the California Bay-Delta Programme (CALFED), which has been a long-term project for policy innovation with the aim of avoiding deadlocks in water issues. They point out that there are many differing views on how to best use water. From a social-ecological point of view, water should mirror natural systems because that way fish habitats, for instance, are most likely to

flourish. From an economic perspective, by contrast, water should only be used where it is of its highest value (i.e. urban households or industry, but not necessarily in farming). This suggests that using water for agriculture is merely an unjustified subsidy, and leading water to where it is of highest value would solve all water management problems. Others focus on improving water management through technical means, namely improving recycling, distribution and reclamation. From this point of view, the main problem is the design of water management. In order to combine all these different perspectives, forums to engage in exchange and bring different actors from different government levels as well as, for instance, local actors, together is a feasible solution for the problems arising with multiple actors' perspectives, boundary issues and the general complexity of water management. Local actors are often highly knowledgeable of not only specific problems, but also the overall conditions surrounding water management. Therefore, in order to create new policies and consensus among actors, new sustainable relationships need to be established and linkages need to be created between groups. However, it is not enough to have these linkages develop by chance; together with the sharing of power, they need to be designed for the respective institution to initiate direct interaction among actors.

In addition to these considerations, managers in governance should be flexible and, at the same time, accountable for their actions and decisions. Advocating an inclusive management practice means that "[the] practice of public managers necessarily involves the intersection of actions they take that create and recreate governance structures and the ways in which governance structures enable and constrain those actions" (Feldman and Khademian 2001, 342–43). Inclusive management should incorporate different actors' knowledge, skills, resources, perspectives as well as process accountability through deliberation and transparency (Lejano and Ingram 2009, 655). In regard to issue boundaries across sectors, such practices can enhance alignment, as they may improve the transparency of decision processes' and, therefore, communication as well as collaboration across sectors.

These factors already partially depict the complexities that arise when dealing with issue boundaries and potential obstacles to be faced when trying to enhance alignment across sectors. Institutional designs need to be able to respond to these complexities. Participation processes and the concept of collaborative participation can be a means to enhance dialogue to build networks and solve issues across sectors. According to Innes and Booher (2004, 421–28), legally required procedures for public participation do often not work effectively. Since

only a limited amount of actors is involved, and, in case citizens are allowed to participate in these processes, they are frequently pitched against the government, thus amplifying adversarial discussions. Moreover, participant groups are often made up of elites, and are therefore not able to represent different interests and opinions. This does not produce viable results, as stakeholders also concerned with the issue are neither involved nor given a voice in the process of decision-making. Moreover, adversarial discussions can easily lead to deadlock situations or citizens being angered by initiatives of uninformed leaders. Collaborative participation should include stakeholders from the government as well as citizens, profit and non-profit organisations. It focuses heavily on dialogue among an inclusive set of actors, in which everyone has a similar amount of power and information and works on a task relevant to all. Furthermore, these processes can help build networks, trust and shared heuristics, which translates into social capital that can also be of use outside of the specific collaboration process. These networks are seen as becoming increasingly important due to globalised networks. Hierarchical authority is seen as becoming less effective, since information mainly flows through networks, whereas power and authority become more and more fragmented. This is increasingly relevant because biased or one-way information, e.g. experts assuming to know what information is important to decision-makers without further communication, or decision-makers assuming that experts are able to credibly answer questions important to themselves, can severely hinder effectiveness. (Cash et al. 2003, 8088)

According to Hanna (2000, 398–401), participation can also take an indirect as well as complex role in planning, since there are differences in access to information and resulting consensus building between e.g. governmental and non-governmental agencies and organisations. This, in turn, also leads to the problem of identifying who is responsible for controlling the dissemination of information, their values, ideology, interest – and whether this source is considered trustworthy by other actors or not. One of the main challenges is the integration of various demands, which are often only visible through public participation. Participation may be considered essential in planning, but information is limited by its respective dissemination system, particularly if it is restricted to e.g. institutional stakeholders only. Hidden or invisible information may even be more influential in a process' outcome than participation, while, at the same time, bias can be strengthened by withholding or spreading certain information.

Ultimately, collaborative networks can contribute to institutional capacity. Even though the processes described are idealised constructs, participation processes in general – and collaborative participation, in particular – can still effectively help in decreasing issue boundaries and produce results which may benefit all parties involved. Nevertheless, without an in-depth assessment of potential conflicts and the ex-ante identification of stakeholders, interests and resources, collaboration processes might not work or be suitable for collaborative participation in the first place. (Innes and Booher 2004, 428–31)

Tying into these issues is the concept of boundary organisations. They are involved in both politics and science, acting as intermediaries between them (Cash 2001, 432; Cash et al. 2003, 8089). As pointed out by Cash (2001, 431), one of the major challenges in agricultural decision making is the linkage between science and decision making across different levels. As an economic sector, agriculture is heavily dependent on information because of, for instance, technological developments. There is a need for information to be produced and integrated across levels. Scientific information in particular is supposed to be able to influence "social responses to public issues to the extent that the information is perceived by relevant stakeholders to be not only *credible*, but also *salient* and *legitimate*" (Cash et al. 2003, 8086). Thereby, credibility is defined as scientific evidence and arguments; salience refers to the importance of evidence and arguments to decision makers; and legitimacy indicates the perception of how information has taken stakeholders' different viewpoints into account, requiring it to be "unbiased in its conduct, and fair in its treatment of opposing views and interests" (Cash et al. 2003, 8086).

Further, the agricultural sector is not only sensitive to technological changes and embedded in the global economy but also highly susceptible to changes in natural systems such as climatic, hydrological etc. However, boundary organisations should go beyond policy and science to incorporate different levels of organisation, from the local to the national level. They are identified as organisations that help connect science with policy by linking them across levels (Cash 2001, 431–32). Boundary organisations can provide an institutionalised space "in which long-term relationships can develop and evolve, two-way communication is fostered, tools for management (such as models) are developed and utilized, and the boundary of the issue itself is negotiated" (Cash 2001, 450). Therefore, with its ability to address different actors' interests, boundary organisations, if existent, can play a vital role in addressing issue boundaries and act

as an efficient network to collect and diffuse information, and involve essential stakeholders in the decision-making process.

Aside from boundary organisations, there are instruments used in the governance process that pertain to issue boundaries and their networks and instruments. “Investments in irrigation have both a *direct effect* on agricultural productivity, farm incomes and employment, and a *multiplier effect* in terms of employment and incomes generated in the nonfarm sector” (Barker et al. 2004, 34). Therefore, financial as well as infrastructural instruments, which are frequently funded by international organisations, are usually favoured in the agricultural sector. Financial instruments such as subsidies and grants can have the benefit of creating additional income for farmers. However, monitoring systems for the use of pesticides and fertilisers as well as instruments used to improve water and resource efficiency (e.g. crop insurance, quality control or infrastructure services) and national planning documents that can give insight to efforts and goals in the water and agricultural sector should be taken into consideration as well, if applicable. (Özerol, Bressers, and Coenen 2012, 63)

Dinar and Mody (2004, 112–20) discuss the pricing of water resources as it is a particularly frequently applied instrument to gain cost recovery and increase efficiency of the water used in irrigated agriculture. Furthermore, raised water prices can have a negative impact on farmers’ incomes as well as employment and thus faces low acceptance among farmers. Water-user associations (WUA; also frequently called WUO – water-user organisation), which reinvest collected fees in irrigation infrastructure, are often a means of achieving better farmer cooperation. WUAs do not only collect water fees, but can also act as an intermediary between users and irrigation authorities, representing farmers’ interests and demands.

Chartres (2014, 32) argues that major infrastructure investments are a current trend in many Asian countries. They are, however, often focused around hydropower generation and flood prevention. The number of dams in Lao PDR has, for instance, increased from 3 in the 1970s to 10 in the mid-2000s, with 55 more dams in the planning. Many of the Asian irrigation schemes are outdated and more than 30 or 40 years old. Thus, new investment in irrigation infrastructure is required. Rethinking water allocation as well as renewing canal irrigation schemes can provide an improvement opportunity for water management. Smallholder-led irrigation through pumps is common across South Asia, with users often paying little attention to water resource constraints and environmental concerns.

Further instrument frequently used in irrigated agriculture are agricultural pesticides and nutrients. Over the last 50 years, global fertiliser use increased by 500%, with over 800% for nitrogen alone, while the world's cropland only doubled. Pesticides have contributed greatly to the increase in agricultural production. However, there is insufficient information on long-term effects and efficiency. Even though pesticides are used widely, losses for soy bean and wheat crops are estimated to be between 26-29%, and for maize and rice between 30-40% – despite the use of pesticides. Nutrient overuse can have a considerable environmental impact as well, and does, likewise, not increase efficiency. In addition to the use of pesticides, intensive agriculture is generally known to have an effect on groundwater and rivers, as nutrients are filtered from the soil and chemicals seep into it. Erosion and an increased sediment load are additional side effects and the run-off caused by farm operations contains residual nutrients that enter rivers, lakes and wetlands and are the cause of eutrophication in these water bodies. (Foley et al. 2005, 571; Lawford et al. 2013, 608; Mueller et al. 2012, 254; Foley et al. 2011, 338)

1.2.3.3. Working Procedures

Strategies and Instruments

Implementing policy instruments for irrigated agriculture requires a great deal of coordination among actors and sectors. The major examples for such instruments are the "expansion of irrigated agriculture, diffusion of water-saving irrigation technologies, and the joint regulations towards the protection of water and soil quality" (Özerol, Bressers, and Coenen 2012, 63). In order to avoid negative externalities, natural as well as physical resources have to be used at an 'optimal' level. In practice, however, reaching this 'optimal' level is unrealistic, not to say outright impossible, to realise. In irrigation, negative externalities include both, damage to the environment and human health, through for instance, the overexploitation of groundwater and water pollution. Irrigation can have positive as well as negative, and short term as well as long-term effects on different types of (poor) people – such as landless labourers, poor urban dwellers or small-scale farmers. Cheaper food and higher incomes through irrigation can reduce poverty. Yet, the positive effects may be outweighed by the negative externalities on environment and health. (Barker et al. 2004, 40; Lipton, Litchfield, and Faurès 2003, 425)

The achievement of network effectiveness in a problem setting such as water governance in irrigated agriculture calls for collaborative capacity, i.e. a long- and short-term problem solving

capacity, and supporting the accountability of public action (Weber and Khademian 2008, 335). Different sectors design and implement their own policy instruments. This can lead to overlaps or even conflicts with other sectors, in case they have already implemented similar measures or acted contrarily to other sectors' instruments. Discovering a solution to these overlaps and conflicts can be difficult to achieve, since miscommunication across sectors and among the relevant actors frequently occurs. (Özerol, Bressers, and Coenen 2012, 60) Expansion of irrigated agriculture often involves interferences with water and land development due to the necessary consolidation of land. At the same time, services such as subsurface drainage to avoid waterlogging or soil salinization, the promotion of water-saving irrigation methods, and the provision of training for farmers to enable them to successfully implement these measures is vital. Mismanagement of farm land can lead to the aforementioned problems, which can force farmers to abandon their land. The development of legal frameworks to protect water and soil from agricultural pollution, and the capacity to implement them at the local level can serve as additional indicators for cross-sectoral alignment. (Özerol, Bressers, and Coenen 2012, 63; Hussain 2004, 4) Furthermore, the promotion of water-saving irrigation methods can lead to more efficient water-use by farmers. One of the main sources for irrigation is groundwater, since it is available throughout the year. However, sustainable groundwater use relies on not exceeding the aquifer's yield. The use of groundwater is often vulnerable to the tragedy of the commons, "which arises when each user pumps to maximize his or her own benefit, knowing that others are doing the same but with the ultimate result that the resource stock is depleted to the point that everyone loses" (McLaughlin and Kinzelbach 2015, 4974). In case this happens, farmers would have to return to rain-fed agriculture and thus lower und less stable yields. Regulating access to groundwater and prohibiting over-pumping, as well as educating farmers on the possible environmental and economic repercussions are possible instruments in evading groundwater deterioration. The development of capacity plays and important role in irrigated agriculture, as local communities in particular need to be educated, so that they can participate in the governance process. (Lawford et al. 2013, 614)

Another aspect of strategies and instruments is the investment in staff training in order to expand knowledge and capacity for irrigation. The reform of existing institutions to build up a cadre of staff who are versed in innovation, environmental sustainability and water-use efficiency is crucial, as opposed to "moribund departments" whose activities are based around

"licencing and regulation – in some cases licensing and extraction of water, driven by bribery and other forms of corruption" (Chartres 2014, 33–34) in Asia.

Networks and Responsibilities

Monitoring or evaluation processes across sectors are rare. However, there is potential for cooperation. Implementing monitoring and evaluation systems for resources can help actors to achieve a higher degree of cooperation and to discern common goals. Achieving successful cooperation through monitoring and evaluation processes would require actors to realise the potential benefits of doing so. (Özerol, Bressers, and Coenen 2012, 60) Collaborating while designing and implementing policies across sectors does not only require interdisciplinary research and participation from a broad range of actors. "Intersectoral research initiatives and intersectoral bodies, which have with [sic] authority and resources and function on a regular basis, are the two indicators of collaborative working procedures" (Özerol, Bressers, and Coenen 2012, 60).

Collaboration is supposed to support and enhance mutual understanding among different parties during the governance process and can even be a starting point for innovation and learning. When dealing with smaller-scale and decentralised processes of common-pool resources, collaboration can be less complicated than when dealing with large-scale processes. Under a collaborative framework, stakeholder groups, agencies and other representatives participate in the governance process and work together across levels. It is not only a means to solve complex problems but also a way of creating new networks through which new competencies can be developed and sustained. However, innovation through collaboration can sometimes be more easily achieved through informal interaction between stakeholders and agencies. (Kallis, Kiparsky, and Norgaard 2009, 631; Fish, Ioris, and Watson 2010, 5626) Conditions for creating a collaborative governance framework include, for example, a relative balance of legal, political and economic power, stakeholders with 'enough' resources and knowledge to create new solutions and manage knowledge transfer, reception and integration across participants, and the willingness of different factions to work together and search for alternative solutions. Moreover, it is important to discern under what conditions innovative agreements occur and which processes or working groups preceded these agreements. (Kallis, Kiparsky, and Norgaard 2009, 637; Weber and Khademian 2008, 334) As with issue boundaries, boundary organisations can facilitate the collaboration process by encouraging shared learning

and providing a chance for direct and personal engagement of different actors, while offering the opportunity to create a shared language to discuss problems and solutions. Within the boundary organisations, boundary objects are used to create a shared or common language to allow to understand each other. These boundary objects can be, for instance, maps, reports, and even workshops. They offer a shared vocabulary to discuss problems and examine and re-organise problems from different perspectives. Creating a shared language can, furthermore, have the added benefit of what Jessop (1998, 33) calls 'noise reduction'. According to him, 'noise reduction' represents a key to successful negotiations, and is achieved by the reduction of a mutual lack of understanding, entailing an enhancement of understanding for other actors' or institutions' unique logic, identity or interests. To merely create a boundary organisation or object is, however, not sufficient. So-called 'bridge researchers' understand the workings of agencies and are able to adapt their roles between research and implementation. They can help transferring new information and understandings, and are thus essential. Moreover, safe spaces where actors can discuss problems freely need to be created. Yet, a safe space can also enforce the image of actors closing themselves off from the public (Kallis, Kiparsky, and Norgaard 2009, 637–38).

However, collaborative governance procedures are not capable of overcoming distributive issues of environmental governance, a core issue that can be found frequently in water conflicts. It can be argued that a governance approach encourages a collective resolution of distributive problems. However, the state cannot be completely absolved from dealing with these issues and has to take ultimate responsibility. (Petersen, Klauer, and Manstetten 2009, 2059; Fish, Ioris, and Watson 2010, 5624) Collaborative governance is also not the same as participatory governance, where citizens are actively involved in the decision-making process. A major criticism of collaborative governance is that a democratic decision-making process in collaborative governance is weakened because it strengthens those who have greater access to the newly created governance mechanisms, e.g. powerful non-governmental organisations (NGOs) "that come to speak for citizens or the environment in these processes" (Kallis, Kiparsky, and Norgaard 2009, 639). Institutional governing arrangements that were previously supplied and organised by the (local or national) state representatives are now in the hands of civil society and private economic actors, giving them a better position in influencing administration and implementation as part of the policy-making process. Besides, the new language created by boundary artefacts within the collaborative process favours those who are willing to

acknowledge and use them. On the other hand, collaboration is a means to resolve stalemates between actors with power, and thus, offers a comparatively pragmatic response to resource conflicts. In order to ensure successful collaboration during the working process, informality, self-organising interaction as well as constant boundary work is needed. (Kallis, Kiparsky, and Norgaard 2009, 639; Swyngedouw 2005, 1992)

Research Gap

After a review of the current literature on water governance in general and water governance in irrigated agriculture in particular, it is apparent that it a complex concept with various interconnected threads. As water governance in irrigated agriculture, and specifically integrated approaches, are a relatively young research area, there is only a limited amount of research, approaches, and information feasible for this master's thesis, as theoretical approaches are either still evolving or too broad in their application. Approaches that combines several dimensions and focus on the integration and interconnectedness of these dimensions, prove to be the most suitable for this area of research.

Moreover, there is a lack of frameworks which focus on the scales of water governance and particularly the alignment across sectors and levels. Özerol, Bressers, and Coenen's (2012) approach is unique in its application and takes most factors deemed important for water governance into account, namely different actors, participation, networks and decision-making processes, and instruments. However, there is a lack of comparative research – especially for East Asian countries. Therefore, this thesis aims at contributing to the analysis of governance patterns in irrigated agriculture in East Asia and establish whether regional trends in water governance in irrigated agriculture can be detected.

1.3. Analytical Framework

1.3.1. General Approach

As has been shown in this chapter, governance as a concept can be opaque in its meaning, as it relies to a strong degree on its interpretation, application, the aspects taken into account, and the subject or sector considered. This thesis will follow an integrative and eclectic approach, incorporating ideas from land, water and environmental governance. The framework's focus will be primarily on the various publications addressing water governance in irrigated

agriculture by Özerol and Bressers (2015, 2017), Özerol, Bressers, and Coenen (2012), and Özerol and Newig (2008), with emphasis in the proposed analytic criteria and categories by Özerol, Bressers, and Coenen's (2012, 60) criteria of cross-sectoral alignment.

Table 2: Criteria of Cross-sectoral Alignment

Criterion	Categories related to the elements of the governance model
Actor Representation	Actors and levels, participation, resources
Issue Boundaries	Problem definitions and objectives, networks and instruments
Working Procedures	Strategies and instruments

Source: Adapted from Özerol, Bressers, and Coenen 2012, 59.

The figure highlights that the aim of this framework is to "empirically analyse cross-sectoral alignment by applying the criteria with data […]" (Özerol, Bressers, and Coenen 2012, 60). Thus, the following chapter will elaborate on how the theoretical literature can be applied as an analytical framework, with categories and criteria and its practical application for analysis. The categories, thus, already relate to the indicators that can be found in the analytical framework, which will provide the basis for the analysis of the country cases in the following chapter. Given the limitations of this master's thesis, the categories and indicators need to be narrowed down in order to enable feasible application and give concrete examples of their respective indicator's execution and limitation. The knowledge and tools needed to develop the frameworks' indicators come mainly from social as well as ecological science. In addition, this framework and the following analysis will draw on a diverse set of literature and documents, including academic writings from various fields of study, research from international collaboration projects, development agencies' reports, and government documents.

The matrix will comprehensively summarise the major points of each criterion and sub-category. These can then be later filled-in and compared, allowing for an easy comparison of the chosen countries. Furthermore, to be able to put the findings into context, background information on the respective country case and the status of their water resources will be given in the country profiles at the beginning of chapter 2.

The framework aims at providing the means for analysing the current state of water governance in a given country with a specific focus on irrigated agriculture and cross-sectoral alignment.

Considering that there are many different factors that can influence the state of irrigated agriculture - e.g. environmental changes, farmers' personal reasons, decisions and education, state of gender equality etc. – and the general breadth of environmental governance approaches in particular, this thesis and the analytical framework will mainly focus on the different governmental set-ups, projects, and focus areas. The qualitative approach highlights contextual factors and their relationships with each other embedded into a governance framework and will ultimately help to answer the research question: "*What are the similarities and differences in freshwater governance in the sector of irrigated agriculture in China, Malaysia and Vietnam?"*

1.3.2. Actor Representation

Organisation across levels and actors

The first category of the criterion actor representation is the organisation across levels and actors. The category actor representation illustrates the multi-level and multi-actor nature of water governance. Understanding how actors are involved across levels facilitates a clearer understanding about the setting in which they operate, as well as how this setting pertains and shapes interests and incentives. This category has four different indicators which aim to give an overview of the category and provide insight into how actors are organised and who is involved in the decision making processes. For effective, inclusive, and aligned water governance in irrigated agriculture, it is important to outline the 'influential actors' as outlined in the state of the art. Thus, not only are governmental actors from water and agriculture sectors involved, but also non-governmental organisations as well as the farmers themselves. The latter often in form of water-user associations that represent farmer's needs. Hence, the first indicator should seek to establish the actors who are generally involved in water governance in irrigated agriculture in a given country and give a general overview over the actors involved.

The second indicator is the organisational structure. The government is, in a best-case scenario, not the only actor active in the governance of water for the agricultural sector. Action is decided upon by the interplay of several actors. However, depending on the general organisational structure, it should be determined whether the organisational structure tend to be centralised

or decentralised. A centralised organisational structure is mainly indicated through a top-down approach, with all decision-making power being located on a high-level of government. A decentralised approach would be indicated by, for instance, policy-makers seeking out assistance by including stakeholders, for instance in the form of water-user associations, or the public in the decision-making process. Furthermore, a decentralised organisational structure can be conducive to cross-sectoral alignment, as local stakeholder's knowledge is or can be taken into account. As shown in the review of the current literature on water governance, water management institutions are most effective when they are managed and developed on the local level, a decentralised approach to water governance in irrigated agriculture is favourable. Further, and under the assumption that local water-users have the best knowledge of local irrigation systems, decentralising irrigation governance can lead to improvements in irrigation, water equity, reduced water conflicts, and overall more sustainable and efficient irrigation. It can affect actors' incentives for engaging in irrigation management and collective action, as farmers are presumably better able to develop appropriate rules for irrigation management than government agents. However, decentralised irrigation does not necessarily mean that access to water is distributed equally and it does also not guarantee that collective action does occur. The World Bank (2013a) lists potential disadvantages and dangers of decentralisation as follows:

- elite capture, corruption, and patronage politics;
- inability to hold representatives accountable for their actions and unclear decision-making that affects accountability;
- inadequate or fragmented knowledge of local actors.

Thus, decentralised governance systems are not a panacea, making a mixture of institutional arrangements between centralised and decentralised systems the most viable option for managing irrigation resources (Zhou 2013, 77).

To further analyse the actor representation in irrigated agriculture, it needs to be established whether the involved actors are represented at different levels of government. In an optimal setting, all actors should be represented at all levels of government. In the practical application by Özerol, Bressers, and Coenen (2012, 61–62), the authors examine actor representation by analysing the organisational set-up (national, regional and local level), and state that a diverse organisational structure is an indicator for decentralisation as well as frequently unaligned

resources in the decision-making process. Furthermore, the involvement of non-governmental and governmental actors on different levels has to be taken into account.

Participation

As the first and major indicator of participation, the existence of mechanisms that enable participation are most important. Participation is not a given, as decrees such as the Aarhus Convention are relatively new and not globally established. However, having the public participate in water governance is essential, as an increase in public awareness, understanding of immediate problem dimensions as well as stakeholder interests are best included this way. For the use of the analytical framework, and as proposed by Beierle and Cayford (2002b, 6), this notion does not include "individual actions or power politics" such as votes for elected officials, lobbying, initiatives or referenda, but focuses on "organized bureaucratic process". In cases in which decision-making processes are closed-off from the public, or at least shielded from those affected by a specific project, unbalanced governance decisions and a de-politicised public can be the result (Molle 2008, 222–23).

A further point of analysis is the participation of farmers as key actors in agricultural water management. One rather common way to include farmers in water management decisions is via means of water-user organisations. These, however, need to be acknowledged by the relevant state authorities in order to facilitate participatory functions effectively. For water governance in irrigated agriculture, the involvement of lay citizens – in this case farmers – are essential. Decentralised systems in which farmers are key-actors have proven to perform better, with more efficient operation and management (O&M), higher productivity, and higher collection rate of water and irrigation fees. Therefore, participatory resource management is correlated with higher performance (Hussain 2004, 4). Participatory management and involvement of lay citizens can occur in the form of groups or associations, most commonly water-user associations. Moreover, the balance of communication should – in a best case scenario – be a two-way interaction. One-way communication usually establishes the authorities as the provider of information, and does thus not take knowledge, needs, and interests of the local level into account. Otherwise, authorities cannot take full advantage of local expertise and knowledge. In the end, participation can help to create a bottom-up approach that enhances interaction between agencies (horizontal) and across local, regional

and state boundaries (vertical), thus tying in to what is also required and advocated by IWRM. What is more, it is important to keep in mind that the mechanics of public participation are not only considered an instrument of democratic institutions but also an inherently decentralising concept. (Delli Priscoli 2004, 225, 1998, 171) They may thus support (idealistic) values or mind-sets that are not necessarily valued by all. Furthermore, Ioris (2009, 828) showed in his study regarding the implementation of integrated water management in Brazil how policy instruments are dominated by the strongest stakeholders, leaving little space for smaller actors. Participatory irrigation management – as well as the transfer of irrigation management to farmers – was implemented in many Asian countries around 20 to 30 years ago (Chartres 2014, 33). If, however, the responsible agencies are not reformed accordingly, these schemes are likely unsuccessful. Özerol, Bressers, and Coenen (2012, 62) pay close attention to the mechanisms of decision-making, as their country of analysis, Turkey, did not sign the Aarhus Convention. The Aarhus Convention establishes the right of access to environmental information, the right for public participation in environmental decisions, and the right to review and challenge public decisions within the European Union (EC 2017).

Resources

Distribution of power and resources can serve as another indicator for actor representation. How are power and resources distributed? Have certain actors more power or resources than others and does this make them dominant in policy processes regarding cross-sectoral issues? (Özerol, Bressers, and Coenen 2012, 60)

Having one dominant actor in water governance, this actor is able to shape discourse and interests. Frequently going hand in hand with a lack of representation, a single dominant actor, e.g. in form of a ministry or agency, can obstruct a comprehensive policy process that includes diverse interests from all levels. As an example serves the case of Turkey. Here, the State Hydraulic Works under the Ministry of Water is the most dominant actor in irrigated agriculture, even though the Ministry of Agriculture should be responsible for the implementation of policies and rural development, its actions regarding water management and environmental protection are limited. Thus, the discourse is predominantly shaped by the State Hydraulic Works. Further, different bureaucratic institutions often stand in competition with each other over influence and resources. Overlapping or not clearly defined responsibilities can be among

the reasons, as well as the restructuring of ministries due to, for instance, a new government. As a consequence, this can lead to unaligned resources. This does, nevertheless, not necessarily constitute that there are generally no bodies which combine different groups of actors and find strategies to work together. There can be associations between, for instance, agricultural and water bureaucracies that work well together, or governmental set-ups than combine water and agriculture in one body and thus enables more efficient water governance for the irrigated agriculture sector. (Özerol, Bressers, and Coenen 2012, 62)

Lastly, the existence of supra-national strategies need to be considered. In the case of the European Union, a supra-national framework which eclipses national bureaucracies would, for instance, be the EU Water Framework Directive. In case such a framework is in place, national bureaucracies have to adapt their strategies and resources to the demands of the supra-national strategy. There are, however, not many organisations world-wide that can take this kind of influence in national resource strategies, as they are not particularly common on a global scale. More often, supra-national organisations can give advice or make demands in exchange for investment. Such conventions are most likely to be found with the United Nations, the World Bank, or the World Trade Organisation (WTO), and in the case of Southeast Asian countries also possibly with ASEAN. In case a supranational agreement or convention has been signed and accepted by a given country, its guidelines need to be implemented and adapted at the national level. This can influence current policies and working procedures, which then need to be adjusted and can have a strong influence on decision-makers and, further down the line, also instruments used and working procedures.

1.3.3. Issue Boundaries

The criterion issue boundaries is split into two categories: problem definitions and objectives, and networks and instruments. This criterion addresses the different policies, legal requirements, and planning documents. Its focus, however, are the range of instruments used in irrigated agriculture. While the former criterion actor representation was mainly concerned with the different actors involved, issue boundaries has a stronger environmental focus, taking for instance the use of fertilisers and pesticides and their impact on the environment into account.

Problem Definitions and Objectives

Problem definitions and objectives denotes the cross-sectoral character of water governance in irrigated agriculture. Here, as with the criterion actor representation, the representation of irrigated agriculture across levels is essential. In this case, however, it is not of concern whether actors are represented, but whether the issue – irrigated agriculture – is. As irrigated agriculture can have different emphases, such as being majorly considered as providing work-places, or for instance, a means to increase national food security, it can be challenging to have aligned local, regional and national practices. Thus, actors' actions have different implications, depending on the level of governance and the actors' organisational structure. The Turkish Ministry for Agriculture has, for instance, a very centralistic organisation structure, which is reflected in their lack of interest in sub-national levels, where irrigated agriculture is not represented. The Ministry of Environment misses organisational structure not only on the regional but also on the basin level, which is essential for an aligned sector. (Özerol, Bressers, and Coenen 2012, 62) However, the alignment of issues across levels can be difficult to achieve and measure. It can be indicated by, for instance, combined knowledge databases or actors that explicitly act across sectors. The former furthers alignment through counteracting the fragmentation of knowledge and by being conducive to collaborative efforts. The latter can help further the alignment of local, regional, and national practices. Furthermore, the decentralisation of irrigation management can improve the reliability of water delivery, as farmers' and labourers' needs are taken into account as well. This is important in particular for the tail end of big irrigation works, where water delivery is frequently less reliable. Through a decentralised approach, increased productivity and income for farmers can be gained. (Hussain 2004, 5)

Networks and Instrument

This section deals with the different embodiments networks and instruments can take in water governance in irrigated agriculture. Irrigation is a crucial part of technologies, institutions, and policies employed by governments to increase agricultural output. It can also be an effective tool to generate greater productivity, provide income, employment, and higher wages. For

farmers, having steady access to irrigation water can mean less risk in investing in new seeds, pesticides, and fertilisers. Those, in turn, can improve yields and income as well as lessen environmental impact (Hussain 2004, 1–2).

Boundary organisations can be considered a network as well as an instrument. In a best case scenario, a boundary organisation combines politics, science, and lay knowledge as well as actors from all levels and sectors involved. In agricultural decision-making processes, linking these different kinds of knowledge and actors across levels is a major challenge. The features of the boundary organisation, if existent, are analysed, as well as possible collaborative procedures and set-ups. Is the organisation solely founded for the purpose of disseminating information? A boundary organisation should combine knowledge from different sectors, namely: politics, science and operate with stakeholder's knowledge across levels, but at least incorporate local and national level actors. A well-developed boundary organisation, and also other or similar collaborative endeavours, have the ability to address issue boundaries and act as a network with the essential stakeholders involved. However, one of the drawbacks of this indicator is that is can only come into effect if there actually is a boundary organisation or collaboration for water governance in irrigated agriculture in a given country.

While boundary organisations depend heavily on cross-sectoral and cross-level interaction within an organisation, the instruments used to address issue boundaries can take on multiple forms. Investments in irrigated agriculture, for instance, can have direct effects on productivity and employment. But they can also act as a multiplier for employment and income. Financial instruments are often the favoured tools in the agricultural sector, such as subsidies or grants, which then, in turn, can have the additional benefit of creating income for farmers.

In order to improve resource efficiency pricing mechanisms, quality control standards, or infrastructure services are commonly found tools. The use of pricing mechanisms is particularly often employed. The Water Framework Directive (EC 2016), for instance, calls for full cost recovery through water pricing mechanisms. However, pricing mechanisms are often difficult to implement and have to be adapted to the local institutional setting and conditions, and are further often not based on economic principles. They therefore do frequently not achieve cost recovery and are dependent on the cooperation of farmers. In Tunisia, for instance, subsidies for technological equipment to improve irrigation infrastructure and efficiency has increased farmers' acceptance of water tariffs. In Thailand, fees can be collected from water users.

However, the state is not allowed to profit from the fees, as they have to be reinvested in irrigation development (Dinar and Mody 2004, 112–20). Higher water charges and decentralised systems have proven to sustain a more equitable distribution. In contrast, in South Asia, irrigation water fees are considered low, which triggers "a vicious circle of poor irrigation performance, leading to low agricultural productivity and the perpetuation of poverty. Fees in this region tend to disappear into central government coffers and are not earmarked for recycling to irrigation managers for improved system performance" (Hussain 2004, 4). The maintenance and operation of infrastructure such as irrigation systems is often suffering from inefficiencies. Even though irrigation is mostly advantageous for agriculture, it can cause waterlogging for the soil or produce salinization effects. Additionally, groundwater pumping - as an infrastructural instrument for instance – can require substantial amounts of energy, which is, in turn, frequently connected with great costs for farmers (Lawford et al. 2013, 608). Further technologies to improve resource efficiency are, among others, precision irrigation or precision land levelling. These methods have been proven to improve water efficiency, as they can raise crop yields by 15 – 20% and reduce water use by 20-30 %. However, they have not yet been widely adopted, as they require training and knowledge. (Hussain 2004, 5) A possibility to increase water storage capacity is aquifer storage. Aquifer storage offers the circumvention of evaporative water loss, sedimentation, and the avoidance of costs for dams or similar (Vaux 2011, 20). Storing water in aquifers can enable water scarce countries to continue irrigation during periods of scarcity or drought, and can thus help alleviate economic stress for the rural population.

The existence of monitoring systems and national planning documents for water governance in irrigated agriculture ties into the issue boundaries criterion as well. While the use of pesticides and fertilisers have contributed greatly to an increased output and efficiency in irrigated agriculture, their usage is often too high in relation to their benefits and yield. Monitoring systems in particular address both, networks and instruments, as a monitoring system can be seen as a network, depending on its set-up, as well as an instrument to supervise the use of fertilisers of pesticides. Poisoning through exposure is also a heavy risk for agricultural workers with around 20,000 deaths per year. Due to frequently inadequate monitoring of pesticides as well as disregarded regulations, many of these deaths occur in developing countries. (Sharma and Sanghi 2012, 3–4) Thus, monitoring the use of pesticides is not only an important component of water governance in irrigated agriculture, but a necessary

one (McLaughlin and Kinzelbach 2015, 4975). National planning documents give an idea of the importance of irrigated agriculture and which areas a government focuses on. They outline key areas as well as issues that need to be addressed or that should be addressed in the future. They can also illuminate if there is a strong environmental or economic focus, and what kind of initiatives are planned in the future. National planning documents are often symbolic for the awareness of certain problems, particularly if they focus on more than one area, i.e. water, land, and environment. However, as the name says, these documents are merely plans and thus, do not necessarily lead to action. Looking at the rules under which stakeholders – which may be individuals or specific groups such a farmers' associations or ministries – have to operate as well as the organisations relevant to the issue (for instance ministries, agencies, individuals) are part of the analysis. Rules can include laws, regulations as well as planning documents. The letter also pertaining to the criterion of strategies and instruments in this framework. Laws in particular can be of significance, as they are frequently referred to. They are, however, often not enforced equally.

1.3.4. Working Procedures

While the previous criterion issue boundaries discussed the different instruments used in irrigated agriculture, and actor representation discussed who is involved, working procedures outlines the actors responsible for undertaking these actions. Overlaps with other criteria may occur, as these sections are interconnected.

Strategies and Instruments

This category aims at illuminating who the actor undertaking the investments discussed in the previous criterion are. Different sectors may implement policy instruments as best fits their particular needs. Thus, overlaps or cross-sectoral conflicts may occur. For example, one rather famous case for a modernising strategy in irrigation infrastructure is the South Korean Saemaul Undong [3] programme, where massive investments were made for the modernisation of agriculture in the 1970s. The programme allowed the regime an extension of its control down

[3] Hangul 새마을운동 translates to "New Community Movement" or "New Village Movement"

to the village level, where the movement's leaders operated as a "parallel authority to the public administrative system" (Müller 2015, 304). Protectionist measures, new techniques of cultivation, as well as seed varieties and new machinery were introduced. Rice was sold at a fixed government price and was directly subsidised, boosting rural income. Even though Saemaul Undong was not sustainable in the long run, the agricultural modernisation benefitted the rural population. (Müller 2015, 304–05) Saemaul Undong demonstrated a state led movement that directly interfered at the local level and introduced many new ideas to the sector but proved to be unsustainable. More generally speaking, irrigated agriculture can interfere with water and land development. Issues such as water-logging, soil salinization, and subsurface drainage are among the most prominent problems and are best addressed through capacity building in form of training of farmers, and projects for governmental actors. The promotion of techniques to counteract these issues is vital. Further, irrigation investment is not necessarily solely a government domain. Investments by the public-sector have proven to encourage farmers to invest privately as well, mostly in small-scale irrigation such as digging wells or boreholes. Moreover, private sector enterprises also often move to irrigated areas and contribute to economic growth through, for instance, new employment opportunities (Hussain 2004, 3).

As a consequence, the provision of training for farmers ties into the promotion of water-saving irrigation techniques. Modern techniques and methods for irrigation management require training to be used properly. But if farmers are not aware of how to correctly use these techniques, they are of little use. Enabling farmers to use water more efficiently, groundwater in particular, and not exceeding aquifer yields leads to more sustainable use of groundwater resources and contributes to bypass the tragedy of the commons. Capacity building projects are one very specific means of creating and expanding knowledge. Trained staff that is knowledgeable in environmental sustainability, innovation and water-use efficiency can contribute greatly to saving resources. Again, Turkey can serve as an example for low alignment. There, various organisations are involved in the provision of training for farmers. There is, however, little coordination among these organisations. Further, even though water-saving methods of irrigation are promoted by the relevant ministries, the implementation is dependent on the farmers and, in turn, on the training they received, incentives and the existing irrigation infrastructure. (Özerol, Bressers, and Coenen 2012, 63) Thus, even though

measures and opportunities are provided, alignment is low as not all relevant actors are considered.

Further, the existence of legislative frameworks to protect water and soil from pollution can not only serve as an indicator for cross-sectoral alignment, as they similarly to the national planning documents indicate that problem awareness exists, but they can also contribute to the protection of water and soil from pollution. Regulations for a law may, however, be incomplete, ineffective, difficult to access for citizens, or even unknown to the relevant actors (Fritz, Kaiser, and Levy 2009, 45–46).

1.3.5. Analytical Matrix

The following matrix (Table 3) summarises the previously elaborated categories and theoretical discussion. It establishes the indicators needed for the following analysis of country cases and highlights the eclectic approach of this framework. Further, it will be used to answer this thesis' research question: *What are the similarities and differences in freshwater governance in the sector of irrigated agriculture in Malaysia and Vietnam?*

Each criterion has a certain set of sub-categories with allocated indicators. The indicators include qualitative measurements, such as institutional structure, as well as many indicators that are binary in their nature, which is to indicate whether an element exists, such as national planning documents or legislative frameworks. As can be seen below, the three major criteria (actor representation, issue boundaries, and working procedures) have been kept as they were in the original matrix by Özerol, Bressers, and Coenen (2012, 59). However, the categories were slightly reorganised to better fit the above made considerations of theoretical literature on the various topics. In this regard, four points stand out. First, participation – even though not explicitly mentioned in the original work of Özerol, Bressers, and Coenen (2012) – is now part of the criterion actor representation. Second, levels and actors were originally treated as two separate categories but are now merged with (organisation across) levels and actors, as the survey of the theoretical literature has shown that both categories share a connection and fit similar indicators. Therefore, they have been grouped together. Third, the aspect of networks originally only appeared under the heading of working procedures. However, even though it is to be expected that networks will play – at least to some extent – a role in all categories,

theoretical literature suggests that they are of equally great importance in context of issue boundaries. Fourth and last, the category networks and responsibilities under the criterion working procedures will be re-allocated and divided between strategies and instruments under working procedures and networks and instruments under issue boundaries, as its focus, collaborative set-ups and procedures as well as monitoring and evaluation systems, will already be discussed under the mentioned categories and are thus redundant as a separate category with its own set of indicators.

The matrix, which represents a comprehensive version of the methodological and theoretical reflection of water governance in irrigated agriculture as discussed above, can be applied to different country cases. Some indicators may show overlaps with other categories. Therefore, while some indicators may be exclusive to one category, others may be discussed as needed. However, this only emphasises the interdependencies and relations across scale of different components in the governance system. Furthermore, categories as well as indicators will be treated equally and without a grading or ranking system, as this framework does not aim at giving more weight to one indicator than another. The interdependencies do, in turn, highlight the relations across levels and sectors.

Table 3: Analytical Matrix

Criterion	Category	Indicator
Actor Representation	(Organisation across) Levels and Actors	Involvement of actors from multiple sectors
		Organisational structure
		Representation of governmental actors at local, regional, national levels
		Representation of non-governmental actors at local, regional, national levels
	Participation	Existence of participatory mechanisms
		Farmers are key actors in agricultural water management (e.g. through WUAs)
		Communication is balanced/one-way
	Resources	Power is distributed evenly among actors
		Actor dominance
		Dichotomy between supra-national organisations & national strategies
Issue Boundaries	Problem Definitions & Objectives	Representation of irrigated agriculture across levels
		Alignment of national and local practices
		Existence of comprehensive databases
	Networks & Instruments	Boundary organisations & Collaborative bodies/initiatives
		Instruments used
		Instruments used to explicitly improve resource efficiency
		Existence of monitoring system for fertilisers, pesticides and their impacts on soil and water
		National planning documents
Working Procedures	Strategies & Instruments	Actor in charge of investment/distribution in irrigated agriculture
		Promotion of water-saving irrigation methods
		Training for farmers
		Legislative frameworks

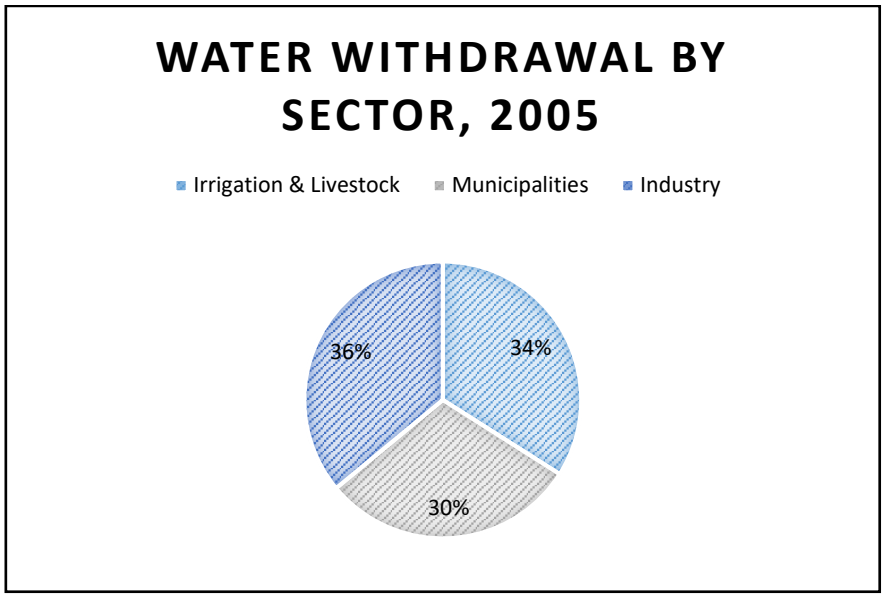
Source: Own design.

2. Empirical Analysis

2.1. Country Background – Malaysia

Malaysia is located in Southeast Asia and is split between the Malaysian peninsula (bordering Thailand in the north and Singapore in the south) and the island of Borneo, which is shared with Indonesia. Malaysia has an area of 330,800 km^2 and a population of 31,190,000 people of which 1,609,900 people are economically active in agriculture. (World Bank 2016a; Aquastat 2011a, 3; DOSM 2017) Malaysia lies in the equatorial zone, meaning that the climate is defined by northeast and southwest monsoons, which last throughout most of the year (Aquastat 2011a, 1). Especially on peninsular Malaysia, a dense network of rivers and streams can be found. Rivers are the main water source for industry, agriculture and domestic supply, as they provide 97% of water resources (Hock 2008). Annual rainfall has a volume of 950km^3. However, around 39% are lost to evapotranspiration. Total internal water resources are estimated around 580 km^3/year. (Aquastat 2011a, 4) Malaysia's river network is comprised of 189 main basins (>80km^2) and has a total of 2,986 basins (DID 2017b). Even though Malaysia is a water rich country, many parts are still subject to water scarcity or stress through droughts which can result in immense drops of the water levels (Chan 2009, 144). Water withdrawal in 2005 was at approximately 13.210km^3. Of this amount 4.520 km^3 or 34% were for agricultural uses. Surface water is available throughout the whole year and is mainly withdrawn for domestic uses and irrigation. In contrast, groundwater availability is limited and only 5% of used groundwater is appropriated for irrigation. (Aquastat 2011a, 5)

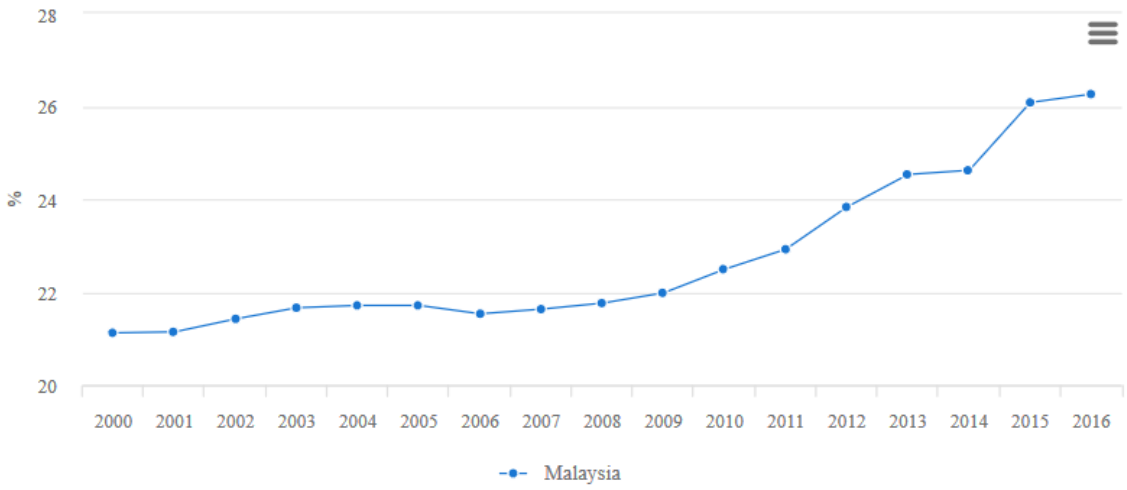
Figure 2: Water Withdrawal by Sector, Malaysia



Source: Aquastat 2011a. Own design.

Arable land is estimated to be 43% of the total area. However, in 2009, only 53% of arable land was cultivated. Agriculture contributes 8.2% to GDP and the share of agricultural land in the total land area has been increasing. The oil palm is the major GDP contributor of the sector with 46.6% and other agriculture at 18.6%, the remainder are livestock (11.4%), fishing (10.5%), rubber (7.3%), and forestry and logging (5.6%). (Aquastat 2011a, 1; DOSM 2018)

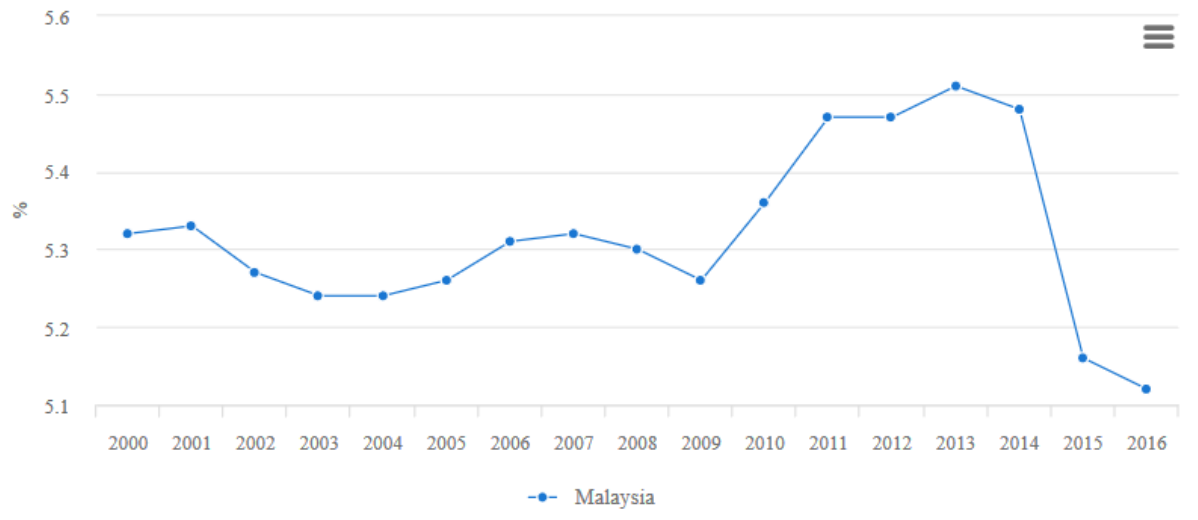
Figure 3: Development of Agricultural Land Share, Malaysia



Source: FAOSTAT 2019.

Although there was in increase in paddy production in 2016 by 28.2% as compared to 2015, the output of rice paddy decreased again in 2017. It is, however, not specified by how much. The majority of crops are permanent crops (76%), whereas the remainder are annual crops, primarily rice. As the agricultural sector is mainly making use of surface water for irrigation, groundwater use amounts to only 8%. (Aquastat 2011a, 6; DOSM 2017, 2018) Irrigation is mainly used for rice cultivation, which, in turn, is mostly done by individual farmers who only have small fields of about 1-2 ha of land available (Aquastat 2011a, 8; PEMANDU 2010, 524). The total amount of irrigated paddies in 2008 was estimated at 322,000 ha (Hock 2008). In the 1980s, the Malaysian government decided to concentrate irrigation development on the 8 major granary areas. In 2012, there were 932 irrigation schemes on Peninsular Malaysia and Sabah (north Borneo), including 8 granary schemes that were assigned to permanent paddy production, 74 mini-granary schemes and 850 non-granary schemes. (Toriman and Mokhtar 2012, 361–63) Yet, the share of agricultural land that is equipped for irrigation has been declining, as the following graph shows.

Figure 4: Land Area Equipped for Irrigation - Share in Agricultural Land (%), Malaysia

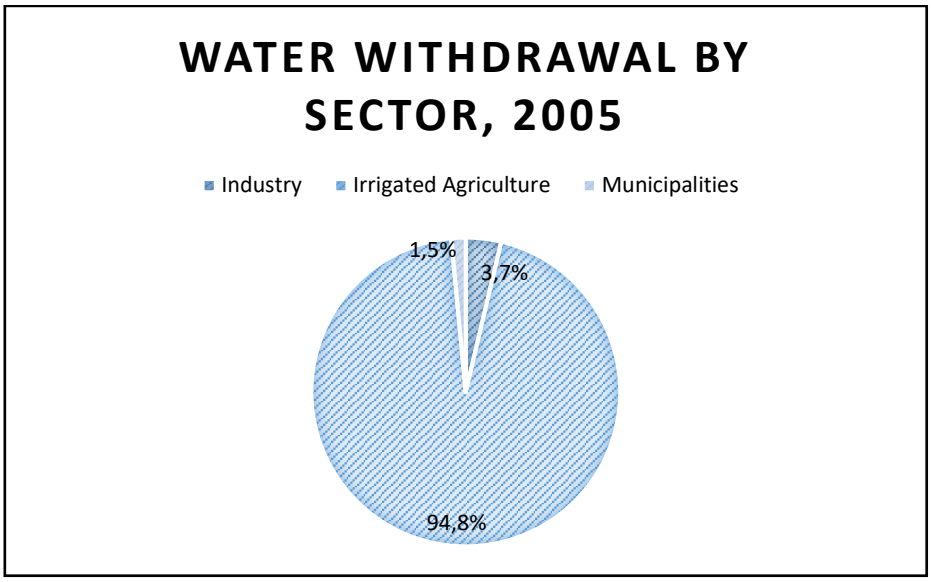


Source: FAOSTAT 2019.

2.2. Country Background – Vietnam

Vietnam, bordered by China, the South China Sea, the Gulf of Thailand, Cambodia and Laos, is located on the eastern Indochina Peninsula (Vietnam Government Portal 2018). Vietnam's total area is 331.000 km^2 with a population of 95,540,800 people. Even though the agricultural sector only contributes 18% to Vietnam's GDP, 48% of its labour force are employed in the agricultural sector. (World Bank 2016b; Sagris et al. 2017, 10) Three-quarters of the terrain is covered by mountains and hills, while the rest is covered by plains (Vietnam Government Portal 2018). Vietnam is divided into 60 main river basins, with the four main basins – Red-Thai Binh, Mekong Delta, Dong Nai, and South East Cluster – generating around 80% of Vietnam's GDP and are predicted to be under water stress by 2030 (Sagris et al. 2017, 7). In the north, the climate is subtropical, whereas it is tropical in the south. The rainy season lasts from April to May and from October to November. Due to irregular monsoon rainfall, the distribution of water resources is volatile. Up to 75% of the yearly runoff is generated in 3-4 months. Moreover, nearly 60% of the country's water resources come from outside the country and are thus easily affected by other country's located upstream. (Aquastat 2011b, 1, 5) According to the Water Environment Partnership in Asia (WEPA 2018), water availability per capita is 4170 m^3, compared to the average in Southeast Asia of 4900 m^3, this is relatively low. Total internal renewable water resources are estimated at 359.418 km^3/year (Aquastat 2011b, 5). Vietnam's river network is comprised of approximately 2,360 rivers which are longer than 10 km. The total renewable water resources amount to 884 billion m^3/year. 43% of the surface water can be sustainably exploited but only 7% of the groundwater resources. However, 63% of Vietnam's water resources originate from outside the country, thus making Vietnam highly dependent on transboundary water resources. Total water withdrawal in 2005 for agriculture, industries, and municipal purposes was 82.03 km^3/year, and 77.75 km^3/year for irrigated agriculture or 94.8% of total water withdrawals. Groundwater withdrawal accounts for only 1.7% of total water withdrawal and is mainly used for municipal water supply in Vietnam's urban areas and is thus not relevant to irrigated agriculture. (Aquastat 2011b, 6; Sagris et al. 2017, 8)

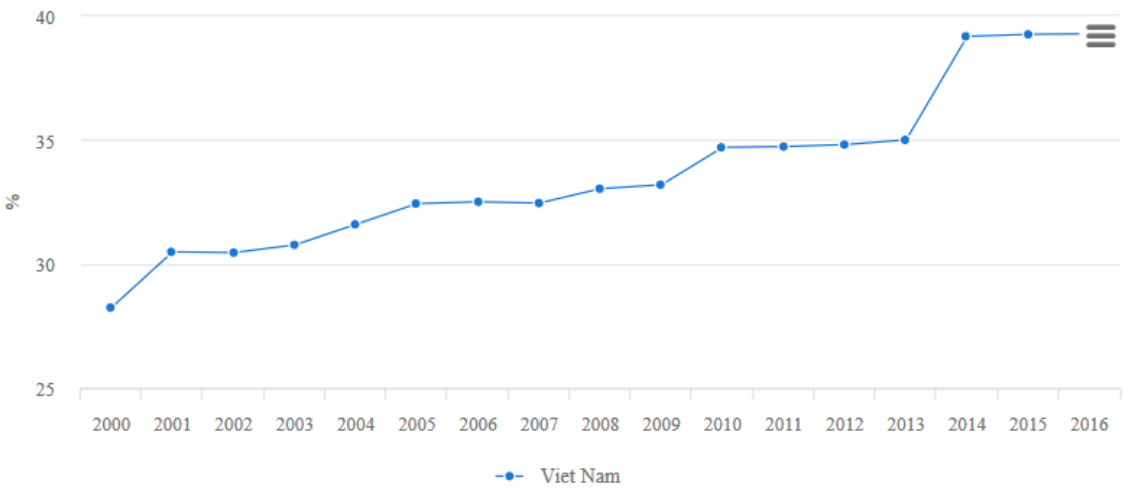
Figure 5: Water Withdrawal by Sector, Vietnam



Source: Adapted from Aquastat 2011b. Own design.

Vietnam's cultivated land was 9.63 million ha, which is 29% of the country's total area in 2011 but has increased to 39.28% in 2016. (Aquastat 2011b, 3)

Figure 6: Development of Agricultural Land Share, Vietnam

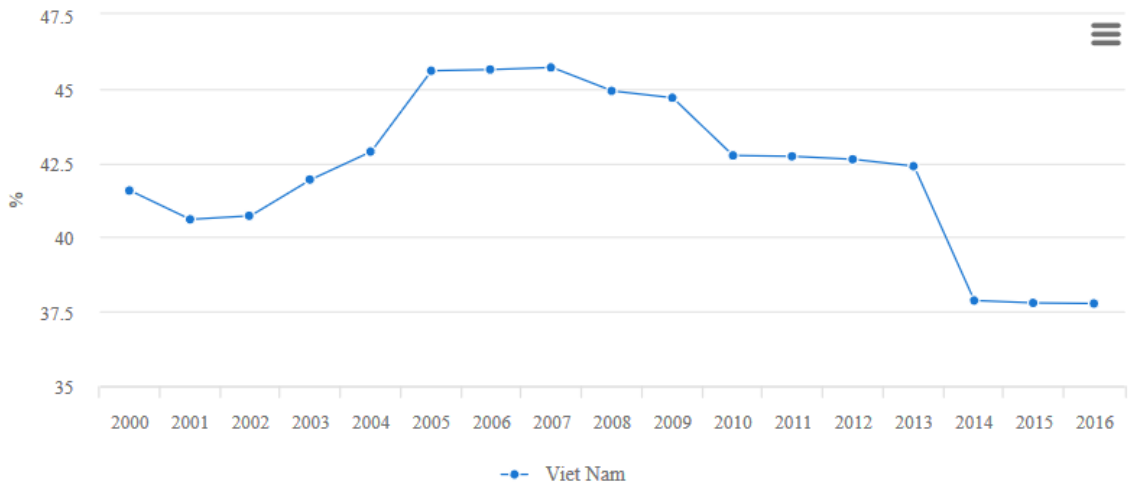


Source: FAOSTAT 2019.

Rice is the largest crop in Vietnam, accounting for 82% of the irrigated area, followed by crops such as corn, sweet potato, and coffee. Most water is used in irrigated agriculture - amounting

to roughly 80% of total water resources, but only 55% of arable land is equipped with irrigation infrastructure. The Red-Thai Basin and Mekong Basin are the agricultural key areas, with 15% and 56% of irrigation works installed. It is expected that by 2020, irrigation water use will have increased by about 30%. (Aquastat 2011b; ADB 2009, iv; Sagris et al. 2017, 10) However, as the following graph shows, the area of land equipped for irrigation has actually declined.

Figure 7: Land Area Equipped for Irrigation - Share in Agricultural Land (%), Vietnam



Source: FAOSTAT 2019.

The average farm size in Vietnam is around 0.2 ha, with the exception of the Mekong Delta, where it is 1.2 ha. Landholdings are generally small and fragmented. (Marsh and MacAulay 2003, 4) According to Barker et al. (2004, v), irrigation in Vietnam accounts for the majority of agricultural expenditure and is one of the main contributors for the growth of exports as well as agricultural employment. With 3.1 and 1 million ha gross irrigated area, the Mekong and Red river deltas are the largest irrigated areas in Vietnam. The Red river's irrigation system is mainly characterised by pumping systems, dikes and reservoirs for flood control. Whereas in the Mekong delta, individual pumps for drainage and irrigation are common. Paddy rice fields are the major crop and accounted for around 58% of the total irrigated area and 96% of the rice area is being irrigated (ADB 2009, 50; Sagris et al. 2017, 10).

2.3. Actor Representation

The criterion actor representation is split into the three segments: 1) organisation across levels and actors, which includes the actors important to water governance in irrigated agriculture in a given country; 2) participation, which establishes the existence of participatory mechanisms, how communication is handled and whether farmers are key actors in irrigated agriculture; and 3) resources, which deals with the distribution of power, establishes who the most dominant actors of the sector are and whether there are disagreements through involvement with supra-national organisations.

2.3.1. Organisation across Levels and Actors

Malaysia

Involvement and Organisation of Actors in Irrigated Agriculture

The Ministry of Agriculture and Agro-based Industries (MOA) has "the mandate to transform the agriculture and agro-based industry into a modern, dynamic and competitive sector, to position Malaysia as a major world food exporter and to develop the agriculture sector as the country's engine of growth" (Aquastat 2011a, 8).

Under the authority of MOA is the Agricultural Drainage and Irrigation Division which plans, implements and assesses irrigation, drainage and flood control projects for the whole country (Aquastat 2011a, 9). Specifically, its tasks include:

- Preparing criteria and policies for implementing agricultural infrastructure;
- Planning, implementing and assessing agricultural infrastructure as well as the development of agricultural drainage programmes;
- The provision of technical services to departments and agencies;
- Developing and providing an irrigation and drainage infrastructure database and inventory system. (MOA 2016)

There are also 8 international Agricultural Representative Offices based in Italy, the Netherlands, China, Japan, Thailand, Australia, United Arab Emirates, and the USA under the authority of MOA. The offices have been established in 2006 and 2007, and are responsible for securing market access for Malaysian agricultural products, not only to expand market access

but also to increase the quality and standards of the products. The offices have to submit regular reports, which is then used to formulate more effective policies for the agricultural sector in Malaysia. (MOA 2017)

Ministry of Water, Land and Natural Resources

Another important actor is the Ministry of Water, Land and Natural Resources (Kementerian Air, Tanah Dan Sumber Asli; KATS), which was formed in July 2018 as a restructured Ministry of Natural Resources and Environment (NRE). KATS combines the former land and natural resource component of NRE, as well as the water sector from the Ministry of Energy, Green Technology and Water, but shed the Climate Change Division and Department of Environment, which were transferred to the Ministry of Energy, Science, Technology, Environment and Climate Change (MESTECC). In regards to water and agriculture, KATS is responsible for water management, irrigation and drainage management, sewerage services, and land management. (KATS 2018a)

Department of Irrigation and Drainage

The Department of Irrigation and Drainage (DID), which was established as early as 1932, was moved from the Ministry of Agriculture and Agro-based Industry in 2004 to the NRE and then to the Ministry of Water, Land and Natural Resources. The DID has a national office as well as branches in each state. These branches (or sub-agencies) have several offices across their respective states. The DID is responsible for river basin management, which has its own division to implement integrated river basin management, water resources management and hydrology, flood management, eco-friendly drainage, and the provision of water for irrigation. Additionally, the DID also controls and manages the country's dams. (Aquastat 2011a, 4; DID 2018)

Muda Agricultural Development Authority & Kemubu Agricultural Development Authority

The Muda Agricultural Development Authority (MADA) and the Kemubu Agricultural Development Authority (KADA), which are semi-autonomous, are legally obligated to report to MOA, but under financial control by the Ministry of Finance. MADA and KADA are mandated

with the operation and improvement of irrigation systems, as well as the supply of credits or similar services to farmers in their respective regions. Both KADA and MADA also have district offices in addition to their main offices. (Aquastat 2011a, 10; KADA 2018)

Ministry of Energy, Science, Technology, Environment and Climate Change

MESTECC was founded after the general elections in 2018. It now incorporates the former Ministry of Science, Technology and Innovation, Green Technology and Energy Components from the Ministry of Energy, Green Technology and Water as well as related components of climate change and environment from the former Ministry of Natural Resources and Environment. However, its functions do not directly pertain to agriculture. The ministry's responsibilities lie in the area of green energy, science and technology, and climate change. (MESTECC 2018)

Located under MESTECC is the Department of Environment (DoE), which is responsible for the control of water pollution. Among its principles listed are integrated decision-making, stewardship of the environment, and sustainable use of natural resources. It has a national office as well as regional branches. (DoE 2019)

National Water Resources Council

According to several authors (Lee 2013; Hezri and Dom 2017; Kim 2012) , there is a National Water Resources Council (Majlis Sumber Air Negara; MSAN) in Malaysia. Set up in 1998, its task is to "pursue effective water management and services" (Ariffin 2013, 168), ensures "co-ordination with state governments in the management of water basins" (Kim 2012, 72) and makes decisions that are in alignment with IWRM practices at the river basin level. The Council is "chaired by the Deputy Prime Minister, has Chief Ministers of all States and Ministers of all federal water-related ministries as its members" (Hezri and Dom 2017, 28). However, there is currently no designated national department that supports the decisions made by the MSAN.

MSAN's achievements are listed as follows:

- Accepted the proposal of IRBM by MOA in 2002 and instructed that master plans for all 189 major basins are to be prepared and adapted by the states;

- Addressed matter of conflict between inter-state river basins in 2010;
- Approved National Water Resource Policy in 2011;
- Discussed illegal dumping of waste and rubbish into rivers as well as sand-mining activities in 2015;
- Discussion of augmenting storage capacities in water-scarce states through inter-basin transfers in 2015. (Hezri and Dom 2017, 29; GWP 2011, 20)

Farmers' Organisation Authority

The Farmers' Organisation Authority (Lembaga Pertubuhan Peladang; FOA or LPP) is the primary body for water-user associations and farmers in Malaysia. Its three tier structure spans across the local, regional, and national level. At the bottom are the Area Farmers Organisations (AFO), 279 in total with 881,684 members in 2018. The middle tier is taken up by the 14 State Farmers' Organisations (SFO), and at the top is NAFAS, the National Farmers' Organisation. NAFAS' role is to represent farmers on the national level. It acts as a business entity and engages in retail business and investment activities with the aim to have a competitive farmers' organisation at the global level, based on participation and effectiveness. (Jakir 2017, 3; NAFAS 2018)

Non-governmental Actors

Non-governmental actors are generally not strongly represented in Malaysia's sector of irrigated agriculture. Of notice is the Malaysian Water Partnership (MyWP). MyWP operates under the mission statement of "support our country in the sustainable management of its water resources" and proposed the National Water Vision and Framework for Action, although the framework is not considered a policy statement. Nonetheless, the framework outlines strategies to improve water resource management in Malaysia by 2025 and was endorsed by the Ninth Malaysia Plan. (Hezri and Dom 2017, 26) MyWP's main objective is the integration of different stakeholders in the water sector and promote IWRM in Malaysia. They have partnerships with the government, private sector, academic institutions and other NGOs. The have further conducted national consultations, conferences, and workshops among public and private stakeholders for the water and environment sector. (Chan 2005, 5; MYWP 2018) They

thus come close to being a boundary organisation. However, there is no focus on agriculture. Water Watch Penang is an NGO which is active only in the state of Penang. They provide training and awareness courses for civil society and work together with academia, the government and the private sector (Water Watch Penang 2018).

Organisational Structure

Actors in the water sector and irrigated agriculture in Malaysia can rely on a diverse organisational structure which spans across the local, regional, and national level. However, according to Chan (2009, 144), water governance in Malaysia is traditionally following a top-down approach with limited involvement of civil actors. As a consequence, MOA and KATS are centralistic in their organisational approach, with policies mainly decided at the national level. Governmental actors are represented across central departments but many have also departments acting on the regional level. The responsibility for administration and management of water resources is shared among various agencies. Although not all ministries are represented at all levels, for instance MOA does not have local offices but is nevertheless represented through the IADAs, MADA and KADA. Similarly, KATS is represented through its divisions, such as the DID, which in turn have offices in each state (DID 2009; KATS 2018c; MOA 2018a).

Table 4: Basic Organisational Structure of Water Management in Irrigated Agriculture, Malaysia

Level	Institution	Agency	Responsibility
National	Cabinet		Executive branch
	MSAN/NWRC		Advisory Body
	MOA	Agricultural Drainage and Irrigation Division	Criteria and policies for irrigation infrastructure
	KATS	DID	Water management; irrigation and drainage management
	MESTECC	DoE	Control of water pollution
Regional	IADAs, MADA, KADA		Credit; operation and improvement of irrigation works
	DID		Irrigation and drainage; flood control; river basin management
	DoE		Control of water pollution; sustainable use of natural resources
Farmers	LPP		Farmer representation

Source: Aquastat 2011a; Hezri and Dom 2017; KATS 2018a; MOA 2018a; MESTECC 2018; Zakaria 2013. Own design. Table shows most relevant actors.

Vietnam

The Vietnamese water sector has seen many changes in the last years. According to the FAO (Aquastat 2011b, 12), the country "has a relatively comprehensive framework of institutions and policies for managing water, irrigation and drainage." Most ministries involved with the management of water and thus irrigated agriculture have a complex structure that extends from the national to the local level. However, responsibilities for the water sector are scattered across organisations.

According to the Vietnamese water resource legislation, water resources are owned by the entire population, which has the right to exploit as well as use these resources but is also obliged to treat water resources in a sustainable manner. The management of water resources falls to the state (Nguyen 2010, 13). Responsibilities are then spread across ministries. According to the Water Law, the Ministry of Agriculture and Rural Development (MARD) is primarily responsible for water resources. However, the government "can delegate authority for specific water uses to other ministries" (Barker et al. 2004, 27). Further, the Ministry of Natural Resources and Environment (MONRE) also participates in the management of water

resources, while the Ministry of Ministry of Finance manages the state budget for water resource projects (Sagris et al. 2017, B1).

Ministry of Agriculture and Rural Development

Consequentially, one of the biggest and most important organisation for irrigated agriculture is the Ministry of Agriculture and Rural Development (MARD). It was established in 1995, formed from the Ministry of Agriculture and Food Industry, Ministry of Forestry and the Ministry of Irrigation. The purpose of combining several single ministries into one ministry was to "reduce the overlap and separation among ministries for more effectiveness in state management in agriculture, forestry, irrigation and rural development" (MARD 2018). Among its tasks are the sustainable management of agriculture and the protection of water resources. Furthermore, MARD works together with provincial governments for flood and drought control in the river basins. Wastewater discharge and water usage, however, are licenced directly by the respective provincial government. (Barker et al. 2004, 27)

Ministry of Natural Resources and Environment

Another important governmental actor in the management of water resources in Vietnam is the Ministry of Natural Resources and Environment (MONRE), which supervises, for example, the Department of Water Resource Management (DWRM) and the Vietnam Environment Administration (VEA). In 2002, MONRE was given responsibility for the management of natural resources and environment. State water management functions are carried out by MONRE, whereas public water services are assigned to MARD or other ministries dealing with water-related issues. Among MONRE's specifically assigned tasks are the surveillance as well as licensing of water resource allocation, the establishment of data bases for water resources, and the implementation of guidelines to protect water resources. However, due to these new assignments, the environmental management responsibilities have been separated from e.g. irrigation services, which still lie within MARD's responsibilities (Nguyen 2004, 1). The Vietnam Environment Administration is a body administered by MONRE. It was established in 2008 and its major function is environmental management and sustainable development (VEA 2009).

Department of Water Resource Management

As a department of MONRE, the DWRM takes care of the state management of water resources, inventory and management of databases on water resources (e.g. classification, pollution), and "carrying out the duties of the Office of the National Council for Water Resources, River Basin Committees and coordinating with the Vietnam Mekong River Commission" among other tasks (DWRM 2006). Their responsibilities are, however, not directly related to irrigation, irrigation management, or agriculture.

The National Water Resources Council

Another actor to be mentioned is the National Water Resources Council (NWRC). The NWRC was established in 2000 and is currently located under MONRE. Among the council's tasks are strategies and policies relating to national water resources, projects concerning the protection, exploitation as well as utilisation of water resources, and the settlement of conflicts as well as coordination between different ministries and departments or ministries and provinces. Furthermore, the NWRC is supposed to act as a recommending institution for the central government/the Prime Minister regarding policy decisions and projects in the water resource sector and the organisation of discussions and meetings for specialists and scientists for water resource strategies. The NWRC is made up of members from several ministries, among them MONRE and MARD, specialists working in the water sector and non-permanent members representing, for example, local and central agencies. NWRC, however, has a solely advisory function, but does not partake in executive decision-making. (Nguyen 2004, 2; VEA 2014; Waibel 2010, 27; Sagris et al. 2017, B1) Thus, to an extent, the NWRC could be counted as a boundary organisation, as it brings several different actors from multiple ministries as well as agencies together in one organisation. However, as of October 2018, the NWRC has not done any accessible work.

Provincial, Sub-provincial, and Local Level

Vietnam follows a four-tier structure, from the national to the provincial, district, and then the commune level. On the provincial level there are the Provincial People's Committees (PPCs). At the district level there are the District People's Committees. They, and the attached agencies

and divisions, are responsible for water resource management in their area. Actors on the national level are responsible for the management of large river basins and reservoirs, whereas the provincial level is responsible solely for water management in their localities. Irrigation Management Enterprises are service providers on the local and district level (Sagris et al. 2017, 5). Furthermore, there are committees on the basin-level, which are tasked with the supervision of the allocation and management of water in the Red river and Mekong deltas, as well as the Dong Nai basins (Barker et al. 2004, vii). Non-governmental actors, such as NGOs and farmers, who also have a stake in the sector are present as well. While NGOs mainly assist government agencies in policy implementation, farmers are only represented through mass organisations that facilitate community participation. According to Waibel (2010, 4), there is also an increasing number of water-user associations.

Table 5: Organisational Structure of Institutions and Governance, Vietnam

Level	Institution	Responsibility
Central	National Water Resources Council (NWRC)	Support Prime Minister in decision-making
	Ministry of Finance	State budget for water projects
	Ministry of Agriculture and Rural Development (MARD)	Dykes & irrigation; flood control; drainage
	Ministry of Natural Resources and Environment (MONRE)	Water resource management; water volume & quality monitoring
Province	Provincial People's Committee (PPC)	Irrigation & drainage management company (IDMC), state investor in irrigation at provincial level
	Department of Natural Resources and Environment - DONRE	Direct water resource management; water volume monitoring
	Department of Agriculture and Rural Development - DARD	Irrigation works; flood control; drainage
District	District People's Committee	Monitoring and protection of water resources; water related incidents
Commune	Commune's People's Committee (CPC)	Monitor and protection of water resources; Water related incidents
Village/Hamlet	Village/Hamlet Head	Water-users / farmers
Service Provider	Irrigation Management Company	Provide irrigation

Source: adapted from Sagris et al. 2017, B1-2. Own design. Table shows most relevant actors.

Organisation: Decentralisation Initiatives

Waibel (2010, 14–15) states that the Vietnamese government has undertaken several decentralisation initiatives in the last decades. There is, however, no comprehensive approach to decentralisation yet. Most ministries and ministry-level agencies have departments or offices at the local and provincial level, either in the form of district administration offices or as a division at the commune level. While national policies are developed by the government and communicated in a top-down approach, they provide the framework under which the respective agencies have to fulfil their duties. However, implementation control is difficult. Most decentralisation initiatives are fiscal or administrative in nature, not political. This is mainly reflected in the People's Committees that have gained influence in, for instance, investments or land management. Waibel further reports that much power has gone to the provinces, but not to the district or commune levels and the system is therefore dubbed "centralised at the provincial level." Splitting responsibility this way can lead to "conflicting priorities between national and local agencies" and further "a deficient legal framework leaves room for a local interpretation and adaptation of centrally promulgated policies and documents" (Waibel 2010, 14–15).

Water-user Associations

Water-user associations are mainly active on the local level, are often community based, and promoted through Vietnam's mass organisations. Through grassroots movements and within the framework of cooperation projects with international organisations the establishment of more WUAs is being encouraged. There are several different kinds of water-user groups: water-user organisations, water-user groups, and water delivery groups, all subjected to different legal arrangements. In addition, there are also non-legal groups. (Waibel 2010, 4) Thus, WUAs are represented on the local level but do not have means of representation on the regional or national level.

International Organisations & Non-Governmental Actors

International organisations involved with financing and technical assistance for projects in the sector of irrigated agriculture are mainly the World Bank, the Asian Development Bank, and the

Asia Foundation (ADB 2006). Although several non-governmental actors are active in Vietnam, few are active in the sector of irrigated agriculture specifically. Among the active NGOs are the International Rice Research Institute (IRRI), the International Union for Conservation of Nature (IUCN), World Wide Fund for Nature (WWF), the Global Green Growth Institute, and the Centre for Sustainable Rural Development (SRD) who are active in programmes providing technical or financial assistance in the agricultural sector, among others. SRD stands out in so far as it is a Vietnamese, not international, non-governmental organisation founded in 2006 that supports sustainable development in the agricultural sector and follows a participatory approach, including field classes for farmers, focus groups, and training classes for farmers on cropping and irrigation (SRD 2018; Sagris et al. 2017, 42–43). Private companies, such as Nestlé or Coca-Cola, are also active in sustainable water projects and work together with NGOs or international multilaterals. Apart from the improvement of infrastructure, most initiatives are focused on improving governance structure, capacity building as well as technological advancement. (Sagris et al. 2017, 25) Further, the Asian Farmers' Association for Sustainable Rural Development is active in Vietnam. Their focus is mainly on the empowerment of men and women farmers in Asia, and to strengthen capacities of national farmers' organisations. They, however, also do not specialise in irrigated agriculture but more general topics such as sustainable and organic farming that touches upon topics such as crop rotation and use of fertilisers and pesticides (VNFU 2017).

2.3.2. Participation

Malaysia

Participatory Mechanisms

According to the Director General of the Department of Irrigation and Drainage (Abdullah (2017), mechanisms for participatory decision-making in Malaysia are underdeveloped. The concept is relatively new and even though it is acknowledged that participatory decision-making under involvement of all stakeholders is a key element in achieving success and sustainability in irrigated agriculture, they are not yet well-developed. Hezri and Dom (2017, i) argue that Malaysia has established river basin authorities which are managed through community participation. One such project is the Sungai Pinang River community engagement

project in Penang State, in which NGOs facilitated community engagement, provided water education programmes and multi-stakeholder discussions for one of Malaysia's most polluted rivers. However, such projects are mostly focused on urban areas (Lai et al. 2017, 4580). As a project example that requires farmers' participation serves MADA's project of amalgamating roughly 50,000 ha of centrally-managed paddies by 2020. Apart from cooperation with other governmental actors, MADA also has to supply ground personnel – especially agriculture and irrigation staff. They take care of communicating closely with farmers to ensure not only government policies for the project's implementation are enforced but also farmers' commitment and participation in the project. Here, MADA acts as a bridge between farmers and government. (PEMANDU 2014)

No further examples for participation projects in irrigation management or related projects could be found. Nonetheless, there are so-called e-participation opportunities on many government websites, for instance with KATS and the DID. KATS states that "the objective of e-Participation is to engage people in development policy and decision-making processes through use of information and communication technologies" and "the engagement with their people allows governments to tap into wider perspectives, sources of information, and potential solutions to improve decisions and services. It also provides the basis for productive relationships, improved dialogue and deliberation, and ultimately, better governance" (KATS 2018b). Contrarily, the DID (2019) states clearly on its website that participants should "avoid discussing political issues". Thus, policy discussion or participation in the policy process is not encouraged and e-participation seems to be merely a tool with which feedback can be given or questions asked.

Farmers' Associations

Malaysia's water-user associations are headed by the Farmer's Organisation Authority (FOA), formed in 1973, under the authority of MOA. FOA fulfils the role of a registrar for the farmers' associations and is, thus, the head organisation of all state and district farmer's organisations. FOA works in support of the current government policies in agriculture: the National Key Economic Areas (NKEAs), the Malaysia Plans, and the National Agro-Food Policy. FOA takes care of, for instance, infrastructure projects such as irrigation and drainage, but also farm roads and

land levelling. They implement and supervise services and coordinate with other departments and agencies such as the DID. (LPP 2014)

The AFOs have first been established in 1967 after the example of Taiwanese farmer's organisations. Act 109 (also called Farmers' Organization Act) defines rights and obligations of the AFOs. The organisation's objectives are the improvisation of economic and social standards, the enhancement of skills and knowledge and to develop a united farming society. AFOs are active in infrastructural services and farm good supplies, but also engage in technological services such as food processing technology and after harvest technology. The AFOs are further allowed to provide training facilities to farmers, assist in land development projects and provide and promote community projects. Any Malaysian citizen engaged in agricultural activity and who is over the age of 18 is eligible to be a member of a farmers' organisation. (MADA 2017; Government of Malaysia 1973) The Third National Agriculture Policy 1998-2010 (NAP3) states that the role farmers' organisation play should be strengthened through participation as business entities in the agricultural sector. Idle land usage will be improved through increased farmers' participation by reorganising farms into large-scale cooperatives and group-farming operations. (MOA 1998)

Vietnam

Participatory Mechanisms

Although participatory decision-making opportunities are still relatively sparse in Vietnam, there are participatory mechanisms which are reflected in the national strategy of participatory irrigation management (PIM). PIM in Vietnam includes provincial stakeholders, irrigation management companies, districts and communes, including village leaders and farmers, in a process on decision-making about decentralisation issues, WUA models and the performance of irrigation systems. (Cook et al. 2013, 6) Vietnam's national strategy for PIM aims at increasing the number of water-user organisations, which manage local-level irrigation. Typically, irrigation management in Vietnam is handled by agricultural cooperatives, which take care of drainage and irrigation. The irrigation and drainage systems, however, are state-owned and thus do not encourage more farmer participation (Aquastat 2011b). PIM supports participation on the local level and is supposed to improve effectiveness of water resource use. One the one

hand, however, farmers do not have much say in how irrigation is managed. Supply, for instance, is top-down in the paddy-rice sector and not decided on by the farmers. Contrarily, Nguyen (2018b) from the Centre of Participatory Irrigation Management which is a branch of the Vietnam Academy for Water Resources states on the centres website that

> […] farmers have proved their community role in irrigation participation (including construction) relating to secondary and tertiary canal. Farmers consider irrigation management as their own task without any decentralization. They themselves dredge canals or pump (or hire pumping) and divert water into their fields. The state only supports the costs relating to headworks, main canal or creating water sources […].

This shows that the use of government led decentralisation initiatives are often not in alignment with the practices on the local level. Farmers already consider the responsibility given to them their own. The implementation of PIM, thus, only reinforces structures that are already in place.

Irrigation management transfer (IMT) is another means of enhancing participation in Vietnam. Water-user cooperatives are in charge of managing the operation and maintenance of previously company managed canals. This has, for example, contributed to a more regular water supply as well as lowered costs and less time used for maintenance. And, moreover, to greater inter-commune unity along the canals managed in this fashion. For this reason, the participation of users in irrigation has thus far been received positively. Nevertheless, IMT's record shows that it can also lead to a reduction in government expenditure – which can be judged positively or negatively, depending on the point of view – and to better maintenance of the irrigation systems. There is, however, "no evidence elsewhere to indicate that it has increased crop and water productivity" (Barker et al. 2004, 30). Furthermore, according to Barker et al. (2004, 26), in the Mekong delta, farmers sometimes organise themselves in the form of cooperatives, in order to share mobile pumps and pumping stations. However, the author was not able to find further or current evidence of the existence of these cooperatives. Additionally, Diza and Bestari (2012, 1) claim that grassroots democratisation processes in Vietnam provide strong support to participative planning and development processes. However, Cook et al. (2013, 1) state that there is a "lack of commitment by provincial authorities to […] irrigation management transfer and participatory irrigation management"

and further that "current models for WUOs do not always provide a sound institutional framework that meets the needs of irrigators or reflects the diverse situations in communes."

2.3.3. Resources

Malaysia

Distribution of Power & Actor Dominance

KATS and MOA are the key ministries with the power to undertake huge investments as well as countrywide projects for irrigated agriculture. As a proxy, governmental agencies under MOA, such as KADA and MADA, undertake irrigation projects.

MADA is a relatively good example for an agency which combines agriculture and water. Being the largest granary area in Malaysia, MADA irrigation system allocated 40% of water in its area to national rice production. Additionally, 40% of Malaysia's rice is produced in the area governed by MADA. Due to MADA's size, the organisation and its respective territory is of strategic significance. The objective of the northern basin water resource development, for instance, has been to provide the MADA area with water. (Aquastat 2011a, 10) However, the report does not define how this has been done. Another example for MADA's strategic importance is the government's goal of strengthening the productivity of paddy farming. The goal is to merge 50,000 ha of paddy fields by 2020, which accounts for 51% of the country's total paddy fields. This scheme is supposed to bring an incentive to farmers to abandon individual farming operations. However, problems in land acquisition have delayed improvement of the irrigation infrastructure. The project, which is undertaken in cooperation with relevant departments and agencies under MOA, also involves the adaptation of new technologies and fertilisers, and is supposed to improve large-scale mechanisation and irrigation schemes. Further, MADA has to cooperate with Padiberas Nasional Bhd (BERNAS), who is the Malaysian distribution regulator of the rice industry, as well as the DID, the Department of the Director General of Land and Mines, the District Land and Mines offices, and the Malaysian Agricultural Research and Development Institute. The project is a great example of the complex relationships and immense coordination efforts of the different ministries and agencies. (PEMANDU 2010, 2014, 2015)

Integrated Agricultural Development under MOA

The eight Integrated Agriculture Development Areas (IADAs), as well as MADA and KADA, operate under the principle of integrating agricultural development approaches that emphasize "the integration of all efforts and activities between the various Departments and Agencies under the Ministry of Agriculture and Agro-Based Industries of Malaysia (as well as other ministry agencies needed)" (MOA 2018b), mainly for Malaysia's rice granary areas. The IADAs take care of infrastructural support, particularly for irrigation and drainage systems, they implement agency services for the development of agricultural institutions as well as farmers, strengthen agency implementation services in the development of agricultural institutions and farmers, and operate on an area of 923,565 ha. Of this area, 52% are agricultural areas and the remainder non-agricultural areas. Approximately 42% of the agricultural area are designated to paddy farming. Moreover, the IADAs have specific objectives accommodating local needs for their respective areas. (MOA 2018b)

Table 6: Physical Size of the IADAs

Granary	Area (ha)		
	Project	Agriculture	Paddy
MADA	126,155	109,501	96,558
KADA	82,900	64,555	31,464
Kerian Sg. Manik	66,282	30,560	27,825
Barat Laut Selangor	199,199	82,044	18,590
Pulau Pinang	104,636	67,095	10,138
Seberang Perak	17,307	16,437	8,529
Ketara	258,736	65,828	5,110
Kemasin Semerak	68,350	46,560	6,160
Total	923,565	482,580	204,374

Source: adapted from MOA 2018b; Ngah 2015, 16.

Supra-National Organisations and Agreements

Malaysia has signed several international declarations that "acknowledge the international consensus on IWRM as the way forward for sustainable management of water resources" (Hezri and Dom 2017, 26). Among these declarations are the International Conference on Water and the Environment, the Earth Summit, and the United National Sustainable Development Summit. Thus, Malaysia is pursuing the implementation of international guidelines.

Vietnam

Dominant Actors

Most dominant in the water and hydrological sector in Vietnam are governmental actors, specifically MARD and MONRE. There are several contributing factors. Both ministries have responsibility in the management of water and land. MARD, as the ministry with the main responsibility for irrigation management, "controls 12 general corporations with the total of 317 companies" (ADB 2009, xiii). Both, MONRE and MARD, are huge organisations with considerable budgets for investment, and can thus invest in countrywide projects. Large-scale investment projects in irrigated agriculture are mainly lead and undertaken by MARD or one of its associated institutes (ADB 2009, 50). After MONRE's establishment in 2002, there have been tensions between MONRE and MARD. The intention behind the founding was to separate water resource management and public service delivery. MONRE's department of Water Resource Management was to take over water resources planning, policy and strategy development. Additionally, MONRE has to assess and allocate water resources, manage surface and groundwater, and water quality. Thus, making MONRE a management agency. However, the transition process started without clarifying MARD's responsibilities in turn. MARD was supposed to keep its responsibility for rural development and public service delivery of water resources. But other functions remained undefined. Infrastructural planning, which is regarded as a considerable decision-making power, for instance, was not assigned specifically, leading to inter-ministerial conflicts. Furthermore, after MONRE "issued the nation's first 'National Water Resource Strategy towards the year 2020' in 2006, MARD published its own 'Strategy for sustainable national water resources development and management'. The paper was not in line with MONRE's policy" (Waibel 2010, 28). Frictions and conflicts between MONRE and MARD persist and are mainly focused on decision-making power as well as control over and access to resources, such as fund allocation for the ministries and funds for project implementation, such as construction works (Waibel 2010, 29–30). As a consequence, the respective roles of MONRE and MARD are often conflicting, particularly due to the lack of water sharing policies and unclear ministerial functions in Vietnam. For instance, even during the dry season, there are no controlled limits for the withdrawal of water, leading to further competition among sectors and private investment over the use of water resources and thus to inefficient and unsustainable resource use (ADB 2009, xvi).

Transfer of Power to WUAs & Involvement of International Actors

Responsibility for small-scale irrigation projects on a communal level has been transferred to the water-user associations (commune and inter-commune branch canals). PIM has been introduced in several provinces, but is mainly financed by international organisations, on which Vietnam relies heavily (ADB 2009, 213). Therefore, while MARD and MONRE are the most important governmental actors, international organisations such as the World Bank also invest in projects for sustainably irrigated agriculture. One such project is the "Vietnam Irrigated Agriculture Improvement Project" which has been approved in 2014 and closes at the end of 2020. The project mainly invests in irrigation and drainage infrastructure and is implemented by MARD. (World Bank 2013b)

In regard to the supra-national sector, there is a whole range of international cooperation projects. Vietnam's water sector is heavily supported by international organisations, and donor agencies bring not only financial support but also the "global water discourse into the national sector development process. Their expert's contribution to the drafting of new laws and policies is considerable" (Waibel 2010, 4). No further indications for conflicts with supra-national organisations could be found.

2.4. Issue Boundaries

The criterion issue boundaries is split into the categories: 1) problem definitions and objectives, which deals with representation of the topic of irrigated agriculture across levels, the alignment of practices as well as the existence of comprehensive databases. And 2) networks and instruments addresses issues such as boundary organisations or collaborative initiatives and the instruments which are used in and for irrigated agriculture, including national planning documents as well as monitoring systems for fertilisers and pesticides.

2.4.1. Problem Definitions and Objectives

Malaysia

Representation across Levels

The organisational structure and representation of irrigated agriculture in Malaysia is relatively well developed and spans from the national to the local level. MOA, and especially MADA and KADA as its biggest agencies as well as the eight IADAs, are centralistic in their organisational approach. However, MADA and KADA' organisation and representation span from the regional to the local level through representative offices and by, for instance, providing training for farmers, or by implementing the Economic Transformation Programme (ETP) of rice paddy amalgamation, as described under chapter 2.1.3. It could thus be said that MOA is the national actor for irrigated agriculture, while MADA, KADA, and the eight IADAs as its agencies focus on the regional and local level. In contrast, KATS Department of Irrigation and Drainage is represented on the national and regional level, with different focus areas according to their respective state's needs. However, responsible for environmental protection is the Department of Environment under KATS, and not the DID. The DID has no division explicitly taking care of freshwater and soil, but among its tasks are "the planning, development and management of water resources for sustainable agricultural and socio-economic growth" (DID Sabah 2018).

A Fragmented Sector

Due to the fragmentation within the sector of irrigated agriculture, the coordination and alignment of national and local practices is difficult. Neither MOA nor KATS have easily accessible databases for, for instance, environmental protection and there is no national approach for the comprehensive monitoring of water and land resources. While KATS's Land, Survey and Mapping Division is responsible for drafting legislations, regulations, and policies on land matters and decisions that affect survey and mapping, the DID is responsible for flood monitoring, drought monitoring and provides hydrological data for rainfalls, water levels, sediment, discharge and evaporation. (DID 2017c; KATS 2019) This shows that there is no overall monitoring division or agency. Rather, each ministry, department or agency has their own system if applicable to their respective functions. There is, however, Malaysia's Open Data

Portal which was established in 2014, aims at increasing the Government's transparency and where datasets for different sectors can be accessed. The data is, however, supplied by the government agencies and the portal must thus rely on their due diligence (MAMPU 2016). Furthermore, the number of actors involved in irrigated agriculture with different areas of responsibility, approaches and needs make the establishment of a comprehensive database, and thus efficient monitoring of water and soil resources difficult. The fragmented nature of the sector and, therefore, also the fragmentation of responsibility creates further gaps of knowledge and exacerbates the difficulty of data collection. However, non-governmental organisations such as MyWP initiate and conduct programmes that encourage inter-Ministry dialogue and bring different stakeholders together. They facilitate multi-stakeholder programmes that discuss policies and plans and intend to further the implementation of IWRM in Malaysia (MYWP 2018).

Vietnam

Representation across Levels

Vietnam has a framework of over 300 regulations concerning water management and several key actors. Yet, the sector still suffers from overexploitation, unsustainable water use, pollution, a divide between the practices on the local level and national policies as well as insufficient coordination of policies and institutions within the sector. (Sagris et al. 2017, 5; Waibel 2010, 24) Irrigation services in Vietnam are split between different levels of government. At the central level, MARD is in charge of service delivery for irrigation. This includes planning as well as assessment and prioritisation for new developments. The distribution of interprovincial water resources and the overall policy framework have been assigned to the DWRM of MONRE. (Barker et al. 2004, 27)

An important level of organisation is the river basin. The set-up of river basin organisations (RBO) in Vietnam has not gone smoothly due to conflicting functions of MONRE and MARD. The first RBOs were designated to the largest rivers in Vietnam, the Red River Delta, the Dong Nai basin and the Mekong Delta. The Red River, for instance, is the second largest river in Vietnam that supports an irrigated area of 650,000 ha that are frequently flooded. The first RBOs were established with technical assistance of the ADB in 2002. Among its goals were the planning of

water resource management, increased stakeholder involvement, and better coordination among government agencies and between provinces as well as capacity building. However, the committees, even though incorporating representatives from all provinces and ministries with stakes in water management, remain powerless. (Benedikter 2014, 12; Molle and Hoanh 2009, 7; Waibel 2010, 35) Molle and Hoanh (2009, vii) present the conflict evolving around the RBOs as follows: "The MoNRE, the river basin scale became crucial for grounding its legitimacy and finding its roles among the established layers of the administration, while for MARD, RBOs became a focal point where power over financial resources and political power might potentially be relocated at its expense." Further, Benedikter (2014, 172) states that "the Vietnamese administrative system does not use the concept of regional governance. Although regional bodies exist, they are not equipped with state management functions and decision-making power." Since 2016, the government of Vietnam has discussed setting up six new major river basin management committees. Although there is a pilot committee in Sesan Srepok River Basin managed by MONRE, none of them have been officially launched. (Sagris et al. 2017, 4)

Alignment of Practices & Comprehensive Databases

Ministries of the central level of government overlap and face inconsistent management functions, MONRE and MARD in particular. The former is, for instance, responsible for the overall management of water resources, whereas rural water and flood or drought management are under MARD's management. MONRE is responsible for the state management of water resources, but river basin management has been assigned to MARD. Recently, however, the Government Office has decided to re-transfer river basin management back to MONRE. Further, irrigation divisions in each province licence wastewater discharge permits into irrigation systems. They do not, however, have the ability to monitor the water quality at the discharge points. These overlapping responsibilities between MONRE, MARD, and the People's Committees obstruct and challenge the management of licences and supervision. Such in-transparent and inconsistent monitoring and inspection management, coupled with a lack of resources, technology and coordinating lead to weak enforcement of environmental standards as well as low alignment. (Sagris et al. 2017, 20–21)

2.4.2. Networks and Instruments

Malaysia

Collaboration Initiative: The EPPs

Malaysia is planning on becoming a developed country by 2020. In order to achieve this aim, the government has launched the Economic Transformation Programme (ETP) and formulated 12 National Key Economic Areas (NKEAs) — agriculture being one of them. The aim is to transform the agricultural sector from a small-scale sector into a sector that is focused on large-scale industry. However, apart from the MADA rice paddy amalgamation project, the ETPs' focus is mainly on herbal production, aquaculture and cattle. The implementation of the MADA rice paddy amalgamation project, Entry Point Project (EPP) 10 of the ETP requires cooperation across sectors and levels. It aims at increasing productivity in the paddy farming area of the Muda basin. Several actors are involved: MADA and MOA, as well as other agencies, namely, the Department of Agriculture and Farmers' Cooperatives. Further, EPP 11 clarifies that other irrigated areas are to follow MADA's example and engage in scaling-up their paddy farming as well. Lead for the initiative is MOA, collaborating agencies are KADA and six different IADAs. In granaries managed by an IADA, initial focus will be on the outsourcing of land management. The ETP Unit acts as overall project manager and will coordinate their specific EPP and monitor implementation, track achievements, as well as organise and supervise weekly problem-solving meetings to find solutions for bottlenecks. (PEMANDU 2010, 549)

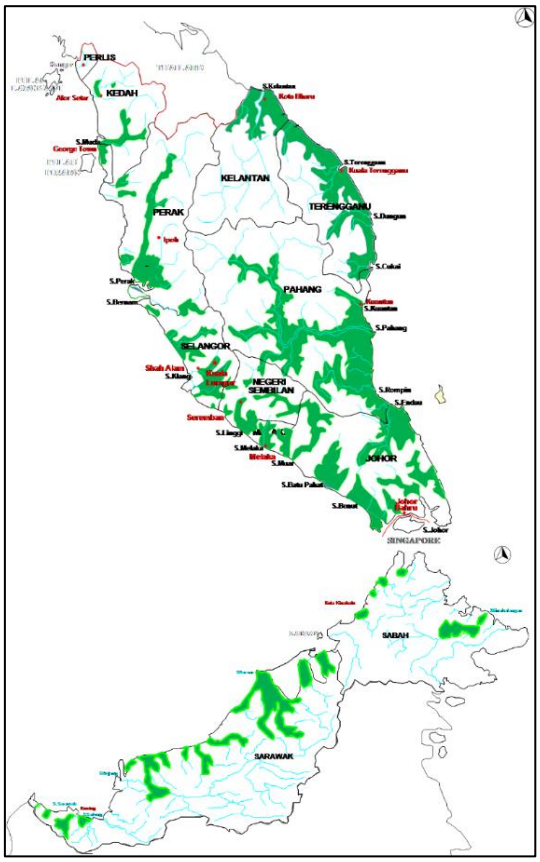
International Capacity building Project: Malaysia-Indonesia

Malaysia and Indonesia started an international capacity building project. Both countries started bilateral discussions on cooperation for food security and set the goal to develop an investment programme in agriculture together in 2009. Malaysia is technologically more advanced, whereas Indonesia has great agricultural assets. The aim of this cooperation would be an investment of capital and technology in Indonesia's agricultural sector for shared benefit. Thus, increasing regional cooperation but possibly also serving as an example for multilateral endeavours within the Association of Southeast Asian Nations' (ASEAN) community (Freedman 2013, 451).

Infrastructural Instruments

The development of irrigation is mainly concentrated on the 8 large irrigated granary areas of Malaysia. For paddy cultivation, flooding irrigation is the major practice, with the irrigation schemes providing separate drainage facilities. Flooding or basin irrigation are applied on rice fields, the farmers are in control of water depth. The major irrigation structures are providing farm roads for ploughing and harvesting and are thus promoting the industrialisation of agriculture. (Aquastat 2011a, 8) With such schemes, farmers can control the depth of the water individually. Salinity, water-logging and similar problems are not reported as critical in the sector (Toriman and Mokhtar 2012, 362). However, the Eleventh Malaysia Plan acknowledges that the protection of water resources and agriculture are crucial. As a consequence, 194 flood mitigation projects for monsoonal, flash, and tidal floods have been implemented (PMO 2015). The following map illustrates that especially peninsular Malaysia is prone to flooding.

Figure 8: Map of Flood Prone Areas in Malaysia



Source: DID 2017a.

Areas marked in green are prone to flooding.

Furthermore, new IADAs are planned, with investments in irrigation and drainage infrastructure. The Malaysian government has "announced an allocation of RM 100 million for the implementation of the related development works during its 2015 budget speech" (PEMANDU 2015, 230). The new IADAs have been approved in 2014 by the Cabinet. They are, however, not yet listed by MOA.

Financial Instruments

Financial instruments used in Malaysia are, for instance, fees for water usage or government interventions through subsidies or price support mechanisms. It is, however, estimated that water fees only cover 10-12% of the operational costs of irrigation systems. As farmers are considered a low-income group by the Malaysian government, full cost recovery is not being sought, thus making the supplementation of irrigation fees an indirect subsidy. (Aquastat 2011a, 10; PEMANDU 2010, 519) In 2012, the nominal irrigation fees ranged from US$ .3 to US$ 15 per ha/year. Apart from investments in irrigation infrastructure, the government subsidies include fertilisers, credits, and the guarantee of a minimum price as well as a price bonus. (Toriman and Mokhtar 2012, 362–63) In 2007, as a reaction to an increase in staple food prices, the Food Security Policy (FSP) was passed in Malaysia. The FSP authorised a budget of MYR 506bn to be spent on agricultural development, and specifically rice cultivation and production. (Freedman 2013, 440) Among the assistances provided by the Malaysian government for the development of the agricultural sector are price subsidies for rice and incentives for producing rice. In addition, the Malaysian government's ETP intends to increase incentives for good farming practices, increase the average farm size from 2 ha to an economic size of 300 ha and thus increase productivity and income of the sector (EPU 2018; PEMANDU 2010, 519).

In order to achieve self-sufficiency in food security and serving as an extension of the FSP, the National Agrofood Policy (NAP 4) has become operative in 2011 and will last until 2020. The NAP combines input and output subsidies in agriculture. It, for instance, guarantees farmers a minimum price for their paddy output, grants them fertiliser subsidies as well as subsidies for paddy cultivation and seeds. Coordinating these efforts is the Federal Agricultural Marketing Authority (FAMA), one of MOA's agencies. Although these measures may produce short-term success for Malaysia's goal of self-sufficiency, they are unlikely to be environmentally

sustainable and too expensive to sustain long-term. (Freedman 2013, 440; Toriman and Mokhtar 2012, 362–63)

Resource Efficiency

Alam et al. (2010, 265) discuss the need for more strategic investments and policies on the regional level in Malaysia. They imply that through the government assigned monocultures of rice paddies, farmers are losing the ability to choose their own crops. As a consequence, these policies increase land degradation through mono crops. However, the development of appropriate O&M mechanisms to ensure sustainable irrigation schemes has led to an improvement in the water-user organisations. Yet, irrigation efficiency is still low at 50% in larger irrigation schemes and 40% in the smaller ones. There are no established recycling mechanisms for irrigation water, which threatens sustainable water use and lowers irrigation efficiency. (Toriman and Mokhtar 2012, 367) As the ETP is aimed at increasing the country's GNI and creating jobs in rural areas, it promotes herbal products, premium grade fruit, and palm oil in addition to rice cultivation (PEMANDU 2010, 41–42). However, bigger farms and more variety in products do not necessarily lead to greater resource efficiency or promote resource efficient irrigation techniques.

Pollution, Water Quality, and Monitoring Systems

Pollution and water quality control is a problem in Malaysia, most water, 98%, comes from the country's rivers (Aquastat 2011a, 11). Of Malaysia's 477 rivers monitored by the DoE in 2017, 51 are classified as polluted. Among the reasons are mismanagement, poor public involvement, and poor law enforcement. (Lai et al. 2017, 2; Dikon 2015, 34; DoE 2018a) Since investments in water infrastructure, and therefore irrigation, rely on good river water quality, mechanisms for quality control are of the utmost importance. Frameworks for the prevention of water and soil pollution are mainly provided by the law. However, the enactment and enforcement is often insufficient (Chan 2009, 145). Ali, Yusof, and Aziz (2018, 789) conducted a survey about farmers perception of pesticide use, in which one-third of the interviewed farmers reported frequent health problems associated with pesticide poisoning. The authors found out that only pesticide sprayers who work with MOA, MADA, or KADA are required to have a sprayer permit.

To obtain the permit, training courses related to the handling of pesticides have to be attended. Further, of the survey's participants 74% disagreed with a proposal of requirement for training programmes and licences or permits before being allowed to use pesticides. The authors state that "the design of these training programs would be better if farmers are included in the process of setting the programs. Farmers' participation will make the program reflect their needs and current information gaps" (Ali, Yusof, and Aziz 2018, 789).

A comprehensive system for the monitoring and evaluation of policies or resources is not in place, either. Rather, most ministries have their own sub-divisions or agencies, such as the DID's Water Management and Hydrology Division, which maintains the National Hydrology Data Bank. Apart from the data bank, the division also processes, archives and disseminates hydrological data for flood and water resource assessment. They work not only with the DID, but also with researchers, the public, and other government agencies (Water Resources Management & Hydrology Division 2005). The DoE under MESTECC is responsible for groundwater and river monitoring. They further also estimate pollution loads[4] for agriculture and provide according reports (DoE 2019). The DoE also provides a yearly environmental quality report, which states that Malaysia has 891 monitoring stations for river water quality. Pollution levels are increasing. In 2017, 46% of Malaysia's rivers were clean (47% in 2016), 43% slightly polluted, and 11% polluted (10% in 2016). Groundwater quality monitoring, established in 1997, is comprised of 110 wells located throughout the country. (DoE 2018a, 24)

A new approach to IWRM, water management and control, is tested by Lembaga Urus Air Selangor (LUAS), Selangor's water resource information management system, created by the Selangor Waters Management Authority Enactment 1999. Formed in 2000 under the objective of implementing water management at the river basin level, it focuses mainly on the monitoring of dams but is also tasked with ensuring the "natural flow of water resources such as rivers, lakes, and coastal waters within the state of Selangor" (Hezri and Dom 2017, 29). LUAS receives only 20% of its budget from Selangor's state government, while the rest is acquired through registration, licencing, and penalty fees. According to Hezri and Dom (2017, 29), LUAS is a pioneer in Malaysia's river basin management, as it has implemented IRBM for two of the

[4] The term *pollution load* refers to "the amount of pollution material that a water body is actually carrying at the given time" DoE (2018b).

state's major rivers and plans to implement IRBM for all major river basins by the year 2020. It further approaches water management issues at the state level, using an IWRM approach.

National Planning Documents: The Economic Transformation Programme, the Malaysia Plans, and National Agricultural Policies

In regard to national planning documents, the Economic Transformation Programme states that Malaysia has decided to achieve 100% rice self-sufficiency by the year 2020, as the country is currently a rice importer that relies heavily on rice as a staple food. In 2017, the level of rice self-sufficiency was at approximately 75%, with the remainder being imported from countries such as Vietnam, Thailand, and Pakistan. This, in turn, has implications for the water allocation in irrigated agriculture. The implementation of the ETP's policy is supported by the Division of Agricultural Drainage and Drainage of MOA, which has received an according budget and, thus, has a chance to focus on the modernisation and improvement of efficiency of the systems. (Aquastat 2011a, 10; Rahim, Hawari, and Abidin 2017, 1, 3; PEMANDU 2010, 41)

The Ninth Malaysia Plan (2006-2010) is also of importance to irrigated agriculture, as its objective was to activate the industrialisation of the agricultural sector and also supported irrigation projects (Aquastat 2011a, 11). It outlines Malaysia's goal to achieve developed nation status by 2020. The National Agriculture Policies (NAP 1-3) mark agriculture as one of the key areas for development. NAP 3 (1998-2010) focuses on programmes for agriculture that increase productivity, while simultaneously conserve and utilise natural resources in a sustainable manner (Murad, Mustapha, and Siwar 2008, 609). The NAPs have been replaced by the National Agrofood Policy (NAP 4), which shares its major aims. Despite the government's focus on policies and programmes for the efficient industrial development of the agricultural sector, the NAPs, National Agrofood Policy as well as the Malaysia Plans also refer to social and ecological goals, such as sustainable development.

Notwithstanding the NAPs' emphasis on need for better infrastructure, sustainable agriculture and land development, the National Agrofood Policy, which covers the years 2011 to 2020, does not outline clearly what role water will play. Instead, it is more concerned with competitiveness in the agro-food industry. Its aim is to increase gross national income to MYR 49.1 billion and create more than 100,000 additional job opportunities by 2020. Contrarily,

modern technology and mechanisation should also be employed to reduce the need for manpower. To achieve these aims, the government provides incentives to increase private sector investments in the agricultural sector. (Dardak 2015, 5)

Vietnam

Collaborative Agricultural Initiative with Thailand

The Vietnam Food Association supervises cultivation and trade of rice. There are efforts to increase the produce's quality, crop yield and increase exports. Moreover, Vietnam and Thailand try for more cooperation, in the hope that they, if they work together as a group, can demand higher prices for their farmers. The production process in the producing countries varies regarding storage, cultivation and logistics. Such a cartel could thus end in a weakened competitiveness for Vietnamese farmers, but could also cause higher prices for their producers and middlemen. (Freedman 2013, 444) However, the initiative does not focus on irrigation and irrigation practices and only pertains to Vietnamese farmers in ways of rice varieties and exports, as the Vietnam Food Association is responsible for 90% of the exported rice (VFA 2018).

Mekong River Commission & NWRC

The Mekong River Commission (MRC) is an inter-governmental body which manages jointly shared water resources for the Mekong River between Cambodia, Lao PDR, Thailand, and Vietnam. China and Myanmar, both upstream countries of the Mekong Basin, are MRC'S dialogue partners. The MRC incorporates sectors such agricultural opportunities via their Agriculture and Irrigation Programme (AIP), flood management, and conservation of ecosystems. The AIP aims at managing sustainable development of water resources in agriculture. Actions include the monitoring of agricultural water use in the basin and real time flood and drought monitoring. However, the scales of AIP irrigation projects were small at the national level. Further, MRC supports the improvement of irrigation efficiency by providing technical guidance. (MRC 2019a, 2019b)

The NWRC, as already discussed under the criterion actor representation, is an inter-ministerial body that works as an advisory body for the Central Government and the Prime Minister. As the NWRC does not participate in decision-making, its influence is limited. The ADB report on

Vietnam's water sector (ADB 2009, xxi, xxv) clearly supports the strengthening of the NWRC through

- a stronger legal base for water and environmental management;
- mechanisms under the NWRC for lower level coordination.

Thus, to an extent, the NWRC could be counted as a boundary organisation, as it brings several different actors from multiple ministries as well as agencies together in one organisation. However, as of October 2018, the NWRC has not done any accessible work.

Instruments Used for Irrigation

According to Nguyen (2004, 1), Vietnam's water quality is declining as a result of industrial activity, while at the same time salinization is increasing due to reduced river flows during the dry season. However, according to the Aquastat (2011b, 13), the quality of groundwater remains high. To improve resource efficiency, strategies include, for instance, more participation by farmers in operation and maintenance, and canal lining. Even though such projects have led to declining expenditure on the government's side, they have not led to increased resource efficiency. The distribution of small private water pumps, however, has contributed to an improvement of water productivity, facilitating both, better management and control of water resources. (Barker et al. 2004, vii) Vietnam's irrigated water sector displays a diverse set of measures and instruments. Tube-well irrigation is practiced mainly for perennial crops such as coffee, which is produced, for example, in the Central Highlands. Surface pumping and small-scale canal irrigation are other arrangements that are in use. Improved water control, for example in the Mekong Delta, permits two to three crops every year. Additionally, the development of public-sector irrigation also advanced investments in irrigation by the private sector, such as the installation of small private pumps for irrigation and drainage, thus furthering greater crop diversification. Generally speaking, the installation of small pumps furthers the farmers' ability to enhance crop production. The 2001 announcement by the government of Vietnam that irrigated paddies do not longer need exclusively be committed to rice production has given the diversification of crops additional momentum. The subtropical climate even permits several crops throughout the year, and is only impaired during the dry season in the lower delta by the intrusion of saltwater through low water tables, and in the

upper delta through floods during the monsoon season. (Barker et al. 2004, vii) An additional problem that occurs during droughts or due to reduced surface water flows is salinization. The Mekong Delta is particularly affected by the intrusion of saltwater, which can cause the water to be unsuitable for irrigation (Sagris et al. 2017, 22).

Instrument: Pricing Mechanisms

Irrigation fees have been practically abolished by the Vietnamese Ministry of Finance in 2013. Since then, farmers merely have had to manage and pay for connecting their fields to an irrigation system. In addition, farmers who use water from irrigation works have to pay an irrigation and drainage company. The payment is based on the irrigated crop area. In contrast, water-users using irrigation works for non-food production or industrial purposes have to pay based on the volume of water they consume. (Sagris et al. 2017, 7) Brown (2009, 51) argues that the abolishment of irrigation fees has led to even further reduced incentives for farmers to involve themselves in irrigation management. This is corroborated by Cook et al. (2013, 1), who state that Vietnam's international development partners consider the waiver to not only place full O&M responsibility on the national budget but also reduce incentives to use water in a sustainable manner.

However, in 2017, a new Irrigation Law was passed by the National Assembly. It stipulates that irrigation services have to be paid for by users and prices will be in compliance the "provisions stated in the Law of Price and shall include management costs, operation and maintenance expenses, depreciation charges, and other reasonable actual expenses and allow for profits which are deemed suitable to the marketplace" (Sagris et al. 2017, 7), with the state determining the price of irrigation services. This re-introduction of irrigation fees does not, however, differentiate between water scarce areas and those with sufficient water resources.

Instruments: Infrastructure

Vietnam agricultural sector suffers from heavy industrial protection. The industries protected tend to be state-owned enterprises, which usually are highly capital intensive (Barker et al. 2004, v). Funding of projects involving a large amount of capital, for example investments in projects for flood-control, are mostly implemented by the central government. The

maintenance of public irrigation systems falls to the PPCs, who manage and maintain these systems and set the irrigation service fees in accordance with national guidelines. They, furthermore, decide on subsidies and investments in infrastructure for the irrigation sector. (Barker et al. 2004, 28) According to Sagris et al. (2017, 20), economic instruments exist, but are neither designed to enforce sustainable water-use nor do they set incentives to do so. Additionally, the use of untreated industrial wastewater for irrigation can have considerable impacts on crop yields as well as health. Paddy rice in the Can Tho area, one of the biggest rice production areas of the Mekong Delta, were impacted by untreated industrial wastewater, causing a decrease in yields by 0.67 tonnes/ha (12%) and resulting in a 26% profit loss. One of the consequences of using untreated water is that farmers have reported skin diseases and instead of three crops only one to two could be planted each year.

Resource Efficiency: Alternate Wet and Dry Irrigation

One instruments to improve resource efficiency is the practice of alternate wet and dry rice management (AWD), which can reduce water use by 30% as compared to the more traditional flooding practice. Vietnam's climate allows for up to three crops per year. Rice has a water demand of around 10,000 – 12,000 m^3/ha, thus requiring high volumes of water to grow. In combination with inefficient and old irrigation systems, water efficiency is low and water stress increases. The IRRI has piloted an AWD practice in Vietnam. Fields are flooded and then dry up in a cycle of two weeks, which is repeated during the whole process of crop growth with the exception of the flowering stage, as the crops are too sensitive to dry soil during this time. AWD has been included into farmers' programmes, and according to MARD, has been fully implemented on 60,000 ha of land, and partially on 300,000 ha of land. The eventual AWD target by 2020 is to cover at least 1,000,000 ha of land. However, there are some challenges for the full implementation of AWD. (1) Farmers are not aware of the economic benefits, as irrigation water is not paid by volume; (2) field conditions make it difficult to control water levels; (3) fragmentation of farm land makes adoption difficult; and (4) farmers lack the capacity to implement AWD successfully. (Sagris et al. 2017, 40–41)

Other Instruments

Overall, Vietnam's irrigation sector absorbs the biggest part of the government's expenditure in the agricultural sector. Barker et al. (2004, vi, 30) state that irrigation systems are a heavy budgetary burden for the Vietnamese government. In a pilot project, small- and medium-scale irrigation systems are being transferred to the farmers at commune or district level (IMT). They are, thus, attempting to decrease the financial strain irrigation systems pose. Agencies such as the World Bank promote IMT strongly. Due to the season's floods and droughts, Vietnam faces a great variety of cropping and water resource situations. Expenditures for irrigation have to include drainage and flood control and account for roughly one quarter of the sector's budget. In the Mekong and Red River deltas, for instance, rice production relies mostly on surface irrigation. Pumping systems help provide a means for water control. The Vietnamese irrigation infrastructure is old and relies completely on state budgets and Official Development Assistance (ODA), with farmers not having enough opportunity to have their voices be heard. The water supply for agriculture is following a top-down approach for paddy rice and is not driven by the farmers. Additionally, the states' financing plans are not sustainable and insufficient, leaving irrigation infrastructure deficient and in a degrading state. (ADB 2009, xxvi) An attempt to improve this situation has, however, been made through the new Irrigation Law. Furthermore, crop diversification as an instrument to improve resource efficiency is curbed by restriction in land-use policies, even though these have been loosened slightly since 2001. However, much of Vietnam's irrigated land is still allocated to rice paddy and alternate uses are constrained. (World Bank 2016c, 9)

Monitoring Systems

There is currently no comprehensive monitoring system established for the monitoring of fertilisers, pesticides and their environmental impacts. There is insufficient data for general pollution levels and no monitoring of heavy metals. (ADB 2009, 26) There is, however, an environmental information and reporting system. The system is comprised of "a national network of environmental monitoring stations, as well as environmental monitoring at the provincial level" (Aquastat 2011b, 11). The Centre for Environmental Information and Data under VEA is responsible for collection, analysing and documenting data (Aquastat 2011b, 12). In cooperation with the Environmental Police under the Ministry of Public Security,

MONRE/DONRE are responsible for monitoring water quality and the identification of violations to regulations. In case a violation is committed, the PPC is informed and takes action against the respective offenders, who can be fined but also stripped of their licence or permit, depending on the nature of the violation. (Sagris et al. 2017, 8)

Use of Chemicals

Most chemicals used in agriculture in Vietnam have a high toxicity, exposure to the farmers as well as use-costs are high, whereas efficiency is relatively low. Farmers are unaware of health risks and proper use of pesticides, leading to severe health problems due to poisoning and declining surface and groundwater quality due to agricultural run-off caused by over-use of fertilisers and pesticides. (ADB 2009, 50; Sagris et al. 2017, 17) Additionally, the use of untreated wastewater for irrigation poses a problem, as it can cause unforeseen health issues. Even the National Water Resource Strategy declares that "the current extent and condition of national water resources has not been fully assessed, and the data on water resources is not reliable and comprehensive" (MONRE 2006, 10).

National Strategies & Planning Documents

The National Water Resources Strategy towards the Year 2020, Vietnam's main national planning document for water resources, states that "[m]anagement of water resources should be implemented in an integrated and uniform manner on a river basin basis" (MONRE 2006, 12). The document outlines several challenges of Vietnam's water sector, with an emphasis on water as an economic good as well as a means to eradicate hunger and reduce poverty as one of the Party's and State's most important directions for socio-economic development. Among the issues discussed are plans to design more efficient irrigation systems, to reduce depletion of water flows and salt intrusion. The issue of pollution is addressed frequently throughout the document, and it is stated that the systems to supervise and manage water resources have not yet been properly developed. Legal systems are as well described as not fully implemented or being efficiently applied. The ascension of Vietnam to the World Trade Organisation (WTO) is discussed as a chance to enhance development capacity but also a demand to amend legal frameworks to ensure enterprise efficiency as well as stable water quality. (MONRE 2006, 1–9)

The strategy further describes that current state of water resource management in Vietnam as "dispersed, poorly coordinated and overlapping between management and exploitation" (MONRE 2006, 9). The specific objectives are listed as follows: (1) protection of water resources, with priority given to Nhue-Day, Cau, Dong Nai-Sai Gon, Huong river basins, and including elimination of unlicenced exploration wastewater discharge as well as controlling water pollution and excessive use of toxic chemicals in agriculture; (2) the exploitation and use of water resources, including appropriate allocation of resources across sectors as well as a water service market that is to include the participation of different economic actors; (3) water resources development, with multi-purpose projects and a focus on integration between planning and sustainable resource development; (4) the mitigation of adverse impacts caused by water, which is mainly flood and draught mitigation; and lastly (5) the enhancement of institutional and legal capacity, which includes a comprehensive legal framework, a more systematic formation of the state management, in order to be more effective at all administrative levels, and the development of water resource knowledge (MONRE 2006, 13–15).

2.5. Working Procedures – Strategies and Instruments

This criterion deals with the strategies and instruments used in irrigated agriculture and related directly to the categories issue boundaries and actor representation. Specifically addressed will be the actors which are in charge of distribution and investment in irrigated agriculture, the promotion of water-saving irrigation techniques, whether there are training opportunities for farmers in irrigated agriculture, and the existence of legislative frameworks.

Malaysia

Investment and Distribution

The rice paddy amalgamation project, EPP 10 of the Economic Transformation Programme, requires cooperation and investment across sectors and levels. It aims at increasing productivity in the paddy farming area of Muda. While it is planned to expand irrigated agriculture by increasing the size of agricultural holdings from small-scale farmers (average 2

ha) to large-scale farms (average 300 ha), a transformation towards a centralised farming system away from small individual farms would also decrease the investments needed for irrigation. Irrigation intensity in the Muda area is low, as it is only "18 metres of irrigation per hectare, compared to more than 30 metres per hectare in granaries other than those for the Muda Agriculture Development Authority, MADA" (PEMANDU 2010, 538). To achieve these aims, three new forms of land management contracts will be introduced by MADA, namely

- fixed rentals which are paid per season and the risk and costs of farming is borne by the tenant;
- profit sharing between landowner and tenant with a guaranteed minimal income; and
- a management fee, where landowners employ tenants to farm their land and are paid by output, but costs are borne by the landowner. (PEMANDU 2010)

Further, MADA will act as the superior tenant operator that employs already existing operators or farmers to manage these farms. Irrigation intensity it to be improved through new tertiary canals that enable a more reliable management of paddy farming and lets farmers maintain stable water tables during rice crops' growing period. The project's impact is expected to reduce farmers' reliance on subsidies as well as increase their income by at least 30%. However, to achieve this aim, the cooperation and acceptance of such a project is needed from all stakeholders. In this case, MADA has sent ground personnel to build ground level networks with the farmers, gain their trust and encourage participation in the project. They have further encouraged youth involvement, mainly through those educated in the MADA Rice Training Centres. (PEMANDU 2010, 539) Hence, most investments are undertaken, either directly or indirectly through agencies, by MOA.

Water-saving Irrigation Techniques

While water-saving irrigation techniques are not explicitly promoted, ditch irrigation, for instance, which is a traditional irrigation method in which ditches are dug and seedlings planted in rows, then watered by placing canals and furrows between the rows, is a method employed mainly by small scale paddy farmers and widely known. Such methods are currently being improved by government agencies such as MADA or KADA. As an example of such an improved

scheme is the Penampang Irrigation scheme in Sabah, which covers an area of 520 ha and is fed by water from the Moyog River. The water is pumped by three sets of pumps with a capacity of 850 litres/second and enables double cropping by the farmers. (Toriman and Mokhtar 2012, 365–66) Irrigation pricing is also not supporting water-saving irrigation methods, as Malaysia has very low use-rates for water-users.

Training for Farmers

Training for Farmers is provided in, for instance, the National Rice Training Centres, or MOA's National Agricultural Skills Training Programme (PLKPK) conducted by the Agricultural Skills Training Division (BLKP). The BLKP sets standards, monitors quality of agricultural trainings, and supervises, designs, and develops agricultural trainings for farmers. (MOA 2018c) There are also agricultural skills training programmes, which focus mainly on the younger generation. The programme provides training for workers, management and supervisory functions but the only branch that might offer training for sustainable irrigated agriculture is paddy plantation. Such programmes should also address water-saving irrigation methods. Water-saving irrigation methods can be used to further sustainability and the sustainable development goals. Thus, the Malaysian government and its agencies should have an interest in their promotion through official training courses and capacity building. Yet, no reports on which measures are actually being implemented could be found.

There are, however, some general training programmes for the agricultural sector, such as the Agriculture Vocational School Enterprise Training Programme. The programme has, in collaboration with the private sector and the Penang State Education Department, successfully trained students with learning disabilities and certified teachers as coaches to train more students (PMO 2015).

Legislative Frameworks

Malaysia's Federal Constitution states that water is a state matter, including river, lakes, streams, and groundwater. However, this right is not exclusive, as state governments have power over certain water-based projects. Irrigation and drainage, for instance, falls under the

jurisdiction of both, the federal government and the state governments. Article 76 of the Constitution specifies that

> the Federal Government has the power to enact any law under the State List for the purpose of achieving uniformity, in compliance with an international treaty, or simply at the request of the state. Nevertheless, these regulations will not be effective unless the State Legislature approves them. […S]tate Governments will have exclusive jurisdiction over the management of water resources like water catchment areas and ground water. In fact, matters related to rivers, land and forest remain under the exclusive jurisdiction of the state. (Rahman and Khalid 2009, 258)

According to Hezri and Dom (2017, 27), Malaysia's legal framework suffers from the government's legalistic, top-down approach and thus needs to be modernised in order to support long-term sustainable water resource management. The current legislation cannot integrate all aspects important to integrated management, which therefore remains a challenge. The National Water Resources Policy (NWRP), which was launched in 2012, is supposed to provide "clear directions and strategies for water resources management, including collaborative governance to ensure water security and continued sustainability" (PMO 2015). However, in Malaysia, the States are the primary decision-makers as well as actors regarding the management of water resources. They have the power to pass new legislation and enable integrated and holistic management of water resources. Yet, only the three following have thus far done so:

- Sabah Water Resources Enactment 1998
- Selangor Water Management Authority Enactment 1999
- Kedah Water Resources Enactment 2008.

However, most states prefer to stick to their own and old legislation, which does not enable integrated management. In addition to the NWRP, the DID has formulated federal laws on water resource management, too. Due to the States' sovereignty over legal water resource matters, the States' Legislative Assemblies have to first accept and then implement the DID's proposal. The law includes new regulations for water resource use, financing, protection of water resources, advice for codes of practice, and it suggests methods and processes for informed decision-making. However, due to Malaysia's strong federalism, there is currently no framework to resolve inter-state conflicts over water resources or any organisation that can coordinate and manage reservoirs and river basins between the states. (Hezri and Dom 2017, 27–29; Rahman and Khalid 2009, 263)

Vietnam

Investments and Distribution

Even though the state management of water has been transferred to MONRE, MARD is still in charge of investments and service deliveries. Among these are, for instance, the rural water supply, flood control and disaster management, and irrigation and drainage (Barker et al. 2004, 27). The irrigation management enterprises (IMEs), which are responsible for the district-level provision of water, collection of fees and maintenance of irrigation facilities are accountable to their respective PPCs. In contrast, the irrigation management companies (IMCs), which were established as a supplement to the IMEs, are supposed to be autonomous and self-financing, even though merely a portion of their income can be derived from irrigation fees. Thus, the balance of their budget has to be provided by the provincial government. (Barker et al. 2004, 28) There is no body or organisation that combines these tasks, thus the administrative set-up of the water sector in Vietnam can be considered fragmented and overly complicated.

Furthermore, irrigated agriculture in Vietnam relies heavily on ODA in maintaining irrigation infrastructure. The Vietnamese government works closely together with multilateral international institutions in the development and implementation of strategies for agriculture and the water sector (Barker et al. 2004, 40).

Projects Financed by International Organisations: Improving Infrastructure & Providing Training

While MARD has the main responsibility for investments in the sector, there are several cooperation projects financed by multilateral organisations such as the World Bank. One such project, for example, started in 2013 with a duration of 6 years (Nguyen 2018a). It is split in four different components and is focused on the Central Coast Region and the Northern Mountain Region of Vietnam, with the reasoning that these regions and their irrigation and drainage systems are representative for the country and lessons learned here can be applied in other regions as well. Component 1 of this project concentrated on the improvement of institutional capacity, in order to reduce government expenditure on O&M, strengthened WUAs and the application of efficiency and performance standards for WUAs, and establishment of supervision, control, and data acquisition systems for water management. Component 2 focuses on the improvement of irrigation and drainage schemes, i.e. the

improvement of infrastructure. As the largest bulk of the investments, large, medium, and small-scale irrigation and drainage infrastructure (canals, pumps, pipes, control mechanisms) will be improved, and small multi-purpose ponds will be rehabilitated or constructed. Component 3 takes care of climate-smart agricultural practices, in order to improve farmers' income, and productivity and quality of agricultural produce. Among the measures will be the on-farm systems for crop intensification and diversification, promotion of resource efficient irrigation systems such as sprinkler and drip irrigation, as well as Farmer Fields Schools, which will provide field demonstrations for farmers. Component 4 explicitly takes care of management, monitoring and evaluation in support of MARD and the provincial Departments of Agriculture and Rural Development (DARD), by financing operational costs and staff trainings. The project's executing agency is MARD. On the ministerial level, the Vice-Minister for Irrigation oversees implementation and provides policy support and guidance. He is supported by the Department of Construction and Management and the Directorate of Water Resources. The implementation of component 3 is overseen by the Department of Crop Production and Plant Protection. (World Bank 2013b, 7). Thus, this World Bank project is an appropriate example for a project which builds capacity, provides training for farmers, and participates in the promotion of water-saving irrigation techniques.

Another actor active in providing investment in irrigated agriculture is the Asian Development Bank. An generic example for the work international organisations do in Vietnam is the sluice-dike project in the northern Ninh Binh province, which has helped provide water for irrigation, prevents seawater from entering the river, and has thus provided sufficient irrigation water for the affected communes as well as increased rice output through a reliable supply of water resources. Additionally, the sluice system has stopped the previously heavy pollution of the Kien Giang River, supplying the region's farmers with clean water not only for agriculture but also for general living. As a result, agricultural activities have increased by 30%. (ADB 2015)

Furthermore, international organisations, such as the Asia Foundation, World Bank, and ADB, are engaged in capacity building and environmental education projects. These projects, however, do not focus on irrigated agriculture or even water, but address general environmental repercussions of e.g. pollution (Asia Foundation 2011). Additionally, Vietnam is

investing in an awareness programme for non-revenue water[5]. The programme's activities include public awareness building activities, capacity building for local authorities as well as water supply companies. There will further be a non-revenue water policy framework as well as technical improvements for the monitoring and maintenance network. (Sagris et al. 2017, 24)

Resource Efficient Irrigation

Currently, there are several ongoing water initiatives, projects and programmes in Vietnam, many of them financed by ODA. The majority, 55%, of this is invested in water supply and sanitation systems. However, 21% are invested in agricultural water resource management. Further, private sector and civil society initiatives provide help with water resource management and capacity building. The Vietnam Water Partnership, for instance, promotes IWRM focused on capacity building and governance. Overall, the major focus is on infrastructure improvement and rehabilitation. Many projects aim to improve irrigation and drainage systems. The World Bank and the ADB are, for instance, active in the rehabilitation of irrigated agricultural production systems via projects such as Vietnam Irrigated Agriculture Improvement Project or the Productive Rural Infrastructure Sector Project. Further, there are initiatives to improve rice and coffee farming practices through implementing agricultural restructuring plans. Nestlé is working with Vietnamese authorities in optimising coffee farmers' water use. IRRI is a key NGO, which assists in rice breeding material exchange, rice varietal improvement, resource management and capacity building, as well as alternate wet and dry practice. (Sagris et al. 2017, 24)

Training

Since 2001, MARD has yearly conducted irrigation training classes for officials of irrigation and drainage management companies and the provincial Departments of Agriculture and Rural Development. Course subjects include the studying of policies and legal documents, norms,

[5] Non-revenue water (NRW) is water that is lost during, for instance pumping, or through other causes such as theft. An estimate for NRW in developing countries is 45 million cubic meters daily, and a value of US$3 billion per year. Kingdom (2016).

standards and regulations. However, as compared to around 20,000 people employed in irrigation, the programmes covering of around 100 participants every year is insufficient. Moreover, farmers and citizens are not included. (ADB 2009, 63) In addition, Vietnam Farmers' Union (VNFU), a government led organisation, also offers skill and knowledge trainings for cadres, public servants, and labourers. VNFU is mainly aimed at capacity building and representation of peasants, and participates in policy formulation as well as dissemination and can thus be considered as a capacity building project. (VNFU 2018) According to Brown (2009, xvi), most government agencies have little knowledge or training in the allocation, development of protection of water resources, neither at the central or at the provincial level. Thus, capacity building and awareness in Vietnam's water sector is insufficient. Management issues, water and its sub-sector issues as well as the relating regulations are inadequate across all levels of government. The availability of practical training or capacity building projects to, for instance, criticize development plans or assess environmental impacts is low.

Legislative Frameworks

The two most important legislative frameworks for irrigated agriculture in Vietnam are the new Law on Water Resources (hereafter called Water Law), and the Law on Irrigation. Both aim at modernising the irrigation sector. The Water Law set Vietnam on a course towards IWRM, even though key aspects are not clearly regulated, according to Sagris et al. (2017, 4). The current Water Law was promulgated in 2012, replacing the original Law on Water Resources 1998/99, and established water policy at the national and subnational level (Nguyen 2010, 13; Sagris et al. 2017, 5). The law describes, in relative detail who is supposed to be involved in the management of water. According to the World Bank (2013b, 2), MARD plans to establish monitoring mechanisms in accordance with the new frameworks, as the Water Law calls for monitoring performance "of resources invested". The new Water Law requires that resources be invested in an economical and efficient manner. Further, the new Hydraulic Law, which was expected in 2013, should have provided more opportunities for modernisation, monitoring, and evaluation (World Bank 2013b, 2). The law, however, has not yet been passed. Instead, the Law on Irrigation came into effect in June 2017, as a complement to the Water Law, substituting the Ordinance on Exploitation and Protection of Irrigation Works. The Irrigation Law defines rights and responsibilities of organisation and individuals, it states that "the State will invest in

building particularly important irrigation works, large irrigation works, irrigation works for which it is difficult to mobilize social resources, and reservoirs in water scarcity areas" and further "organizations and individuals will be encouraged to invest in building irrigation works in the form of public-private partnership. […]. Organizations and individuals will be supported in building, repairing and upgrading small-sized and inner-field irrigation systems; advanced and water-efficient irrigation systems; advanced and modern watering and drainage systems" (Nguyen 2018a).

3. Discussion of the Findings

3.1. Malaysia

3.1.1 Actor Representation

In Malaysia, water resource development is sectorally managed, whereas irrigation water supply is handled by the respective agencies unilaterally (Ariffin 2013, 167–68). Several actors are active in Malaysia's management of irrigated agriculture. The organisational structure features government institutions that span mainly across the national and regional level. The local level is not as well-represented. Responsibility for water and irrigated agriculture lies mainly with the MOA and its agencies MADA, KADA, and the IADAs, and with the KATS, and its agency the DID. Matters pertaining to water are under the government's and the federal states' jurisdiction. The water sector of Malaysia is fragmented, there are too many institutions involved acting either under MOA's or KATS' authority, while ministries such as MESTECC are stakeholders, too. Decentralisation only slowly proceeding, the national government and therefore its agencies still control most of the sector (Hock 2008, 72).

The representation of non-governmental actors is low and almost negligible. Furthermore, farmers have no influential means of representation on a political level through Malaysia's WUAs. The farmers' organisations act as business entities. Thus, even though the IADAs take local needs into account, farmers can only react as business entities. The basin level is well represented through the DID's division for river basin management, whose role it is to implement IRBM.

Consequentially, Malaysia's participatory mechanisms in water management are insufficient. Although the government has acknowledged the importance of participatory decision-making processes to involve all stakeholders, implementation of said processes has not yet happened and is limited to farmers involved in the few official farmers' organisations. As stated by Zakaria (2013, 132), there is a need for more awareness and advocacy at all levels, so that stakeholders' participation increases in water resource management. WUAs have been established in 1973 through the Farmer's Organisation Authority (FOA) as the head of all farmer's organisations. As FOA works in direct support of the national government's policies and works in close cooperation with other government agencies, too, it can be considered a key actor in irrigated agriculture, but not one that can act independently from the government and its agencies. Under FOA are the Area Farmers' Organisations and State Farmers' Organisations, which have

been established as early as the 1960s. However, Malaysia's WUAs are built like business entities with shareholders. No evidence for direct involvement of farmer's in decision-making and policy processes could be found. NGOs do also not have great impact on the sector, as their key areas are not directly related to irrigated agriculture. As Hezri and Dom (2017, 30) phrase it, "there are struggles in the water domain between centralised infrastructure and business models, and more decentralised, participative and diversified models" in Malaysia. The latter does usually not pertain to irrigated agriculture but solid waste management initiatives, or similar. The authors further propose the establishment of community groups for the agricultural sector, where paddy farmers in irrigated regions could reduce water losses by coordinating the timing of cultivation and thus, irrigation. This would enable more efficient water use and reduce losses as well as increase cropping intensity and yield. (Hezri and Dom 2017, 30)

Nevertheless, the scope of responsibilities the farmer's organisations have, e.g. extend agricultural production among farmers and smallholders, provision of necessary farming facilities and services to modernise plantation business, and the promotion of group actions through community projects, can be considered rather extensive (LPP 2018). Although farmers should be key actors in sustainable irrigated agriculture, the farmers' organisations do not focus on sustainability. Therefore, even though there are established platforms for farmers to organise, participation opportunities in the shaping of the political discourse are not given and insufficient.

There is no single agency or ministry in Malaysia that dominates the sector. However, government ministries, especially MOA, are by far the most dominant actors. Particularly MADA under the authority of MOA frequently serve as best practice examples for other IADAs. The DID, and thus by extension KATS, is the other governmental branch with considerable influence, as they are responsible for river management and IRBM implementation. These organisations have the power to undertake investments as well as countrywide projects. However, the provision of water for irrigation is the responsibility of the DID, which is in agency of KATS, even though it is still listed as a MOA division by the ministry itself (as of December 2018). The main responsibility for irrigation infrastructure, however, lies with MOA's agencies. Responsibilities distributed this way can lead to unaligned resources as well as inter-agency conflict and

competition. Furthermore, the involvement of supra-national organisations is negligible and no indication of dichotomies between such organisations and national strategies could be found.

Table 7: Actor Representation, Malaysia

Actor Representation				
(Organisation across) levels and actors	Involvement of Actors	Agriculture •MOA • MADA, KADA, IADAs • KATS •DID	Water • KATS •DID	Farmer/WUA •FOA, AFO, SFO
	Organisational Structure	Mainly Centralised		
	Representation of governmental actors	national	regional	
	Non-governmental	national	regional	farmer
Participation	Existence of participatory mechanisms	Yes		
	Farmers are key actors in local agricultural water management	No	Farmers are involved through FOs	WUAs established (farmers' organisations)
	Communication is balanced/one-way	Top-down, but with attempts at bottom-up communication through e-participation		
Resources	Power is distributed evenly among actors	No		
	Actor dominance	• MOA • KATS		
	Dichotomy between supra-national organisations & national strategies	No		

Source: Own design.

3.1.2. Issue Boundaries

Malaysia's water sector has been undergoing several changes in its institutional structure and alignment in the last years. The sector of irrigated agriculture is still largely run by the government in a typical top-down approach. One constraint faced by the federal agencies is

the absence of legal jurisdiction, as, according to the Constitution, water and land are the states' matters. Furthermore, the linkages between agencies are weak, as there is no single authority that is responsible for water resource management (Zakaria 2013, 128). Much of the data on water management is outdated, and procuring current data or activity taken in the sector is difficult. Moreover, Chan (2009, 145) claims that much of the power of the sector is in the hands of private companies, which have strong ties to governmental actors and can thus make effective use of resources without having to consider other sectors or actors.

The disparity between vertical and horizontal alignment is great. Water resource management is hampered by the administrative boundaries of each level, with each level having their own focus and priority. However, initiatives such as SRD that further inter-ministerial dialogue and bring stakeholder together can be conducive to alignment and build awareness of inter-sectoral issues. The ETP proposes several initiatives that are aimed at increasing yields and modernising the sector. However, even though the initiatives require collaborative effort, they are still restricted in their focus and action, as their sole purpose is the implementation of the Entry Point Project. Therefore, factors that do not directly pertain to the EPP are not considered.

Another indicator to unaligned resources is the fight against pollution at the river basin level. The basin level tends to have low priority among local governments if it doesn't affect them directly, as there is greater incentive to meet local needs and focus on local resources. Flood control, water extraction, pollution levels are split across ministries and agencies. Zakaria (2013, 126) aptly phrases the alignment problems across levels and sectors:

> Over the years numerous new departments have been created to regulate, manage and provide services related to water. In carrying out the duties and responsibilities assigned to them, agencies have carried out planning; implementation of projects; operation, maintenance and management of schemes; extraction of river water; […]; issuance of licences; formulation of rules and regulations; enforcement of regulations and laws; prosecution; either individually or in cooperation with other agencies. Some agencies are responsible for more than one such function, and overlaps in responsibilities are not uncommon. It is also not unusual to find agencies having the technical expertise but no legislative enforcement powers; and *vice-versa*.

As agriculture is one of Malaysia's national key economic areas and is considered crucial for the provision of rural employment, food security, and income, the country aims at enhancing the sectors productivity and exploit market potential. Even though irrigated agriculture is represented across levels of governance, it is only expressly considered as one of the country's key targets through the increase of average yields in paddy farming. Other areas, such as

seaweed farming or herbal products, are considered more important as they promise higher market values.

Malaysia's actors in irrigated agriculture are highly fragmented with differing interests and no initiatives to align these interests, such as boundary organisations. Thus, the fragmentation is caused by a centralistic approach on a horizontal level (MOA and KATS) but also on a vertical level (DID, MADA, KADA, and IADAs). However, through the IADAs, MADA, KADA, and the DID, Malaysia is at the least equipped to handle problems at the regional level and if needed also the local level, and can take measures to address such problems.

Malaysia has no national approach for water or soil pollution and the only accessible database is the DoE's Environmental Quality Report through Malaysia's Open Data Portal. As most agencies or ministries have their own ranges of duty, they also employ their own systems. Particularly for agencies such as KADA and MADA, it would be essential to be able to easily access information of, for instance, state of soil pollution, fertiliser use, and flooding issues, as it directly relates to their aims of ensuring and increasing paddy production. Sustainable agriculture is, however, none of their aims. The fragmentation of the sector and division of responsibilities can create loss of data but even more importantly loss of knowledge. A national level approach to monitor resources would be needed to ensure alignment. Further, the protection of farmers is also lacking, as they are often not aware of health dangers pesticide use can pose. The mechanisms for enforcing the existing legislation for importing, registration, distribution, usage, and disposal should be reviewed. Consequently, public awareness of the negative effects of pesticide use need to be increased as well. Information of alternative techniques and training courses would not only increase farmer's safety but also environmental safety. (Ali, Yusof, and Aziz 2018, 790)

Coordinating the implementation of policy instruments across actors and sectors is a difficult endeavour due to high fragmentation. The recent restructuring of ministries has shifted responsibilities but has not decreased the sector's fragmentation. KATS, the former Ministry for Natural Resources and Environment, is now the DID's superior organisation, instead of the Ministry of Agriculture and Agro-based Industries. The majority of water-related issues lies with them. However, MOA is still the organisation with the major authority in the agricultural sector, thus splitting water and agriculture, instead of working towards further alignment.

Instruments favoured are financial and infrastructural. The transformation from small-scale farms to bigger, business-sized farms is one of the major aims of the Economic Transformation Programme. Government agencies support farmers through ETP projects that aim at increasing the sector's contribution to GNI, and paddy farming by 60%. Subsequently, an increase in rural employment as well as higher income by 2 to 4 times is expected. The Entry Point Projects support these aims. EPP 10 and EPP 11, in particular, are targeting irrigated agriculture. Strengthening paddy productivity in the Muda area as well as increasing productivity in other paddy and irrigated areas can increase national food security and self-sufficiency as well as reduce farmers' dependence on government subsidies. Although water and agricultural bureaucracies have to work together for the EPPs, a boundary organisation including experts from all involved actors would be conducive to such a project.

Malaysia has an abundance of national planning documents. The Malaysia Plan, the EPPs, and the ETP are only three of the major documents and visions that address irrigated agriculture. The focus is not on sustainability or further alignment of the sector, but on its competitiveness on the international level, agricultural enterprises, niche markets that can be exploited (such as seaweed), and the decrease of rural poverty. The focus on an increased GNI, higher employment rates, and a modernised sector that exploits niche markets neglects the implementation of resource efficient tolls for water-use. Furthermore, the current National Agro-Food Policy, NAP4, focuses mainly on agro-food businesses and does not outline clearly what role water and irrigation will play. Therefore, these plans may be unsustainable in the long-term.

Table 8: Issue Boundaries, Malaysia

Issue Boundaries			
Problem definitions and objectives	Representation of irrigated agriculture across levels	**National**	**Regional**
	Alignment of national and local practices	**No** • **Fragmented sector**	
	Existence of comprehensive databases	**Yes** • **Malaysia Open Data Portal**	
Networks and Instruments	Boundary Organisations & collaborative initiatives	• **MSAN** • **Rice paddy amalgamation project**	
	Instruments used	**Financial** • Subsidies • price support • subsidies for fertilisers • credits • minimum price • price bonus	**Infrastructural** • flood mitigation • new IADAs
	Instruments used to explicitly improve resource efficiency	**Infrastructure** • Increase of farm size • Rice paddy amalgamation programme	• Sprayer permit for MADA/KADA area
	Existence of monitoring systems for fertilisers, pesticides, and their impacts on soil and water	**DoE** • River monitoring • Pollution inventory (agriculture) • Groundwater monitoring **Water Management and Hydrology Division (DID)** • National Hydrology Data Bank	
	National Planning documents	**Yes** • NAP 1-3 & National Agro-Food Policy • Malaysia Plans • ETP	

Source: Own design.

3.1.3. Working Procedures

The implementation of policy instruments across sectors demands coordination among several different actors. Malaysia aims to consolidate land through economies of scale and to transform small agricultural holdings (~ 2 ha) to agribusinesses (300 ha) that operate in large

clusters and have access to modern infrastructure and are centrally managed. Developing services to increase irrigation efficiency and investment in higher-value activities are examples of the instruments used. EPP 10, increasing productivity in the Muda paddy farming area, is the prime example for such a project that also highlights how power is distributed in the sector. Investments in such projects are mainly undertaken by the government through MOA and its agencies, in this case MADA. However, the success of such instruments is dependent on the acceptance of farmers and their adoption of new methods and opportunities. This, in turn, is dependent on the flow of information and available training facilities.

Malaysia offers farmers training through various organisations facilities. MOA's Agricultural Skills Training Division, for instance, conducts trainings that aim at enabling farmers to develop entrepreneurial skills and further the development of a competitive sector, which is in accordance with the ETP and the NKEAs. Yet, the focus of the trainings programmes is not on, for instance, water-saving irrigation methods. Furthermore, the current pricing mechanisms do not enforce sustainable irrigation methods, as their rates are too low. The status of capacity-building is insufficient and needs further development. Sharing and integration of knowledge among actors as well as archiving and analysing said knowledge and making it available for decision-makers could develop management practices and help Malaysia achieve its objective of obtaining the status of developed country by 2020 (Zakaria 2013, 132).

Enforcement of legislative frameworks is low and ineffective. According to Chan (2009, 145), Malaysia's legal frameworks are mainly related to the protection of water resources from pollution, and the treatment and supply of water for civic and industrial use. Thus, the current laws are lacking and do not take irrigation sufficiently into account. As stated by Hezri and Dom (2017, 28), if Malaysia wants to further its integrated management of water resources, it needs "legally-binding codification of management principles in law at various levels of government" as well as acknowledge the interconnectedness of ground and surface water. Both need to be subject of new laws. Giving the federal states' sovereignty over their water resources is not conducive to integrated management and alignment of resources. Here, a boundary organisation or at least a collaboration project across states would be beneficial, as many of Malaysia's major river basins cross different states. Zakaria (2013, 127) addresses the legal problems of the water sector in Malaysia in no uncertain terms:

With rapid economic development of the country the overlaps and gaps in the land-water base development have become more apparent. As negative impacts of water stress, escalating floods, increased pollution, and diminishing biodiversity emerge, conflict areas and confusion have also been created. At the federal level, the enforcement of water laws and legislations are carried out by the various water-related agencies. Many of these laws are outdated, redundant or ambiguous. These diversified legislations have focused on limited aspects of water resources and services that are directly related to the responsibilities of the respective government agencies.

A balance between approaching water resources from a hydrological point of view and from a political perspective, for instance boundary organisations established through administration, needs to be found. Further, a comprehensive water law should also consider water conflicts that may occur due to climate change or other meteorological causes. Even though the National Water Resources Policy combines aspects from a variety of sectors, its implementation cannot be successful without the amendment of current laws and responsibilities.

Table 9: Working Procedures, Malaysia

Working Procedures			
Strategies and Instruments	Actor in charge of investment/distribution in irrigated agriculture	**Government** **• MOA**	
	Promotion of water-saving irrigation techniques	**• Ditch irrigation**	
	Training for farmers	**Government**	NGO
	Existence of legislative frameworks	**Yes**	

Source: Own design.

3.2. Vietnam

3.2.1. Actor Representation

The management and protection of water resources falls under the authority of MONRE and its agency DWRM, whereas MARD is responsible for sustainable management of agriculture. Quality standards and criteria are managed by the Ministry of Health. Pricing is determined by the Ministry of Finance and the Ministry of Construction. However, final decisions are made by the PPCs (ADB 2009, 16). Furthermore, the roles of the different institutions are oftentimes not clear and appear conflicting to stakeholders, not only among ministries and departments, but also among public and private stakeholders (ADB 2009, xv), thus causing unaligned resources and overlapping responsibilities. However, the main responsibility for irrigated agriculture is located under the Ministry of Agriculture and Rural Development, which was explicitly founded with the goal of increasing effectiveness and reducing overlapping responsibilities as well as reduce the plethora of ministries active in the management of rural resources (forestry, agriculture, and rural development). The NWRC only acts as an advisory organ and does not have any decision-making powers. NGOs are present but not explicitly active in irrigation. However, multilateral organisations such as the World Bank and the ADB are frequently engaged in the sector of irrigated agriculture through investment and infrastructural projects. The representation of farmers through WUAs is encouraged through such projects as well. WUAs are, however, only active on the local level and do not have direct influence on the policy process or strong influence on decision-makers. (Barker et al. 2004, vii) claim that due to insufficient cost recovery as well as badly kept infrastructure, Vietnam's water sector is largely regarded as poorly managed. But through, for instance, water-user participation in the area of operation and maintenance, new ways for participation and thus, greater involvement of those directly concerned by decisions in the water sector are being pursued.

The organisational structure in Vietnam has changed over the last decades. As many decentralisation initiatives have been undertaken, the local level can be considered decentralised, while the general management and communication approach is still centralised and top-down from the national level. Even though governmental actors are represented at the local or district level through administration offices or divisions on the commune level, they still have to adhere to the policies that are developed by the central government. Further, the PPCs have grown in power and can make independent investments or participate in land

management. Therefore, even though power has gone to the provincial level, the local and commune level are still left without much decision-making power.

The distribution of power leads to considering the available participatory mechanisms in Vietnam's sector of irrigated agriculture. Although mechanisms are still sparse, there have been efforts, pushed by international organisations, to include PIM and IMT. PIM in particular has been endorsed by the central government through the national strategy of participatory irrigation management. Through PIM, local water-users can manage local level irrigation, thus encouraging participation in irrigation management and efficient water-use. There seems to be a lack of understanding between the different actors regarding participatory resource management. However, as stated by Nguyen (2018), farmers already consider irrigation management as their domain, with or without official decentralisation initiatives. IMT is the second tool used to enhance participation. Through farmers' participation in O&M, water supply became more reliable and maintenance costs can be lowered through IMT. Its success, however, is contested. To successfully implement participatory mechanisms, appropriate legal frameworks that clearly establish responsibilities and rights are needed. Participation should not only be encouraged through international organisations but also by the central government. Mechanisms that enable farmers to communicate needs and problems to higher levels of government would be conducive to successful implementation.

However, power remains mainly with MARD, MONRE, and the PPCs, indicating unbalanced communication und an uneven distribution of power. The tensions between both ministries further exacerbate these issues. Conflicting strategy papers and fights for control over decision-making power can hinder aligned development of the sector.

To sum up, Vietnam's agencies in the water sector, and in particular in irrigated agriculture, still suffer from centralised top-down approaches and low public participation. Although there were several initiatives in the last years to decentralise the organisational structure and include a greater range of, at least, environmental education and capacity-building projects for NGOs in the environmental sector. However, problems that arise at the local level need to be monitored and discussed at regional and national level. This requires actors being able to handle problems at different levels of government and through diverse measures. The centralistic organisational structure of Vietnam's water sector reflects these problems. Overlapping responsibilities between the two major governmental actors MONRE and MARD,

as well as the just recently installed river basin level committees demonstrate the lack of concern for the sub-national level.

Table 10: Actor Representation, Vietnam

Actor Representation						
(Organisation across) levels and actors	Involvement of Actors	Agriculture • MARD • MONRE	Water • MONRE	NGO	Farmer/WUA	International • World Bank • ADB
	Organisational Structure	Mainly Centralised			Decentralised on local level	
	Representation of governmental actors	national	provincial			
	Non-governmental	national	regional	local/farmer (through ODA projects)		
Participation	Existence of participatory mechanisms	Yes				
	Farmers are key actors in local agricultural water management	Yes • IMT • PIM	Farmers are involved • IMT • PIM	WUA established		
	Communication is balanced/one-way	Top-down				
Resources	Power is distributed evenly among actors	No				
	Actor dominance	• MONRE • MARD				
	Dichotomy between supra-national organisations & national strategies	No				

Source: Own design.

3.2.2. Issue Boundaries

Irrigated agriculture in Vietnam is represented across levels of governance – national, regional, local, and - in theory - the river basin. At the national level, irrigated agriculture is needed to provide food security, whereas at the local level, irrigated agriculture provides employment and income. However, governmental representation spans mainly from the national to the regional/provincial level. The local level is mainly covered through ODA projects by actors such as the World Bank or the ADB. Further, although environmental NGOs are active on the local and national level, there is nothing that indicates their influence on the policy process. Their

actions lie mainly in the provision of technical and financial assistance. The river basin, as a separate level of organisation, is represented through Committees and the MRC. Ministries, agencies on the ministerial-level and other agencies that are attached to the government are tasked with national level water resource management and large river basins. Following in the hierarchy are the People's Committees at the provincial, city, and district levels, who have their respectively attached agencies or divisions that manage water resources within their localities. Additionally, irrigation and drainage companies and WUAs are also stakeholders in water management in Vietnam. Thus, even though irrigated agriculture is represented across levels, the plethora of actors causes fragmentation and unaligned use of resources.

The main conflict that hinders alignment across levels and sectors is between MONRE and MARD, which is exemplified by the problems in setting up RBOs. Through the RBOs, MONRE saw a chance to further its legitimacy and role in the administrative set-up, whereas MARD saw them as a means for financial power and political influence (Molle and Hoanh 2009, 19). The authors (2009, 17) further argues that "[s]ince RBOs are largely promoted by foreign partners and are, thus, likely to be associated with the future delivery of loans and projects, they may also 'attract' more investments, which makes their control even more desirable. In other words, the legitimacy of RBOs as 'registration chambers' for projects – rubber-stamped with the seal of IWRM – can be attractive for the departments traditionally involved in structural interventions." The founding of MONRE can be interpreted as complicating the previously existing set-up of ministries, as water management functions were previously located under one ministry. Separating these functions is not conducive to integrated management or the alignment on practices across levels. The divide between national and local practices is increased through top-down communication, the absence of comprehensive databases which are accessible to all, and the relative low power of farmers in the policy process as discussed under actor representation.

There are few collaborative bodies and initiatives or boundary organisations for irrigated agriculture in Vietnam. The MRC stands out in so far as it is an inter-governmental body that also invests in agricultural programmes in the Mekong Basin. The NWRC would have the potential for becoming a boundary organisations if it would include and represent stakeholders from all levels, including farmers. However, due to MARD's and MONRE's disinterest in the

council it “seems to be rather inefficient” (Waibel 2010, 28), and has thus far not done any to the author accessible work.

In the agricultural sector of Vietnam, there is a tendency to favour infrastructural instruments. Salinization, waterlogging, and similar issues cause water quality to decrease, in turn increasing the importance of resource efficiency and appropriate instruments. So far, Vietnam has failed to make an impact through, for instance, canal lining projects and increased participation in operation and maintenance through farmers. Although they have decreased spending on the government’s side – in particular through farmers’ participation in O&M – an increase in resource efficiency has not been achieved. More successful was the distribution of small water pumps, as it has enabled farmers to individually in- and decrease irrigation quantity, according to their needs and experiences. Moreover, the distribution of small private pumps and the government’s announcement in 2001 to allow for greater diversity in crops furthered crop diversification.

Financial instruments, such as the charging of irrigation fees, had been effectively abolished in 2013, but were reintroduced in 2017 through the new Irrigation Law. Farmers had to pay an irrigation and drainage company with adapted fees that are based on the crop area, in contrast to the former more inflexible irrigation fees. This system stood in stark contrast to other water-users, such as industrial companies, which had their fees based on the volume of water used. The downside of the abolishment of irrigation fees can be found with the WUAs and irrigation and drainage companies, who had to adapt to managing their work without the additional benefit of the irrigation fees paid by farmers. However, 2017’s new Irrigation Law initiated the establishment of new pricing mechanisms for irrigation services. The new law was supposed to change the perception of water and irrigation to a commodity, with different pricing mechanisms for state and non-state funded irrigation products and services. As stated by Sagris et al. (2017, 7), there is no differentiation between areas that have sufficient water resources and those that suffer from scarcity. Thus, the new pricing mechanisms give disadvantage to farmers in the drier regions. Additionally, the abolishment of irrigation fee and their subsequent reintroduction caused high administrative costs.

The overuse of fertilisers and pesticides is another problem for the sector, as it relies heavily on the use of unpolluted water for irrigation. Untreated industrial wastewater can cause huge profit losses as it diminishes yields as well as affect farmers' health. Since there is no effective monitoring system for neither, quality or quantity of fertilisers and pesticides used, their impacts on water and soil go unchecked as well. There are several separate monitoring stations, but since different stations' data is collected by various actors, effective monitoring and enforcement of environmental hazards through fertilisers, pesticides, and other pollution cannot be warranted. Furthermore, farmers are often unable to make informed decisions in their use of fertilisers and pesticides, as they are unaware and uninformed of the possible consequences. Due to the difficult situation, informed decision-making by all stakeholders is not possible. Even pertinent government departments may have difficulties in accessing relevant data, as data collection and management is spread across several actors. According to interviews conducted by Sagris et al. (2017, 7), stakeholders mentioned that available data "may have been adjusted to reflect certain standpoints rather than reality", thus implying that even the existent data is not reliable and gives a distorted picture of state of soil and water. Further, and not aided by the lack of available pollution data and the impact of fertilisers and pesticides on soil and water, the level of pollution of Vietnam's surface water is increasing, and whereas upstream river water is still of relatively good quality, downstream river water of some of the major rivers have low water quality (Aquastat 2011b, 12).

Vietnam's major national planning document for water resources is the National Water Resource Strategy towards the Year 2020. Even though the document reads very critically of the current state of water resource management in Vietnam, it still uses many unclear formulations, such as "appropriate and fair allocation […] of water resources among actors", but does not specify to what standard "appropriate" or "fair" should aspire. However, as the National Water Resource Strategy is a general planning document with only few specific projects and actors mentioned in its Annex, such formulation is probably to be expected. And even though it does not offer concrete solutions, it shows awareness of the water sector's current problems and expresses a need for these issues to be dealt with. Although the National Water Resource Strategy has been published in 2006, Sagris et al. (2017, 4) reason that resources are still mainly managed within the individual sectors or provinces and not in an integrated manner. Thus, even though there have been some initiatives and changes, the

sectors' full potential and the National Water Resource Strategy's aims have not yet been reached.

Table 11: Issue Boundaries, Vietnam

Issue Boundaries				
Problem Definitions and Objectives	Representation of irrigated agriculture across levels	**National**	**Regional**	**Local**
	Alignment of national and local practices	**No** • **Fragmented Sector**		
	Existence of comprehensive databases	**No**		
Networks and Instruments	Boundary Organisations & collaborative initiatives	• **MRC** • **NWRC**		
	Instruments used	**Financial** • pricing mechanisms • subsidies and investments	**Infrastructural** • IMT • drainage and flood control	
	Instruments used to explicitly improve resource efficiency	**Infrastructural** • canal lining • participation in O&M • private pumps	• AWD • Crop diversification	
	Existence of monitoring systems for fertilisers, pesticides, and their impacts on soil and water	**MONRE** • Water Quality monitoring • Environmental Monitoring Stations		
	National Planning documents	**Yes** • National Water Resource Strategy towards the Year 2020		

Source: Own design.

3.2.3. Working Procedures

The case of Vietnam clearly demonstrates that investment and policies should not be isolated per sector. State management is split between MONRE and MARD, with active international organisations that support agricultural investment. MARD emphasises that "rural development recognizes the critical role of investments and policies in the nonfarm sector in sustaining agricultural growth and realizing the multiplier effects of that growth on economic development and poverty reduction" (Barker et al. 2004, 40). A majority of investments are undertaken either by international organisations, e.g. World Bank or ADB; and even the National Water Resource Strategy demands to "make full and efficient use of ODA (Official Development Assistance)" (MONRE 2006, 19). Heavy reliance on ODA can, however, prevent more integrated development, as they usually have very specific aims in mind, such as the building of sluice gates to improve irrigation in a designated region. Training and capacity building projects do rarely reach the local level. MARD's training classes are aimed at the irrigation and drainage management companies, and thus, end at the provincial level. There has been, however, an increase in such projects, as Vietnam recognises the need for more awareness and knowledge, not only on the national but also the local level.

Vietnam features are rather comprehensive framework for water and irrigation management, Aquastat (2011b, 12) noted that the secondary legislation needed for the implementation of many objectives is not yet given and is still an ongoing process.

> The government has enacted laws, created institutions, expanded investments and decentralized authority to manage the country's vast water resources efficiently and sustainably. However, rapid economic development, high population growth, worsening environmental conditions and frequent natural disasters are overwhelming the capacity of the existing policy and institutional framework and in turn are undermining the effectiveness of numerous government interventions. Given this history and context, the management of water resources is one of the most critical issues in Viet Nam. (Aquastat 2011b, 14)

Vietnam's water sector is equipped with a complicated policy framework of over 300 regulations. Yet, water management is still suffering from unsustainable use and overexploitation of water resources, water pollution and a lack of connection between local practices and national policies as well as coordination within the sector. Furthermore, sustainable water use and allocation are not working in tandem with the current economic instruments in use, thus making it important for Vietnam to design incentives for sustainable

agricultural water use. For the implementation of AWD, for instance, MARD has to take the lead in addressing the problems farmers have and increase capacity building projects. Creating capacity and awareness through farmer trainings as well as investing in infrastructure to improve irrigation efficiency are key challenges that need to be addressed across levels, but are, as of 2019, confined to single organisations such as IRRI or MARD. For a successful improvement of resource efficiency, MARD, MONRE, NGOs, WUAs and other farmers' organisations as well as irrigation and drainage companies will have to work together.

Vietnam's policy and regulation framework misses clear guidelines and lacks enforcement. According to Sagris et al. (2017, 29), the key challenges are a lack of "capacity at provincial government departments and missing incentives for sustainable water resource management." Combined with a lack of technical capacity at the local level, more training facilities and direct support for farmers is needed and can long-term improve sustainable water use as well as levels of pollution. The discussed river basin management committees are another step that would include different actors across levels and could work as an efficient boundary organisation, further alleviating Vietnam's water stress. Currently though, there are no functional boundary organisations in Vietnam.

Measures and instruments employed to increase resource efficiency and therefore, water-saving irrigation methods are comparably diverse. Crop diversification, for instance, has been increasing through greater distribution of small pumps through private sector investments. Small-scale canal irrigation and small private pumps further crop production as they allow for more controlled and efficient water use. This indicates that Vietnam is aware of the benefits crop diversification and new irrigation methods can bring. Not only through an increase in yields, but also through resource efficient technology. Still, problems such as salinization due to droughts or reduced surface water flows remain. None of this will be effective if there are no capacity building projects for all relevant stakeholders. However, mainly through the help of ODA, knowledge capacity is slowly being increased through several projects. Although these projects focus mainly on sustainability and environmental issues, they are a first step in the right direction to build more knowledge and awareness among actors.

The new Water Law and Irrigation Law show that Vietnam's government invests and experiments with different kinds of instruments and incentives. It proves that the government

is aware of limited resources as well as farmers' involvement in and possible impact on the sector, and puts emphasis on the need to become more resource efficient. Nevertheless, failing to take different regional conditions into account and unable to provide appropriate resource monitoring systems, there are several projects and focus areas, but none that take all relevant actors into account. The absence of functional and integrative river basin committees and too much reliance on ODA counteract many attempts at resource efficiency and alignment.

Table 12: Working Procedures, Vietnam

Working Procedures					
Strategies and Instruments	Actor in charge of investment/distribution in irrigated agriculture	Government • MARD • MONRE	International • World Bank • ADB		
	Promotion of water-saving irrigation techniques	AWD			
	Training for farmers	Government		Capacity-building projects	
	Existence of legislative frameworks	Yes			

Source: Own design.

4. Conclusion

> We know that controlling water also means controlling life and people's livelihood. Exercising this control, therefore, illuminates what is valued by whom. (Delli Priscoli 2004, 221)

This thesis set out to compare the current state of water governance in irrigated agriculture in Malaysia and Vietnam. Included were factors and elements that shape the current status of water governance in irrigated agriculture from an alignment perspective, which allowed addressing the factors that contribute to the 'wickedness' of the issue. Although it may seem simple to just assess the current status of water governance in a given country and contrast it with that of another, there are several challenges that complicate accurate description and analysis. Not only is there a plethora of approaches to water governance but these approaches also have different emphases. As phrased by Rauschmayer, Paavola, and Wittmer (2009, 144) water governance is confronted with various "challenges regarding the integration of different levels of decision making governed by their own rules, and the integration of political and natural scales examined through scientific concepts that are often difficult to synthesize." As irrigation is a major contributor the food security and rural employment in many countries, this chapter's aim is to answer this master's thesis' research question:

"*What are the similarities and differences in freshwater governance in irrigated agriculture in Malaysia and Vietnam?*"

Water governance is a multi-disciplinary problem. For the scope and purpose of this thesis, an eclectic analytical framework has been developed based mainly upon the literature of Özerol and Bressers (2017) and Özerol, Bressers, and Coenen (2012). Through the analytical matrix established in chapter 1.3, the various indicators were assesses without ranking. The analytical matrix allowed the analysis of similarities and differences in the respective countries governance structures of water resources in irrigated agriculture. Moreover, this framework allowed analysis of cross-sectoral issues, namely different levels, instruments, and actors involved in water governance in irrigated agriculture, under an alignment perspective. The approach highlights the interconnectedness of actors and instruments across scales and levels and that has thus far not been applied to East Asian countries. The empirical analysis illustrated several relevant findings.

Actor Representation

Both, Malaysia and Vietnam have a developed institutional structure with two dominant ministries each. Bureaucracies for water and agriculture are not combined in one body but spread across ministries and their agencies. In Malaysia, water is managed by the government and the states. In Vietnam, the central government, its ministries and the provinces are the major actors. In both countries, the representation of the local level is lacking. WUAs or similar organisations do not wield any considerable influence on the policy process. Furthermore, multilateral organisations and NGOs are more active and better represented in Vietnam than in Malaysia. This is not to say that there are no international organisations or NGOs active in Malaysia, however, their actions do not extend to irrigated agriculture. The absence of NGOs can lead to low visibility of the sector. This, in turn, influences accountability and international pressure to advance the sector in a sustainable manner. Further, both countries have National Water Resource Councils with limited influence and are lacking in proper boundary organisations. However, whereas Malaysia still favours top-down and centralised approaches, Vietnam has made considerable efforts at decentralising their organisational structure through transfers of powers to the provincial level and the establishment of WUAs. These have mainly been implemented through pressure from international organisations. The involvement of local actors who bring expertise into the governance process should be further encouraged and taken into account, as they can improve alignment for actor representation and the sustainable development of natural resources, particularly when they are key actors. Mechanisms to increase bottom-up communication are sorely needed in both countries. It has, however, been shown that decentralising irrigation does not automatically provide success. Merely setting up local water-user organisations does not automatically mean that decision-making rights are shared or resources are distributed equally or fairly. This is demonstrated by the distribution of power that lies in both, Malaysia and Vietnam, with the national level ministries. They are the ones that can undertake investments and influence water and irrigation policies. Therefore, although there is awareness of issues in representation and participation, the implementation is lacking.

Consequently, Malaysia acknowledges the positive influence participative mechanisms can have on water governance but implementation is insufficient. In contrast, Vietnam, not least because of the influence of ODA, invests more than Malaysia in participation through IMT and

PIM. However, both do not provide farmers' with means of representation at higher levels. Thus, Vietnam's participatory mechanisms could be considered as more advanced, they are both still similar in the way policies are communicated and implemented, namely in a top-down approach without farmers' contribution.

Issue Boundaries

Irrigated agriculture is represented mainly at the national and the regional level in Malaysia. Although the IADAs are active on the local level as well, the focus is to provide regional schemes and strategies. The alignment of practices suffers from this approach, as the national level does not always take local level needs into account. Differences in objectives further exacerbate this problem. The same is true for Vietnam. Here, the national level ministries and the PPCs are the actors in power. The divide and overlap in responsibilities by MONRE and MARD and the accumulation of power the provincial level are not conducive to alignment of practices. Due to spatial-temporal differences, complete alignment between policy-makers, farmers, and ecological processes may be impossible. However, the previously discussed participatory mechanisms could, if properly implemented, lead to an increase in alignment through "adopting a precautionary approach in order to create preparedness and awareness regarding uncertainties and risks" (Özerol and Bressers 2015, 8). Achieving higher resource efficiency, increased sustainability, and alignment.

The analysis of networks and instruments highlighted the different tools that are employed in irrigated agriculture. Collaborative initiatives are rare, and boundary organisations are practically non-existent. Even though Vietnam and Malaysia both have a water resources council, their function is limited. Instruments used are primarily financial and infrastructural in nature. Both countries use pricing mechanisms, although the strategies differ. For Malaysia in particular, not many specific instruments used were mentioned in the available literature. The situation is different for Vietnam through donor reports and reviews that outline more clearly what measures are taken to improve irrigation practices and mechanisms. The relative focus on projects related to paddy farming for both countries is caused by rice plants being the major water resources user. Monitoring systems for fertiliser and pesticide use are lacking in Vietnam and Malaysia, with dire consequences for farmers who take severe health risks when using fertilisers and pesticides. What is more, unsupervised use of fertilisers and pesticides can also

impact groundwater and soil long-term, leading to further health risks for farmers as well as consumers. Monitoring focuses mainly on water quality and environmental problems such as droughts or floods. However, Malaysia's Open Data Portal is a step into the right direction for providing greater transparency and access to relevant data.

What stands out in regards to Malaysia is the current focus on industrialising the agricultural sector through, for instance, bigger farms as outlines in the ETP. Increasing paddy productivity is in line with the aim of increasing national food security and farmers' income. Vietnam, in contrast, invests more in resource efficiency instruments, such as improved canal lining but also crop diversification to allow higher yields and AWD as an advanced irrigation technique.

Both countries have national planning documents that show awareness of the sectors problems. Whereas Vietnam has the National Water Resources Strategy towards the Year 2020 as their main planning document, Malaysia has the NAPs, the Malaysia Plan, and the Economic Transformation Programme. However, more planning documents do not necessarily lead to better alignment, resource use, or sustainability, as the discrepancy between what is written and what is enacted can be considerable.

Working Procedures

The actors in charge of investment and distribution are in both cases the country's major agricultural ministries. However, in Vietnam, investment in irrigated agriculture is also undertaken by international organisations such as the World Bank and the ADB, actors that are not overly active in Malaysia. Vietnam has shown greater awareness for the need of water-saving irrigation methods. This may be due to the fact that the country has more immediate concerns of being water-stressed but may also be accounted to the influence of ODA and foreign actors.

Training for farmers to learn new techniques and gain knowledge is often provided by NGOs. However, training programmes that particularly pertain to irrigated agriculture are rare. Governmental programmes are frequently only available to their own employees and do not provide a wide array of courses. The inclusion of farmers in training courses would not only increase resource efficiency but could also provide knowledge, increase participation, and

encourage the government and its ministries to take farmers' know-how and experience more into account.

Enforcement of legislative frameworks in Malaysia is low and not focused on irrigation. The separation of jurisdiction between the states and the federal government adds to these problems and is not conducive to alignment. Vietnam, in contrast, has recently passed the Law on Irrigation, which specifically addresses current issues in the sector. However, in practice, enforcement of law is low in both countries.

Research Problems and further Questions

One of the major problems of research on water governance in irrigated agriculture is the access to data. Even though there is much available at first glance - as most ministries are at least superficially rather well-organised and there is a plethora of development agencies' reports as well as academic writings on topics related – (recent) data and information is often inaccessible or access is restricted. This may be either because it has not been published yet, or because it is inaccessible to the public. Further, country reports are often only available in in either Vietnamese or Malaysian, even though there are more and more published in English as well. Even international organisations such as FAO/Aquastat mainly have data that is more than a decade old. As Waibel (2010, 1) writes, "development agencies have different knowledge management practices and many consultancy reports are not made public. […]. These reports have often been claimed to be confidential which limits the possibilities of citation and publication." In combination with a fast changing sector, this does not make for very gratifying research. The fast-paced change in the sector leads to the problems that research and data that is only one or two years old is not up to date anymore, as ministries and organisational structures have been changed. This does not only complicate the analysis of levels and scales but also indicates that there is currently considerable focus on the sector. However, these issues could be counteracted through further field research in the respective countries.

Another issue is the application of a framework that has mainly been established for 'Western' countries. The framework for analysis and its corresponding theory is, in majority, based in Western academia. Thus, it can be assumed that the framework incorporates "assumptions about the power and independence of electoral voting, the presence of civil society

organisations engaging in the policy process and the upholding of the rule of law" (Mollinga 2010, 512). Therefore, it needs to be asked whether an analytical framework that has been developed in the context of Western political systems, also applies to North- or Southeast Asian countries. To an extent, the answer is yes, it can. However, as Özerol, Bressers, and Coenen (2012) are focusing on Turkey, a country influenced by several European Union policies, some of the categories have little to no impact on North- and Southeast Asian countries, such as international conventions (e.g. Aarhus Convention). Other areas for future research could include a greater focus on the role of land-use policies and issues such as land-grabbing, women's role in agriculture, as gender disparities often go unacknowledged and farm holders are mostly men (EIGE 2016), and the influence of corruption or collusion of actors for mutually beneficial relationships and power in irrigated agriculture. These issues have not been addressed in the framework at all. However, as put by Fish, Ioris, and Watson (2010, 5629) "[t]o use a simply analogy, the integration of agriculture and water management is not like a jig-saw puzzle with a relatively small number of large pieces which simply have to be put together in the right order to create a complete picture. Rather, it is more like a puzzle in which the sizes and shapes of a large number of pieces are constantly changing, producing different patterns and configurations over time."

For Malaysia and Vietnam, it can be said that the 'wicked problem' of water governance and irrigated agriculture will become more and more important. The research has shown that although aims are often similar (e.g. increase rural employment, achieve food security), the strategies which are used to deal with these issues can differ. The share of agricultural land has been increasing in both countries, pointing at a growing agricultural sector and an increase in the need for water resources. Yet, the land area that is equipped for irrigation has been decreasing, which is counter-productive and counter-intuitive as both countries rely heavily on the agricultural sector. The interconnectedness of problems, water resources' meaning for economic as well as sustainable development, and the implications it can have for politics and society are substantial and warrant further research.

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Abstract

Irrigated agriculture is an essential sector for achieving food security and reducing poverty. As agriculture is frequently the major user of water resources, it can affect sustainable development. To address the 'wicked' cross-sectoral nature of water governance in irrigated agriculture, the concept of cross-sectoral alignment based on three governance criteria has been introduced: actor representation, issue boundaries, and working procedures.

This thesis focused on the Southeast Asian countries Malaysia and Vietnam. Both countries rely on the agricultural sector to achieve food security and economic development. However, the political systems of both countries differ. Malaysia is a federal constitutional elective monarchy, whereas Vietnam is a one-party socialist republic. This implies that strategies for managing water and land resources may differ. The analysis showed that alignment in all three categories is low for both. There are differences, particularly evoked through the influence of ODA in Vietnam, in instruments used to improve irrigation and in the inclusion of farmers and WUAs on the local level. However, the organisational set-up, the sectoral fragmentation, and the inadequate supply of participatory mechanisms are similar. Furthermore, there are inconsistencies in problem awareness and implementation as well as in the enforcement of laws. The results of this thesis can serve as the basis for future research on natural resource management in East Asia as well as the development of strategies to improve irrigated agriculture.

Zusammenfassung

Bewässerungslandwirtschaft ist ein Schlüsselelement um Ernährungssicherheit zu erreichen und Armut zu reduzieren. Landwirtschaft ist einer der größten Nutzer von Wasserressourcen und kann somit nachhaltige Entwicklung beeinflussen. Wassergovernance und Bewässerungslandwirtschaft sind sektorübergreifende Themen. Um diese zu behandeln wurde das Konzept von sektorübergreifender Ausrichtung basierend auf drei Kriterien eingeführt: Repräsentation von Akteuren, Problemabgrenzung und Arbeitsabläufe.

Der Fokus dieser Masterarbeit liegt auf den Ländern Malaysia und Vietnam. Der landwirtschaftliche Sektor ist für beide Länder essenziell um Ernährungssicherheit erlangen und wirtschaftlich zu wachsen. Des Weiteren sind klimatische Bedingungen sowie die Landfläche ähnlich. Die politischen Systeme sind jedoch unterschiedlich. Malaysia ist eine parlamentarisch-demokratische, konstitutionelle Wahlmonarchie mit föderalem System, wohingegen Vietnam eine sozialistische Republik mit Einparteiensystem ist. Dies impliziert bereits mögliche Unterschiede für Managementstrategien von Wasser- und Landressourcen. Die Analyse hat gezeigt, dass die Angleichung in allen drei Kategorien niedrig ist. Einige Unterschiede sind vor allem auf den Einfluss von Entwicklungszusammenarbeit in Vietnam zurückzuführen. Dies ist insbesondere in den Bereichen Instrumente für die Bewässerungslandwirtschaft sowie bei der Inklusion von Bauern und WUAs auf der lokalen Ebene deutlich geworden. Der organisatorische Aufbau, die Fragmentierung des Sektors und das mangelhafte Angebot von partizipativen Mechanismen sind ähnlich. Weiterhin gibt es außerdem eine Disparität zwischen Bewusstsein von Problemen und ihrer Implementierung sowie bei der Durchsetzung von Rechtsvorschriften und Regelungen. Die Ergebnisse dieser Masterarbeit können als Grundlage für weitere Forschung im Bereich des Managements natürlicher Ressourcen im Ostasiatischen Raum sowie zur Entwicklung von Strategien zur Verbesserung der Bewässerungslandwirtschaft dienen.