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Water and its Many Issues

Methods and Cross-cutting Analysis

Regional Social Sciences Summer University
"Tam Đảo Summer School Week" (Việt Nam)
July 2012

NHÀ XUẤT BẢN TRI THỨC

Water and its Many Issues

Methods and Cross-cutting Analysis

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Foreword

Regional "Tam Đảo Summer School Week": A Valuable training Platform

The first Social Sciences Summer School was held in 2007 as part of the *"Fonds de Solidarité Prioritaire en Sciences Sociales"* (FSP2S) project "Support for Research on Economic and Social Transition Issues in Việt Nam", implemented by the École française d'Extrême-Orient in partnership with the Việt Nam Academy of Social Sciences.[1] It was established because the Joint Franco-Vietnamese Scientific Council within the FSP2S organisation had observed the need for capacity-building for Vietnamese researchers, teaching researchers and Ph.D. students, covering methodology, survey tools and data treatment. Held again in 2008 and 2009, the "Journées de Tam Đảo" ("Tam Đảo Summer School Week") – also known as JTD – maintained its objective of introducing future Vietnamese social scientists to the intellectual tools and know-how necessary to gain a rigourous knowledge of social reality and to provide them with the theoretical and methodological basis to draft a scientifically pertinent research project. The sessions were held in Hà Nội and in Tam Đảo, a hill station near the capital, and resulted in the publication of three works published in both French and Vietnamese.[2]

2010-2013: An Agreement for Partnership, Change on a Regional Scale

Given the success of the first three years, and in order to support the development of the Summer School, the Việt Nam Academy of Social Sciences (VASS), the Agence Française de Développement (AFD), the Institut de Recherche pour le Développement (IRD), the University of Nantes, the École Française d'Extrême-Orient (ÉFEO) and the Agence Universitaire de la Francophonie (AUF)[3] decided to confirm their combined commitment in a partnership agreement signed April 15th, 2010 at the AFD headquarters in Paris for the four years 2010-2013.

[1] Project finished May 7th, 2009.

[2] Lagrée, Cling, Razafindrakoto and Roubaud (scientific Eds.) (2009), *Les Journées de Tam Đảo. Stratégies de réduction de la pauvreté: approches méthodologiques et transversales*, Éditions Tri Thức, Hà Nội, July 2010, 624 p. (French version), 620 p. (Vietnamese version);
Lagrée (scientific Ed.) (2008), *Les Journées de Tam Đảo, Nouvelles approches méthodologiques appliquées au développement* (2), Summer School in Social Sciences, Éditions Thế Giới, Hà Nội, September, 401 p. (French version), 398 p. (Vietnamese version);
Lagrée (scientific Ed.) (2007), *Les Journées de Tam Đảo, Nouvelles approches méthodologiques appliquées au développement*, Summer School in Social Sciences, Éditions Thế Giới, Hà Nội, November (reprinted in May 2009), 348 p. (French version), 350 p. (Vietnamese version).

[3] AUF: Funding: "Innovatory Action" 2010-2012.

This partnership aims to maintain the continuity of the Tam Đảo Summer School Week with previous training sessions, with the general objectives of:

- Supporting multi-disciplinary training of an excellent standard: improving knowledge, methods and survey tools in the social sciences; reinforcing capacity for the analysis of economic and social changes; consolidating skills in methods for evaluating the impact of development projects;
- Constituting a policy discussion platform, as well as developing a pool of researchers open to the Southeast Asian region: the JTD were designed as a forum for the study of strategies, methods and working practices in development, but also for training and exchanges between researchers and decision-makers;
- Developing the profile and appeal of the Tam Đảo Summer School Week: the JTD aim to attract a wide academic and non-academic audience throughout Southeast Asia.

Building on the evaluations of the first three years, the regional project 2010-2013 also has new ambitions:

- A specific theme of a regional or international nature is set each year, then elaborated and debated according to different methodological and cross-cutting, transverse approaches;
- At the VASS, the first two days of training and discussions conclude with a synthesis session which kicks off multi-disciplinary consideration by discussing proposed methodological tools; this part of the programme is designed to be an introduction to the thematic workshops;
- The four workshops, each attended by around twenty participants for five days, are followed by a one-day plenary session for synthesis; in this way, participants and trainers meet at the end of the week to share and present the output of each workshop;
- In order to increase its appeal to a wider geographic area, the Summer School Week welcomes researchers and participants from Southeast Asia. This regional expansion greatly reinforces visibility in the region and allows a wider network for exchange and scientific collaboration. The audience is composed of approximately fifty Vietnamese participants and around thirty from the region (Cambodia, Laos, Malaysia, Thailand and other neighbouring countries).

An Annual Trilingual Scientific Production

The proceedings will be published in three languages – Vietnamese, French and English – in the year following each training session in the AFD series, *Conférences et Séminaires*, co-edited by the EFEO and the Tri Thức publishing house. Each work is available on CD-ROM and as a free download on the site www.tamdaoconf.com, as well as on the sites of the partner organisations. To complement this, www.tamdaoconf.com also offers further reading to expand and deepen understanding of the themes and fields touched upon, an in-depth biography of each trainer and a triple evaluation provided by the trainers, participants and reporters.

"Water and its Many Issues, Methods and Cross-cutting Analysis"

The major thread of the JTD 2012 was to address the problematic of water through the lens of economic, human and social sciences, in different milieus and scales of interpretation; following the logical framework model, this sixth edition was organised according to complementary axes:

– Training in plenary sessions lasting two days at the VASS, 13th and 14th July 2012. Six presentations introduced and developed issues linked to water from a methodological and cross-cutting angle: modelling, legal, political, economic and anthropological approaches. The documentary *"Prey Nup, A Community on Water"* (Cambodia) was shown at the end of the first day. The two plenary days wound up with a wrap-up session of what had been said.
– Four thematic workshops lasting five days at the Tam Đảo hill station, from Monday 16th to Friday 20th July. Here issues related to maritime space, risks and governance (Workshop 1), urban growth, social needs and sevice offers in water and sanitation (Workshop 2), economic and social management within the framework of training for field studies (Workshop 3), a practical approach to agent-based modelling (Workshop 4) were addressed.

A first introductory lecture was given by the anthropologist and member of the École française d'Extrême-Orient, Hà Nội, Olivier Tessier. His presentation analysed the hydrological development of the Red River Delta by the Imperial and then Colonial State – from the 12th to the mid-20th century. To do this, Olivier based his presentation on an understanding of the imperial archives that he compared with a reading of village steles. The first written laws concerning hydrological development and protection against flooding date back to the 15th century. The foundations for a modern and reasoned development of the delta were laid three centuries later, thanks to the policies of the Emperors Gia Long and Ming Mạng. Then the period of troubles and instability that marked the beginning of the colonial period, and the long war of conquest that followed in the North of Việt Nam, resulted in a greater and greater forced withdrawal of the imperial and mandarinal powers in the hydrological domain to the benefit of the protectorate's technical services. Here Olivier paused to focus upon how these specialised services, which were essentially founded upon the rationality of the engineer and the certainty of the superiority of the Western model over local technical know-how and the works that had been achieved up to that point, were perceived. His conclusion underlines the fact, albeit impressive, that the outcome of this systematic hydrological development policy of the delta's polders and salt marshes during the colonial period remains quite disappointing. Let us underline the fact that the accompanying text proposed by Olivier concerning the policy implemented in the 19th century and the impressive bibliography, which covers the whole of the period, help to throw light on the long history of the mastery of water and the hydrological network in Việt Nam.

After this first presentation, our attention then focused upon the developments and institutions of agricultural water management in the Red River Delta from the 1960s. Jean-Philippe Fontenelle, an agronomist, turns our attention to major upheavals in irrigated agriculture in the Red River Delta linked to the evolution of the management methods of the

means of production, and the associated technical and management systems. Three principal periods are highlighted: that of the collectivisation of the means of production, which resulted in the near bankruptcy of the country's economy and threatened food security, particularly as a result of the farmers' rejection of the system, in spite of previously unseen investment in the hydro-agricultural sector (1960s - beginning 1980s); a period of strong growth of agricultural production over a period of twenty years; the liberalisation and normalisation policy promoted by the State, locally driven dynamics, with notably the implantation of local pumping stations; finally, today, the delta's agriculture is still bearing the full brunt of the effects of competition, which have become even more evident since the integration of Việt Nam in the world economy. Farmers' incomes have reached a ceiling, even though they must face new risks linked to the consequences of climate change, as well as increased land pressure resulting from the political priority given to industrialisation and urbanisation.

At the beginning of the afternoon, Nguyễn Mạnh Hùng, a political scientist, gave us a presentation about water resources on the Mekong River. This paper, which we have not been able to include in this publication,[4] aimed to give a general overview of challenges for sustainable development and the preservation of the environment and to analyse the factors influencing cooperation between the countries located in the important geo-political area: the Southeast Asian peninsula.

Finally, the first day was intended to be a genuine complementary aid and was enriched by the showing of the documentary *"Prey Nup, a Community on Water"* – French version with Vietnamese and English subtitles. The short version (17 minutes) looks back on a decade of intervention in favour of the rehabilitation of the Prey Nup polders in Cambodia. The project, which took place in the province of Sihanoukville and was financed by the AFD over the 1998-2008 period, assured the protection of 10 500 agricultural hectares and affected about 50 000 people. The project culminated in February 2008 with the signing of a framework agreement between the Ministry of Water Resources and Meteorology (MWRM), the Community of Polder Users (CPU) and the local authorities.

The documentary is built around an evaluation/capitalisation approach. The use of audiovisual supports for the evaluation of the "Building Against the Tides" project takes into account the point of view of the players and facilitates the exploitation of the results of the project's evaluation in the eyes of the different publics concerned by the implementation of the development projects. The film talks about: 1) technical difficulties: the building of a dyke on clayey soil; 2) social complexity: the creation of a users' association in a place still bearing the marks of Khmer Rouge collectivisation; 3) political stakes: the modification of institutional rules to go from centralised authoritative management to a participative one. The commentaries of Jean-Philippe Fontenelle (GRET) and José Tissier (AFD) accompanied the showing.

[4] Constraints of a technical nature have not allowed us to edit the text that was accompanied by many illustrations provided by the author; the editor sincerely apologises for this.

The second day began with a presentation by Jean-Pierre Beurier, a legal expert specialising in the domains of the legal regime of the deep-sea bed, and in its exploitation and protection in the face of world maritime issues. The presentation was based upon the notion of a "last frontier", the extraction of natural resources, threatened ecosystems, and concluded by talking about the merchant navy and sailors.

Our attention then turned to the topic of "Rapid Urbanisation, Social Demands and the Offer of Water and Sanitation Services", presented by Catherine Baron, a teacher/researcher specialising in the development of space and urbanism at the University of Toulouse 2, and Claude de Miras, an economist at the IRD.

The demographic dynamic and the geographical imprint of the towns, as well as the proportion of the urban population, are progressing in a particularly rapid manner, both in least developed countries and in emerging countries: consequently, the need for basic urban services is rapidly increasing everywhere. Pro-poor policies for the generalisation of access to basic services, including for poor households and those living in precarious and under-equipped neighbourhoods, have been conceived. The question of equity for access to basic urban services, particularly water and sanitation, is becoming more and more important: poorer districts take up an ever – increasing portion of urban space, in a context of urban spread that characterises, for example, African cities. However, all the individual needs of city dwellers for water and sanitation do not become demands, as certain populations do not have the means to pay connection costs and/or the bill for water consumed. The problematic of needs and demands for services and offers of services appears to be on the one hand complex and of an evolving nature in the medium term and, on the other hand, gives rise to multiple territorial, institutional and financial systems of governance of water and sanitation networks.

The last lecture, given by Alexis Drogoul and Benoit Gaudou, computer scientists respectively from the IRD and the University of Toulouse, concerned methods of agent-based modelling. The use of these methods has been developed over the last twenty years in a growing number of academic disciplines and scientific fields, particularly in social sciences. They allow us to envisage the reproduction and the study of a part of the real world's complexity through the carrying out of *in silico* experiments, referred to as "simulations", in which the individual and collective dynamics of computer entities, "agents", are programmed, observed and analysed. These simulations may confirm the appearance of the complex dynamics of the emergence of a "whole" from the behaviours of "parts". They suggest cause-effect relations that allow us to test different development scenarios, or to put to the test, through experiment, different hypotheses. They also make concrete multi-disciplinary exchanges about the same object in the form of manipulable abstractions, and allow the incorporation of both quantitative and qualitative data stemming from these different disciplines within common models that may be verified in direct connection with observations of the real world. This general overview is followed by the presentation of the European project MAELIA, in which a platform is developed for the simulation of the effects of the implementation of management and governance norms for water resources, territories and the environment: geochemical and hydrological dynamics on

the scale of a water catchment area; occupation and use of land and its incidence on resources; human activities linked to the exploitation and management of resources; and effects of climate change, particularly on water resources.

Finally, François Roubaud, an economist at the IRD, wound up these two days of presentation and exchanges with a critical conclusion.

The training continued from Monday July 16th to Friday July 20th in the framework of thematic workshops conducted in parallel at the Tam Đảo hill station, located 80 km outside Hà Nội.

The objective of the workshop "Sea, Risks and Governance" is to analyse the economic and legal issues regarding the exploitation of maritime space and resources through the research of sustainable development indicators, real life situations and the analysis grids of some maritime activities (bio-economic models, competitive analysis, effects approach, contingent valuation, etc.). The programme is built around the four following principal themes: sustainable management of fisheries resources; sustainable aquaculture and foreign trade of sea produce; competition in maritime transport, impacts of global change on the coastal environment; new uses of maritime space. The trainees are introduced to the Tralin game that allows a simulation of competition in a network of regular sea routes in the form of practical work carried out in sub-groups; role-play is also organised following the model of a general assembly of the International Maritime Organization.

Workshop 2 was an extension and more in-depth look at the presentation given at the VASS about social needs and service offers in water and sanitation was related to urban growth. This workshop first concerned the role of donors and the development of aid in the drinking water and sanitation sector in developing countries (example of the AFD) and a presentation about the diverse modes of governance in the water sector in the urban milieu (case studies in Africa and Southeast Asia). Then a process of reflection in sub-groups took place, before leaving the trainees to work on the conception of a questionnaire for a quantitative survey to be carried out at Tam Đảo. Let us here emphasise the particularly cross-cutting character of this workshop, which grouped together a broad spectrum of development and research stakeholders (university lecturers, IRD, non-govermental organisation, GRET, AFD).

The workshop "Social and Economic Water Management" had a twofold aim of introducing tools and survey methods in socio-economy and anthropology and applying them on a real time basis in the field: three days of survey in Làng Hà village, Hồ Sơn commune (Tam Đảo foothills). On the first day the trainees were made aware of the problematic through two complementary presentations: "The Depiction of a 'Fluvial Civilisation' in the Mekong Delta Through the Study of the Founding of a Village Following the Excavation of the Rạch Giá-Hà Tiên Canal in the 1930s" (Pascal Bourdeaux, Historian), and "The Transformations of the Peasant Economy, Red River Delta" (Christophe Gironde, Economist). A methodological complement concerning interview techniques was provided by Olivier Tessier. In Làng Hà, the trainees, who were divided into groups and then pairs, approached the training according to the following four axes: economic management and local financial constraints of the functioning of hydrological agriculture

(Mireille Razafindrakoto); political and social management of hydrological systems according to a multi-scalar approach from village to district (Olivier Tessier); water usage and developments of agricultural systems during the colonial, collectivist and post-renewal periods (Christophe Gironde); water and its uses in popular culture and practices (Pascal Bourdeaux). The field results were exploited by having each group interact in order to familiarise the trainees with a cumulative approach.

Subsequent to what was said and developed in the plenary session, the practical approach to agent-based modelling was at the heart of Workshop 4. The week was organised around the GAMA modelling platform that was developed by the IRD and its partners (*c.f.* http://gama-platform.googlecode.com) and a tutorial built upon a role-playing game about water management, "Wat-a-Game", developed by the Centre de coopération internationale en recherche agronomique pour le développement (CIRAD; *c.f.* http://sites.google.com/site/waghistory/home). The aim was to allow the trainees to discover agent-based modelling and all its potential, by conceiving and progressively adding to a group of models of growing complexity on the topic of water management by a group of stakeholders (administrators, water-using activity managers, etc.). Different subjects were progressively addressed, from the installation of the GAMA software programme to the conception of "realist" human behaviours, against a backdrop of the coupling of heterogeneous data (environmental and social) that allow us to create multiple scenarios.

Principal characteristics of the thematic workshops of the JTD 2012

Workshops	Scale / Level of Analysis	Disciplines	Tools / Methods
-1- Sea, Risks and Governance	National, regional, international scales	Economy, law	Case studies, comparative approach
-2- Urban Growth, Social Needs and Service Offers in Water and Sanitation	Macro, meso and micro scale	Economy, socio-economy, development	Case studies, household surveys
-3- Training for Field Surveys. Economic and Social Management of Water	Local scale: communes and villages. Unit of analysis: surveys of households and individuals	Economy, history, socio-anthropology, socio-economy	Qualitative interviews
-4- Practical Approach to Agent-based Modelling	Regional scale (water catchment area, delta) Institutions, individuals	Computer science, modelling, geographical information sciences	Agent-based model, GAMA

The four workshops were designed for participants from different disciplines, the priority being to allow all participants to use the most open as possible approaches and tools. This wish to provide an interdisciplinary view by adopting a cross-cutting approach became clear on the last day of restitution, Saturday, 21st July. As is customary in the JTD, a certificate of participation and programme completion signed by the VASS, the AFD, the IRD, the EFEO and the University of Nantes was awarded to each trainee at the end of the session.

Profile of the Trainees

The selecting of trainees was again particularly difficult this year as 235 candidates applied for only 80 places. This selection process was deemed necessary in order to preserve a strong group dynamic and a relevant pedagogical approach during the workshops at Tam Đảo.

In total, there were nearly 100 participants in the plenary sessions at the VASS. The application forms submitted allow us to draw the following profile:

– A high proportion of women: 70% of the trainees;
– A young public: 20% between 20 and 25 years of age, 45% between 26 and 30 years of age, 18% between 31 and 35 years of age and 17% over 36;
– A great diversity of statuses and levels of education: Master's (19), Master's and teacher (5), Master's and development (2), doctorate student (9), doctor/doctorate student and teacher (5), researcher (25), researcher and teacher (2), teacher and development (6), development practitioner (5);
– Multi-disciplinarity: sociology, anthropology and socio-anthropology, economy, statistics, demography, geography, history, political sciences, management, development, legal sciences, computer science;
– The majority of participants were from Hà Nội (29 enrolled), but the South of Việt Nam was also well represented: Hồ Chí Minh City (26 enrolled), Cần Thơ (3 enrolled); other trainees were from the provinces of Lào Cai and Vĩnh Phúc in the Northern region; Huế, Đà Nẵng and Nha Trang for the Centre and Centre-South regions;
– A regional openness: Cambodia, Laos, Thailand;
– Institutional pluralism:
  • Việt Nam: VASS Training Institute; Việt Nam Economic Institute (ASSV); Sustainable Development Institute of the North (VASS); Hà Nội National University; Institute for Human Research (VASS); Institute of Anthropology (VASS); Institute of Sociology (VASS); Institute of Population and Societies (VASS); Institute of Research and Cultures (VASS); Institute of Philosophy; *École normale* of Hà Nội; Museum of Ethnology (Hà Nội); Institute for the Study of Environmental Sciences and Social Affairs (Hà Nội); Institute of Chinese Research (VASS); Centre Region Institute for Sustainable Development Studies (VASS); Lê Quý Đôn University (Hà Nội); Institute of Southeast Asian Research (VASS); Vĩnh Phúc *Ecole Supérieure*; Lào Cai Culture, Sports and Tourism Service; Centre for the Study and Develoment of Social Affairs (Huế); Duy Tân University (Đà Nẵng); Highlands Research Institute; *Ecole supérieure* of Culture Arts and Tourism (Nha Trang); *Ecole polytechnique* of Hồ Chí Minh City; Thủ Dầu Một University (Binh Dương); Centre for Urban and Development Studies (CEFURD, Hồ Chí Minh City); University of Human

and Social Sciences of Hồ Chí Minh City; Institute of Research into Development, Hồ Chí Minh City; University of Resources and the Environment, Hồ Chí Minh City; Service of Science and Technology, Hồ Chí Minh City; Institute of Politics and Administration, Cần Thơ; University of Cần Thơ;

- Cambodia: Institute of Technology; Royal University of Law and Economic Sciences; *Agence Universitaire de la Francophonie*;
- Laos: Academy of Social Sciences;
- Thailand: Chulalongkorn University; Ubon Ratchanthani University.

Finally, we cannot conclude this short introduction without announcing the next Tam Đảo Social Sciences Summer School that will take place from 19th to 27th July 2013 at the Đà Lạt hill station in the Central Highlands region of Việt Nam; this seventh edition will concern a subject that is just as exciting: "Perception and Management of Risks".

Stéphane Lagrée

Acknowledgements

The institutional synergy sealed by a four-year partnership agreement gives the Tam Đảo Summer School Week a regional reach on the scale of Southeast Asia and beyond, and for this we would like to thank: Việt Nam Academy of Social Sciences, Agence Française de Développement (AFD) – Research Department, École française d'Extrême-Orient (ÉFEO), l'Institut de Recherche pour le Développement (IRD) – Direction for the Program for Research and Training in the South, University of Nantes as well as the Agence Universitaire de la Francophonie.

This publication is indebted to Philippe Cabin for his recommendations and it is important for us to thank Support for Knowledge Management at AFD for the quality of our exchanges with them.

We extend all of our gratitude to the entire team of trainers for their scientific and pedagogical contributions during the organisation, execution and improvement of this year's Tam Đảo Summer School Week: Catherine Baron, Jean-Pierre Beurier, Aymeric Blanc, Pascal Bourdeaux, Pierre Cariou, Christophe Cluzeau, Claude de Miras, Alexis Drogoul, Jean-Philippe Fontenelle, Clément Frenoux, Benoit Gaudou, Christophe Gironde, Arnaud Grignard, Patrice Guillotreau, Nguyễn Mạnh Hùng, Yves Perraudeau, Mireille Razafindrakoto, François Roubaud, Patrick Taillandier, José Tissier, Olivier Tessier and Võ Đức Ân.

The work involved in transcribing the sessions and workshops is a particularly long and arduous task, and our thanks go to those who made the effort to provide such quality texts: Jean Verly, plenary sessions and workshop 2 (ESC Rouen and diploma in modern literature at Paris-Sorbonne); Lena Kéravec, workshop 1 (diploma from Rennes University II and from the Institut Régional du Patrimoine- IRPA); Emmanuel Pannier, workshop 3 (Ph.D Candidate in Anthropology, University of Provence); Youssef Ouali Laalami, workshop 2 (M.A. in Organisational Management).

Finally, we would like to congratulate the interpreters and translators who have accompanied this 2012 JTD: Trần Thị Phương Thảo, Kiều Thị Thuý Quỳnh and Nguyễn Việt Tiến, University of Hà Nội; Lê Thanh Mai, Vietnamese Ministry of Foreign Affairs; Ngô Thị Hồng Lan, National Economics University; David Smith and Mary Glémot, freelance translators.

Opening Remarks

Võ Khánh Vinh
Vice-President of the VASS, Director of the Graduate Academy of Social Sciences

Jean-Marc Gravellini
Director, AFD, Việt Nam

Olivier Tessier
Representative of the EFEO in Việt Nam

Jean-Pascal Torréton
Representative of the IRD in Việt Nam

Yves Perraudeau
University Professor, Head of the mission of the University of Nantes in Việt Nam and Southeast Asia

Olivier Garro
Director, Asia-Pacific, AUF

Opening Remarks by
Võ Khánh Vinh
Vice-President of the VASS, Director of the Graduate Academy of Social Sciences

Honoured guests, Ladies and Gentlemen, lecturers and representatives of the French and Vietnamese research institutes and establishments,
Dear Participants,

In the name of the VASS and its training Institute, I would first of all like to offer you a heartfelt welcome. It's a great pleasure for me to welcome our historic partners: the *Agence Française de Développement*, the *Institut de Recherche pour le Développement*, the *École française d'Extrême-Orient* and the University of Nantes, for this sixth edition of the Tam Đảo Social Sciences Summer School, also referred to as the JTD. Beyond the financial support, the cooperation that has been established has been marked by the sending of experts and lecturers to Tam Đảo in the framework of both the plenary sessions and the thematic workshops. This dimension truly enhances the sharing of experiences with both the Vietnamese trainees and those from other neighbouring countries: Cambodia, Laos and Thailand.

Our platform for exchanges, which is enhanced by these trilingual publications – Vietnamese, French and English – is the concrete result of Franco-Vietnamese cooperation in the fields of scientific training and research. This model of cooperation is particularly appreciated by French and Vietnamese social sciences as it allows us to make our contribution to academic excellence. What are the principal assets of this summer school?

– The themes developed on a yearly basis bring some answers to the big regional and international issues concerning Southeast Asia;
– The format is adapted to favour its multi-disciplinary aspect and cross-cutting analysis;
– Each edition results in an academic trilingual publication that is published shortly after;
– The visibility and reputation of the JTD increases every year, if we are to go by the number of applications received.

The 2012 JTD concerns *"Water and its Many Issues, Methods and Cross-cutting Analysis"*. This question is critical and follows on from the Sixth International Water Forum, which was organised in Marseilles, France last March. Many different subjects can be linked to this theme: access to drinking water and sanitation; the protection and sharing of water resources; the fight against pollution and the reduction of public health risks; food and energy security; but also, and maybe

especially, conflicts and their management concerning cross-border cooperation.

Here today, and for the next ten days, we have gathered together about ninety Vietnamese and foreign trainees. The VASS welcomes all trainees from Laos, Cambodia and Thailand: those from the Laos Institute of Social Sciences; those from the Royal University of Law and Social Sciences; those from the Institute of Technologies in Cambodia and those from the Thai universities Ubon Ratchanthani and Chulalongkorn. Vietnamese trainees are, for their part, attached to multiple structures present in both the North and South of the country: the VASS; the École Normale in Hà Nội; the University of Hà Nội; the University of Thủ Dầu Một in the province of Bình Dương; the Cần Thơ Academy of Administration and Politics and the Polytechnic Institute in Hồ Chí Minh City, etc.

We expect an active and serious participation from our JTD trainees in both the plenary sessions and in the workshops and also in the framework of the field work studies.

I would like to thank our French partners for their different forms of help given to the JTD, as well as to the team of interpreters, and naturally the Francophone cooperation cell at the VASS, which has organised this ambitious regional programme.

I wish the Tam Đảo Social Sciences Summer School 2012 good health and success.

Thank you.

Opening Remarks by
Jean-Marc Gravellini
Director, AFD, Việt Nam

Dear Vice-President of the Việt Nam Academy of Social Sciences, dear teachers, trainees, colleagues and friends,

I should first and foremost like to say how happy I am to be participating for the first time in this sixth edition of the Tam Đảo regional summer school in social sciences, which is also referred to as "Tam Đảo Summer School Week" or "JTD" (*Journées de Tam Đảo*), and has been held annually since 2007 and shows all the signs of being a continuing success. I am also happy because the JTD constitute an intensive training period for young researchers both in Việt Nam and in neighbouring countries – Laos, Cambodia, Thailand – where they are taught by experienced academics. I should also like to emphasise the regional dimension of this multi-disciplinary training course, which is based upon both practical and theoretical scientific learning, and is both rich in debate and exchanges of experiences. And finally, I am happy because the JTD are the fruit of the coordination between different partners: the VASS, which is welcoming us today, the IRD, the EFEO, the University of Nantes, the AUF and the AFD.

This year's theme *"Water and its Many Issues"* is a key issue which has been the topic of several major events over the last few months, such as the 6th World Water Forum which gathered together in Marseilles, from 12th to 17th March, more than 35 000 participants who reflected upon "Time for Solutions" or, more locally, the screening in several countries of Yann Arthus-Bertrand's latest film *"Our Thirsty World"*. In Việt Nam, this film was shown on the 16th of May at the French Cultural Centre, *l'Espace*, Hà Nội. It was followed by a debate led by Tran Quang Hung, the General Secretary of the Việt Nam Water Supply and Sewage Association, and Jean Pascal Torréton, representative of the IRD. The documentary was filmed in twenty different countries and is about the mysterious and fascinating world of fresh water, which is revealed to us thanks to some spectacular images filmed in regions that are seldom seen. As well as revealing some of the most beautiful landscapes of our planet, this documentary allows those who are engaged in the cause and who innovate to express themselves, in order to bring water to places where it is scarce, to use it in a more intelligent manner, to purify it, or better still, to stop polluting it.

Water is one of the major stakes for our planet, for its inhabitants, support and development organisations, research, and of course for the activities of the AFD in this region. As far as the theme of your research is concerned, the AFD is indeed closely following several national and regional projects that concern:

- The integrated water resources management through the promotion of an equitable water usage in the big river basins, such as the Mekong and the Red River;
- The development of irrigation in agriculture;
- Hydroelectric production;
- Access to drinking water for urban and rural populations;
- Health care preventing risks of water borne diseases;
- Management of the risks linked to climate change and more particularly the fight against the risk of flooding and natural disasters;
- The anticipation of conflict risks concerning access to water;
- The monitoring of fishing zones in the maritime zone.

The question of water and sanitation is thus a major international issue that has a direct incidence on health, the environment, poverty reduction and also gender equality. In the year 2000, 193 states committed themselves to the framework of the Millennium Development Goals (MDGs) in order to halve the percentage of the population without permanent access to drinking water and sanitation.

Since 1997, France, *via* its different agencies for financial cooperation (the AFD, and the French Treasury), has been leading thirty or so projects in Việt Nam in the domains of water and sanitation which represent almost EUR 350M of financial commitments. Whether it be in the basins of the Mekong, the Dong Nai, or the Red River, the AFD has supported projects aiming at a better sharing, distribution and control of water. The agency also supports a programme for the extension and improvement of the drinking water network in the towns and cities of the Mekong Delta. Since 1997, the AFD has carried out 13 projects in the domain of water and sanitation in Việt Nam, which represent financial commitments of more than EUR 270M. The *Direction Générale du Trésor* has financed projects for the treatment of drinking water and sanitation in diverse cities and provinces throughout Việt Nam for a total amount of EUR 75M. The French players in the water and sanitation sector, whether they be players in the integrated management of the basin, French local authorities, Non-Governmental Organisations, professionals in the water sector or research and development organisations, are all associated with different stages of the project or strategic thinking.

Over the last few years, Việt Nam has made considerable progress in attaining the MDGs: in 2010, 83% of rural populations had access to drinking water, compared to 30% in 1990. However, the increase in demand for water for urban, industrial and agricultural usage is raising new challenges. Climate change is also having a disruptive effect on the natural balance.

To conclude, I should like to emphasise the importance of your research work, which will allow us to take into account all the strategic and operational dimensions that characterise the water sector and to review and adjust our aid policy in this sector.

Allow me, finally, to applaud the excellent work of the JTD organisers, reaffirm the AFD's support for them, and wish you every success for your week of reflection and research, which I am certain, will be fruitful.

Thank you.

Opening Remarks by
Olivier Tessier
Representative of the EFEO in Việt Nam

I am very happy to be participating in this sixth edition of the JTD. Over the years, this annual event has become a key event of Franco-Vietnamese social sciences cooperation to the point that its reputation has gone beyond the borders of Việt Nam and is now attracting participants from other countries in the region. Before I speak about the special ties between the JTD and the EFEO, I would like to say a few words about the latter.

The EFEO is an old institution that, in spite of everything, has succeeded in staying "young". It was created in 1900 in Saigon and then opened in Hà Nội in 1902 – the year the city became the capital of Indochina – at number 26 of the street that is now called Lý Thường Kiệt, which up to a very short time ago was home to the Institute of Social Sciences Information (Viện Thông tin-ASSV). Following the opening of Việt Nam in the 1980s, and after an interruption of more than three decades, the school once again opened in Hà Nội in 1993 and settled into the premises it now occupies (at n° 5A xóm Hạ Hồi) in 1995. The Hà Nội centre, which is part of a network of 17 EFEO centers in Asia, boasts a library of about 7 000 publicly accessible social science works (history, anthropology, archaeology), and a publishing service. The centre's publications can be placed in the framework of three collections (*Bibliothèque vietnamienne, Documents pour servir à l'histoire de l'Asie* and *Pistes d'histoire*) and a special issue series (twenty-three works and seven electronic editions). The team of three tenured researchers (two historians and one anthropologist) assigned to the centre, have a dual mission: the first aims at scientific production, the development of research and the training of future researchers; the second, the preservation of tangible and intangible heritage, is specific to the history of the school and its specialised disciplinary fields (history, anthropology, archaeology, philology, studies of religions and beliefs).

This dichotomy is reflected in the range of scientific projects carried out over the last twenty or so years and the diversity of scientific partnerships that it has created over the years. Without drawing up an exhaustive list, allow me to mention the principal ones: the Vietnam Academy of Social Sciences (VASS) first of all, which is the EFEO's institutional partner in Việt Nam, and a network of partners specifically mobilised according to our projects, such as the Hà Nội University of Social Sciences, The Association of Historians of Việt Nam, the National Archives, the National Library, the Centre for the Preservation of the Heritage of the Thăng-Long / Hà Nội Citadelle, the Chăm Museum in Đà Nẵng, the Lào Cai and Quảng Ngãi Popular Committees, etc.

Since its reopening, the centre has carried out and completed four scientific programmes:

- « *Programme Village* » (1996-2002): a multi-disciplinary programme participating in the renewal of the classical approach adopted by Vietnamese rural studies;
- *Cooperation with the Chăm Sculpture Museum in Đà Nẵng*: restoration of art works, training of museum staff within the framework of FSP museum studies;
- FSP Project « *Appui à la recherche sur les enjeux de la transition économique et sociale du Việt Nam* » (2005-2009): Franco-Vietnamese development and guidance in the field of social sciences;
- Lào Cai Project: « *Programme conservatoire des pétroglyphes de Sapa et histoire du haut fleuve Rouge* ». Inventory, cartography and study of the engraved rocks of Sapa; documenting and study of ancient manuscripts conserved by the Yao ethnic group in the Lào Cai province (14 000 manuscripts identified, 1 000 digitised).

As well as five editorial projects:

- Trilingual re-edition of Henri Oger's « *Technique du Peuple Annamite* » (1909) (introductory book accompanied by 700 plates grouping together 4 200 drawings; translation into romanised Vietnamese of the legends in Chinese (Hán) and demotic (Nôm) characters);
- « *Publication de l'inventaire et du corpus intégral des inscriptions sur stèles du Việt Nam* »: project associating the EFEO, the EPHE and the Institute Hán-Nôm studies for the digitalisation and publication of 22 000 rubbings of inscriptions in characters on steles first done by the EFEO (22 volumes, each containing 1 000 rubbings and 7 catalogue volumes);
- Publication of the complete version of « *Géographie descriptive de l'empereur Đồng Khánh* » (306 colour maps; 2 800 pages of quadri-lingual Chinese-Vietnamese-French-English text);
- Electronic re-edition of 120 copies of the *Bulletin des Amis du vieux Huế* (13 000 pages of texts; 4 000 illustrations);
- « *Documents pour servir à l'histoire de l'Asie* »: digitilisation and electronic re-edition of old and rare Vietnamese periodicals. Up to now, the EFEO, under the patronage of the association of Historians of Việt Nam, has re-edited five periodicals in their totality: *Tri Tân; Thanh-Nghị; Sử Địa* (Saigon); *Văn Sử Địa* (Hà Nội) and *Đại Học Sư Phạm*, that is to say a total volume of about 35 000 pages.

We are currently involved in five scientific projects:

- Programme « *Les Marches du Royaume du Đại-Việt* ». A study of cultural relationships and of the transformations of societies and space. History and anthropology of the eastern side of the peninsula (XVth - XXth centuries);
- « *Projet archéologique et historique: fouilles de la cité impériale de Thăng-Long (Hà Nội)* ». Heritage conservation and development support of the excavated site;
- Project « *Édition et préservation du patrimoine écrit et photographique* ». Preservation and re-edition of old documents and rare periodicals. Publication of research tools and guides;
- Project « *Histoire et patrimoine de la région centrale du Vietnam: étude de la muraille de Quảng Ngãi - Bình Định* ». Research projet and training in history, archaeology and anthropology;

- Project « *Le Việt Nam, une société de l'eau* ». Anthropological and historical study about State/peasantry relationships examined through the prism of hydraulics (XVIIIth-XXth centuries).

The reorganisation of the EFEO in Việt Nam

From September 2012, two of our tenured staff, Andrew Hardy and Philippe Le Failler, are going to return to the school's headquarters in Paris for a few years. The Hà Nội center will then only have one tenured member of staff, I myself, who will represent the EFEO in Việt Nam, as well as a contracted researcher, Stéphane Lagrée, whom it is no longer necessary to introduce to you…

At the same time as this staff reduction in the North, a new project is going to begin in the South. It will be led by Pascal Bourdeaux (EPHE), who will be assigned to Hồ Chí Minh City for two years. The EFEO will share premises with the AFD for this project. This new scientific project, entitled « *Comprendre la culture et l'environnement du Sud Việt Nam: perspectives historiques, approches contemporaines* », sets out to develop a multi-disciplinary analysis of State/peasantry viewed over the long-term, particularly from the standpoint of water management and the conquest and development of the Mekong Delta.

What are the existing links between the JTD and the EFEO in Việt Nam?

First of all, on behalf of the EFEO, I developed and managed for one and a half years the FSP project « *Appui à la recherche sur les enjeux de la transition économique et sociale au Vietnam* », which was itself at the source of the JTD launched by its "historical" founder, Stéphane Lagrée.

Secondly, the EFEO participates with the VASS, the AFD, the IRD and the University of Nantes in the scientific policy of each edition *via* its steering committee and contributes financial support.

Finally, the Hà Nội centre has been directly implicated in the activities and guidance proposed by the JTD since its very outset:

- Lectures in plenary sessions: Philippe Le Failler (2007) and Olivier Tessier (2007, 2008, 2010, 2012);
- Organisation of workshops: Olivier Tessier has been co-organising and facilitating the « *Atelier sur les méthodes d'enquêtes en socio-anthropologie* » for the past five years (from 2008 to 2012).

We can only wish long life to the JTD and hope that this novel experiment in Việt Nam and in the region inspires new initiatives and forms of cooperation, working towards the development of social sciences and a better understanding of both past and present Southeast Asian societies.

Opening Remarks by Jean-Pascal Torréton

Representative of the IRD in Việt Nam

Dear Vice-President of the Việt Nam Academy of Social Sciences, dear colleagues and participants, Ladies and Gentlemen,

The IRD and its partners have been involved in this social sciences summer school since its inception in 2007 and are once again this year happy to be part of this annual scientific event, which is of utmost importance for researchers and post-graduate students in this domain.

This partnership between French institutes and universities and the Việt Nam Academy of Social Sciences, which was initiated and has been maintained thanks to the continuing demand of the President of the VASS, converges with the wishes of the IRD and the *Agence inter-établissements de recherche* (AIRD) to involve even more their partners in the south of the country in the defining of common objectives in an ethical approach to the partnership. It is in this spirit that the IRD is now asking its partners to sign a charter of partnership that contains these principles, and it is a pleasure for me to remind you that the Graduate Academy of Social Sciences at the VASS is the first partner from the South to have signed it. The AFD, which is also associated with this event, is furthermore the first partner from the North to have signed it.

This training event aims to transfer an approach both to research and methodologies that will be useful to the scientific managers of tomorrow, whose analyses will provide the definition of the public policies which aim to reply to the development stakes. This transfer of knowledge and competences is at the heart of our institute's missions.

The inter-disciplinary approach to the themes and methods that is favoured by the organisers, in order to render the debates more fertile, is equally in agreement with our institute's spirit of intervention.

Finally, the regional character of this annual event helps with the development and animation of regional research dynamics, which also corresponds with the missions that the IRD has set itself.

This year's chosen theme, *"Water and its Many Issues"*, recalls a majority of the priority set of themes in the IRD's 2011-2012 performance contract. Among which we may mention "Health and Environment", "Development and Governance", "Natural Risks and Hazards", "Water Resources", "Ecosystems and Biodiversity" and "Food Production and Security". This year's JTD thus constitute an excellent opportunity to remind you of the IRD's research projects for development in this domain and to clarify how they are implemented in Việt Nam.

A large part of the IRD's 56 units carry out research into issues linked to water in the context of climate change and the increase in pressure from humans. As far as continental water systems are concerned, the IRD and its partners study particularly the water cycle, water resources, the pollution of these resources, the biodiversity of the organisms found in these waters, the transport of elements, governance etc.

As for the oceans, the themes in which the IRD and its partners are interested concern the interactions between the ocean and the climate; hydro-dynamism and the transport of particles and pollutants; the biological and biogeochemical functioning of lagoon, estuary, coast and ocean zones; the diversity and state of coral reefs; and more generally, the biodiversity of marine organisms, fishing, aquaculture, etc. "Water" and its many issues linked to development is thus a domain where the IRD's expertise is essential.

Both the past and the future of Việt Nam are closely linked to water, as you will be reminded during certain presentations in the lecture theatre. To illustrate this point, one only needs to remember that the fresh water which annually circulates in Việt Nam represents 891 km^3, that is to say the equivalent of water to a height of three meters over the whole surface of the country, which is a considerable amount, and the mastering of this water has, over time, structured the landscape of the deltas. More than 60% of this resource comes from upriver countries, which illustrates the necessity of approaching the problem on a regional scale. Everyone knows Việt Nam's two big deltas, but the country also has, as well as a few natural lakes, hydro-agricultural installations which have led to the creation of more than 3 500 small and 650 medium-sized reservoirs used for the control of flooding, irrigation, fishing, aquaculture and energy production.

Việt Nam is also a maritime country with 3 260 kilometers of coast that generate a large contribution to the national economy. The quality of the freshwater's impact on the ocean habitat, which has been altered by agriculture, industry and urban development, is necessarily important as there is, on average, an estuary every 20 km along the coast.

Finally, Việt Nam is one of the countries that will be the most affected by climate change, particularly by its incidence on the sea level and the water cycle.

This will result in the salinisation of low-lying lands and aquifers and heavier rainfall during the wet season in the central part of the country, with increased risk of flooding and less rainfall during the dry season. There will be more typhoons because of the increase in temperature of the ocean surface, and here again, beyond the human risk, this will have a big impact on water resources.

In Việt Nam, IRD research is concerned with water at different stages and scales.

The IRD has studied the hydrology of the Mekong both upriver and downriver, along with the AFD and the CNRS, as well as the governance of the waters in the Red River Basin. The institute is currently studying continental water quality with its partners in the face of agricultural practices on sloping land, and, finally, downstream, some IRD units are carrying out research with their partners into the consequences of fluvial deposits on the ocean habitat by studying the currents of coastal waters and the transport of pollutants, as well as their effect on biological diversity

and the biodiversity of coastal zones, which are greatly exploited.

In these projects we can see the diversity of themes linked to the multiple uses of water. The integration this year of the institute's activities within a regional priority programme should reinforce this investment into water-related themes, one of the four priority axes being coastal waters and the regional ocean, the projects involving freshwater being integrated into the "Inland Asia" axis, and a third axis "The Forecast: Evaluation and Attenuation of Risks", which aims to integrate risks linked to tsunamis, floods and the consequences of climate change.

As well as this research, the IRD is also very involved in university teaching in this domain by developing, in partnership with the Hà Nội University of Science and Technology, a Master's in water-environment-oceanography and the corresponding research department.

This rapid glimpse at things shows that the spirit, method and content of this summer University in social sciences devoted to "Water and its Many Issues" is closely linked to the IRD's missions.

I wish you all lively debates and fruitful discussions for this 6th edition of "Tam Đảo Summer School Week" and thank you all for your attention.

Opening Remarks by Yves Perraudeau

University Professor

Head of the mission of the University of Nantes in Việt Nam and Southeast Asia

Dear Presidents, Directors, doctoral students and colleagues,

I am once again honoured to be participating in the opening ceremony of this new 2012 edition of the regional summer school in social sciences also referred to as "Tam Đảo Summer School Week" or JTD (*Journées de Tam Đảo*), entitled "Water and its Many Issues". As Project leader sent by the President of the University of Nantes to cooperate with Việt Nam and Southeast Asia, I thank you most sincerely; I also do so on a personal level.

In the name of Olivier Laboux, the new President of our university, and in the name of Gwénaëlle Proutière-Maulion, his Vice-President for International Relations, we are very happy to be present today for this 6th edition. The new management team of our university wished to continue our presence here at the JTD in order to show our willingness to pursue this cooperation. We esteem that this type of work is positive for the doctoral students, teachers and researchers in the Southeast Asia region.

Furthermore, following our participation in the *"Doctoriales"* (April 2011) and in different colloquia (2009-2011), our initiative for the doctoral school project with certain departments of the Việt Nam National University in Hà Nội has enriched the current approach of the AUF and the Việt Nam Academy of Social Sciences. Today, the University of Nantes is present in the collective project "Doctoral Nursery".

In the framework of its international cooperation policy, our university regularly participates in partnerships. That's why we have delocalised certain masters' programmes; certain departments of the University of Nantes are present here in Việt Nam, under agreements with Vietnamese universities, such as in the field of medicine (Hà Nội and Hồ Chí Minh City), pharmacy (Phú Thọ), dentistry (Hà Nội), technical sciences (Đà Nẵng and Cần Thơ), economic sciences and management (Hà Nội, Phnom Penh, and Hồ Chí Minh City). However, this strategy is limited by our human resources and the number of delocalised masters' will not increase much.

As the director of the Nantes Institute of Economy and Management, I would like to underline our presence in Việt Nam with

four master's programmes in the fields of economy and management. Furthermore, the projects in Cambodia and Thailand, respectively, are taking form and making headway, falling in line here with the regional opening promoted by the JTD.

It is also as a teacher-researcher interested in maritime economy that I am especially happy to be participating in this cooperation. This year's JTD theme is fascinating. For an economist the question of water, both as a natural resource that it is necessary to manage and as the natural element in which maritime and fluvial traffic operates, is evidently fundamental. What is the best way to manage this natural, renewable asset? By adopting an optimal biological, economic or social approach? By examining the judicial and economic question of the delimitation of the zone belonging to the coastal State? Maritime and continental fishing and aquaculture may also be analysed as an industry, from the producer or the importer towards the retailers or transformation enterprises, then domestic distribution or export; the aquatic product is thus a food product for which supply and demand considerations can be applied and for which numerous techniques of economic and management analysis may be used.

Furthermore, maritime transport makes up more than 80% of international trade and its link with the evolution of the international economic situation is thus very clear, without forgetting that the cost of a merchant vessel is between 100 000 and 150 000 US dollars a day, which explains why it is in the ship-owners' interests to bulk ship tonnages in order to obtain economies of scale, find an agreement and create situations of imperfect competition, which is an interesting field of study for market and game theories, etc. I look forward to some fruitful debates in which Jean-Pierre Beurier, Pierre Cariou, Patrice Guillotreau and I are going to play an active role.

Let me thank Stephane Lagree, Bùi Thu Trang and their colleagues, who through their daily efforts have made these JTD possible. Thank you also to the Việt Nam Academy of Social Sciences in Hà Nội for welcoming us.

Finally, on a personal note, I am very happy to be in Southeast Asia, which is a region I have been travelling to for more than 15 years. So, thank you for giving me the chance to return here once again.

On behalf of our President, Olivier Laboux, let me thank you once again. I am both happy and honoured to be among you and with you in this common project. I should like to wish all the participants both good health and success.

Opening Remarks by
Olivier Garro
Director, Asia-Pacific, AUF

Dear Vice-President of the Việt Nam Academy of Social Sciences, dear colleagues and friends,

The *Agence Universitaire de la Francophonie*, which I am representing here, is both very happy and proud to have been associated for some years with this regional social sciences summer school, which gathers together numerous partners and allows every year about 80 participants from Cambodia, Laos, Thailand and mostly from Việt Nam to work together for ten or so days both in the lecture theatre and in workshops.

First and foremost, we are happy because this is an event which concerns a part of the world that has historic relations with the French language.

The AUF's vocation is to promote the French language, and our methods of defense of the French language are neither complex nor overcautious, they are in the very image of the task that is being permanently undertaken during these JTD (*Journées de Tam Đảo*). Indeed, French is used here as one of the languages for our exchanges as is Vietnamese. It is also, along with English, one of the languages in which JTD will be disseminated.

However, I would like to emphasize that here, French does not only represent a means of communication, it is also the vector of a wide and rich scientific culture and of an original way of modeling and conceiving the world. It is also a vector of different types of knowledge and know-how disseminated by a large part of the teachers and researchers who have either come from or originated from several different French-speaking countries, in order to teach, exchange ideas and quite simply participate in the work being undertaken. That's why French is a language that is synonymous with success in Southeast Asia.

Moreover, I'd like to take this opportunity to pay tribute to the great commitment of the French and French-speaking institutions present at these Days. I am thinking here of the AFD, the IRD, the EFEO and the University of Nantes.

Going beyond the language aspect, we also believe in this summer university because it meets several needs.

We can only acknowledge that if these JTD have gradually become an important part of the human and social sciences landscape, this is above all because they meet a great need for the creation of a network of expertise, for knowledge sharing and for exchanges about common problems.

I would also like to insist on the importance, which is often ignored, that the social sciences have for development, in the training of

geographers, anthropologists, jurists, or high quality economists for example, who go on to become in their countries important players in a more reasoned and harmonious development.

The chosen themes – water this year – demonstrate, if it were necessary to do so, that the organisers remain attentive to the needs and preoccupations of the region.

Beyond contributing to the training of these future development managers, this summer university also participates, year after year, in the creation of a veritable network of doctorate students, young researchers and university lecturers in social sciences. If the project for a regional doctorate nursery in social sciences, about which we are currently in discussion, should become reality, it is clear that by their position, renown and importance, the JTD will have constituted an important foundation stone.

Finally, I would like to underline the quality of this initiative.

The chosen form of this summer university seems to me to be of particular interest because its length, and especially the way in which it is organised into field workshops during the week at Tam Đảo, allows a different type of exchange to the more formal seminars and lectures that master's and doctorate students are used to. It is also another type of interaction with the organisation of workshops that encourage debate, the exchange of opinions and a real interactivity in an interesting system of multilingualism.

I only want you to remember these key words that for us sum up all the interest of these Days: a *Francophonie* rid of all hang-ups and an attempt to meet the needs of development and quality. That is what we applaud here.

It only remains for me to thank the Việt Nam Academy of Social Sciences without whom this beautiful adventure would not have been possible.

Thank you for your attention and let me wish you all many fruitful debates.

Map 1. Localisation

Source : Tomorrow Media.

Conférences
& Séminaires

Part 1
Plenary Sessions

1.1. Hydrological Development of the Red River Delta: A Historical Perspective of the Role of the Imperial then Colonial State (From the XIIth Century to the First Half of the XXth Century)

Olivier Tessier, EFEO

The history of the development of the Red River Delta and the presence there of humans is closely linked to the history of water mastery and the hydrographical network, which shaped history through a long process of aggradations. The central preoccupation of protecting oneself from the violent rise of rivers by erecting dykes is a constant part of Việt Nam's ancient and modern history, which has played a role in the structuring of relationships between the State and the peasantry, if for no other reason than in this almost exclusively rural country, agricultural production constituted the greatest source of income for the Imperial State through the taxing of (inscribed) peasants and land. It was thus necessary to work for centuries to secure this tax, which was indispensable to the very existence of the Imperial State in a region that was characterised by chronic agricultural uncertainties and the threat of drought for fifth-month harvests and was followed by the risk of river swelling and flooding, synonymous with the destruction of the tenth-month harvest. All this resulted in one essential characteristic of the delta:

a huge flood plain whose evolution had been paralysed for a long time because of man. The containment of the principal river systems of the Thái Bình and the Red River has indeed fixed for centuries topographical inequalities that were only temporary and that the natural flooding of the plains would have progressively flattened if the rivers had not been contained by an ever-increasing network of dykes.

The aim of this presentation is to provide a few historical landmarks concerning the hydrological policy implemented by the successive imperial dynasties, which ruled the country from the XIIth century, by basing myself on a study of imperial annals. This vision from "above" – as it is that of a central power – will be frequently confronted with a vision from "below": the village steles.

1.1.1. An Overview of the Geomorphologic and Hydrographic Characteristics of the Red River Delta

Some data concerning the whole of the delta will allow you to better understand the issues.

The Red River Delta forms a huge flood plain (14 700 km^2), which looks like a triangle whose base runs along the Sea of the East (Biển Đông) and the summit is situated near to Việt Trì at the confluence of the Red River (Sông Hồng) and the Clear River (Sông Lô), not far from the confluence of the Black River (Sông Đá). In counterpoint to this impression of perfect horizontality that one first sees, the delta is characterised by a non-negligible general slope (northwest/southwest) of ten to twelve metres and by a certain number of topographical features.

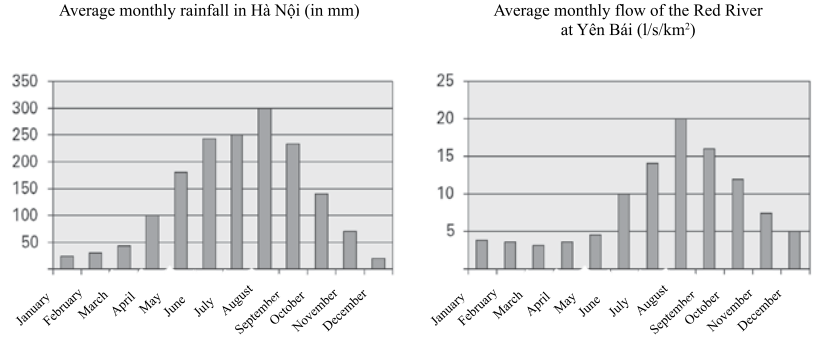
Map 2 The Immense Alluvial Plain of the Red River Delta

Sources: Author's construction from Google 2007 (http://maps.google.com/).

The delta was formed by two river systems: the Thái Bình and the Red River.

The Thái Bình, which flows in the northwest of the delta, is a river with a strong but regular regime, which carries few solid elements. It stems from the meeting of three rivers coming from the Upper Region: the Sông Cầu, the Sông Thương and the Sông Luc Nam. However, at its very beginning, the Thái Bình River is joined by its first tributary, the Sông Đuống (referred to as the Rapids Canal during the colonial period), which stems from the Red River and swells its flow. Not far from its mouth (Cửa Thái Bình), it again receives waters from the Red River by the intermediary of the Sông Luộc (formerly named the Bamboo Canal). In spite of the addition of these waters, the Thái Bình system, including all its tributaries and distributaries, has an average swell that is largely contained by dykes.

Figure 1 Rainfall and River Flow in the Red River Delta



Sources: National Water Resources Council (2003), "Vietnam Water Resources Atlas".

The Red River system seems to be the very opposite of the preceding system. The Red River, swollen by its two major tributaries (Sông Đá or Black River; Sông Lô or Clear River) is alimented by a large catchment area of 130 000 km^2, which covers the whole of the northwest of the Upper Region, and a part of Yunnan. Its swelling is exceptionally violent and at the origin of the devastating flooding that periodically affects the region. However, it has also been the principal constructing force of the delta and its major source of fertility, thanks to the considerable mass of sediment deposited over the centuries of which the thickness of the accumulated layer measures twenty or thirty metres in places. Its sediment load is estimated to be near to 130 million tons per year, which thus places the Red River in 8th rank in the world, according to criteria for carried solid loads, although it has not the flow of a great river (Béthemont, 2000). What's more, it is this great density, which earned it the name Red River, a colouration stemming from the deep red clay drained by the rains in the Yunnan catchment area. At a length of 1200 km, its flow follows

a rigorously northwest/southeast direction and completely crosses the delta, that is to say from Việt Trì to its mouth (Cửa Ba Lạt), over a distance of 220 km, which is 165 km as the crow flies: it thus meanders little, which helps explain its considerable flow, which can attain 28 000 m^3/second, compared to the size of the catchment area feeding it. This flow, in times of flooding, greatly raises the river level, leaving it virtually perched above the plain. However it is prevented from spilling over in normal periods by the dykes surrounding it. In practical terms, in winter, during the low-water season, the average water level of the river is around 2.50 metres above sea level. From the beginning of the summer high-water period (June-October), the level rapidly rises and can reach ten metres in a few days.

Photos 1, 2 and 3 A Temperamental River with Violent and Unpredictable Swelling

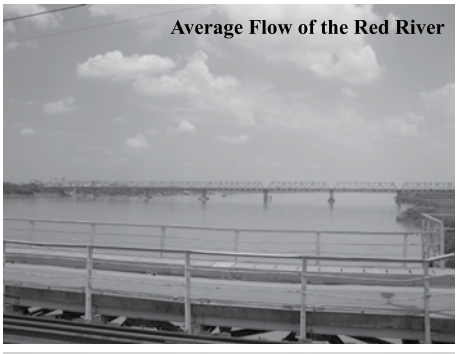


Photo credits: Olivier Tessier.

Without making a detailed description, we can identify by diagram six different geomorphologic regions:

- The highlands of the northwest, which are characterised by being higher than the rest of the delta, as well by some impressive river bank elevations (from 13 to 15 metres) created by the Red River on both sides of its bed, and which dominate depressions situated at about five metres below, often permanently occupied by ponds;

- The medium altitude lands of the centre, located to the east of the preceding region, are characterised by being less elevated but nevertheless significantly high (from 5 to 6 metres), as well as by less salient river bank elevations;
- The lowlands of the northeast, crossed by the Thái Bình and its confluences, are at a much lower altitude (from 50 cm to 2 metres) and are almost without riverbank elevations. The low-lying character of this region is particularly visible to the north of Hải Dương, where the arroyos take up more space than the land;
- The lowlands of the south form a region whose characteristics are similar to the preceding region (low altitude, amphibious terrain), but which is different because of the Red River riverbank elevations, which continue almost to its mouth;
- The sea walls form a strip of a width of 10 to 35 km, which stretches from the south of the delta to Hải Phòng. It is formed by a succession of ripples of an altitude of two metres separated by 50 cm extended depressions.
- The salt marshes are the result of the presence of man, who has thus conquered from the sea some very low and flat land by taking advantage of the Red River aggradations. This is why the salt marshes are not located in the south of the delta. Elsewhere, in the centre and in the north, the sea walls constitute a last rampart against the sea.
- Generalised containment compartmentalises the delta into hydrological units called polders, each one independent from the other, on the one hand for the supply of irrigation water from the river and on the other for the evacuation of surplus rainwater towards the same river. Currently, the delta is thus divided into thirty primary polders of an average area of 5 000 to 180 000 hectares, that is to say as many distinct and compartmentalised hydrological systems that it is imperative to drain throughout the rainy season.

A Few Figures about the Red River Delta

At the beginning of the 1930s, the agronomist René Dumont and the geographer Pierre Gourou both predicted, at an interval of one year, a bleak future for the Red River peasantry; the main reason being the remarkable human density, linked to the high growth rate of the population that the region had to support: of the delta's 14 700 km^2, 12 000 km^2 were intensively exploited by 6 500 000 farmers, which represented an average density of 430/inhab./km^2. René Dumont saw here a "grave danger" for the countryside's survival, and Pierre Gourou made the diagnosis of an "illness without a cure": "[…] *the excessive density of the population is an evil without a cure.* […] *These farmers are already taking from the soil the maximum of what it can give; the hydrological works and technical upheavals cannot raise production to the point where it can change living conditions* [chronic poverty]." Not only is the delta densely populated but its population is almost exclusively rural: in 1931, Hà Nội, the capital, had a population of 128 000 inhabitants, that is to say a slightly higher population than Hải Phòng (124 000 inhabitants). The development of North Việt Nam's urban network is recent; it was a phenomenon accelerated during the colonial period in order to meet the centralising demands of the powers in place and satisfy the needs of the colonial apparatus.

In these conditions, the problem of the supposed over-population of the Red River

Delta was seen in terms of agricultural potential. Rice growing occupied a preponderant position in the food production systems and was a real hub of economic and social development centred on domestic unity, which was part of large inter-dependent village networks. Every year, the farmers obtained one or two harvests depending on the topographical position of their rice fields. Rice growing determined the irrigation and drainage capacity of the plots. The highlands, which were difficult to irrigate in winter but non-floodable in summer, were used for monsoon or tenth-month rice that could be followed by the planting of a dry crop (soya, sweet potato, etc.). The low-lying lands that are easily irrigated in winter but floodable in summer were the domain of winter rice, or fifth-month rice. Finally, the medium-altitude lands allowed a yearly double rice crop of which the harvest of each crop depended on the winter climatic hazards (droughts) and the summer ones (floods, typhoons and even droughts). At the beginning of the 1930s, the Red River Delta could be divided as follows: 500 000 hectares of two-crop rice, 500 000 hectares of tenth-month rice and 250 000 hectares of fifth-month rice for a total surface area estimated at 1.1 million hectares. Calculated in terms of a grain/ population ratio, and by basing ourselves for this on the average harvests established by Y. Henri in 1932, annual production in the Red River Delta was thus 17 200 000 quintals of paddy which, in relation to a total peasant population of 6 500 000, results in an average of 2.6 quintals per mouth to feed. However, we are speaking about paddy, the raw product whose transformation into edible white rice results in a loss of between 30% and 35% of the harvest weight: finally, an average of between 180 and 200 kg of rice/inhabitant/ year, a ration which is hardly sufficient for the diet of one adult.[1]

Sixty-six years later, the Red River Delta has absorbed a population of three times the size. It is currently home to 18.5 million inhabitants, of which 13 million live in rural areas (70%), for an average density of 1 000 inhabitants/ km^2. This average hides some peaks of density of 1 500 inhabitants/ km^2, particularly in the province of Thái Bình, which represents one of the most populous areas of the world in a rural area. Even though, over the last twenty years, we have witnessed large growth in urban areas, the population remains largely rural and is found in the 2 000 communes that cover the delta, grouped within more than 80 rural districts, which in turn are part of twelve provinces.

If the economic and social crisis which should have resulted from this increased pressure on land has still not occurred, it is thanks to the combined effects of two strong policies adopted by the young Democratic Republic of Viet Nam in the 1960s to transform traditional agriculture: the modernisation of hydrological agriculture and the adoption of "green revolution" principles (introduction of new varieties of rice with high potential yield).

[1] It is generally considered that the average necessary intake per adult corresponds to an annual ration of 300 to 350 kg of paddy, or 210 to 250 kg of rice per inhabitant/per year.

Photos 4, 5, 6 and 7 Human Occupation of the Red River Delta: A Pattern of Villages

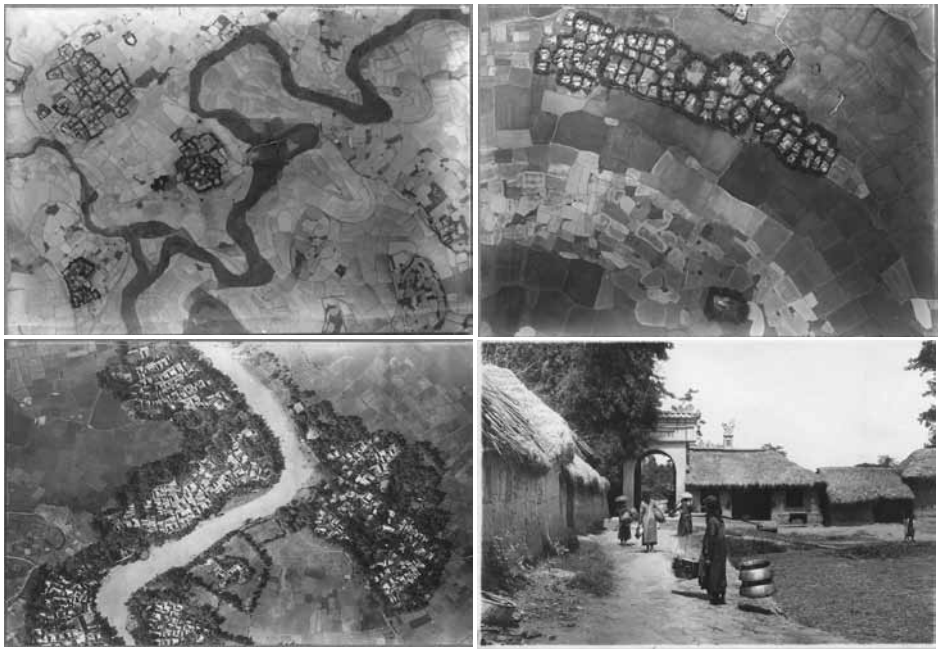


Photo credits: EFEO photo archives (Paris).

On these old photos, you can imagine the human occupation of the delta by the arrangement of the villages in a pattern, as if they had been placed there by an invisible hand, but they have nevertheless taken advantage of the slightest elevation. The traditional "bamboo hedge", which has today disappeared, adds to this sense of isolation.

Photo 8 Extract of Bắc Ninh Province (SPOT, 2003)

Sources: Author's construction from Google 2007 (http://maps.google.com/).

Today still, as you can see on this extract of a SPOT satellite image of the province of Bắc Ninh, we find the importance of elevation for the implantation of villages. On the other hand, they are gradually becoming less isolated as a result of being connected in a network and the urbanisation dynamic along major roads.

1.1.2. Mastering Water: A Priority throughout the Centuries (XIIth - XVIIIth Centuries)

The Progressive Installation of a Strong Network of Dykes

The colonisation of the Red River Delta and its agricultural development significantly began when the Central State and its administration organised the construction of dykes.

In Việt Nam, as in China, the construction and maintenance of dykes was the direct prerogative of the Emperor. The celestial mandate, which confers on one man "supreme authority", that is to say the legitimate right to command his fellow men, demands in return the benevolent protection of his subjects.

This political and symbolical dimension was reaffirmed every three years at the moment of *Nam Giao,* a form of heavenly worship where *"the Emperor seems to have established himself as the designated representative of his people: in the name of all, he prostrates himself,*

makes an offering, gives thanks and asks for help". As an intercessor, he can thus be held responsible for a dyke burst causing major flooding, the people seeing in such an event the disapprobation of the Heavens regarding the sovereign's actions. At the same time as this quest for divine assistance – reaffirmed each year at the moment of the "opening of the furrow" ceremony *(le tich dien or le ha dien)*, which marked the opening of the season of rural works, the protection of the population and the harvests also imposed on the Emperor the duty to directly intervene on hydrological systems in an effort to protect the countryside from flooding.

The first allusion to the realisation of containment works, after the long period of Chinese domination, dates back to the end of the XIth century and is recorded in the Cang Muc: *"In the year Mau Ti, the eighth year in the Hôi-phong period, the King Nhon Tôn of the Ly Dynasty (1099)… in the tenth month, a dyke was erected on the bank of the river, in the Co Xá village"* (former province of Hà Đong, present-day Hà Tây). It is necessary to point out that the Red River can be particularly violent.

Photos 9, 10, 11 and 12 The Terrible Anger of the Red River

1926 flood: Hà Nội - Hai Phong railway line

1911 Swelling and flooding in Hà Nội

1926 Flooding Bắc Ninh Province

1926 Flooding in Hà Nội

Photo credits: EFEO photo archives (Paris).

However, this first explicit reference does not necessarily signify that dykes had not been erected at an even earlier period: the presence of protection works has been documented in the former provinces of Sơn Tây and Hưng Hóa since the beginning of the Christian era and is thought to have resulted from a technological borrowing from China. Indeed, for Pierre Gourou, *"As soon as the inhabitants of the Delta (Red River) stopped living from fishing, from the moment there were too many of them to exclusively exploit the highlands and the the river bank mounds, they found themselves obliged to build dykes"* (1936). Generally speaking, the hypothesis retained by the authors who have carried out research into the origins of the dykes is that they resulted from an endogenous local dynamic: to thwart late summer river swelling or spring floods, peasants and isolated villages built small dykes on the banks of small streams, which surrounded finished plots of cultivated land. With the passage of time, the system became generalised and the small dykes were joined together to form the beginnings of a network, which never stopped increasing in size (Rouen, 1915).

The question that leaves this hypothesis unresolved is that of the role of the State in its interventionist capacity. As far as this essential point is concerned, although the thesis defended by Karl Wittfogel in his polemical work *Le Despotisme Orientale* has been the object of a great deal of criticism, the author has managed to remind us that the mastering and control of water inevitably generates power struggles between the central power and peasant societies.

And *de facto,* it was from the XIIIth century, that is to say from the establishment of the foundations of an essentially military and aristocratic power by the Trần Dynasty, that the imperial annals speak of the realisation of great hydrological works and gradually reveal the beginnings of a specialised military and administrative organisation. Following the floods provoked by the heavy river swelling that burst the Long Đàm or Thanh Đăm dyke (present-day province of Hà Nội) in 1245, an event which by inference highlights that the containment of the Red River was already in part achieved, the *Đại Việt Sử Ký* mentions: *"Reign of Trần Thái Tôn (1225-1258). Period Thiên ứng chính bình* […] *Seventeenth year of the same period, 3rd month, cyclical year Mậu thân (April 1248): the construction of the Đỉnh Nhĩ dam began. All the provinces received the order to participate in the construction of a dyke running from the source (of the Red River) to the seacoast. Its aim was to make flooding impossible. The King appointed a director general and a vice-director of works for the containment of the river. Wherever the dyke ran, the surface area of the covered rice fields was measured and the people were financially compensated for the loss. This dyke was named Đỉnh Nhĩ."*

Faced with such a huge task to accomplish – the complete containment of the Red Rive – the Emperor created a first specialised provincial direction and put an easily mobilised work force at its disposal, the army, *"Fifth year of the Nguyên Phương period in the reign of the same Emperor* […] *4th month (May 1255): the King delegated in each province a military mandarin to take on the post of director general of works for the dykes of that province. Every year, at the end of the agricultural season, the army was employed to build dykes and dig canals so that there would no longer be any fear of floods or droughts."*

However, in spite of this form of organisation and the management of hydrological works, the considerable effort of containment, consented in the XIIIth and XIVth centuries, does not register in a comprehensive plan of delta development and called upon empirical construction techniques that were of unequal quality from one province to the next. Consequently, the fragility of the earth ramparts thus created and their connection to a network, whose mapping was sometimes defective, did not succeed in efficiently containing medium intensity swelling of the Red River and of its distributaries, as the many reports concerning dykes being washed away, flooding, reinforcements and the construction of new works testify.

Consultation of the *Đại Việt sử ký toàn thư,* the annals of the history of the Đại Việt written in 1697, gives a fascinating insight into the reality of the hydrological threat that permanently loomed over the populations. Thus, we succinctly learn that in the seventh month of the years 1164 and 1199, flooding was such that all the rice fields were waterlogged; in the eighth month of 1359, waters engulfed peasants' homes and the rice harvest was lost, etc. During certain years, flooding continued throughout the rainy season, as in 1586 when the annals record heavy flooding on the fifth day of the fourth month, followed by the bursting of the banks of the Mã River in the province of Thành Hóa on the 25th day of the same month, the violence of which was such that the waters carried away the debris of houses to the sea, followed by a third and fourth flood on the second and twenty-fifth days of the seventh month, with the author concluding that within the space of one year, seven great floods had occurred. But these dramatic episodes did not only affect the countryside: in the seventh month of 1270, the streets of the capital Thăng Long were submerged and people had to move about by boat; in the sixth month of 1630, the River Nhị (Red River) burst its banks and flooded the streets, the water cascaded into the city through the south gate and many inhabitants drowned, etc.

In the XVth century, with the advent of the Lê Dynasty, the country experienced a period of appeasement and peace with China and the Champa over which it had just victoriously stamped its authority. No doubt, the constitution of a centralised and conquering Confucian State under the Lê Dynasty, which had led the country with the support of a mandarin system present in the furthest rural outpost, was a determining element for hydrological development and protection against flooding.

The great agrarian policy initiated by the Emperor Lê Thái Tổ continued under the reign of Lê Thánh Tông: following a burst dyke on the Tô Lịch River, the Emperor ordered the repair of the dams and roads throughout the country and created new mandarin posts for agricultural encouragement *(khuyến nông)* and for the responsibility of dykes and roads. This marked determination continued until the first years of the XVIth century and concerned not only the construction and reinforcement of dykes, but also the incentive to implement irrigation procedures. Thus, in 1503, under the reign of the Emperor Lê Hiển Tông, Dương Trực Nguyên (tả thi-lang bộ Lễ) requested the authorisation *"to erect dykes along the Tô Lịch River from the Trát bridge to the Cống River in order to protect the rice fields from flooding, and to dig a canal from the village of Yên Phúc to the commune of Thượng Phúc to irrigate the rice fields. The King gave his consent."*

This wish to rationalise and systematise the maintenance and reinforcement of the dyke network was announced in the Lê Dynasty code, which designated mandarins of different administrative levels as those responsible for the efficient enforcement of the sovereign's directives.

Box 1 A Rationalised and Codified Containment

"Art. 181: Dyke restoration work must have begun before the tenth day of the first month, the date at which all the inhabitants of the villages located in the zone protected by the dykes must go to the part of the dyke they have been assigned to restore. This work must be done within a period of two months; on the tenth day of the third month this work must be finished. When it is a question of the construction of a new dyke, a period of three months will be accorded for the execution of the work. Quan lộ [mandarins] must make every effort to continually survey the works, and the work inspectors and directors must continually make every effort to ensure the swift completion of the works […]".

Then, until the advent of the Nguyễn Dynasty in 1802 with the Emperor Gia Long, sources speaking about the issue of hydrological development are often highly tenuous. Indeed, the country was going through an extremely difficult period of chronic political instability, marked by the Mạc revolt and by a series of bloody wars between the lords Trịnh and Nguyễn.

At the beginning of the XVIIIth century, in the eighth month of 1708, the *Cương Mục* documents the *"order to repair the Nhị River* [Red River] *dykes: the Nhị River overflowing every year, the dykes were in a very bad state in many places. The two services of the Government and the Administration (trấn thù) were then commanded to direct the workers to carry out repairs according to needs in the interest of the farmers"* (quoted by Langlet, 1978). Three years later (1711), in the seventh year of the reign of Vĩnh Thịnh, the sovereign decided to modify the organisation of dyke reparation by sending mandarins from the capital to supervise the works.

However, the writer noted, *"The tasks were subsequently increased, but the flood damage could not be avoided"* (quoted by Langlet, 1978: 516). In the end, only four passages of chapters 33 to 35 of the *Cương Mục* (1663 to 1721) speak about containment and only speak about repair work and not about new constructions.

This situation contrasts with the references to droughts and flooding synonymous with dearth and famine, which succeeded each other throughout this same period (seventeen references), thus giving the picture of a weaker and impotent State than official historiography would have us believe: "(Eighth month, 1684, reign of Trịnh Tạc) – *the waters swelled because of the typhoon, the River Nhị came out of its bed [also called Phú Lương,*

that is to say the Red River]; many rice fields were damaged or lost in the northwest sub-prefectures [huyện]".

One of Trịnh's greatest errors was to not have paid sufficient attention to the question of agriculture in general, and to water mastery in particular, whose management was delegated to provincial mandarins only. Of course, subsequent to the bursting of dykes, the State had to once again take on the role of commander of containment works, but from 1797, responsibility was once again handed back to regional civil servants, the government having fallen into complete decadence (Lê Thành Khôi, 1992).

Irrigation and Drainage: Powerlessness of the Imperial State

Regarding the other aspect of water mastery – irrigation – documented sources are rarer than those about containment, but testify to the constant preoccupation of successive dynasties concerning the problem of drought and its dramatic consequences for the population. However, although the imperial power had been attempting to intervene in this domain since the XVth century, it must be noted that these initiatives did not bring any notable improvement in practices: no infrastructure in direct contact with the rivers was realised before the XIXth century. It must be said that at this period the problem that needed to be resolved was formidable.

The supply of water to the lands was possible because of the proximity of the low-lying lands that form a network of ponds and arroyos. These zones, which are flooded during the monsoon, serve as reservoirs for irrigation during the dry winter period, their filling depending on the rhythm of the high tides, which attain a maximal elevation of four metres, the effect of which is visible in the whole of the delta. *"We are in a delta, a slightly sloping aggradations zone of very low altitude. The reduced river flow during the dry season allows an upwelling of seawater at high tide, this acts as a block on the flow of fresh water and thus raises the water levels in the rivers" (Gourou, 1936).*

In the coastal zones, farmers have known for centuries how to profit from this phenomenon: they erect a great number of floodgates in rot-resistant lim wood, which they manœuvre in order to let water penetrate when the swell enters into the river mouth and opposes the flow of the river, thus provoking a rise in the river water level.

Elsewhere, developments for irrigation principally concern ponds and small arroyos in order to extend the ephemeral life of these natural water reserves. Thus, a village stele engraved in 1764 mentions the digging of an irrigation canal realised conjointly by two communes in the middle of the XVIIIth century.

Box 2 Local Initiative

The two communes of Thời Ủng and Chu Lũng carried out irrigation work to secure the lives of the population. In the year Đinh Mão (1747), ramparts were erected and trenches dug, in the year Quý Dậu (1753), an irrigation canal was dug and in the year Mậu Dần (1758), arable land was brought for the renovation of the temple. To date, the mandarins of the two communes have carried out survey work, 99 trượng [1 trượng = ten Vietnamese yards = 4 metres] of ramparts and trenches have been created, 581 trượng [about: 2.32 km] of canal have been dug, the temple covers a perimeter of 61 trượng and 6 thước (61 trượng and 6 thước (Vietnamese yards). […] *Overall, the total amount of donations is 1 010 quan tiền sử, 148 people have donated their land for the construction of the canal. To give thanks to those who have donated land and money, the two communes have erected a stele on which their names are engraved and have decided to be eternally grateful to them."*

"At the same time as these local initiatives, the imperial power issued a series of decrees inciting the population to erect small dykes, dig reservoirs and clean out canals and arroyos in order to increase available resources and facilitate fifth-month harvests and, eventually, be able to plant quick-growing rice to replace ordinary rice for the tenth-month harvest destroyed by dyke bursts" (Pouyanne, 1931). It was thus that the Sông Đào canal was dug at the end of the XVth century, which was to both irrigate rice fields during the dry season and drain low-lying zones during the monsoon.

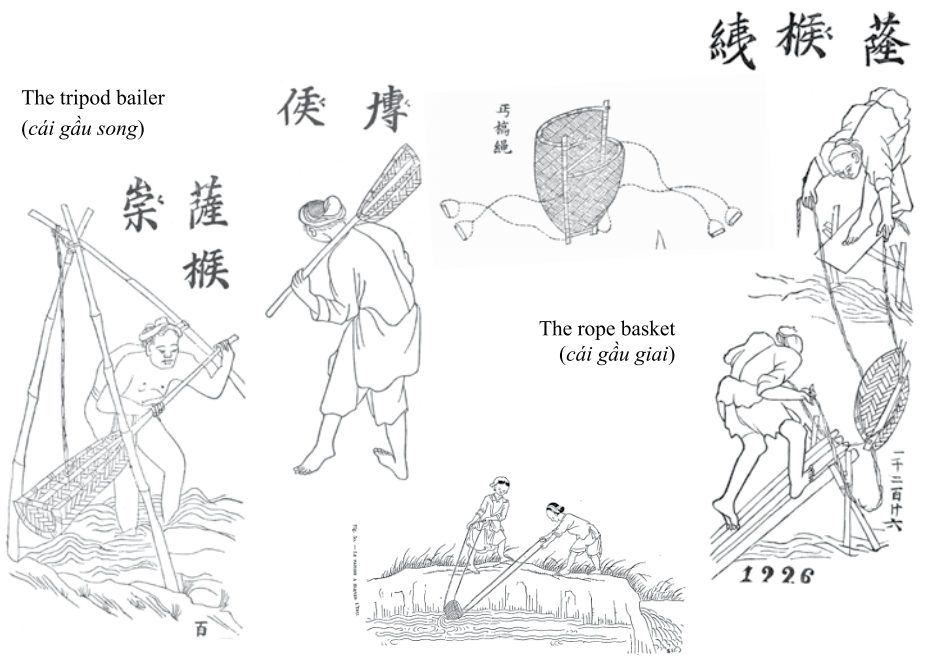
The impossibility of piercing the dykes, as well as the contours of the ground where there are elevated riverbanks and natural hollows, imposes the use of mechanical water extracting systems to draw the water from the rivers in the dry season. In his study into irrigation, E. Chassigneux examined this point and noted that although some texts and decrees urge the mandarins and the population to "build machines to carry water", there are no precise details about the nature of these "machines", nor of their very existence. Might they have been small pedal norias that could be seen at this period in certain provinces of the delta?

What is more, in periods of drought, the principal possible recourse was heavenly. Many passages of the *Cương Mục* are testimony to this as here we find, on the one hand, massive amnesty measures considered to be pious gestures of reparation in the face of the government's excessive rigour thought to be the reason for the natural disasters (Langlet, 1970) and, on the other hand, prayers and offerings to the mountain and river divinities in order to soften their anger and invite them to trigger the much awaited rains. Thus, it is indicated that in the year Quí hợi, năm thú 4 [1143]: *"The drought having continued from spring to summer time, the King himself conducted a religious ceremony to pray for rain. In the month of June it rained";* or again in the year Mậu thìn, năm thứ 6 [1448]: *"In the month of April, it is summer. Drought. The King*

makes sacrifices to the gods to pray for rain. He freed prisoners."

Finally, for lack of an efficient technical mastery of the irrigation process, the King accords partial or total tax exemptions and distributes rice from the royal reserve among the poorest population in order to in some way mitigate the sufferings of the population in periods of drought.

Photo 13 Traditional Irrigation Systems

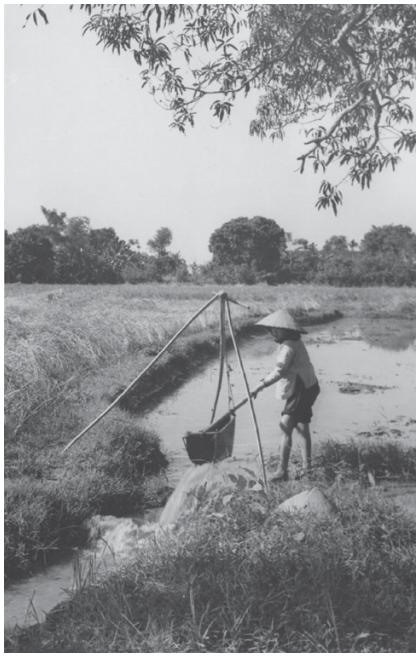


Sources: Olivier Tessier and Philippe Le Failler (2009), Technique du Peuple Annamite *by Henri OGER, revised and expanded, trilingual re-edition (ed.), nxb Nhã Nam, Hà Nội, 2 volumes (plates: 700 p.; introduction: 271 p.).*

Photos 14, 15 and 16 Traditional Irrigation Systems

Small pedal noria

The trod bailer (*cái gầu song*)



Private bailing stations

Photo credits: EFEO photo archives (Paris).

What is more, traditional irrigation from the ponds and arroyos, fed by the natural flows of rivers, remained the norm until the construction of gravity-fed networks. Every farmer was responsible for the supply of his plots and bailed water from a specific place situated along the arroyo or pond, referred to as a bailing station, as illustrated in the picture above. These stations were private, the owner having priority over the other villagers wishing to irrigate their rice fields. The bailed water was then either directly poured into the plot or into a canal that ran to the farmer's land. Bailing was carried out with the help of two simple, inexpensive tools whose usage depended on the height of the water sought, and which are still used today for reasons that will be explained later.

The tripod bailer *(cái gầu song),* which is made of plaited bamboo fibres, is 70 cm long and 25 cm wide at its opening and has a 1.5 to 2 metre handle. It is suspended on a bamboo tripod by a rope, so as to be in a horizontal position ten centimetres or so above the water's surface. This tool is manipulated by one person and moves in a swing-like motion: first of all, the bailer is obliquely plunged fifteen centimetres beneath the surface, then the operator begins a pendulum movement that he halts at the moment the bailer reaches its discharge point. The water is then propelled by its own force and runs into the

plot or canal. The tripod bailer can be used for a maximum elevation of 40 cm. Eleven days of this difficult and monotonous work are necessary to transfer 10 cm of water to a one-hectare rice field.

A second instrument, the rope basket *(cái gầu giai),* is used for surfaces at an elevation of more than 40 cm, but which cannot exceed 1 metre. It is a conical shaped bucket in strips of plaited bamboo to which two ropes are attached, one at the base and one at the top.

The operators necessary for its manipulation let the basket fall into the water by leaning forwards with outstretched arms; then they straighten up, at the same time tugging on the upper rope. Once the basket has reached the end of its course, they pull on the bottom rope thus toppling the basket and pouring out its contents. For land at an elevation of 90 cm, thirty days of work are necessary to transfer 10 cm of water into one hectare of rice field. In addition, it is sometimes necessary to proceed in several stages to attain the rice field that must be irrigated.

Faced with such difficult and fastidious work, it is easy to understand why water theft regularly occurred and became a source of major conflicts between neighbours, particularly during periods of drought. Indeed, there is nothing easier than opening up a breach with a spade in the small dyke separating two rice fields, the water thus flowing into the lower field.

Finally, there existed two other systems of elevating water, but they were used a lot less than the two previous methods. The first is the sliding bailer *(cái gầu kèo)*. This is a simple container made from woven bamboo fixed to a handle. Immersed in the water, it slides along a smooth and sloped earth wall: the operator, in a sitting position, pulls the instrument towards himself and the water mounts the wall and flows over as soon as it reaches the top of the dyke. Although very efficient, it is only usable for an elevation of between 10 to 20 cm and its use thus remained confined to a few districts in the lower delta, characterised by a very slight change in elevation. Finally, the pedal (or string) noria, which allowed for an elevation of between 10 cm and 1.5 m, was *de facto* reserved for the wealthier farmers owing to its complexity and high price.

By comparing the irrigation tools used in the Red River Delta at the beginning of the XXth century with those which appeared in a Chinese agricultural treatise in 1210, *le Keng tche t'ou,* in which 23 drawings are devoted to rice growing, E. Chassigneux establishes a technical filiation that leaves hardly any room for doubt. The delta farmers' tools stem from technical borrowings from China: only some adaptations and improvements have been added to the Chinese methods, particularly for the first method described, whose original counterweight system had been replaced by a bamboo tripod.

1.1.3. The Nguyễn Dynasty: A Global and Innovative Vision of Hydrological Development

Although the capital of the newly reunified country had been transferred to Hué, the first Emperors of the Nguyễn Dynasty paid particular attention to the socio-economic recovery of the North of the country, which had been bled dry after several decades of war and desolation. To make their power felt everywhere, they set out to make their mark as great builders by undertaking the construction of roads, bridges, ports and also

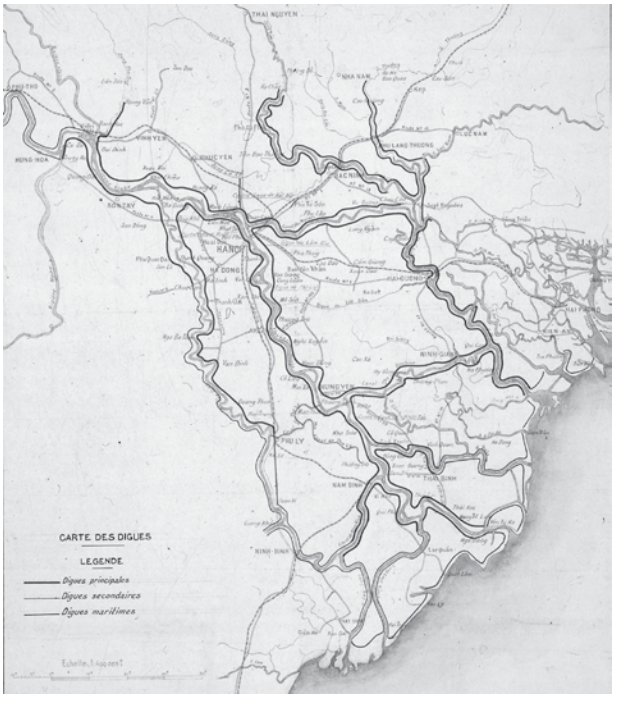
strong citadels built in the same manner as the French fortifications of Vauban in order to put down peasant revolts. Here is one of the ambiguities of the first half of the XIXth century: although the implementation of an absolute monarchy allowed the modernising of the Red River infrastructures, the increased control of the populations by a largely corrupt bureaucratic and mandarin apparatus aroused growing peasant discontent, which on many occasions resulted in insurrection. Consequently, peasant chiefs like Phan Bá Vành, and mandarins nostalgic for the former Lê Dynasty, mobilised thousands of poor peasants and resisted the regular forces in the coastal region of Quang Yên (Sơn Nam) for six years (1821-1827). Although the administrative reforms undertaken by Minh Mạng in order to re-establish order in the country led to a brief lull, the crisis grew under Tự Đức and culminated at the beginning of the 1850s with the arrival of Chinese hordes fleeing the repression subsequent to the Taï Ping revolt. (Le Thành Khôi, 1992).

Towards a Generalised Containment of the Red River Delta

In the hydrological domain, the Emperor Gia Long first of all, then Emperors Minh Mạng and Tự Đức, had carried out some major works that principally aimed at controlling the swelling of the Red River. Thus, according to figures from the inspection carried out in 1829 by the principal mandarin responsible for dykes (Đê chính), Lê Đại Cương, the total length of the principal dykes in the Red River Delta (recorded in 739 xã belonging to 38 huyện of 5 tỉnh) was 952 km (238 660 trượng) of which 144.5 km (36.127 trượng) was built in 26 years by the first two Emperors of the dynasty (Đỗ Đức Hủng, 1979).

The effort made was such that Pierre Gourou estimates that at the eve of colonial intervention, the generalised containment of the Red River Delta was complete, that is to say that the network of dykes was nearly as dense as that which he could observe at the beginning of the 1930s. It consisted of nearly 2 000 km of principal dykes and nearly as many secondary ones (Gourou, 1936).

Map 3 Map of Dykes (supposed date: 1905)



Sources: Gauthier (1931).

In 1809, the Emperor Gia Long reformed dyke administration and created a central specialised service under the authority of the court mandarin *"quan Đê chính ở Bắc thành"*. At the same time, he issued a structured regulation in eight articles that dealt with the realisation of works and their inspection, the protection of the works and the planning of future constructions associated with the evaluation of their cost.

These regulations established a dyke typology according to three levels of importance (đê đại giang, đê trung giang, đê tiểu giang) and defined for each of them a standard template of works – width of the base and platform, height and density of compaction.

Finally, just like the Lê code, the Gia Long code lays down strict sanctions that even include capital punishment for any person found guilty of "*Clandestinely breaching the river dykes – Art. 395*" and "*Not intervening at the right time to repair the dykes – Art. 396*",[2] this last article contains the principal elements announced in the Lê code.

[2] Art. 395: *"Those who clandestinely pierce river dykes (built by the State) will be punished by 100 lashes; those who clandestinely pierce dykes or pond levees (privately owned) will receive eighty lashes […]."* Art. 396: *"Whenever the river dykes have not been (built and) repaired (before accidents occur) or (although repaired), they have been repaired at the wrong moment, the civil servants and employees responsible for the general direction of the service will receive fifty lashes […]"* (Philastre, 1896).

In spite of this package of measures aiming at a rationalisation of the human and technical management of the dykes, bursting and flooding happened every year during the reigns of Gia Long and Minh Mang, bringing with them deadly floods, famine and peasant revolts. Almost every year, from the sixth month, the *Đại Nam Thực Lục* established a disaster inventory of the more or less serious disasters triggered by the violence of flooding or, on the contrary, by drought; the Emperor giving emergency aid in money and rice to the victims and partial or total exemption from taxes.

In this respect, the 1827 floods were catastrophic: *"Bắc Thành suffered from serious flooding, the dykes burst in the three provinces of Sơn Tây, Sơn Nam, Nam Định, houses and rice fields were submerged, several people were drowned. The city dignitaries sent people everywhere to distribute aid to the victims and reported back to the King.* […] *I read the report on the lamentable plight of the victims for whom the help offered was somewhat insufficient and still remains too little. I therefore order the provincial dignitaries to distribute supplementary aid, each person, be it a man, a woman, old, young or drowned, shall be allotted 3 quan tiền (unit of currency), if the person is very poor, he will be given 2 quan tiền, 1 phương (barrel) of rice, if the person is poor, he will be given 1 quan tiền and 1 phương of rice."*

Minh Mạng then promulgated in his eighth year of reign (1828) an order removing the responsibility of dyke construction and maintenance from the provincial mandarins accused of negligence and incompetence, and entrusting it to a corps of specialised civil servants. This text precisely states the dimensions and different types of dyke, which must be heightened in relation to the standard template established by Gia Long, and also indicates where they should be placed; it also orders the planting of bamboo at their base and the stocking up of baskets and bamboo before river swelling to facilitate repairs; finally, it prescribes the edification of a temple to the water spirits at the confluence of the Red and Clear Rivers.

However this changed little. Minh Mạng then decided in 1833 to completely reform dyke administration. He dissolved the specialised service he had created six years previously and handed back dyke administration to provincial mandarins (*bộ Công:* Public ministry) which from then on were responsible for the part of the river flowing through their respective territories. This complete U-turn was motivated by the following observation: experience has shown that specialised mandarins only focus on construction and repairs of the works without paying any attention to agricultural activities, particularly the possibilities of creating drainage channels or irrigation.

In 1862, the dyke service was again dissolved and the policy of great hydrological works halted. The Emperor justified this choice by citing financial problems, but even more so because of the incursion of Chinese pirates in the north of the country and the French colonial intervention in the centre of the country.

In summary, in spite of an impressive overall assessment, the Nguyễn hydrological policy was characterised by turnarounds and discontinuities, which give us a direct insight into the weight of the unilateral decisions and grave mismanagement of the mandarin system.

The debate thrown open in 1803 about the utility of maintaining or not a network of dykes is the illustration of this.

Debate about the Utility of Maintaining and Reinforcing the Dykes

This succession of administrative and technical reorganisations must be placed in the framework of a substantive debate the terms of which were made clear by Emperor Gia Long in 1803: by decree, the latter ordered the mandarins and inhabitants to discuss the utility of maintaining the dykes or whether it was better to level them. Indeed, with the densification of the dyke and counter-dyke network, the peasants and the farmers began to see what negative effects it could have on the irrigation and drainage of the delta's rice fields. Thus the descriptive Geography by Emperor Đồng Khánh (1888) specifies about Sơn Tây province: *"The soil and waters of low-lying districts are healthier, similar to those of the southeast provinces. Heavy rains originating from the heights of the neighbouring provinces of Hưng Hóa and Tuyên Quang arrive during a period of a few weeks between summer and autumn; the rivers then flow very rapidly and the water level can reach 18 or 19 feet, while at the same time the crops growing on the other side of the dyke are stricken by drought."*

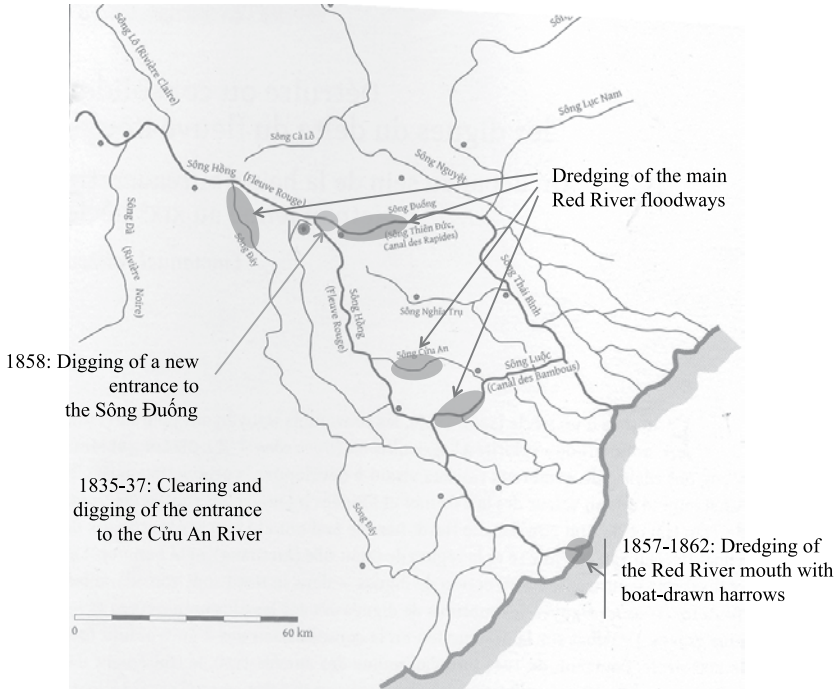
Thus the question was asked about whether it would not be more judicious to get rid of these dangerous and costly works so that the great rivers could spread freely throughout the summer over the entire surface of the delta, in the same way as a slow and progressive flooding and no longer like a cataclysm. The result of this would be abundant moisture, which would solve the irrigation problem while at the same time increasing the fertility of the soil thanks to alluvial deposits. In other terms, the question is to discover whether or not the dykes constitute a remedy worse than the evil that they are supposed to fight. This was why, after each flood, the populations of the affected regions asked for the suppression of the dykes, as was notably the case in 1804, 1825, 1835, 1847, 1872 and 1879: the principal reason motivating these demands was that when there was flooding caused by a burst upstream dyke, the downstream sections, which remained intact, prevented the retreat of the waters when the level of the river waters fell, thus annihilating any hope of a harvest (Pouyanne, 1931).

Although fortunately, no Emperor of the Nguyễn Dynasty ever resolved to order the destruction of the dykes on a delta-wide scale, this vital question resulted in complementary alternative solutions aiming to palliate the imperfections of the dyke system.

They first attempted to lower the water level of the Red River by increasing the drainage capacity of its natural distributaries and by creating artificial ones. It was thus that with the administrative reform of dykes in 1833, Minh Mạng decided the same year, following the advice of two specialised mandarins, to deepen and clean out the Cửu An River, which had to simultaneously serve as a Red River distributary at the level of Hưng Yên and as an irrigation canal. From 1835 to 1836, 20 km were dug so as to establish the junction between the Red River and the Cửu An River, whose dry season bed was dredged and widened over a distance of more than 40 km. As well as these excavation works, the dykes of the low-lying areas of Hưng Yên were either greatly reduced in height or purely and simply levelled (Đỗ Đức Hùng, 1998).

The impact of these large-scale structural changes was the exact opposite of what had been expected. Four months after the completion of work, announced to the Emperor in the sixth month of 1886 by the famous author and mandarin Nguyễn Công Trứ at that time *Tổng Đốc* of Hải Yên, the opening of the Cửu An River on the Red River was washed away in three places: the provinces of Hưng Yên and Hải Dương were submerged beneath two metres of water and the city of Hưng Yên was completely drowned. It was the most disastrous flood the two provinces had ever known (Đỗ Đức Hùng, 1998). It earned Nguyễn Công Trứ a violent dressing down from the Emperor who blamed him for the situation and asked him to repair the damage. From 1837, substantial reinforcement work began on the Cửu An River. In response to the pleas of the provinces devastated by the floods which were repeated each year, the upstream opening of the Cửu An River was completely plugged and its function was no longer anything more than a drainage canal for the evacuation of the waters from the low-lying lands in the province of Hưng Yên towards the downstream part of the Sông Luộc – the Bamboo Canal (Pouyanne, 1931). There was no other option than to rebuild and reinforce the dykes in the Hưng Yên, Hải Dương and Nam Định provinces, a task undertaken by Emperor Thieu Trị during the six years of his reign (1841-1847).

Map 4 Principal Works Carried Out in the XIXth Century Aiming to Lower the Water Level of the Red River



Sources: Author's construction.

However, in spite of this disastrous experience, the issue was again debated again in 1852 by Emperor Tự Đúc who opened a new discussion about what attitude to adopt concerning the network of dykes. The latter did not hide his distrust for the pursuit of the containment of the delta, as evidenced by an annotation written in his own hand in the margins of a passage from the Đại Việt Sử Ký devoted to the construction of the Đỉnh Nhĩ Dyke (*c.f.* above): "*It was an irresponsible enterprise which has caused us countless calamities*". Nevertheless, after five years of procrastination, it was finally those in favour of maintaining and reinforcing the system who won the day, the majority of the court dignitaries admitting that attempts to abandon certain dykes had caused floods over the previous decade of a frequency and a magnitude hitherto unknown.

Once the debate had been decided, the service for dykes was re-established in 1857. The new mandarin in charge of the service *(Đê chính)* made a series of concrete proposals that should be priorities in terms of hydrological and regulatory works against river swelling (Đỗ Đức Hủng, 1979). On this basis, and in addition to the new dykes and counter-dykes built on the Red River to prevent it from leaving its bed, dredging work was undertaken using harrows pulled by boats to deepen the river mouth and allow a more rapid flow of its tumultuous waters. They also attempted to deviate part of its flow towards the Thái Bình River in order to lower its water level and thus limit the violence of its swelling. It was thus that in 1858 Tự Đức had a new entry to the Sông Đương dug upstream from the old one, which had been totally blocked by alluvium (Chassigneux, 1914). However, in 1862, while development work on the Sông Đương had still not been completed, the dyke service was once again dissolved and the great hydrological works policy was put on the back burner. The Emperor justified this choice by evoking financial problems and, above all, the serious troubles provoked by French colonial intervention in the centre of the country.

Public Dykes, Private Dykes

The coexistence of two categories of dyke is a historical reality intrinsic to the very process of the containment of the Red River Delta. Thus, in 1665, in the eleventh month, the *Cương Mục* fixed the deadlines for the repairing of dykes and set out works of a different nature according to their importance: *"In the tenth month of each year the administration service (thửa ty) of each province (xứ) was to order the authorities of the subordinate sub-prefectures to go and carry out an inspection on the parts of the dyke needing repair work. Small repairs were to be made by the population of the communes that were threatened by the force of the current under the control of prefectural authorities; as for bigger repairs, a mandarin would be asked to manage them."*

However, for the first time under the Nguyễn Dynasty, these two categories were clearly disassociated. Thus, in his attempt to carry out a census in 1829 in the four provinces of the delta (*c.f.* below), at the same time as an inventory of public works, the principal mandarin responsible for dykes *(Đê chính)*, Lê Đại Cương, mentioned 698 km of privately owned secondary dykes and 16 similarly owned locks (Đỗ Đức Hủng, 1979). The part of privately owned dykes at this period thus represented more than 40% of the 1 650 km of infrastructure examined in the five

provinces. On which typology is this criteria based?

Public Dykes

Public dykes were erected at the Imperial State's initiative under the direction of a specialised or provincial mandarin system, according to the period. They were considered strategic in so much as they guaranteed the protection of major geographical and human groupings, as their bursting might trigger flooding that would affect district or provincial capitals and entire provinces. It was a question of the most imposing works which encircled the flood plains of the Red River and its most tumultuous distributaries, the construction and maintenance of which had to scrupulously follow the standard norms stipulated by the State concerning dimensions and compaction. In order to periodically mobilise the masses of workers necessary for the realisation of such infrastructures, the State disposed of two possible levers. The first was the mobilisation of villagers through one of the three great obligations that they had as vassals, the corvée (fixed at sixty days per year, per vassal by the Gia Long Code), which obliges each subject to take part without pay in the collective works ordered by the mandarin system. For the big construction sites, thousands of peasants were mobilised, often with the support of soldiers and sailors (biển binh). Thus, in 1835 (tenth month), in his report to the Emperor about the digging of the Sông Cưu An, Nguyễn Công Trứ gave some impressive figures: *"Digging rivers and building dykes is difficult work, it is thus necessary to hire 20 000 coolies (including 6 000 from Nam Định, 4 000 from Hải Dương, 3 000 from Hưng Yên, 3 500 from each of the neighbouring provinces of Hà Nội et Bắc Ninh), the works will be restarted next January."* The repairing of the damaged or washed away sections of the dyke also demanded a large quantity of manpower as shown in the report by Tổng Đốc of Hà Nội - Ninh Bình, Đoàn Văn Trường: *"4 000 coolies have been mobilised to repair the burst sections of the dyke in the districts of Chương Đức, Hoài An, Thanh Liêm of the province."*

The second lever consisted in remunerating workers (money and rice) in the form of piece work, the use of salaried workers having become indispensable in view of the considerable number of men and women that it was necessary to mobilise during the few months of the dry season that separated the tenth-month harvest from the first river swellings of the spring. Thus, for the construction of new dykes in the North (Bắc Thành), the mandarins Đặng Trần Thường Làm and Nguyễn Khắc Thiệu requested permission from Emperor Gia Long in 1889: *"The dykes in provinces of Sơn Tây, Kinh Bắc, Sơn Nam Thượng have collapsed, the construction of three new sections of dyke and the reinforcement of two old sections using hired workers is envisaged. For the other sections where the currents are not too strong and bearable, the local workforce will be mobilised for their repair. The King gave his consent."* It is easy to understand that the combination of these two possible systems of mobilising a workforce represented a source of tension between the financial means the State was ready to invest in the construction and repair of dykes and their effective use in the field. Even though certain reports presented to the Emperor explicitly mentioned the peasants' reticence to participate in the works, it also appeared that local dignitaries embezzled the money granted by the State to remunerate the workers by obliging the inhabitants to

make a financial contribution or by imposing the corvée on them. Thus, while praising the diligence with which the repair reinforcement work on the dykes on the Cưu An River – finished in 1837 – had been carried out, and while distributing gratifications to the mandarins, dignitaries and the population, Emperor Minh Mạng reminded people that they should not confuse the two sources of labour, which were salaried workers on the one hand and use of the corvée on the other, the money distributed to the local populations being a reward and not a salary.

Even though the financial outlay in the XIXth century greatly varies according to the Emperors and their great hydrological works, investment in this sector was never questioned in spite of the continual destruction of works, which fed the debate about their utility. Let me quote this passage from the annals of the reign of Minh Mạng in which the Emperor reminds us of the importance of the financial participation of the State and, from there, addressed a bitter reproach to the mandarins of the provinces of Sơn Tây, Sơn Nam and Nam Định following a series of dyke bursts and severe flooding: *"The dykes are of great importance for the inhabitants of your provinces. You can well see that we have been generous, since every year we place at your disposal a credit of 100 000 ligatures, with benefits in kind to assure the good maintenance of the dykes.* [...] *Why did you not take the necessary precautions beforehand to avoid such catastrophes? Why didn't you, when the violence of the flow increased, take new precautions?* [...] *This proves your negligence."*

Privately Owned Dykes

Privately owned dykes are, by default, considered as secondary and less strategic, as they have been built on more stable and regular sections of the river, whose eventual swelling and overflowing only affect human dwellings and small areas. The State thus made an empiric distinction between the private and public domains, that is to say a sharing of the tasks and responsibilities conditional on the financial capacities of the moment and the political priorities of the kingdom's governance in general, and hydrological management in particular. The privately owned improvements were carried out at the initiative of the peasant communities and self-financed by the latter after they had received, and this is the essential point, the Emperor's agreement, [3] since according to land ownership laws, the State was the unique legitimate and permanent owner, the peasants being simple tenants whose tenure was conditional to the development of the land and payment of taxes.

The relative weight of public intervention in relation to local initiatives follows the changes in the attribution of responsibility for the dykes, and is finally a true reflection of the versatility of the relationships between the successive Emperors of the Nguyễn Dynasty with the containment system of the principal rivers of the delta. Thus, the dissolution of the dyke service in 1833 and the search for an alternative solution to containment, particularly through work to have the Red River flow into the Cửu An River, coincided with a clear disengagement

[3] Article n° 389 (title 1) of the Gia Long code entitled "building without permission", stipulates that the works can be undertaken only after receiving the approbation of the superior authority, which fixes the indemnities of those carrying out the corvée – *op.cit.*

of the State *vis-à-vis* its regalian prerogatives in terms of hydrological management, which it temporarily handed over to peasant communities (Đỗ Đức Hủng, 1998).

The works carried out locally were sometimes only of moderate size and only implicated the inhabitants of an isolated village, as stated on some village steles. The phường Hồ Khẩu stele conserved in the Chúc Thánh pagoda, which dates back to 1858 (Tự Đức thứ 11), thus explains that the repairs following a dyke burst necessitated large sums of money and that private donors were called upon to participate in the expenses. *"The section of the dyke situated in the Quảng Bố neighbourhood burst, water invaded the Hồ Khẩu neighbourhood, its inhabitants had to repair it and as this work was very expensive, the compassionate were asked to contribute. Mme Nguyễn Thị Vạn offered 30 quan tiền and asked for the anniversary of her death to be later celebrated at the Chúc Thánh Pagoda. The residents of the neighbourhood erected a stele to pay tribute to her and established the annual commemoration of her death."*

However, the infrastructures built at the villages' initiative were sometimes of such a size that their development should certainly have been carried out by the State. The existence of these works clearly reveals the State's shortcomings and its difficulties to manage the global hydrological development of the delta and, consequently, the capacity of the populations to organise themselves at a local level to carry out work of general interest. This was the case from the very beginning of the Nguyễn Dynasty, as shown by the example of the construction in the Mĩ Lương – Yên Sơn region (today the districts of Chương Mỹ and Quốc Ai, tỉnh Hà Tây) of the Thập Cửu dyke, whose total length was 50 km (3.1 metres wide at the base for a height of 2.30 metres), which protected a rice-growing zone of 8000 *mẫu* (2890 ha). Remarkably, it was built between 1808 and 1812 by the inhabitants of a group of 19 communes, and resulted in the writing of an extremely detailed village convention *(bản khoán ước),* which spells out exactly the responsibilities incumbent on each commune in terms of the surveillance, protection and maintenance of the works (buffalo grazing, bamboo plantation, etc.), financial participation and sanctions in case of infractions and deliberate damage. Given its importance, once the work was finished the works were placed by royal decree under State responsibility, which thus integrated the public sector without spending a penny (Huy Vu, 1978).

However, it is necessary to highlight the passivity and interested wait-and-see attitude of the central powers in the case of the construction of the Thập Cửu dyke was not always the rule, as demonstrated by the many requests for the construction of works recorded in the annals and the approval of which was accompanied by the granting of State financial aid: *"A new dyke has been built in the Mai Xá commune, in the province of Nam Định (measuring more than 200 trượng). The inhabitants of the commune all showed good will in its construction. The provincial authorities reported this to the King who welcomed this news and gave his authorisation. When the works were completed, the inhabitants were given a reward of 5 000 quan."*

In other words, in order to encourage local initiatives, the Emperor could grant partial or total tax exemptions for a period of three years, mobilise the army to help the

population, grant rewards and honorary distinctions to dignitaries and deserving peasants, and compensate farmers whose rice fields were used to build infrastructures or as land reservoirs for construction.

Irrigation and the Conquest of Salt Marshes: The First Well-Thought-Out Developments

Although the successive Nguyễn Emperors were above all concerned about protection works against the swelling of the Red River, they were also behind technical innovations in the hydraulic agricultural sector.

Conquest of the Salt Marshes and the Coastal Cordons

The first of these concerned the conquest of the salt marshes and coastal cordons. It can really be classed as a XIXth century innovation, since historical sources speak about the conquest of the foreshore as early as the XIIIth century, a movement which might even have been the source of the first containment works built in the delta, if certain authors are to be believed. Thus, J. Gauthier believes that *"The first Tonkin dykes were quite probably coastal ones, completing the protection originally assured by the sand dunes"* in order to exploit the rich virgin lands that the continual lengthening of the delta on the sea were revealing.

The innovative aspect lay in the rationalisation of the conquest of the salt marshes by containing the land temporarily exposed, which allowed large-scale settlement. The first and principal enterprise of this type was launched in 1828 and concerned the salt marshes of the Thái Bình and Ninh Bình provinces. The work carried out under the management of Nguyễn Công Trú allowed the creation in 1829 of two new coastal districts, Tiền Hải and Kim Sơn: *"The district of Kim Sơn was created and attached to the Yên Khánh, Ninh Bình district. Nguyễn Công Trứ was appointed Dinh Điền Sứ (mandarin responsible for exploiting fallow lands), and outside the Hồng Lĩnh dyke, the superficies of the fallow land measured was equivalent to 14 620 mẫu (1 mẫu = 3 600 m^2), which was given to 1 260 poor inhabitants. Three villages, 22 ấp (domains), 24 trại (farms) and 4 giáp divided into 5 tổng (cantons) were established on this land and permission was asked to establish a district named Kim Sơn and a person who had a good understanding of the place was chosen as district head to make communication easier."* [4] At the beginning of the XXth century, these two districts had more than 20 000 ha of agricultural land and helped to feed 120 000 inhabitants.

Here again, at the same time as intervention from the central authorities, the conquest of the new territories was also the fruit of local initiatives. Thus, a stele dating from the tenth day of the sixth month of the thirty-second year of Tự Đức (1880) tells us that the Hải Yên province (present-day Quảng Ninh province) carried out the containment of 50 mẫu of wild lands conquered from the sea, thanks to a network of large and small dykes which prevented salt water from penetrating into these lands. The same source gave in detail the communal convention, which stated the rights and obligations of each *giáp*.

[4] *Đại Nam Thực Lục*, tập II, nhà xuất bản Giáo Dục, 2004, p. 843.

Yet Irrigation is the Most Striking Innovation

It was indeed necessary to await the beginning of the XIXth century for the invention of a procedure to channel water from the river. Until then, it had seemed impossible to technically master a breach in the dyke that would not degenerate into a bursting and thus cause large-scale flooding. The principle consisted in tapping the resource directly from the river flow using underground pipes solidly anchored in the dykes and easily opened and closed like valves or locks. This system, which sought to provide an alternative to the only solution to drought that the largening of water reservoirs had constituted until then, proposed to resolve by gravity alone the problems relating to the irrigation of rice fields and the drainage of surplus water accidentally accumulated following a dyke burst, or more usually in lower zones of the polder after heavy rains.

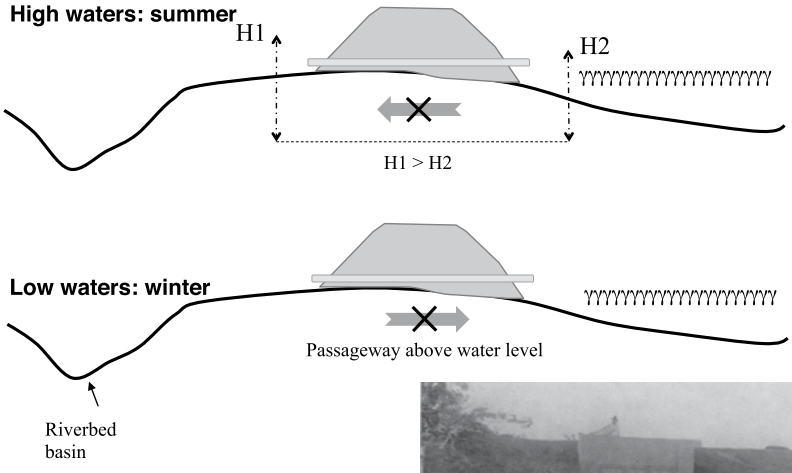
The first texts relating to works carried out directly on the dykes themselves trace the origins of their construction to the first years of the reign of Gia Long. However, it cannot be excluded that there had been similar attempts in a more distant past. Thus, the regulations issued by Emperor Gia Long in 1809 assigned to the newly created dyke service the first task of establishing an official register listing all dykes and locks *(cống nước)*. The first works were rather crudely designed, made from hollowed out tree trunks, which sometimes compromised the dykes' ability to keep water out. Consequently, more elaborate developments, real vaulted aqueducts, were built in brick with the help of very resistant and adherent mortar, which ensured their permanence (Gauthier, 1930).

In 1829, the survey of hydrological works mentioned fifty principal locks and sixteen private ones, which all assured the double function of drainage and irrigation, knowing that the report presented to Emperor Minh Mạng in 1833 by the three mandarins responsible for the reform and administration of dykes encouraged the general use of these systems. *"Henceforth, the provinces have Đại Viên Đốc, Phủ assigned to serve the population's interests. You are therefore requested to entrust public and private dykes to the mandarins of the province in accordance with the programme. As for the sections of the dyke along the river, if the building of locks along these sections makes agricultural work easier, it is necessary to make a formal report to ask for rapid authorisation. The locks will be open at times of drought and flooding for the fifth and tenth month harvests to facilitate irrigation and drainage, they will be closed at times of river swelling."*

How efficient were the locks? They provided satisfactory results in the maritime zone, where uncertainty surrounding certain crops was due a lot more to the swelling of the Red River than surplus rainwater (Pouyanne, 1931). However, as soon as we move away from the coastal areas, we must concede that they only provided isolated improvements that largely failed to meet expectations. The first reason was of a technical nature: the inadequacy of their size at their initial conception, exacerbated by the building up of sand at periods of river swelling, did not allow these water intakes to let through sufficient current. More importantly, during the high-water season, in the high and medium-lying areas of the delta, the height of the contained rivers at periods of swelling was significantly higher than the lower-lying zones of the polder, thus preventing the draining by the locks of

surplus water which continued to form huge lakes. As for the question of irrigation, the fall in the river level in the winter dry season left most of the valves above water.

Diagram 1 Locks: Insurmountable Technical Challenges



Old lock,Thái Bình Province

Sources: Author's construction. Photo credit: EFEO photo archives (Paris).

Finally, although the Emperors of the Nguyễn Dynasty understood well that the rivers of the delta constituted an inexhaustible supply of water that agriculture had to use, the very topography of the delta did not allow irrigation by gravity alone: the absence of any mechanical means of drainage prevented them from overcoming this difficulty (Chassigneux, 1912).

Consequently, irrigation from the arroyos and ponds fed by the natural flow of the rivers remained the norm until the construction of gravity networks. In this system, each farmer is responsible for providing water to his own plots and bails water from a specific place situated alongside an arroyo or a pond, called a bailing station. As these stations were private, the owner had priority over other villagers wishing to irrigate their rice fields. The bailed water was then either directly poured onto the plot or used to feed a canal that served the farmer's lands.

We have already spoken about the incentive measures issued by the Emperors in order to

increase water reserves for the fifth month rice harvests, whether it was by cleaning out the arroyos, digging irrigation canals or erecting small dykes and dams in order to increase the storage capacity of the thalwegs. However, even more than for the construction of the dykes, the fluctuations of investment granted by the Imperial State as well as powerlessness to propose efficient solutions for irrigation were the two factors that drove peasant communities to conceive and carry out their own developments. Although it appears impossible to establish a quantitative assessment of these local initiatives, village traditions, as well as the steles, sometimes speak about their existence, such as the stele in the commune of Đắc Sở (huyện Đan Phượng tỉnh Hà Đông), engraved in 1854 (Tự Đức thứ 7): *"The hydrological development is in close relation to agricultural activities. Certain mandarins, venerable village elders, have donated money to finance the installation of a stone lock in the commune in order make drainage and irrigation easier for agricultural services."* In order to see the true scale of things, let us remember that at the end of the XIXth century, the accumulation of public development works, especially those aiming to improve irrigation and/or drainage, made it possible to produce two rice crops per year on one-third of the total surface of the Red River Delta."

Finally, at times of drought, the Nguyễn Dynasty Emperors, like those of the preceding dynasties, prayed for divine intervention in order to trigger the much-awaited rains. Among the passages from the Đại Nam Thực Lục, devoted to the quest for celestial assistance, the extract printed below (seventh month, 1826) evokes the doubts and worries of Emperor Minh Mạng when faced with a climatic phenomenon over which man had no power: *"The drought usually happens in spring-summer, but recently it has been occurring in autumn-winter, this is due to adverse weather conditions! For the last few weeks, as it has not rained, it has been so hot that man seems to feel a burning in his stomach and the plants and rice fields cannot be as luxuriant as they should. In the palace, I have not had one good night's sleep. Last night, sitting in the court yard, looking up towards the heavens, I saw a black cloud which was quickly dispersed by a south-easterly breeze, how difficult it is to get rain!" The King turned towards Phan Huy Thực: "I'd like to test the hearth gods, if someone is able to trigger the rains, he will be rewarded, if not, their worship will be suspended. It will also be a way for the elders to measure the powers of the gods. But the wind and the rain are natural phenomena, the gods cannot intervene* [...]." [5]

1.1.4. Colonial Period: Towards a Rationalisation of Hydrological Developments

The Engineer's Rationality When Faced with "The Celestial Mandate"

The end of the XIXth century was dominated by the colonial intervention and the long war of conquest that followed in the north of the country. Seen from a hydrological standpoint, this period of troubles and instability ended in a more and more marked forced disengagement of the Nguyễn Dynasty to the benefit of the protectorate's technical services. It goes without saying that our aim here is not to engage in a historiography of relationships between the colonial power and the colonised people, but simply to

[5] *Đại Nam Thực Lục*, tập II, nhà xuất bản Giáo Dục, 2004, pp. 524-525.

briefly envisage the point of view of a handful of observers from the period about hydrological development in the delta, principally containment. In other words, it is here a question of examining the perception of the specialised technical services of the protectorate, which was essentially based upon the engineer's rationality and on his certitude about the superiority of the Western model in relation to local technical knowledge and what had been previously achieved.

The size of the task that had been accomplished forced the admiration of Western observers, who described a people of "hard-working" and "docile" peasants and construction sites comparable to "ant hills" in their organised hierarchy. Thus, E. Chassigneux wrote in 1914 *"It is easy to imagine what the construction of the old dykes must have been like: the same type of operation, being carried out today before us, is done using means that are in no way modern and which are most certainly very similar to those used in preceding centuries.* [A description of the different stages follows.] *All this is done in a surprisingly fast and orderly way. It is most certainly the active, incessant and methodical work of an ant hill."* (1914: 97) In the same vein, Pasquier described in these terms a site he had witnessed: *"In Thái Bình, I remember having visited the site of a canal being constructed which was carried out by corvée. In the middle of this grey and muddy patch of land, twelve thousand natives were working away. The site is remarkably organised. Bamboo fencing indicated the spaces reserved for each canton. This space was divided between all the villages in the canton.* […] *The huyện, with his employees, remained permanently on site in order to direct the works. Thus, according to the law governing labour specialisation, each community had a determined task"* (quoted by Vesin, 1992).

However, although all the observers claimed to be impressed by this age-old will to master the swelling of the rivers, their judgement of the quality of the works carried out is categorical. L. Constantin provided a good overview which, in his eyes, fully justified the civilising French intervention: *"These dykes have been constructed in a haphazard manner, without any global study and without any determined programme, the native authorities possessing only the vaguest of experimental data to guide them. It is only since the beginning of French occupation, and especially since 1909, that the question of reinforcing the old dykes and building new ones has been seriously addressed, following a well-defined programme whose execution is methodically pursued with the help of large credits allocated each year for this work."* (1918). Other authors, such as P. Gourou or J. Gauthier, propose a more moderate, nuanced vision, and place French intervention in the river containment sector in the continuity of the age-old efforts deployed by the imperial power. However, whatever their appreciation of the situation, most of them clearly gave their evaluation of the works that had been carried out by identifying five major weaknesses in the conception and realisation of the works which prevented them from containing average intensity river swelling.

- Firstly, because of the absence of any well-thought-out plan based on the whole of the system, the dyke network formed a complex maze of works whose often meandering, sharp-cornered route did not allow a regular flow from the swelling, thereby increasing the height of the water level.

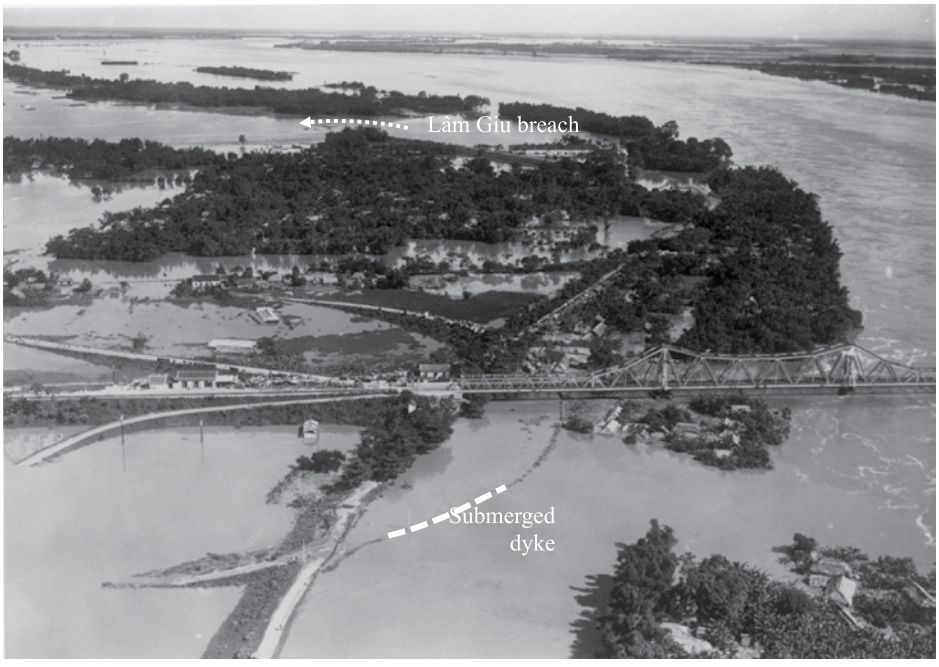
- Secondly, the dykes were not high enough: in accordance with Hà Nội laws dating from the end of the XIXth century, dykes were only nine metres high, whereas the river water can reach a height of twelve metres as was the case in 1926.
- Thirdly, in some places the longitudinal sections of the dyke were poorly suited to contain the violent pressure of the currents: the slope of the bank was too steep and the earth used was insufficiently compacted and not watertight.
- Fourthly, the path of the dykes containing the river was sometimes too near to its floodplain, which consequently increased the height and speed of the current and thus the risk of bursting, particularly in the case of concave banks, or in the case of the water flowing over the crest of the dyke, the latter thus behaving as a spillway. The consequences were all the more serious and immediate as the low-water bed of the river was not fixed.
- Finally, the fifth identified weakness was not of a technical nature but an organisational one. The successive, often incoherent reforms of the dyke administration were opposed to the development over time of a solid management tradition for hydrological infrastructures and the surveillance of river swelling. Thus, the engineer A. Pouyanne wrote about the 1833 reform: *"The modification of the general organisation of the Tonkin hydrological services prescribed by Minh Mạng, which consisted in handing them over entirely to the provincial authorities, has divided responsibilities in a confusing way and made it practically impossible to establish any global project for the work needing to be done. This modification has most probably been one of the factors leading to the failure of the Emperor's projects."* (1931)

In other words, the French claimed to not only to possess the rational superiority of the engineer over the empiricism of local technical knowledge, but they also imposed their conception of what a specialised service should be, namely a sustainable centralised structure which had a certain autonomy *vis-à-vis* politics, particularly concerning all aspects relating to its technical prerogatives. The report by the principal engineer Rouen, written in reply to the note about flooding addressed in 1915 to the *Résident Supérieur* of Tonkin by the former Kinh-lược (viceroy) Hoàng Cao Khải, is symptomatic of the clash between knowledge and practice that were totally opposed. He condescendingly refuted point-by-point Hoàng Cao Khải's observations and propositions, whereas the latter had given his unconditional support to the colonial enterprise, by arguing that the Annamites did not possess the necessary scientific and technical ability to conceive a satisfactory system of containment for the delta. Thus, he wrote: *"However, both for the successive raised structures that have certainly been built, and for the first infrastructures, the Annamites did not possess enough knowledge to determine how high it was necessary to build the dykes in order for them to contain the waters from the highest river swellings. How could they have succeeded when even nowadays in Europe specialised engineers are not always certain about this?"* (Rouen, 1915). This was a feigned admission of weakness, emphasising the inaccessible superiority of Western rational knowledge.

The fragility of the system appears evident when the frequency of the Red River swelling is envisaged. From 1890 to 1945, Hà Nội experienced thirty-nine river swellings of over ten metres in the months of July and August.

Such frequency necessarily provoked the bursting and submersions of dykes.

Photo 17 1926 Flood, Ramp of the Bridge at Gia Lâm



Sources: Gourou, P. (1936), Les paysans du delta tonkinois, Publications de l'Ecole Française d'Extrême Orient, Les Editions d'Art et d'Histoire, Paris.

During the same period, Dominique Vesin counted eleven major floods, which covered several hundreds of thousands of hectares of rice fields with water. Thus, at the time of the exceptionally long river swelling in 1913, thirty local dyke bursts caused damage that was estimated by the Public Works Service to have affected about 100 000 hectares where the rice harvest was completely lost, the waters not having been evacuated fast enough to allow the transplantation of rice; a loss equivalent to 150 000 tons of paddy. The particularly severe swelling of 1915 alone caused forty eight dyke bursts: half the flow of the Red River poured onto the plain thus flooding 365 000 hectares, that is to say one quarter of the total surface area of the delta, a violence of the waters that the map drawn up by the Public Works Service allows us to visualise (see maps). This chronic hydrological insecurity explains why the principal aim of colonial hydrological management in Tonkin until 1930 focused on reinforcing the dykes. From this standpoint, considerable efforts were made even though the fight against the violence of the waters sometimes

seemed one-sided. Two great periods of investment by the colonial authorities for the rehabilitation of the Red River dykes can be identified: periodic interventions (1890-1918) and the implementation of a reasoned development plan (1918-1930). [6]

1890-1918 Period: The Colonial Authorities Relaunch the Debate about the Dykes

Of course, from 1890 to 1918, large-scale works were undertaken, but only periodically and with limited human and financial means. In addition, it was between 1892 and 1893 that the biggest effort was made: 100 km of new dykes were built and a further 300 km or more repaired. After that, work was often limited to attending to the most urgent things by repairing the damage caused by dyke bursts and thinking up projects, sometimes outlandish, that could not possibly be implemented (Vesin, 1992). It must be said that this period of indecision was in part due to the bitter debate which only terminated at the end of the First World War.

Subsequent to the catastrophic flooding of 1893, a first dykes' commission was created in 1895, which was followed by two other commissions in 1905 and 1915. There was a struggle between those in favour of a general heightening and reinforcing of the dyke system, who saw it as the only possible option to combat river swelling, against those who wanted to destroy all or a part of the network. The latter argued that it was necessary to put a stop to the endless spiral of containment that they considered to carry much of the responsibility for the increase in risk of ever more violent swelling, that they believed to be the consequence of the change in hydrological regime of the rivers cut off from their natural outlets *("Les digues dans le delta",* 1902). Thus, nearly a century after Emperor Gia Long had first raised the question about the advisability of retaining or conserving the dyke network, the technical and political authorities of the protectorate rushed into the breach, completely forgetting the disastrous experience of dyke levelling carried out in Hưng Yên province between 1833 and 1837.

As a preamble, let us remember that this debate was a uniquely colonial one and that it had begun before French intervention. It again reared its head at the moment of the study groups, created after each big flood or drought, about hydrological conditions in the delta and ways of improving water mastery.

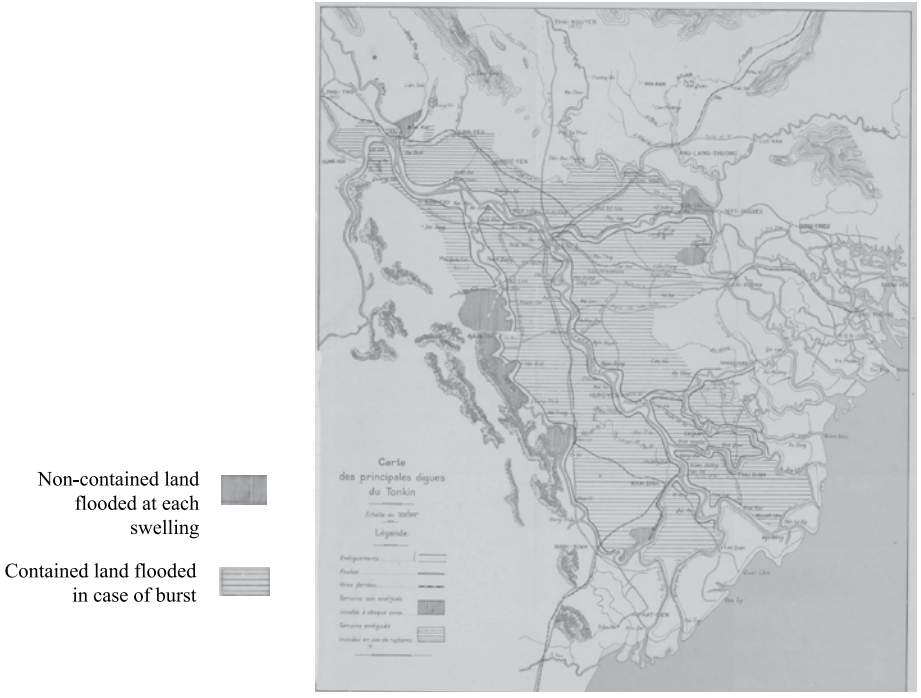
A range of solutions was recommended to fight against flooding: the creation of retaining reservoirs in the Middle Region; installation of outflows, realisation of works on the Red River riverbed and on its distributaries, and partial or total suppression of containment. The last solution was permanently abandoned when the general programme of dyke consolidation was adopted in 1918.

The studies carried out into the hydrological regime of the great rivers of the delta and into the impact of containment, as well as the general ordonnance of the delta carried out by the Geographical Service of Indochina (scale of map 1/25000°) had indeed produced enough scientific arguments to convince the political authorities. It was thus demonstrated that the presence of dykes had not caused

[6] A precise chronological overview has been established by Dominique Vesin (1992).

any big, permanent modifications to the riverbed over the previous century and that if a river had a tendency to rise this should not at all be attributed to containment. [7] Sense finally prevailed over risky projections. The solution proposed by those in favour of the removal of the dykes would doubtlessly have been worse than the problem itself, as E. Chassigneux observed as early as 1912: *"The idea of allowing the rivers to freely spread and roam over a surface as regular as that of the Tonkin Delta, and then claim to be saving it from both drought and violent flooding, and at the time assuring silting and fertilising clay deposits, would be tantamount to condemning this unfortunate country to ruin."*

Map 5 Map of the Floods in the Case of a Dyke Burst (1926)



Sources: Gauthier, J. (1931), Digues du Tonkin, International colonial exposition - Paris 1931, IDEO, Hanoi-Haiphong.

[7] Later, engineers such as A. Normandin, J. Gauthier and A. Pouyanne demonstrated that the only indisputable plugging of a contained river, that of its flood plain, did not have a great influence on the height of its water level during swelling.

From 1918: Priority Given to Reinforcing the Network of Dykes

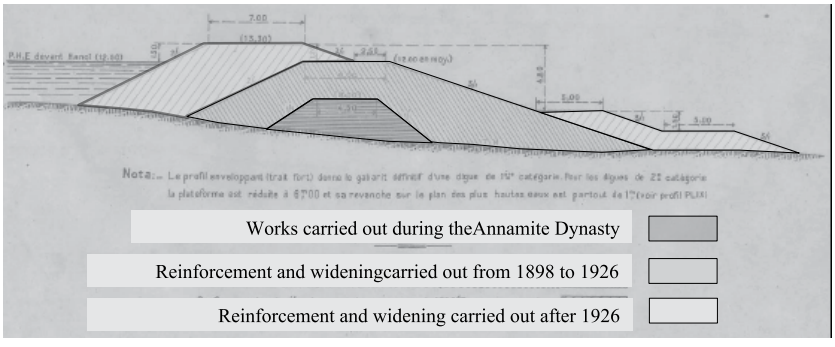
In 1918, following the particularly violent swellings of 1915, a general consolidation programme to increase the height of the dykes was established for the first time. It particularly concerned the development of the Vĩnh Yên and Sơn Tây basins, as well as the total containment of the Red River's principal distributary, the Đáy River.

If a theoretical profile of the dykes was to be fixed allowing them to contain a swell of twelve metres, the 1926 swelling seemed the logical reference to define a new programme for the whole of the system, capable of guaranteeing a satisfactory protection of human establishments and land. The works undertaken between 1926 and 1931 were considerable: upgrading[8] of more than 800 km of dykes, the protection and stone-surfacing of the banks, construction and repair of 170 locks. The complementary programme of 1931 concentrated on the secondary networks of dykes, which had been hitherto neglected.

Photos 18, 19 and 20 1926 Flood, Gia Quát Breach and Side Profile Indicating the Reinforcements that had been Successively Carried Out on the Red River Dykes

◄ Breach at its beginning

Breach after flooding of the polder ►



Source: Gauthier (1931).

[8] In 1930, the dykes along the right bank of the Red River were the following heights: 17.8 metres at Việt Tri; 15.1 metres at Sơn Tây; 13.7 metres at Hà Nội and gradually decreased in height when the river neared the sea (Gourou, 1936).

Photos 21 and 22 Reinforcement of Works and Construction of New Dykes

Reinforcement and elevation of the Gia Lâm dyke (1926)

Building of the new Nhur Trác dyke
(Phase 1 of works; to the right of the old dyke)

Source: Fonds de la photothèque de l'EFEO (Paris); Gauthier (1931).

Finally, the results fully justified the financial and human means invested, since no bursting of the reinforced dykes occurred between 1926 and 1937, that is to say during the decade when the improvement of the whole of the network was associated with a satisfactory maintenance system during the high-water season. The general regulation of dyke surveillance was defined in 1917 and completed in 1935. It provided for the different tasks incumbent to the specialised services and the Public Works administration, while delegating to the communal authorities the responsibility of periodically controlling the physical state of the works and immediately notifying the authorities in the event of anomalies. During periods of swelling, this control had to be carried out night and day.

In November 1948, the "Sub-Committee for the Modernisation of Indochina" made an assessment that was, to say the least, glowing, but how could it have been any different? The containment works carried out by the colonial powers since the end of the XIXth century: 1 500 km of dykes had been reinforced using 300 000 000 cubic metres of earth for a total cost for the whole of the programmes of 25 million piasters. By way of comparison, the cost of the damage caused by the 1915 swelling was estimated by the Public Works services at 5.5 million piasters, that is to say a fifth of total investment.

For the authors of the same report, the 1945 bursts, which had caused the submersion of 230 000 hectares, did not call into question the satisfactory level of protection of the delta against river swelling but were due to *"A complete failure of the system of control and defence of the dykes, following the Japanese invasion and the eviction of the French administration by the Viet-Minh."* As for the ambitious programme of hydrological development (dykes) defined by these very same authors for the 1949-1959 period, it remained quite evidently in draft form.

Gravity Irrigation and Drainage

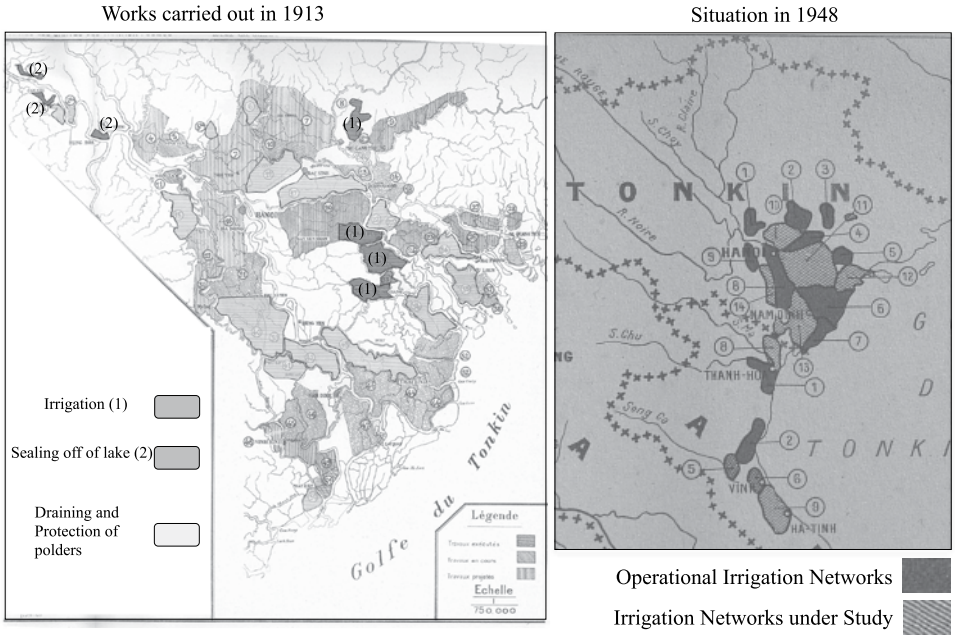
The series compiled by P. Brocheux and D. Hémery from the Statistical Yearbooks of Indochina (1913-1943), show there had been a declining trend in the alimentary situation since the beginning of the century. This decline resulted from a combination of factors of which we can retain, on first analysis, the population rise, which came about primarily because of the fall in infant mortality. It was the principal explanation retained by the colonial technical services for the rise in numbers "of a rural proletariat" in the north of Việt Nam, *"where food density (the number of inhabitants by square km of rice field) was as high as 678 for the whole of Tonkin and from 800 to 1 200 for several provinces in the delta"* (Henry, 1932).

However, faced with constant decline in the peasants' conditions, until 1930, the Colonial State's investments in the hydrological domain were principally limited to the consolidation and development of the powerful network of dykes surrounding the Red River and its principal tributaries and distributaries.

And yet, the vital issue of the implementation of irrigation infrastructures in the delta as a means of significantly improving the condition of the populations had been raised since the end of the XIXth century. Ambitious programmes of global development had been discussed, such as the Sallenave project (1895) or the Godard one (1898), but the level of required financial investments had until then been judged too high by the technical services and protectorate authorities. It must be said that in the zone of the delta, the implementation of hydrological networks can only be carried out on a large scale in order to allow not only irrigation, but also the drainage of surplus water during the monsoon: this made it necessary to provide substantial mechanical means to elevate the water, as well as to dig large irrigation and drainage canals.

Certain works were, however, engaged upon at the edges of the delta where the presence of very uneven terrain allowed a flow by gravity and thus an increase in agricultural output at lower costs.

Map 6 Location of Hydrological Infrastructure in the Delta in 1913 and 1948



Source: Brénier (1914).

After the failures of the first attempts at the end of the XIXth century and beginning of the XXth century, the success of the implementation of the Kép network relaunched the colonial project, which aimed to succeed in irrigating the whole of the High Delta and was partly represented by the construction of three other irrigation networks allowing the generalisation of a yearly double rice crop. The networks of Vĩnh Yên and Sông Cầu were built with the help of the borrowing fund programme of 1912 and the Son Tay network with the help of the 1920 programme. The principle consisted in taking the resource directly from the river after a body of water had been created by a dam, or water had been pumped mechanically to feed the principal canal, as was the case for the Sơn Tây network.

At the beginning of the 1930s, four important irrigation systems were up and working, all situated in the high delta.

Table 1 Irrigation Networks in Service at the Beginning of the 1930s

Network	*River Used*	*Beginning of Work*	*Completion Date*	*Surface Irrigated*	*Total Cost and/ha (Piaster)*
Kép	*Sông Thương*	*1909* *1913*	*1912* *1914*	*5 500 ha* *2 200 ha*	*675 000; 90/ha*
VĩnhYên	*Pho Đáy*	*1914*	*1922*	*17 000 ha*	*1 230 000; 70/ha*
Sông Cầu	*Sông Cầu*	*1922*	*1929*	*28 000 ha*	*4 000 000; 140/ha*
*Sơn Tây**	*Fleuve Rouge*	*1927*	*1931*	*10 000 ha*	*1 200 000; 120/ha*
Total				*62 700 ha*	*5 400 000*

** The Sơn Tây network was the first fed by pumping from the Red River.*

Source: Author's constructions.

The largest of these, the Sông Cầu Network, had the particularity of combining its agricultural vocation with a river transport one: the primary irrigation canal was navigable for all of its 53 km, divided into seven reaches with locks, thus allowing the establishment of a direct link between Thái Nguyễn and Hải Phòng. It was fed by the Tac-Oun dam and branched out into seven arteries and twelve sub-arteries.

When each of these works was achieved, the colonial authorities did not hide their unmitigated feeling of triumph. Thus, on the occasion of the inauguration of the Sông Cầu Canal, this work was qualified as "a veritable revolution in the Tonkin Delta"; at the moment of the inauguration of the Sông Cầu Network M. Monguillot, the Résident Supérieur, declared: *"It is not, however, only circulation which has been improved, agricultural production itself has been improved by these great hydrological works."*

Although the importance of these works cannot be denied, they must be placed in the general context of the delta. The developed surface area at the beginning of the 1930s stood at 60 000 ha for a total surface area of 1 200 000 ha. Even though we may agree with Pierre Gourou, who argued that only half the delta region needed this type of development, that is to say 600 000 ha, the constructions overall only represented 10% of the required efforts, and were the easiest to accomplish from a technical point of view. On the other hand, Dominique Vesin remarks that the peripheral networks were the object of much criticism: sometimes qualified as lavish spending, they had not been built where it was urgent to build, that is to say in the "overpopulated" polders of the middle delta, but in a lot less populated region. This choice was probably made not only because of technical constraints but also because some of the developments, particularly the Sông Cầu Network, primarily benefitted a small number of French settlers.

The international crisis of 1929 and its repercussions on the colonial economy caused a dramatic decline in the material conditions of the peasantry, which resulted in famines and revolutionary movements. However, this crisis was only the trigger, the catalyst of a situation that had been fomenting for several decades. Indeed, endogenous mechanisms for regulating, particularly the periodic redistribution of communal lands, which represented 21% of the delta's lands in 1930 (Đào Thế Tuấn, 1998), and the complementary revenue assured by a large and dynamic traditional artisanal sector, were no longer sufficient to counter the growing pauperisation of the peasantry, and the rise in number of landless peasants, tenant farmers, farmers and smallholders living in extreme poverty, strangled by usury and debt. This spiral of "under-development", as P. Brocheux and D. Hémery (1995) called it, must be seen in the framework of the French colonial system for which, as is always the case for such regimes, the colonised country must above all be profitable, both by the income generated by its exploitation and by the captive market it represents.

Furthermore, it was this objective to secure and increase colonial income, combined with the wish to rationalise State-peasant relationships through a better mastery of village power structures that were totally unknown to the coloniser, when they were not openly hostile to him, which inspired the first big reform of villages implemented by the colonial authorities in 1921: replacing the Council of Dignitaries by an elected village council, and imposing a communal budget. This was a complete failure, which only served to exacerbate internal village tensions, while at the same time leaving the way open for communal land grabbing by a minority. The issue of the period was not therefore the development of agriculture and the improvement of living conditions in the countryside, but indeed the securing of colonial revenue. In the preface to his work, the agronomist R. Dumont explains that upon his arrival in Hanoi in 1929, the head of agricultural services in Tonkin asked him *"not to work too hard, as that would show that, until now, the agricultural service had done very little for rice growing"* (1995).

It is also necessary to remark that the launch in 1931 of a systematic hydrological development policy for the delta's polders and the salt marshes marked a real change of attitude of the protectorate's authorities regarding the countryside. Their objective was to provide the delta with hydrological infrastructures that would allow the generalisation of two annual rice crops, an objective coupled with a policy to lower population density in the most populated provinces by organising migratory movements towards the under-populated areas of the Centre and the South of the country. To do this, the colonial authorities defined a series of priorities that would allow them to combine the two major constraints posed by irrigation and drainage on the basis of the local hydro-geomorphologic characteristics identified by a meticulous zoning of the middle and lower delta. Indeed, the challenge was a lot more complex than for the gravity irrigation networks in the upper delta.

For the same polder, it was necessary to protect the rice fields from the intrusion of exterior waters and, at the same time, drain and evacuate the water that accumulated in the lower-lying parts of the polder, while

assuring an ample enough supply of water for the whole of the rice fields.

This involved determining a drainage and de-watering plan that would increase the capacities of the existing outlets by digging, when necessary, new canals adapted to the sudden variations of the hydrological regime of the great rivers during the monsoon, and establishing irrigation networks fed either by an elevation of the water level through the use of a dam, or by pumping directly from the river, which would function thanks to manipulation of a series of locks and valves and the periodic filling of secondary and tertiary canals. The complexity of the system was increased by the obligation to integrate the hydrological behaviour of each of the thus developed polders into a global plan so that the remedy would not be worse than the evil, that is to say that the satisfactory drainage of one polder did not result in the submersion of all or part of a neighbouring polder situated at lower altitude.

Substantial work was carried out, since in 1937 and the irrigated or developed surface area stood at 278 000 hectares (including 72 000 ha of peripheral development dating from before 1930 and 25 000 ha of salt marshes), but reached 377 000 hectares in 1945 (Vesin, 1992).

Table 2 Situation of the Hydrological Infrastructure in the Delta in 1945

Polder of:	Nature of Development	End of Works	Developed Surfaces
Kép, VĩnhYên, Sông Cầu Sơn Tây	Networks built before 1930		62 700 ha
Thái Bình south	Draining, protection against saltwater, lower irrigation network	1934	46 000 ha
Thái Bình north	*idem*	1937	67 000 ha
An Dương - Kim Thành	*idem*	1937	10 000 ha
Bắc Ninh north-east	Draining	1937	13 800 ha
Vĩnh Yên	Gravity irrigation (extension)	1938	3300 ha
Nam Định east Ngô Đồng	Draining, protection against saltwater, lower irrigation network	1942 1942	35 000 ha 11 000 ha
Hà Đông - Phú Lý	Drainage and gravity irrigation	1938 1942	50 000 ha 60 000 ha
Developed polders total			358 700 ha
Salt marshes	Plots of land formed on the sea coast by alluvial deposits		25 430 ha

Sources: Author's construction from Vesin (1992).

On this subject, P. Brocheux and D. Hémery remarked that although the results were impressive, they were *"nevertheless disappointing if we are to consider that in the absence of a sound agrarian and agronomic policy and new industrialisation of the country, the acceleration of the hydrological development of the delta only allowed them to maintain peasant consumption at its already precarious level, to avoid famine but not to raise the rural masses from the under-nourishment and under-development in to which they were slowly sinking"* (1995).

From this standpoint, the efforts made were enormous (Vesin, 1992), but so was the increase in fiscal pressure. Between 1920 and 1934, the tax burden for a family of five went, in its equivalent in paddy, from 323 kilos to more than one ton (Brocheux et Hémery, 1995). What is more, the collection of taxes no longer seemed to suffer from the same derogations and adaptations as it did in the past.

This observation is all the more alarming as the population displacement programmes, "small indigenous settlements" then later "small family settlements" in the Middle and Upper Regions, as well as in the Centre and South of the country, globally failed. The colonial administrators and the scientific community of this period attributed this failure to the unwillingness of the Vietnamese peasantry, who were rooted in their native land and terrified at the idea of leaving their ancestors' village, to move (Gourou, 1936). Recent studies show that this was also a result of the unwillingness of the Colonial State. This is illustrated by the administrative and financial barriers, which dampened the enthusiasm of candidates wishing to migrate: for the authorities, limiting movement was synonymous with population control and thus maintaining the stability of a regime which, from 1930 onwards, had to confront a resurgence of discontent and resistance (Hardy, 1999).

Conclusion: The State Faced with Dyke Administration

At the end of this rapid long-term historical perspective, from the XIIth century until the first half of the XXth, let us note by way of a preamble that in the Red River Delta, water management and the great hydrological works that constitute the dykes generated specific relationships between the State and the peasantry which were sometimes antagonistic. This is not at all surprising: in this almost exclusively rural country, agricultural production constituted, until a very short time ago, the biggest source of income for the Imperial State through the taxation of "inscribed" peasants and land. Over the centuries the State had had to intervene to best secure this income, which was indispensable to its very existence. On this subject, the Colonial State showed an astonishing continuity. It pursued and rationalised the works engaged upon by the different succeeding dynasties, substituting the engineer's technical rationality for the Emperor's celestial mandate. Its aim was similar to that of the Imperial State: the protection of the population and the harvests in order to secure and increase the amount of taxes, whose collection represented the main source of income of the colonial system of exploitation.

However, the intensity of this interventionism was not always uniform and the relative weight of this State intervention in relation to local initiatives can be seen to follow

the fluctuations in the attribution of responsibility for the dykes, and, at the end of the day, is a good reflection of the versatility of the relationship the Emperors of the successive dynasties had with the systems of containment of the delta rivers.

- Lê Dynasty: a big agrarian and hydrological policy founded on a mandarin system present at district level. The wish to rationalise and systematise the development and maintenance of the dyke network is codified (Lê Code).
- Trịnh Lords: the State is powerless when faced with the problems posed by water mastery, whose management is delegated to the provincial mandarins alone.
- Nguyễn Dynasty: in spite of a globally impressive record, their hydrological policy was characterised by discontinuities and U-turns, which fully reveal the weight of the unilateral decisions and dysfunctions of the mandarin system of this absolute monarchy.
- Colonisation: transfer of management to the protectorate's technical services. The latter affirm their evolutionist vision of the superiority and rationality of the engineer over the empiricism of local knowledge and impose their conception of a specialised technical service, which had to be a centralised, stable and sustainable structure.

Finally, from a conceptual and methodological point of view, this study flies in the face of the culturalist hypothesis, which relegates the State and its interventionist capacity to a secondary level. Indeed, as soon as the focus of observation is widened beyond a strictly local scale, we can observe that the management and use of water inevitably generates a power relationship between the Central State and peasant societies. This observation is part of an on-going debate, which has been dividing the scientific community for more than a century, namely the emergence of a hydrological bureaucracy at the very origin of States in Asian agrarian societies, for which the question of hydrological control (agricultural, strategic and navigable communication routes) is an essential factor of their development and often a crucial issue upon which their survival depends. [9]

This being said, it is not a question of getting lost in a hypothetical organic link between the construction of the State and hydrological society, or even of thinking of water control in Manichean terms: "intervention by the central powers" in opposition to "local initiatives", but of analysing the evolving relationship between the first and the second.

Lexture text (www.tamdaoconf.com)

Tessier, O. (2011), "Outline of the Process of Red River Hydraulics Development During the Nguyễn Dynasty (Nineteenth Century)", in M.A. Stewart and P.A. Coclanis (eds.), *Environmental Change and Agricultural* 45 *Sustainability in the Mekong Delta, Advances in Global Change Research* 45, DOI 10.1007/978-94-007-0934-8_4, © Springer Science+Business Media B.V.

[9] Debate relaunched in 1957 at the publication of Karl Wittfogel's polemical work "Oriental Despotism". The author extends the concept of the "Asiatic mode of production" developed by Marx by radicalising it under the form of despotic exercising of power, which traced its origins to the bureaucratic and political centralisation engendered by large-scale hydrological works. (Wittfogel 1964).

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Exchanges …

Alexis Drogoul, IRD

Does the same amount of research and documentation exist for the Mekong Delta? Is it possible to make a comparison between their developments?

Yves Perraudeau, University of Nantes

When you speak about the military body responsible for dykes, is it possible to draw a parallel with the *Ponts et Chaussées* University in France? Is there a specialised school?

Jean-Pierre Beurier, University of Nantes

Were there any projects to build upstream dams in the past?

Olivier Tessier

As far as the South is concerned, there has never been any work on this scale to contain the whole of the Mekong, even though today some dykes are appearing in order to protect human establishments and urban and industrial spaces. There the problem is different, because although violent flooding with dramatic consequences for the regional economy and population happens regularly in the Mekong delta, the control of the swelling of the major rivers by a containment project similar to that in the North has never been undertaken. The historical conditions

of settlement in the region, the high density of the hydrological network (natural and artificial) and the titanic task that a global and efficient development would in turn imply, are some of the reasons that explain this fact. In comparison to the North, the opposite choice has been made: the conquest of the Mekong delta was carried out gradually by the digging of a powerful network of canals that stretch out to Cà Mau and continue until Cambodia. Consequently, there is not the same relationship with water in the Mekong and Red River Deltas. In Hà Nội, most inhabitants live within the dykes and they have very little direct contact with the river except for the few specialised corporations such as the boatmen, the fishermen and the transporters who work and live on the river. On the other hand, in the Mekong Delta, a large part of economic and social life takes place on the water and uses the canals not only for agricultural purposes but also for navigable waterways along which an intensive human and commercial traffic flows. This salient feature of the regional culture inspired the writer Sơn Nam to coin the expression "fluvial civilisation" *(văn minh sông nước)* to characterise in the best way the common cultural base linking the different components of the pluriethnic population implanted in the Mekong basin. A comparison between the hydrological practices and how water is perceived in the Mekong and Red River Deltas is an exciting project, which is being currently implemented through the creation of a new EFEO project in the South centred on this subject.

To reply to Yves Perraudeau's question, to my knowledge, there is not currently any special school, but it is the universities that train the future engineers and managers of this resource. Concerning dams, I did not find in the imperial archives any trace of an ancient tradition of dam building directly on the Red River or on its tributaries or effluents. However, the existence of small retaining lakes for irrigation in the hilly regions (Middle and Upper regions) is sometimes spoken of. Today, there is a big dam at Hòa Bình on the Clear River, and a second is being built in the province of Sơn La, which have both been built to produce hydro electrical power. This evolution, which is relatively new, stems from the fact that until a very short time ago, people sought above all to protect themselves from river swelling and only used it in a roundabout way without entering into direct contact with it.

To answer the question about engineers, we must remember that after independence in 1954, the documents produced by the colonial administration were classified in two types of archives: the sovereignty archives – political, military archives and those of the Governor general, etc., which were sent to France, and the technical and management archives, which remained in Việt Nam.

In Hà Nội, a cooperation programme was put in place and a transfer took place between the burgeoning Vietnamese State and the corps of French engineers who had graduated during the colonial period. The national engineers thus already benefitted from an education and intervened more and more on the systems. Thus, the transition was not too difficult, as real technical knowledge had been accumulated during the colonial period up to independence.

1.2. Development and Management Institutions of Agricultural Water Supplies in the Red River Delta in Việt Nam (1960-2012)

Jean-Philippe Fontenelle, Gret

(Retranscription)

Hydro-agricultural development has an essential place within the Red River Delta, by securing the existence and satisfaction of the alimentary needs of a big population. Since the beginning of the 1960s, irrigated agriculture in the Red River Delta has undergone major upheavals due to progress in the ways of managing the means of production and the technical systems and the water management systems associated with it. This upheaval is the consequence of the progress of power relationships between the State and farmers and, through them, of production methods and the institutionalising of public policy.

The collectivisation of means of production, which lasted twenty years – until the end of the 1980s –, thus ended in the near bankruptcy of the country's economy and with a threat to food security, particularly because of farmers' rejection of the management system, in spite of unprecedented investments in the hydro-agricultural sector.

A period of rapid growth in agricultural production, which also lasted twenty years, followed. The reasons for this improvement

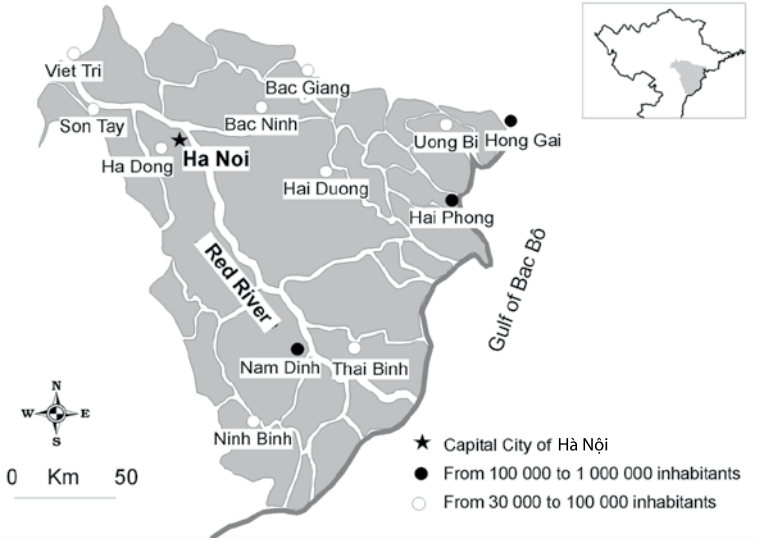
are to be found as much in the liberalisation and normalisation policy promoted by the State, such as in the redistribution of agricultural land, as in locally driven dynamics, including the creation of local pumping stations. The local stations which were managed in a decentralised way caused the technical fragmentation of the delta's hydraulic systems. This had a direct effect on the way decisions were made, financing, and the regulation of water management in the whole of the delta.

Today, agriculture in the delta seems to have slackened. It has been hit head-on by the effect of competition, which is more present since Việt Nam integrated the world economy. Farmers' incomes have levelled off while they must face new risks linked to the consequences of climate change, as well as growing land pressure resulting from the political priority given to industrialisation and urbanisation.

During this plenary session I will principally present research from the Red River programme (1988-1999), a bilateral cooperation project between France and Việt Nam, and more particularly between the *Groupe de recherche et d'échanges technologiques (a non-governmental organization,* GRET) and the Việt Nam Agricultural Science Institute (VASI). This development research programme, related to agrarian systems and agricultural progress in the north of Việt Nam, was carried out within the framework of the de-collectivisation reforms that began at the end of the 1980s. As well as participating in this programme, I also wrote a thesis during my stay in Việt Nam (1994-1999) about agricultural hydraulics management in the Red River Delta, which I defended at the Catholic University of Louvain in 2004. Social management of water is also based on a systemic approach to the relations between different components of water management such as the technical tools, organisation, means, and management institutions and rules.

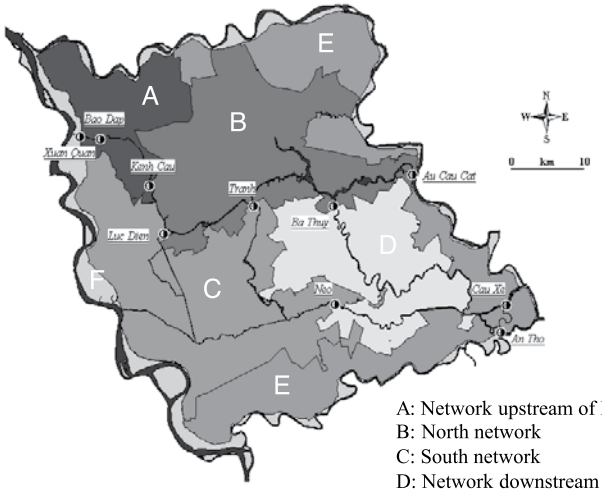
Our object of research, the Bắc Hưng Hải polder – a stretch of land isolated from the Red River by a network of dykes – was studied according to several themes: a technical approach looking at hydraulics and agronomy, and a social approach using tools from geography, history and anthropology. Furthermore, it was necessary to work on different scales, from the State level to the local one, including the intermediate ones such as the province, district and management organisations, such as the hydraulic companies created in the 1960s. At a local level, we took a look at the commune, production cooperatives, villages, families and households. All these segments were examined according to three historical dimensions – present time, short-term and long-term – through several written and oral sources – archives, secondary sources, surveys and old photographs.

Map 7 Hydrographical System, Red River Delta



Sources: Author's construction taken from plate 3 "Red River Delta Structure"; (Fontenelle et al.*, 2000)*

Map 8 Drainage Zones of the Bắc Hưng Hải Polder



A: Network upstream of Kent Cau
B: North network
C: South network
D: Network downstream from Neo and Ba Thuy
E: Zones outside the Bắc Hưng Hải network
F: Zones outside dykes

Sources: Author's construction taken from plate 9 "Water Control System"; (Fontenelle et al.*, 2000)*

The Bắc Hưng Hải polder, a quadrangle formed by the rivers Đương, Luôc and Thái Bình and the Red River (Sông Hồng), is one of the thirty biggest polders in the delta: it covers about 200 000 hectares, that is to say about 20% of the total area of the delta.

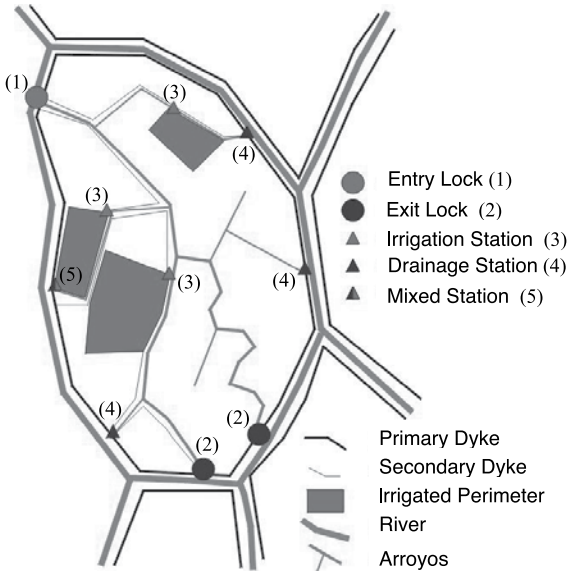
What are the methods of water harvesting and management techniques in this perimeter?

The natural water flow is here represented with isolated drainage zones using channel systems. The most rectangular portions correspond to ditching work and the circles to locks that allow the isolation of diversion bays – a space between two canal locks maintained at a constant level – in order to control drainage. The sub-units of the polder constitute as many drainage units. The grey zones (E), more linked to the river than to the inner canals, are directly controlled on the outer level.

The irrigation network is totally different from the drainage network: the agricultural water supply units, which represent as many irrigated perimeters, are a lot more numerous and vary greatly in size – from less than 1 000 to 40 000 hectares. This data comes from an intermediary player, the company responsible for the management of the Bắc Hưng Hải polder.

In the 1960s, irrigation and drainage systems were installed first with petrol and then with electric motors. The widespread equipping of the delta with pumping equipment for irrigation (raising of water level) and drainage (evacuation of water) came through technical progress and close cooperation with the USSR and China who had a privileged relationship with Việt Nam.

Diagram 2 Diagram of Hydro-Agricultural Development in the Red River Delta



Sources: Author's construction.

A polder functions in two ways, at high-water and low-water periods. In low-water periods, the lock that is situated upstream from the station is opened and allows water to flow from the river into the canal system. Different sized pumping stations have been built along the lower canals. Some of these have the capacity to irrigate up to 10 000 hectares. These big hydraulic units take the water from the lock situated upstream, whose direct source is the river.

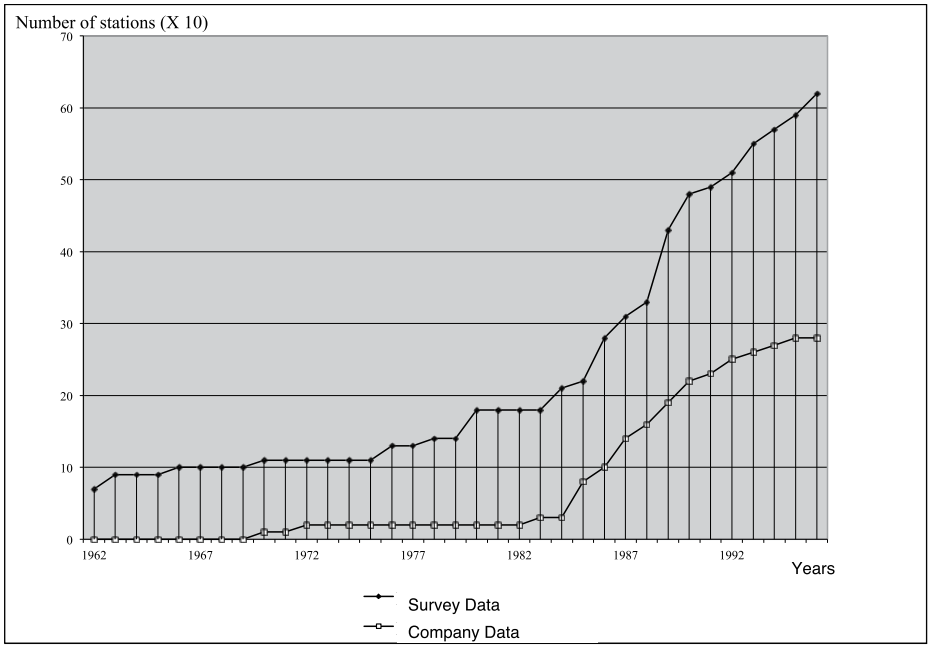
The high-water period is characterised by heavy rainfall and a river level that is higher than the land. There is then a problem of waterlogging of the land and a problem of evacuating the water. There are two principal systems for drainage:

- A gravity system linked to tides. At low tide, there is a drop in the water level of the river, the locks situated downstream from the station are opened and the water is evacuated by the difference in water level. Nowadays, a more modern system of flap gates prevents the intrusion of outer water, thus making the system more efficient. This system is reserved to the parts nearest to the coast where there is the biggest drop in water level;
- Pumping stations situated at the end of channels. The pumping is carried out in the drainage channels to supply irrigation stations in low-water periods, and to evacuate water drained from the rice fields, by pumping it up and over the dyke and into the river.

A complete transformation of the milieu, marked by drainage and irrigation capacities closely linked to the capacities of the equipment, is gradually taking place.

At the time of our field surveys, we were able to observe many small, low capacity pumping stations installed along the canals and channels. Were they there to complete the existing network as backup or were they part of another model? After having received information from the communes (about 380) regarding the inventoried number of pumping stations, we discovered more than 200 communes equipped with at least one local backup station.

Figure 2 Local Stations in the Châu Giang District



Sources: Author's construction taken from Figure 21 "Development of Local Pumping Stations in the Van Giang Irrigation Scheme" (Fontenelle, 2004).

On this graph we have the number of inventoried local stations and their year of construction across the district of Châu Giang since the beginning of collectivisation. If we compare the data provided by the district hydraulic company with the number of stations inventoried by the communes, we can note a similar trend even if there is a certain discrepancy. In the beginning, small stations were built at the end of the perimeters much downstream of the canals as a pumping complement to resolve problems of water supply to the land at the end of the network. Other stations were rapidly installed upstream of the network at different points along the irrigated system and their number multiplied. From ten in the 1960s, the number increased to more than sixty in the 1990s with a big change in the 1980s, a period which corresponds to liberalisation reforms and land redistribution. Local equipment, which was more readily available, was installed.

During the period of the collectivist economy, the management system for water was based upon equipment sized to meet real needs according to a supply logic. Each day of the week, a part of the perimeter was irrigated *via* a water tower, the precise calendar being fixed in advance. With liberalisation and the appearance of "spare" local stations, a water management logic based upon demand began to develop. The local equipment allowed things to not be determined by the predefined calendar of the water towers

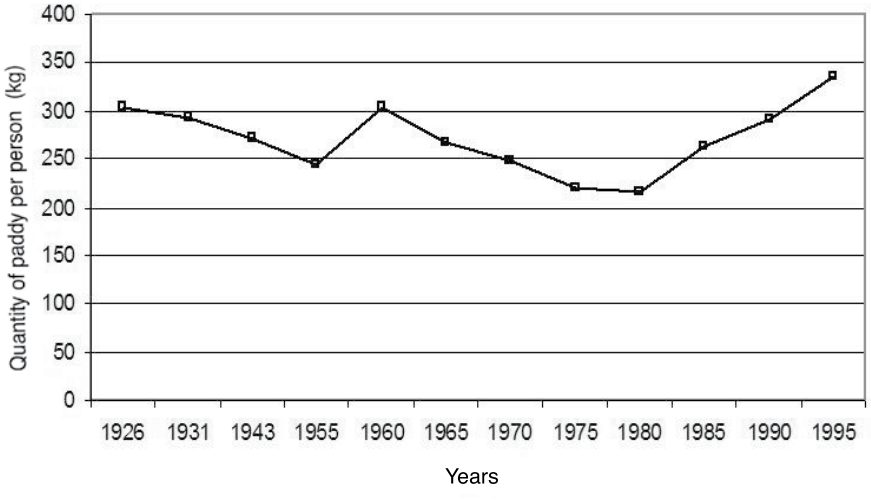
with the difficulties linked to the latter, such as respecting the calendar or the tension between communes sharing the same water tower. This demand-side based equipment logic aimed at providing more flexibility and reactivity.

During the 1960s, the State also modified the network of canals watering the rice fields, driven by its wish to install gravity-fed irrigation over the whole of the delta thanks to a comprehensive mesh of raised canals allowing to water plots of land directly by gravity, once the water had been drawn up by the pumping stations.

Today we are witnessing the disappearance of the smallest of these canals (tertiary and quaternary levels), which have been over excavated, and the reintroduction of manual bailing. This phenomenon is proof of farmers' wish to master more exactly the level of water in the fields, to raise water levels according to the water deficit, or to drain it into an over-excavated canal during periods of excess. This became possible after the de-collectivisation and redistribution of land, because the plots were smaller and the individual mastering of tasks had replaced the cooperative system of production.

This technical, economic and organisational model, which again puts the village at the centre of irrigation management, pre-existed the collectivist period. The history and culture of the village facilitates its social acceptation and its political legitimacy. Thus, as Olivier Tessier demonstrated, the State continues to manage the protection of the territory by constructing dykes and bringing water within the system, but it is progressively reducing its role in the irrigation of plots, which is now managed by the villages at the pumping station level and the farmers *via* the bailing out system. A fragmentation of the systems is thus found modelled on the geographical limits of village land.

Figure 3 Evolution of Agricultural Productivity



Sources: Đào Thê Tuấn, 1998.

On the agricultural level, research carried out by Đào Thê Tuấn is revealing about the quantity of paddy per capita.

- The colonial period (up until 1954), with its levies, its droughts, its floods and its demographic growth, shows a downward trend in the quantity produced by each individual until reaching a level which no longer satisfied the alimentary needs of the population;
- Agrarian reform in 1955, marked by the intensification of labour and the redistribution of land, was followed by a clear rise in production;
- From the beginning of the 1960s, in spite of the huge investment made in hydraulics, we can observe a progressive decline in individual productivity, which during the 1970s fell beneath levels recorded in the 1940s;
- From the 1980s onwards, liberalising reforms, land redistribution and the free market, and progress in hydraulic equipment characterised by the emergence of small stations, stimulated agricultural growth in a strong and progressive way.

Table 3 Agricultural Development and Enhancement

	Infrastructures	Inputs	Exploitation
< 1960 Imperial period, colonisation	Dykes, channels, ponds, bailers	Individual bailing, gravity,	1 rice/season 350 to 250 kg/per capita risks, taxes
1960 < 1980 Planned collectivist economy	Wide perimeters, Centralised pumping stations	Collective pumping and gravity	2 rice/season 300 to 215 kg/per capita Bureaucratically heavy and rejected
> 1980 Decollectivisation, Liberal reforms	Breaking up of the perimeters, local stations	Individual pumping, gravity and bailing	2 to 5 cycles > 450 kg/per capita local initiatives

Sources: Author's construction taken from table 20 "Historical Comparison of the Technical Systems for the Control of Water and Agricultural Enhancement in the Red River Delta" (Fontenelle, 2004).

This summary table defines certain characteristics for different historical periods.

Before the 1960s, the infrastructures were composed of dykes, channels (natural or excavated low canals) and ponds, which served as reservoirs and bail scoops. Little infrastructure was linked to irrigation, the methods were gravitational or individual, agriculture only had one date for rice transplantation, and there were many natural risks and levies.

From 1960 to 1980, during the period of collectivisation and the planned economy, large perimeters of several thousand hectares of land were developed in an almost systematic fashion, with large pumping stations that were collectively managed by technicians in the same way as the water towers system. Decisions were taken at the cooperative, commune or district level. The "green revolution" brought with it the generalisation of two rice crops per year. However, in spite of these investments, the bureaucratic burden and difficulties of this system, coupled with its rejection by the people, triggered an inexorable drop in productivity.

The 1980s saw the fragmentation of the perimeters, the multiplication of local stations and the emergence of a mixed system using pumping in different ways and bailing out. The individual once again returned to the centre of rice management and decided himself whether to irrigate or drain his plot. We observed a rapid and marked impact of the implemented reforms, with a passage from two to up to five crop cycles – one rice cycle and four cycles of market vegetables. Vegetable growing in the delta demands an efficient mastering of irrigation and strong local initiatives at producer level (choice of vegetable, sowing dates, irrigation), particularly due to the agronomic difficulties faced during the monsoon.

Table 4 Players Involved in the Management

	Superior	Intermediate	Local
< 1960 Imperial period, colonisation	State	-	Villages, users
1960 < 1980 Planning collectivisation	State	Technical services	Production cooperatives
> 1980 De-collectivisation, liberal reforms	State	Technical services, Companies (fees)	Service co-op. (communal and village), users

Sources: Author's construction taken from Table 21 "Historical Comparison of the Organisation of Policies and the Participation of Local Players in Water Management" (Fontenelle, 2004).

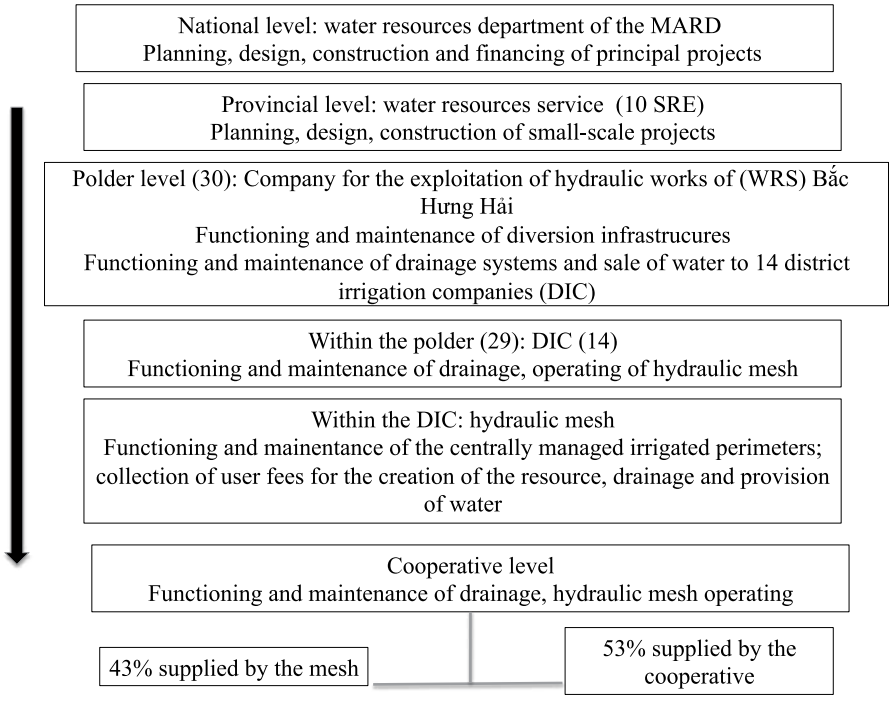
Before the 1980s, the State and its technical services intermittently intervened in dyke management, as Olivier Tessier demonstrated, and also in the management of the system's dykes, but intervened very little inside the system. Irrigation and drainage were locally managed at the village level.

From the 1960s onwards, when equipment became generalised, a technical service managed the pumping stations and the

gates within the system. At a local level, the cooperative and cooperative workers, organised into specialised production brigades, took the place of the village as a production and management unit.

From the 1980s, the parties involved were both the State, which created intermediate bodies (hydraulic companies), and the user who had to pay a tax to gain access to the water. At the local level, service cooperatives were formed, most often at village level. It was again a sign of a return of local management towards a more traditional unit and the possibility of offering the users the chance to take initiatives in their irrigation choices, the latter being linked to the economy they were given concerning their choice of crops.

Diagram 3 Organisation Tree



MARD : Ministry of Agriculture and Rural Development.
Sources: Author's construction; translation from figure 7.3. "Water Management Organisational Framework in the Bac Hung Hai Polder" (Fontenelle et al.*, 2007).*

We can observe a return to individual responsibility. This duel irrigation system improves pumping capacity – the water needs of crops being met – but the cost of equipment is higher per hectare. However, the stations are used for shorter periods owing to their higher capacities and facilitated management, due to the reduction in size of the irrigated perimeters. Observations carried out in the field noted

lower running costs and a reduced water consumption per irrigated unit as the system was more efficient and flexible. This was especially made possible by greater autonomy in decision-making – no more predefined calendars or water towers – and the necessity for farmers to pay the bill for consumed water *via* the payment of a water tax.

However, this tax is high and opaque for farmers. Clear differences can be seen in the level of tax from cooperative to cooperative, depending on the mode of water supply and the choice of investment. On average, the tax only represented 8% of paddy production. However, if you add other levies such as land tax, local tax and security, this figure rose to between 20% and 25% of production. Before the abolishment of these levies and taxes, there was thus a lot of fiscal pressure on rice production of which the market value was low.

The cooperatives' accounts seem to be globally balanced, but the information and supporting documentation produced lacks transparency and homogeneity. The amounts paid to the district irrigation company vary from 30% (local irrigation) to 75% (centralised irrigation) of the expenses covered by the cooperative.

At district irrigation company level, heavy cumulated debts, which are often higher than annual revenue, can be noted. This is particularly because of unpaid subsidies for heavy maintenance work or technical upgrades. Furthermore, the rate of payment for taxes from the cooperatives is 90%. The economic deficit of the district irrigation companies does not stem principally from the farmers' refusal to pay the tax, which does not cover the whole of their expenses in any case. Thus, the budgets are not balanced and the acquired means are globally used for everyday running, to the detriment of maintenance and repairs.

There are perceptible institutional difficulties and contradictions. There is a discontinuity between functional units and management. For example, the Bắc Hưng Hải polder covered four provinces and reported back at a ministerial level. However, other polders covered one province or one district and were thus dependent on them. There was not necessarily any overlapping between physical and administrative water management units.

The water fees were fixed at a legal level by the provincial Popular Committees and then completed by the cooperatives according to different modalities. The companies thus had very little control over their collection/revenue.

The principal expenses of the company were the cost of electricity. Debts were contracted between public electric companies and public irrigation and drainage companies. This debt was deferred by necessity because it was socially unthinkable to not drain. Stakeholder games also arose between the cooperatives, who sought to pay as little as possible, and the district irrigation company, resulting in discrepancies between the declared surface areas and the real irrigated ones.

Many changes have come about since: the water resource law of 1998 and the inter-ministerial council in 2000, which really addressed the issue of water and its different uses, while it had been principally associated with agriculture in the past. Three organisations were created in the Red River basin in 2001. An inter-ministerial vision

was adopted regarding the environment, industry, the protection of the population and economic and rural development. The Ministry for Natural Resources and the Environment was created in 2002. The lowering and then the abolishment of land tax (2003) and water fees (2008) were endorsed.

So, who pays today for the electricity and water management costs? Do the farmers still pay a tax at the cooperative level? This does not figure in the national figures, only State contributions and the notional fee appear. However, when the cooperative has to set the stations to work, does the State pay for the electricity or does the cooperative pay for it *via* a tax levied among the farmers? This question merits some research.

There are many new stakes at play. What organisational model should be adopted for the financing of water management institutions? The development of a system of payment for a service was implemented in the 1980s but difficulties linked to farmers' incomes lead to its abolishment. This being said, is it the State's responsibility to shoulder the totality of the costs? Where are we with the implementation of fiscal policies? Thailand, for example, takes responsibility for the cost of water and pumping in respect of an agreement addressing these issues, which makes the process more transparent. The choices to be made are above all political.

The place of agriculture regarding urbanisation and industrialisation issues and the increased pressure on land space are to be taken into consideration – growing population, reduction of agricultural land, lower per capita incomes. Furthermore, the transformation in the use of land, built-on land and the presence of many asphalted infrastructures lead to a concentration of water on smaller surfaces, which may result in flooding risks. These urban/rural cohabitation issues are old ones, but are becoming more acute against the backdrop of climate change and vulnerability to natural hazards.

With the development of industrial capacities and more costly economic infrastructure, what level of risk can the State tolerate and absorb? What are the development policies that must be implemented for the Red River to absorb this risk?

Lecture text (www.tamdaoconf.com)

FONTENELLE, J.P. (2006), « La décentralisation de l'hydraulique agricole du delta du fleuve Rouge au Viêt-nam : rupture ou continuité ? », *Hérodote,* n° 121, p. 55-72.

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Exchanges…

François Roubaud, IRD-DIAL

We get the impression that water management is returning to the individual level since de-collectivisation and agrarian reform. How are the different levels of this management system, which appear to be efficient by producing bigger harvests, articulated, coordinated and managed? The financing is insured against lost funds by the State, perhaps for social reasons, whereas the country had previously partially adopted a market economy. Was the pressure of privatisation not felt in the water sector?

Jean-Philippe Fontenelle

We can see some continuity in the management of the major infrastructures of the dykes. The names have changed but the hydraulic services have been maintained. The management of the connecting locks to the river by the irrigation systems companies did not pass into local management hands. State retreat is evident in the management of the paddy fields, contrary to during the collectivist period. It is no longer the engineers who decide about the type of crop, the date of transplantation or irrigation, but the farmers themselves. As far as irrigation is concerned, there is nothing to stop someone from buying an individual pumping station. Certain countries have adopted this type of model. In Viet Nam, we therefore still have the collective pumping system, which is more socially acceptable. A compromise has been found between the desire for autonomy and individual initiative, and a socially accepted collective management at the village level. Sometimes, cooperatives of communal services exist. However, if we look more closely, the perimeters are individual to each village, even though the management unity remains communal. In other cases, the division and unity of the village are a lot more radical. We can observe that the State no longer has a say in agricultural management or in the choice of crops. For example, since 1994, lychee orchards have been developed in Nam Sách, in the Hải Dương province. The State authorised the possibility of changing the agricultural use of this land. It was also during this period that the villages began

to build beyond their bamboo perimeters. Houses are now built in the fields or at the side of the road. All this is proof of a change in the State's management of territory.

Benoit Gaudou, University of Toulouse 1 Capitole

In France, the State regulates irrigation and water collection to avoid anarchic development. What are the laws or the norms in Viet Nam? Are there any limitations? On the other hand, is irrigation linked to the problem of drought? How does the State resolve this problem?

Jean-Philippe Fontenelle

I am not up to date with current legislation, but when I carried out my research, no limits had been set for taking water. It was a question of taking surface water; a lack of water was never seen as a risk. There could be a problem of access to water when the canal was obstructed, but the solution here was more linked to the means available to sufficiently clean out the canals and channel the river water to the pumping stations. The issue here is different from that in France where there is a problem of over-consumption of water. There is competition for its use (dams, industrial use, agriculture, etc.). The major prevailing issue in Viet Nam is centred on constraints linked to excess water, and thus to drainage rather than irrigation, even in the dry season.

Clément Frenoux, GRET

The construction and technical management of the Red River dykes network are different from those of the Mekong. Has there been a comparative study of the modernisation and mechanisation of pumping between these two deltas in production terms?

Jean-Philippe Fontenelle

I carried out research with the IRD into the three deltas of Chao Phraya (Thailand), the Mekong and the Red River. At the time, we observed the installation of irrigation systems in the Mekong delta similar to the hydraulic model on the Red River. In the past, the narrow range of the Mekong's swelling – a few centimetres a day – was accepted. With the development of several rice cycles and vegetable crops, flooding has become a risk, which has justified the construction of dykes and pumping stations following the example of the North. We have entered into a mode of the progressive closing off of space to the river.

Phan Đình Phước, Institute of Development Studies, Hồ Chí Minh City

There are a great many public policies in the agricultural sector in Việt Nam, but incomes generated by agricultural activities remain modest. What are the agricultural development policies that have been implemented in France?

Jean-Philippe Fontenelle

I am not going to describe French policy, which is part of a wider European framework policy, but I think that the French and Vietnamese proportion of agricultural populations is very different. With 4% of farmers in France, the issues are very different. There are other management techniques and other ways for the public and private sectors to access investment. The two canal companies of the Provence and Bas-Rhône

regions are both interesting cases. The State, which has the initiative in these development policies, has given its support to investments with public money and also to the creation of semi-public companies, which receive a fee from farmers who pay for the infrastructures and their management according to the volume of water (registered on a meter) consumed. The pertinence of these systems depends on the economic development of the production, which progresses according to agricultural markets. What's more, urbanisation issues linked to the sale and consumption of water are appearing, particularly on the Canal de Provence, which terminates in the City of Marseilles. The sale of drinking water in the cities is essential to the company's economic balance, whereas it was a regional development plan implemented to develop agriculture.

Catherine Baron, University of Toulouse

How are the cooperatives constituted? How do they work, what exactly is their intermediary role in this system? Must all users adhere to the cooperative?

Dương Hiền Hạnh, University Thủ Dầu Một

The management of some companies at the district level is losing money. Has there been any research into this? Into corruption, water needs?

Jean-Philippe Fontenelle

The cooperatives were created with collectivisation, first on the village level, then communal from the middle of the 1970s. These production cooperatives, which manage the land and all agricultural tasks, went bankrupt in the 1970s, but have, however, maintained a production capacity of obligatory collective services, notably hydraulic and electric ones. They were reformed by new laws and were renamed services cooperatives, irrigation in particular. These cooperatives are managed by executives and have a pre-defined territorial perimeter (commune or village) and are mandatory. An unbalanced budget does not necessarily signify corruption. Spending plans may be higher than income, particularly when proposed public grants do not arrive or are delayed, or taxes are not totally collected. Evidently, corruption, water loss, etc. may also play a role in the imbalance, but not exclusively.

Why oblige people to pay for this resource? The issue of the right to water as a natural resource is the subject of a worldwide debate. We do not pay for water as such, we pay more for the service in relation to an economic development we can get from water. Not obliging farmers to pay water fees demonstrates the strong political will of the State to maintain the farmers' production capacities.

1.3. Documentary "Prey Nup, A Community Built Around Water (Cambodia)"

Jean-Philippe Fontenelle, GRET

José Tissier, AFD

It has become a JTD tradition to enrich our debates with documentaries, both in the plenary sessions at the VASS and in the workshops at Tam Đảo. These complementary documentaries are designed to serve a veritable educational purpose; this year the short version of the documentary "Prey Nup, A Community Built Around Water" was shown on the first day of the plenary session (French version with English and Vietnamese subtitles). The seventeen-minute version looks back at a decade of interventions to restore the Prey Nup polders in Cambodia. Prey Nup is situated in the province of Sihanoukville and the operation was financed by the AFD during the 1998-2008 period and resulted in the protection of 10 500 agricultural hectares and affected more than 50 000 people. The project wound up in February 2008 with the signing of a framework agreement between the Ministry for Meteorology and Water Resources (MMWR), the Community of Polder Users (CPU) and the local authorities.

The documentary is built around an evaluation/capitalisation approach. The use of film to evaluate the "Build Against the Tides" project takes the players' points of view into account and facilitates the development of the results of the project's evaluation among the different members of the public concerned by the implementation of development projects. This film talks about the project's history: 1) the technical difficulties: building a dyke on silty soil; 2) social complexity: the creation of users' associations in an area scarred by Khmer Rouge collectivisation; 3) the political stakes: the modification of institutional rules to change from a centralised-authority management model to a participatory management one.

The screening was accompanied by the commentaries of Jean-Philippe Fontenelle (GRET) and José Tissier (AFD). The DVD that comes with this edition gives a filmed summary of the project.

Bibliographical references

We recommend the following references to the reader with a link to downloadable documents and publications on the AFD and GRET sites:

http://www.afd.fr/home/projets_afd/developpement_rural/projets_agriculture/Appui-a-la-rehabilitation-des-polders-de-Prey-Nup (references to download the project's PowerPoint presentation and the press release dossier "In the Field"; a short five-minute version of the documentary is also downloadable on this site);

Mounier, É. (2008) « Construire contre les marées. Évaluation filmée du projet Prey Nup au Cambodge, 1998-2008 », 58', AFD – Studio K (the DVD includes the film, the chapters and the focus areas).

Lagandré, D. (2007) « Étude d'impact du projet de réhabilitation des polders de Prey (Cambodge), Études et Travaux », online series n° 15, Éditions du Gret, www.gret.org, 217 p.

(Transcription)

José Tissier

The selected film only lasts seventeen minutes, which is a short format when compared to the original film, which lasted more than one hour.

The operations carried out on the Prey Nup polders are close to our hearts, because this case alone illustrates the AFD's agricultural and rural development support strategy. What's more, five years after the last phase was completed, the project has delivered a certain number of results, as much on a technical level as on an economic, financial, institutional and political one.

This project is situated at the intersection and crossroads of different AFD strategic axes. Indeed, it has quite a large economic component, which was our point of departure: increase rice production in Cambodia in order to meet needs in terms of food security. This primary objective explains all our operations.

There also exists an axis that deals with the social organisation of those who use irrigation, since following the logical argument – once the investments have been implemented to improve food security – the problem of the continuity of the investments and their functioning must be addressed. This was a major aspect of the project, as a lot of infrastructure had already fallen into a state of disrepair and was out of use on the Prey Nup polders. This notion of social organisation is linked to territorial organisation, as it was a question of developing the lower part of a water catchment area by counting heavily upon an organisation grouping together the users of irrigation: the Community of Prey Nup Polder Users.

The third axis of the project was based upon the implementation of an institutional dialogue with the Cambodian authorities. This institutional support aimed to reflect upon the new public policies, land management, etc.

We shall see that this operation's main point of interest lies in the shuttling between these three axes: economic, territorial organisation and support of public policies.

In order to place ourselves in the Cambodian context, let me remind you that in 1994-1995, the AFD was operating in a recently secured zone. Here, it was a problem of a polder with an incomplete control of

water, as there was no possible water reserve for dry periods. Furthermore, there was also the problem of protecting the area from seawater and the drainage of excess water in rainy periods. Each water storage area did not possess internal partitioning and we had five or six storage areas for a total surface area of 110 000 hectares – each measuring from 600 to 2 000 hectares. This posed a specific problem as the control of the water sheet is, on the one hand linked to the morphology of the land which may not be flat, and on the other to the large number of farmers wishing to diversify their crops when faced with a collective management of the water sheet.

When the project began, this 11 000 hectare zone was the object of a relatively large-scale abandonment, since about 3 000 hectares had been left fallow. The yields of the remaining surface area were low.

The project had five different targets:

- Renovate infrastructures using economic and food targets: the protection dyke running the length of the mangroves and the structures for controlling the entry of saltwater and for drainage;
- Transfer of polder management. The chosen solution was to make users participate;
- Work on polder land tenure security, in close liaison with the Cambodian land register for a pilot operation in order to establish a precise inventory of the definition of lots and property rights, and develop land plans and registers, which will eventually be used for taxes;
- Support and advise the project's development dimension;
- Develop a long-term sustainable credit sector, which is linked to cooperation with microfinance institutions – this last point is not very well highlighted in the film you are going to see.

The fact that it was not only a project to renovate hydraulic infrastructures, but also a project involving social reconstruction, institutional support and dialogue with all the players, whether it is on a local or national level, was a factor of major interest for the AFD. It is for this reason that this operation is emblematic of the AFD's strategy. Thank you very much.

Screening of the documentary film

Jean-Philippe Fontenelle

This project is original on several different levels: it is a question of the control of public works, piloted by a ministry and operated by the NGOs Handicap International and GRET, which has a certain experimental component. In spite of the scale of the problem, nothing was already written and everything had to be invented. The initial situation had not been the object of a detailed feasibility study, which had technical and social consequences, particularly regarding a prior consultation with the public. The latter only learned about the project when the team arrived, and about the aim only once work had begun. The particular historical context made it difficult to carry out a preliminary feasibility study. The results are good: dykes have been repaired, infrastructures are still functioning today, arable land surface has been increased by 30%, production has doubled, there is now access to microcredit, land rights have been regulated and the first 12 000 land titles issued in Cambodia, an association has been created, an agreement concerning management transfer has been reached, etc.

In spite of these globally positive results, there remain a few problem areas and questions. How will the CPU association develop? Are we still really within a framework of "community management" with 8 000 families? Of course, there is no general assembly that gathers together all the families to decide on the management arrangements of the system. It is rather an associative-like structure assuring a professional service, which functions thanks to a tax paid by the farmers.

When the project began, village meetings to discuss the collective management of water had a very low turnout, but this changed when the issue of land rights was introduced. The farmers were quick to see that this project could benefit all parties concerned.

The CPU allowed coordination between farmers about management and required water levels, which were affected by many factors: rice-transplanting dates, labour, crop types and varieties, etc. This mode of functioning was closely linked to the participation of and consultation among villagers about questions concerning the dates for raising water levels in the polders, for example. The process is satisfactory, which explains the villagers' agreement to pay a tax. There are several reasons for the high rate of payment of this tax:

- Anticipation of a loss of 10% corresponding to the land that has been affected by problems. An equalisation is used for the 10% who will not be able to pay the tax as they have no harvest;
- 10% unpaid taxes corresponding to those who refuse to pay. A system, which associates local authorities, the communes, the district and the province, has been implemented to deal with them.

Our challenge was to develop technical capacities and a relevant organisation and register it institutionally. The project resulted in huge progress in the domain. Today, even though it has the right to, the CPU does not decide alone the amount of tax to be paid; this is the fruit of a consultation between the communes and the district. It is therefore a political decision made by the local administration. In my point of view, the CPU is gradually moving in the direction of the premises of an inter-communal management of a public service. It can be likened to a technical service managed by the communes *via* a committee, which groups together the ten communes and is presided over by the district commissioner. The CPU is not independent; it is not an outside organisation.

José Tissier

Outside support for the operation was assured within the framework of an association between the AFD and two NGOs. The results of this cooperation dispel certain accepted ideas, heard in various places, according to which the AFD, a development bank, is incapable of working with and for local populations, or that NGOs remain concentrated on their local and microeconomic competences and are incapable of working on the more general level of public policies.

The main question raised by Jean-Philippe concerns the sustainability of the project. A certain number of elements are encouraging in this respect, even though several developments of the CPU (erroneously referred to as Community of Polder Users, while the very notion of community is not relevant) may be foreseen.

One of the paradoxes of the project is that it began without any great consultation with the population, even though it aimed from the outset to transfer the responsibility of polder management and maintenance to the farmers. The *ex post* analyses that have been made emphasise a low level of appropriation by the population, who behave rather as simple users of the services provided by the CPU. However, they accept to pay a tax corresponding to the services provided. Should we then be disappointed and should we logically aim for the population to get more involved in the democratic life of this organisation? Perhaps we should! It's a possible direction to take which is of interest to the AFD, particularly in the Cambodian context of democratic reconstruction. However, this way forward appears difficult for financial and economic reasons. The development of the CPU as a private professional delegated public service structure (management and maintenance of works) and functioning thanks to tax-generated revenue (even complementary support from the public powers) may also be a relevant way forward.

The development of the CPU's relationship with local authorities might become a source of conflict, particularly if in the future the latter maintain effective powers in terms of imposing taxes. The relative financial powers of the CPU also constitute a possible source of tension. The development towards a public service of inter-communal interest that Jean-Philippe spoke about is also an interesting possibility. For the moment, the collection of taxes falls under the responsibility of the CPU, but the latter depends on the local authorities and their community police service when certain users refuse to pay.

Finally, regarding the format of this documentary, it is interesting to note that it has been produced from a 58 minute film, made from an *ex post* evaluation. A certain number of quantitative and qualitative criteria were taken into account, such as the conditions for carrying out the works, their cost, their effectiveness, their efficiency, their sustainability, the purposes of the operation in relation to targets, such as an increase in production, the improvement of the population's living conditions, etc. This film avoids being didactic and constitutes an interesting educational support that is beginning to be used in higher education and in universities.

Exchanges…

Olivier Tessier, EFEO

How can you explain the population's lack of implication at the beginning of the process, which runs counter to the current approaches encouraged by donors? Was it an assumed choice or was it by default? What was the relationship between the AFD, which was acting as both bank and donor, and the NGOs? Can you tell us about the preparation of the project in task sharing terms? Did you prepare it together or did you contract consultants to implement a process that had been previously defined by the donors?

Patrick Tallandier, University of Rouen

Has there been any increase in the level of taxes?

Mireille Razafindrakoto, IRD

In the documentary we get the impression that everything goes without any problem. However, did you come up against any

particular difficulties at certain moments in the project? The final assessment seems positive, even though there are some weak points and some uncertainties relative to the CPU. Which factors would you highlight in order to explain these global results in a difficult context? Or, on the contrary, did the context have a favourable effect?

José Tissier

To answer Mireille's question about the "a little too smooth" picture of the situation conveyed in the film, the project evidently came up against a few difficulties. The absence of any detailed draft project, linked to the urgency of the situation and the particularly political context of the period, brought with it a few technical problems – for example, the shearing of the dykes due to an ignorance of the geological substrata – as well as a few socio-technical problems – after the dyke had been built, the fishermen, who had not been taken into account in the project, unlike the rice farmers, opened up breaches in the dyke to preserve access to the sea. However, the positive image conveyed by the film corresponds quite well to the image of the situation we have today! This documentary presents the different points of view of the development players, from the local level right up to the highest level, concerning the economic, social and institutional dimensions linked to the question of public policies. While the Cambodian government was at first reluctant to commit itself to the project and saw the project developing in another direction, it finally accepted the principal choices that had been made. In 2008, it signed a Memorandum of Understanding (MoU) with the CPU giving concrete expression to this collaboration and the role of the association. A certain number of decrees and texts have been published to reinforce the system.

The protean dimensions of this project and its multiplicity of components doubtlessly constitute its factors of success. Generally, donors prefer simple projects with a single aim. Here, the different constituent parts give coherence to the whole of the project, the renovation of the infrastructures, management transfer, the land component, development and support of agricultural production and microfinance all contribute to this success by their complementarity.

Jean-Philippe Fontenelle

As I have already been involved in other renovation projects, which combine social and technical aspects, I have remarked that the technical dimension was given more importance than the social one. The rhythm of the time scale established by the engineers dictates that of the social actors who work with the population. In this project, this was not the case, particularly thanks to the synergy between Handicap International and GRET. There was a convergence of vision between the Secretary of State, the project manager, the Minister for Water Resources, the AFD and the operators. Furthermore, the flexibility of the players allowed us to adapt to particular situations, to reduce "friction" with the population and to meet their needs. Today, this type of research/action-based project is tending to disappear and is being replaced by very structured projects where the social and communicative parts are not a priority. This is why I think it is important to talk about this type of project and its characteristics.

As far as the tax is concerned, we have seen an increase in the number of people paying it, with a 60% payment rate at the outset. Today,

it would be a good idea to carry out another impact study.

Vietnamese public

Did the local authorities intervene when the project was implemented? Was the project superposed with others? I myself participated in a project financed by the Ford Foundation in order to promote aquatic rice growing in the central province of Vietnam. An MoU was signed between the donor and the province concerning the construction of two irrigation canals. A year after the project began, another project for the extension of sugar cane growing in the province was implemented – each household received one million dong and a loan of seven million dong for investment, etc. The population then abandoned rice growing to return to sugar cane, thus sabotaging our project.

Jean-Philippe Fontenelle

The local authorities played an increasing role. The project was first piloted by the ministry and then relays were put in place by the decentralised water services and an authorisation was negotiated with the local authorities. However, in the organisation and realisation of the meetings with the farmers, the local authorities only participated a little. However, the latter were associated with decision-making regarding the amount of tax to be paid, land issues, policing, water management, etc. in order to avoid any stalemate.

As far as the overlapping of different projects in the same place is concerned, it is effectively a problem we come up against in certain contexts; sometimes the two projects can collaborate and sometimes they cannot, owing to the competition between the different actors. In this project it was not the case.

José Tissier

To add to what Jean-Philippe said concerning the example given about rice and sugar cane and the competition between the two projects arbitrated by the local populations, let me emphasise that the Cambodian government played a regulating role. Neither the government nor the local authorities decides which crops will be grown. However, when there is a collective constraint and technical issues, such as the control of the water sheet, the CPU gathers together the farmers. It can register the crop intentions of the farmers and from this establish the water sheet management modalities which best meet farmers' needs. In this way there is no problem of project overlap.

In conclusion, I would like to underline the different articulations that have underpinned this project: a land register project was structured around the land dimension, and there was also a microfinance institution project that accompanied the microcredit component. The implementation of this project has inspired others, particularly a hydro-agricultural sector project with the Asian Development Bank (ADB). This project also resulted in another very specific AFD project related to the rice sector, its quality and commercialisation, and to other institutional support operations concerning public policy issues.

Conférences & Séminaires

1.4. World Maritime Issues

Jean-Pierre Beurier, University of Nantes

(Retranscription)

It is not necessary to be an expert in maritime affairs to understand the importance today of world maritime issues. The ocean belongs to the domain of superlatives. It covers three-quarters of the planet's surface, its average depth is 3 000 meters, it represents 1.5 billion cubic kilometers of water, which is composed of more than 40 components including metals and metalloids. It is the biggest known source of natural resources. 300 billion tons of living vegetable matter, essentially composed of single-cell algae, and 75 billion tons of living animal resources can be counted. Only 200 tons of marine products are edible by man, which constitutes our first dilemma. Industrial products are of major importance, but are still badly estimated and largely unknown.

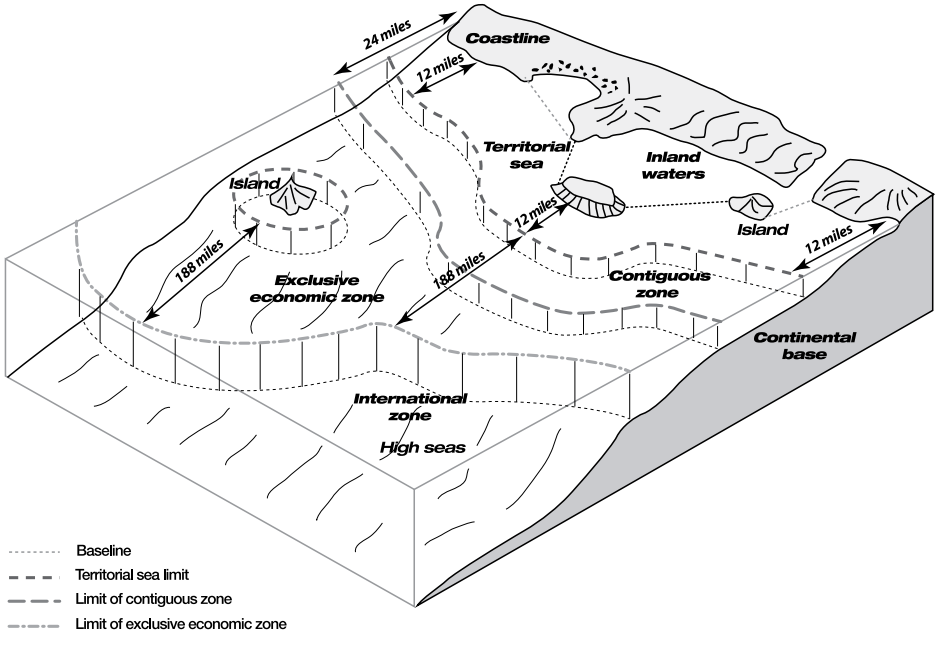
World ocean fishing is stagnating at around 80 million tons, almost all of which is caught on the continental shelves, an area thus largely over-exploited. On the surface, 40 000 to 50 000 big ships sail the seas and are responsible for 80% to 90% of world maritime trade. The strategic importance of ocean shipping lanes and straits incites States to build larger and larger military fleets to control these obligatory points of passage. Thirty percent of the world's petrol that is accessed *via* drilling comes from beneath the ocean floor and has become fundamental to world energy production. The near totality of marine aggregates (sand or gravel used in construction) comes from the ocean.

Unfortunately, every year one million tons of petrol is deliberately released into the oceans, and few states are reacting. Eighty percent of ocean pollution stems from the land; this is telluric pollution and most States refuse to tackle it. Consequently, the pillaging and wastage of resources, the destruction of marine habitats, and the over-population of coastal areas, where 50% of the world's population are squeezed together each day, pose a bigger and bigger threat to the ocean's future and represent today more than one-third of the issues concerning the future of human societies. The creation of a maritime law to attempt to manage all this is directly proportional to the development of techniques allowing man to venture out on – and into – the sea in order to develop his economy and power. Three centuries ago, this law could be reduced to that of the strongest, but we have since witnessed the advent of customary law, treaties, and the creation of a legal system of the ocean based on the

principle of the recognition of a strip of sea adjacent to a State territory: territorial waters, where each State exercises its sovereignty to protect itself. Modern ocean law, which was created in the XXth century, was the fruit of the extension of man's ocean competences owing to the progress in oceanology, which has essentially developed since 1960.

The more ocean activities man has, the more it is necessary to avoid conflicts and limit his greed. We have seen the creation of an Exclusive Economic Zone and of an International Zone of the Deep Seabed. Before I illustrate my arguments with a few examples, let us take a look at a few different ocean zones.

Diagram 4 Maritimes Spaces



Sources: Author's construction.

This diagramme summarises the system that allows us to partition the ocean and determine a legal regime corresponding to each maritime space. Let us randomly choose a coastline with a more or less broken line, a bay, a promontory, a river mouth, and some islands. The idea of this coastal strip referred to as territorial waters, where each State exercises its sovereignty, is to extend the limit of this coastal zone to 12 nautical miles beyond this coast. Given the indentations on the coastline, things would be unmanageable if the line drawn was not simplified. That's why there is a baseline, which is used as a departure point for all the calculations. The baseline simplifies the coastline by plugging

up a bay or a river, by joining up the coast to a nearby island, or one island to another, etc. Within this line are determined inland waters, not to be confused with continental or fresh waters, which are not oceanic. Within these inland waters, the State exercises its sovereignty and chooses whether to accept or not foreign vessels. Beyond this line begin the territorial waters that the Europeans originally fixed at three nautical miles[10] and which today have been extended to twelve nautical miles. The State also exercises its sovereignty in this zone, but contrary to in inland waters, it is obliged to accept the passage of vessels. A foreign vessel that passes through these territorial waters, and that does not pose a threat to the interests of the coastal State, has a right of transit and the latter cannot prevent it from doing so. Beyond these territorial waters, there is another twelve-mile zone known as the contiguous area. This area is a projection beyond territorial waters where certain police competences are exercised by the coastal State, such as customs and immigration control. Before the United Nations Convention relative to ocean law of 10th December 1982, commonly referred to as the Montego Bay Convention (MBC) and in effect since 1994, beyond territorial waters lay the high seas. The airspace, water, ground and underground were of free access to all States, coastal or not, and the latter were free to exercise their leisure, economic and military activities on condition that they did not infringe upon the same freedom of other States. The MBC completely changed things for economic reasons. The ocean floor and the continental shelf (the slope on which the emerged continents rest) contained a very large amount of resources, as we have known since the XIXth century. From 1945, States agreed that the resources of the continental shelf belonged to the State of which the shelf was the natural extension of its terrestrial territory. Thus, these provisions allowed the coastal State to exclusively exploit mineral and fossil resources. However, fishing was open to everyone as the State did not exercise any sovereignty over the continental shelf. So then, from the 1960s onwards, coastal States have sought to extend their jurisdiction in order to limit exploitation by third parties by creating reserved fishing zones. However, international law will never recognise these reserved fishing zones beyond twelve nautical miles. This situation has led to many conflicts throughout the world. We had to wait until the 1970s for the appearance of the idea of extending non-territorial waters, that is to say State sovereignty at sea, but creating an area situated at 200 miles from the base lines called the "Exclusive Economic Zone" (EEZ). In this zone, the State cannot prevent third-party activity, but it reserves the right to explore and exploit living or non-living resources already known and not yet discovered. This idea radically changed ocean cartography. At 188 miles from the territorial sea, the State exercises powers that allow it to manage as it sees fit and be responsible for ocean resources, while at the same time allowing free circulation to air and maritime traffic and other non-economic activities. The high seas are not beyond the 200 mile limit; during the period that the MBC was being discussed, polymetallic nodules had just been discovered in the deep seabed at a depth of between 3 000 and 6 000 metres in the abyssal plains. It was believed to be the Eldorado of future resources, which was

[10] 1 mile = 1 852 metres.

not totally wrong. The States then thought that they could not let these resources be freely explored and exploited and that they should be used for the common good of humanity. It was thus that the concept of a deep seabed constituted by the ocean floor and what is beneath it beyond the limits of national jurisdiction, that is to say beyond the 200 mile boundary, was inscribed in the MBC. The sea floor and what is beneath it became humanity's shared heritage, as well as whatever resources might be found there. The International Seabed Authority (ISA) was created to manage it and its headquarters was established in Jamaica.

It is a historical irony that today it is not polymetallic nodules that are exploited. All existing minerals are also found on dry land and are a lot less costly to exploit. An ocean exploitation of these resources will perhaps begin in 2030. The problem of genetic, living resources arose and had been foreseen by nobody. Indeed, at present, microbiology allows us to discover in the water column of the high seas, but also and especially on the deep seabed of the international zone, single-cell life whose genes possess remarkable qualities, which are likely to be of interest to our pharmacopeia, industry and future. These genetic resources are directly usable at this very moment, and are relatively cheap to collect. However, in article 135 of the MBC, it is clearly stated that solid, liquid and gas mineral resources are part of humanity's shared heritage. Consequently, today everyone has free access to these genetic resources. The International Seabed Authority (ISA) has a limited activity, as no request to exploit these nodules has been made. Of course, the big maritime powers have requested some blocks, particularly in the Pacific, where there exist higher concentrations, but they are not thinking about exploiting these resources today or even in the immediate future.

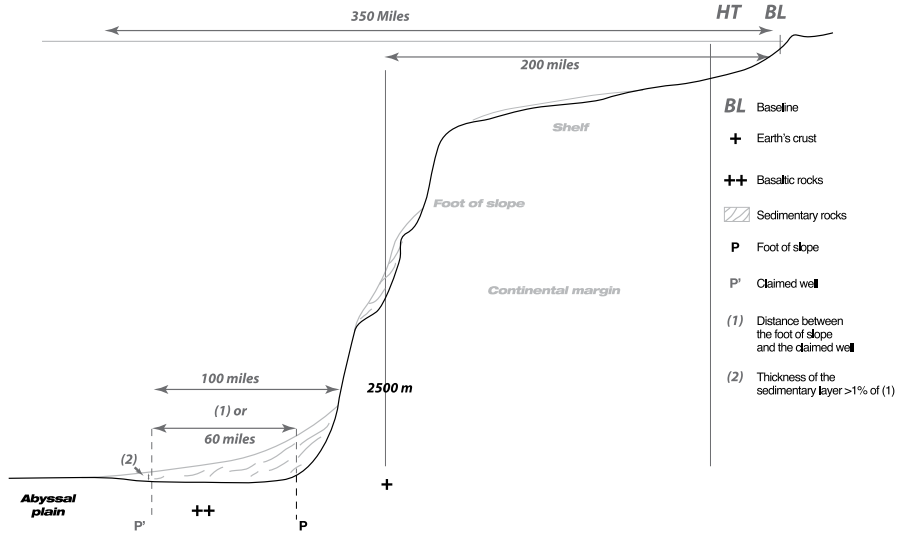
So, from this general outline, let us try to highlight a few major points that show recent changes in this law. Let us first take a look at the question of the "last frontier".

1.4.1. The Last Frontier

The United Nations Convention on the Law of the Sea of 10th December 1982 (MBC) allowed for the creation of the EEZ, as well as the extension of the continental shelves beyond the 200 mile limit. This important concept was a little lost in that of the EEZ, which covered all the economic needs of the coastal States, allowing them to reserve for themselves both living and non-living resources. In the case where the shelf stretched beyond the 200 mile limit, conventional law recognises the coastal State's exclusive jurisdiction over non-living resources and some sedentary living resources, if the State can prove that that the claimed area is indeed the natural extension of its terrestrial territory; the nature of the rocks is essential here. According to the application of article 74 of the MBC, the State with the claim must prove this natural extension before the Commission on the limits of the Continental Shelf at the United Nations (UN); which is what States such as Argentina, Canada, Australia, France or again Việt Nam are doing. It is a complex procedure: the committee, which is composed of experts, gives a simple opinion; a lot of geological arguments are necessary for the rebuked claimant to contest this opinion before the community of States party to the convention. To prevent States

from extending their exclusive powers too far, their claims are not permitted to go beyond the 350 miles from the basic lines or 100 miles from the 2 500 metre isobaths.

Diagram 5 Maritime Limits



Sources: Author's construction. Mapping: C. Lamberts, L. Pourinet – CNRS-LETG UMR 6554 – Géolittomer.

It is thus a race to obtain geological expertise. Sensing a change in the wind, the UN created a Continental Shelf Commission, staffed by ninety members who receive the requests from the states claiming that their continental shelf stretches beyond 200 miles. States had ten years after the MBC entered into force to present their claims. The decisions will soon be revealed and are not going to please all the coastal States, particularly those that cannot hope to be treated fairly. At present, there are about 400 conflicts throughout the world concerning the limits of the EEZ. As far as the continental shelves are concerned, a conflict between France and Canada will certainly arise concerning Saint-Pierre-et-Miquelon and other issues.

1.4.2. Extraction of Natural Resources

The maritime fishing legal regime leads to a buffer that one cannot go beyond by retaining the principal fundamentals of freedom of fishing in the high seas. Over-exploitation is almost the general rule, and only 10% of resources are exploited in a sustainable fashion. This concerns deep-sea fishing, offshore and coastal fishing, artisanal fishing and even subsistence fishing. It has become necessary for a thorough revision of deep-sea fishing practices. It is necessary to fight abuses, the scourge of illegal non-regulated and non-controlled fishing. Uncontrolled fishing must be replaced by a sustainable system of resource management

led from the top and monitored at the bottom. It without doubt spells the end of the freedom to fish in the high seas, or at least as it was conceived in the MBC. Some measures of control already exist; the problem resides in the reticence of States to implement them. In 1993, the United Nations Food and Agricultural Organisation (FAO) made State members sign an agreement asking them to respect conventions concerning the exploitation of deep-sea resources; it was thus a question of one convention replacing another. As for aquaculture, it has made remarkable progress and generated many jobs, particularly in the Pacific. Unfortunately this economic and technical success came at a price; part of the coast was privatised which resulted, above all, in serious bacteriological and chemical pollution.

As far as non-living resources are concerned, the exploitation of minerals and marine aggregates is stagnating in territorial waters and is little developed on the continental shelves. On the other hand, the millions of cubic meters of aggregates extracted for urban constructions are causing huge damage to marine habitats.

The exploitation of the deep seabed under the high seas is still in its infancy. The UN International Deep Seabed Authority has enacted a mining code for the extraction of polymetallic nodules, but the exploitation of the latter is not forecast to begin before 2030 at the earliest. The International Authority is seeking a way to channel the current prospection and control the extraction of resources, particularly genetic ones, by basing itself on article 145 of the MBC, which obliges it to protect the marine environment in the international zone.

As for fossil resources, the search for gas and petrol is more and more frequent and is happening further and further from the coast and at greater and greater depths. Nowadays, extraction at deeper than 2 000 meters underwater or at 4 000 meters into the bedrock is usual. The legal system implemented by the coastal States is currently well known; a system of prior authorisation to prospect facilitates the mining company's work and a mining license will then allow it to exploit the discovered deposits. The system of production differs from State to State, however, risk or production-sharing contracts are most usually found.

1.4.3. A Milieu Under Threat

Sixty years ago, the law did not cover marine environment protection, except for a few national laws that were applicable in sovereign areas. Progressively, under pressure from public opinion, States have been obliged to implement a complex legal system to fight against the deliberate release of oil and petrol. But, what it is necessary to know is that in both terrestrial and marine environmental law, States always have knee-jerk reactions and then do the minimum. States react to public opinion when there has been a catastrophe, but even then they react in a way to create the least possible disturbance for the economic players. For example, the 1954 London convention for the fight against voluntary oil and petrol pollution – ballast tank flushing at sea – only concerned petrol tankers of 500 tons of registered tonnage, crude oil cargoes (holds were not included), and only in a strip of 50 miles off the coast of some States. With the passage of time, the legal technique used

has evolved and become more complex. The fight against accidental spillage, against the immersion of industrial wastes, against all pollution from sea vessels and, finally, against telluric pollution, which accounts for 80% of all pollution, has been stepped up. States have been obliged to equip themselves with the tools to begin a global fight against all types of pollution. Finally, under the pressure of the United Nations Environment Programme (UNEP), they have accepted a more efficient "global-regional" system to fight against pollution, which takes into account the different marine eco-systems. This conventional typology has shown itself to be supple and efficient as it is based on a mandatory minimum framework convention (general terms), but is also accompanied by additional protocols (hydrocarbons protocol, exploitation of continental shelves protocol, protection of biodiversity protocol, etc.), the adhesion to which can be deferred according to the political and economic possibilities of the party States. It was the "Barcelona System" in 1976 that resulted in the progressive creation of twelve regional seas, which have binding convention terms, but have created a strong North-South cooperation synergy. Nowadays, legal frameworks cover the near totality of the seas, which represents considerable progress. It is the coastal States themselves that are accepting their responsibilities.

1.4.4. Merchant Navies and Sailors: The End of the Adventure

The sailor was a free agent who chose both his ship and his route. The captain was the only figure of authority and he alone was responsible for the maritime expedition. The ship owner, who was proud of his vessel, did his utmost to ensure that it was the best one possible. This world has partly disappeared owing to the fact that maritime transport has become the business of financiers and competition. The flag, which was a strong symbol of State sovereignty, has become a devalued commercial brand. The economic crisis, which followed the three post Second World War decades of economic expansion, resulted in an every-man-for-himself mentality in the merchant fleets; ship owners are now only interested in reducing costs at any price to make immediate profits, by putting out to sea sub-standard sea vessels, which are dangerous, and many States do the same for the vessels belonging to their citizens, whose only aim is to drastically reduce freight rates by dumping.

The results of this downward spiral were clearly visible in the 1980s: a shipwreck a day throughout the world, a high sailor and passenger death rate, repeated oil slicks, a marked degradation of the transport service and some very poor statistics for insurance underwriters. Faced with the negligence of certain States, the insurance brokers established a black list and coastal States, notably France, reacted by refusing that their coastline be polluted. These States invented alongside the "Flag State", the concept of the "Coastal State" and also that of "Port States". These new types of States have laid claim to, and have recognised, new powers based on their sovereignty of their inland or territorial waters. They have thus been able to impose their own laws in application of international conventions in force on vessels flying the flags of States that have not ratified the conventions of the International Maritime Organisation (IMO).

Consequently, the random controls, the boarding of vessels and their seizure and even the banishment of repeat offenders have been made possible thanks to the Memorandum of Understanding (MoU), Paris, 1982. Today, seven other MoUs exist, which have resulted in the removal of most sub-standard vessels from the major zones of commercial shipping.

We are today witnessing a slow "rising from hell": a tangible improvement, which owes less to the virtues of the financiers than to the refusal of underwriters to continue covering such risks. The checks, although imperfect, are becoming stricter and stricter and the international community now has a set of conventions regarding maritime security. Furthermore, the IMO has placed maritime transport within a framework of a set of surveillance techniques that allow it to know at any moment where the vessel is located and the route it is following. It is a shame that the greed of some resulted in the merchant navy losing the part of greatness and adventure that the ocean had bestowed upon it.

Thank you.

Exchanges…

Jean-Pascal Torréton

You spoke about chemical and bacteriological pollution linked to aquaculture; another form of pollution is appearing in Europe, notably genetic pollution, which echoes the genetic exploitation you spoke about. Is there a legal system to address this problem? For example, I'm thinking about the salmon in Northern Europe that are falling victim to genetic erosion due to the difference between farmed stocks (weaker genetic diversity) and natural stocks.

Public

What is the UN's role in the maritime conflicts in the Asian region?

Jean-Pierre Beurier

You are absolutely right about salmon genetics. There does not seem to be any conventional or legislative solution to genetic erosion in salmon farms, except perhaps regarding concentrations – that is to say intensive farming should be become less intensive, and the control of antibiotics, of pharmacopeia, the fight against pollution, etc. However, there is another genetic problem consisting of Genetically Modified Organisms (GMOs) and the monitoring and control of transgenic salmon.

As far as the role of the UN in the implementation of the convention and the arbitration of conflicts, Part 13 of the MBC concerns the International Tribunal for the Law of the Sea, whose headquarters are in Hamburg. It has intervened several times to appease the conflicts resulting from the convention's texts and is at its ninth ruling. However, the UN has no supranational powers; the States have never granted it this power. Consequently, sovereignty conflicts can only be resolved by the protagonists themselves. The UN can propose its system of conflict resolution, with the International Court of Justice (ICJ), but certain States do not recognise its jurisdiction. Furthermore, many States do not seek the help of the ICJ and prefer arbitration or conciliation, which are also peaceful ways of resolving differences. Conflicts related to marine space are globally diminishing. As I said, there are about

400 difficult cases of boundary drawing for the EEZ throughout the world. However, most cases concern land difficulties such as the conflict between El Salvador, Nicaragua and Honduras over the Gulf of Fonseca, decided by the International Court of Justice in 1992. The difficulty of drawing boundaries through virgin forest and marshes is more technical and legal than political.

Yves Perraudeau

It is perhaps through texts about animal welfare that concentration problems are addressed rather than through texts about genetic problems.

Public

What mechanism is used to share out the profits generated from the exploitation of resources said to belong to humanity?

Jean-Pierre Beurier

As far as the sharing of profits is concerned, polymetallic nodules are not exploited in the international deep seabed zone. However, sulphides and cobalt-rich crusts are exploited in the international zone around deep-lying hydrothermal springs, between 2 500 and 4 500 meters. If the zone is within the EEZ, it is exclusive to the coastal State and is its responsibility. However, if it lies beyond the 200-mile boundary it is in the international deep seabed zone, which is common heritage for all mankind. The MBC tells us that part of the profits from exploitation, which can only be made in fact by a handful of great maritime powers (about ten States), should be given to the poorest States in the world.

As far as the sharing out of living sea resources is concerned, there is a web of conventions throughout the world that all go to create international maritime fisheries commissions. Adhesion to these international organisations is free. Thanks to these committees, which get together on a regular basis – at least once every two years – decisions are made to determine the permitted volume of catches and to ensure that the member States of the commission share this volume. The problem is that there are States that are not members of these fishery bodies, and that some ship owners change their ship's flag to one bearing the colours of a non-member State. It is an interesting but fragile system as there is no power of obligation. It is only by making people aware of the problem that we might one day succeed in making people respect the quotas.

1.5. Rapid Urbanisation, Social Needs and Water and Sanitation Service Provision

Claude de Miras, IRD – Catherine Baron, LEREPS, University of Toulouse 1

(Transcription)

Claude de Miras

After taking a look at the state of river and sea water, we are going to have a look at water in an urban environment and more particularly in peri-urban zones where the issues are all the more acute and interesting. We shall divide our presentation into two parts: first of all Catherine Baron will present you with a demand-side approach to water, and then I shall continue by expanding on the issues linked to the supply side. It is a rather simplified vision, since it is evidently the responses of supply to demand and the positioning of demand in terms of volume, quality and price that condition the water problematic.

Catherine Baron

Worldwide Stakes of the Drinking Water Sector

I shall begin my introduction with a few statistics that are often referred to when the problematic of access to drinking water and sanitation in big cities is discussed. Often the figures concerning the two domains are given separately and have only recently been associated in international reports.

A certain amount of progress has been made regarding access to drinking water, whether it be on a worldwide scale or in developing countries (DCs), with a progression of 10% between 1990 and 2006, which makes it one of the first Millennium Development Goals (MDGs) to be attained.

Box 3 Worldwide Stakes of the Drinking Water Sector

Drinking water: progress in world coverage
1990: 77%
2006: 87%
MDG: 89%

Sanitation: little progress
1990: 56%
2006: 62%
MDG: 77%

900 million people without drinking water
2.5 billion without sanitation
Sub-Saharan Africa lagging far behind
Rural coverage still limited

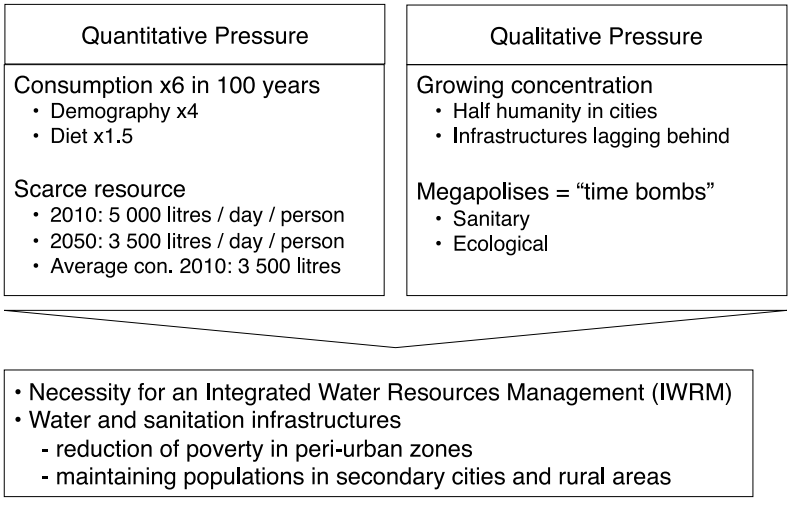
Sources: Framework for Strategic Water and Sanitation Intervention, 2010-2012, AFD, p.6.

As far as sanitation is concerned, the progress made has been a lot slower with a progression of only 6%, even though the MDG was fixed at 77%. On a worldwide scale, 900 million people have no access to drinking water and 2.5 billion live without sanitation. Let us remark that Sub-Saharan Africa remains an exception to this general progress. Furthermore, urban coverage experienced bigger net growth than rural coverage.

However, it is necessary to point out that this data remains extremely general and raises a certain number of questions about the realities it refers to, particularly because of the heterogeneity of the situations between continents, between emerging and developing countries, between cities, and even between rural and urban areas. Consequently, it is evident that Việt Nam and Niger do not share the same problematic regarding water, just like the peripheral and central areas of developing cities on a smaller scale.

All these statistics hide a diversity of contexts and circumstances that must be taken into account.

Box 4 Worldwide Stakes. Resource Under Double Pressure



Sources: Framework for Strategic Water and Sanitation Intervention, 2010-2012, AFD, p.9.

A double quantitative and qualitative pressure on water resources can be put to the fore. It is thus important not to disassociate the access to drinking water services problematic from that of water resources, both in quantitative and qualitative terms.

In many countries, particularly Sahelian ones, there are various reasons for the quantitative pressure linked to the availability of the resource:

- Worldwide consumption has increased six-fold over the last century, particularly because of demographic factors;
- The change in eating habits has caused increased pressure on water resources;
- The scarcity of the resource following climate change that affects certain regions of the worlds more than others.

It is forecast that the quantity of water available per capita per day will be 3 500 litres in 2050 compared to 5 000 in 2010.

There also exists qualitative pressure, as the drinkability of water is a major issue. Beyond the World Health Organisation's (WHO) recommendations, the definition of good quality drinking water norms is a much-debated issue. For example, European drinking water is not the same quality as so-called "drinking water" in Africa or Asia. Often, the ambiguous term "clean water" is preferred in order to avoid conflict surrounding the definition of drinkability, particularly in the MDG framework. Furthermore, in the big cities of the developing world, sanitary and ecological constraints can be added to the classical issues surrounding water quality.

A certain number of proposals have been made, particularly in the IWRM (Integrated Water Resources Management) framework, a policy which is highly valued on an international scale in order to emphasise the quality aspects and favour the taking into account of a diversity of uses (industrial, agricultural, domestic), and the participation of all the players, etc. But the implementation of IWRM is complex, as it reflects among other things the difficulty of coordinating water resources management issues with access to clean water for all.

Furthermore, the correlation between the implementation of drinking water and sanitation infrastructures and the reduction of poverty in urban areas, and more particularly in peri-urban or rural areas, is not clear. Does access to drinking water and sanitation automatically result in a reduction in poverty?

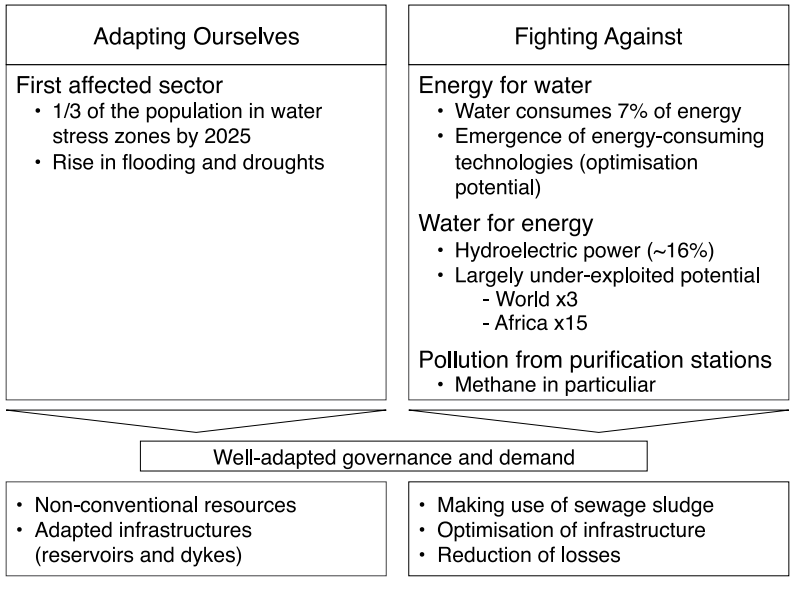
Stabilising populations in intermediate cities constitutes another type of proposal to meet the MDG challenges regarding infrastructure and basic services, since many DCs are experiencing a problem of predominant cities: one or two big cities attract the majority of the population, which has consequences on water access and the implementation of networks.

It is also interesting to compare domestic per capita consumption by country in so far as this reveals the gaps between geographical zones. In North America, households consume 400 litres per person per day, and in Europe 200 litres. The reduction in water consumption in Europe is linked on the one hand to its rising price, and on the other to making people aware of environmental issues and the importance of fighting against wastage. In Sub-Saharan Africa, where the only usual access to water is by collective fountains and not by domestic tap, water consumption is a lot lower: 10 to 20 litres per day.

In big Asian and Latin American cities, the total quantity of water produced by public services is high: 200 to 600 litres per person per day, but per household consumption is a lot lower, as 70% of this is lost through leaks. One can rarely have confidence in the service there and water quality is generally questionable The problem of actual water loss has been around for many years, and has reached 20% in France, but can reach up to 80% in other countries. For donors and international organisations, solving this problem is often a major issue.

Finally, there is a strong link between access to drinking water and sanitation issues. Often, access to drinking water and sanitation form an essential part of public health issues. Many works have established a correlation between waterborne diseases and their impact on infant mortality – it is especially children under the age of five who suffer most from the consequences of poor quality water, particularly in African countries. The World Health Report, established in 1999 by the WHO, revealed that 3.4 million deaths were the result of water-related diseases in 1998 – more than half of these were children.

Box 5 Worldwide Stakes. Water and Climate Change



Sources: Framework for Strategic Water and Sanitation Intervention, 2010-2012, AFD, p.10.

Currently, climate change is at the forefront when the problematic of access to drinking water is discussed. In spite of global trends, it is rather difficult to measure its impact on a local scale, and even more so in urban areas. However, it is necessary to take into account its consequences, such as the rise in the number of water stress zones that will affect a third of the world's population before 2025, or the rise in the number of floods and droughts that also affect urban areas. On the other hand, climate change increases pressure on the demand for water in urban areas, particularly with climatic refugees, the migrant populations in the cities from the Sahelian zones.

The energy dimension is also fundamental to the access to drinking water and sanitation problematic.

Faced with these elements, considerations relating to governance, to a demand that is hard to assess and to a diversified offer must all be taken into account.

Water issues are complex and call for the intervention of several academic disciplines, such as economy, sociology, anthropology, law, geography, hydrology, etc. The subject of general access to water services and sanitation also goes beyond the technical dimension and cannot be limited to the understanding of a succession of network connection projects with their predicted quantitative targets, schedules, financing and technical subcontractors.

1.5.1. Demand for Drinking Water

The problematic of general access to water, sanitation and rainwater is linked to the demand for drinking water that depends on different trigger factors in developing cities; these factors are closely linked:

- To recommendations, specifications and guidelines issued by donors and international institutions;
- To social demands and movements, which put pressure on demand and help influence policies;
- To the will to carry out a water policy on the basis of demand, which must be defined beforehand: what choices are to be made concerning water access, a basic service, for whom, etc.? Equity occupies a central place in these questionings.

This represents the three aspects of demand that we have organised around four points for pedagogical purposes:

- International concerns;
- Conception of public services and social contract;
- Links with the specificity of rapid and extensive urbanisation in developing countries;
- Demand linked to the water needs of the population and their income. Non-satisfied needs may generate social impatience, which is a factor of urban instability.

Water access: An International Concern For More Than a Quarter of a Century

In 1972, at the time of the Stockholm Conference, links between economic growth and the environment were discussed. Then, the 1980s were marked by the International Drinking Water and Sanitation Decade (IDWSD). This was a package of recommendations implemented by the UN to favour individual access for all to drinking water – that is to say *via* the tap. Even though this may have been utopic, the broad guidelines were drawn at this period: the issue of water began to be seen through the prism of equity and general access.

The beginning of the 1990s marked a clean break in access to drinking water, as much on the theory and research level as on the political one. The dissemination of neoliberal standards in DCs spread to a certain number of sectors, including that of water. The 1992 Dublin Conference decreed that water is an economic good and no longer only a human right, which enshrined the principal of payment and pricing for water. The conferences that followed continued to respect this philosophy and ideology, particularly the different World Water Forums that take place every three years and gather together the principal players and donors of the access to drinking water and sanitation sectors. At the same time that the sixth World Water Forum (WWF) was held in Marseilles in March 2012, presumptuously entitled "Time for Solutions", an alternative forum (FAME), organised by NGOs, was held that dealt more with the question of the right to water, which was recognised in 2010 as a fundamental human right by the UN, and the implementation of this. However, few links, exchanges or bridges were observed between the two forums.

The MDGs of the year 2000 for 2015 marked another important moment, even though drinking water and sanitation were not directly mentioned. These two themes do not appear as integral targets, but are

included in Goal 7 that goes beyond them – *Preserving the environment: preservation of wet zones and their diversity; protection of groundwater, rivers and catchment areas; taking into account the water needs of ecosystems in water allocation.* The goals are divided into targets, and target 10 mentions, *"Reducing by half, by 2015, the percentage of the population that has not sustainable access to a water supply or to basic sanitation services".* Target 11 speaks about *"Improving notably, by 2020, the living conditions of 100 million slum dwellers".* It should be noted that sanitation was added at a later date, at the time of the World Summit on Sustainable Development in Johannesburg in 2002. It is interesting to see how the definition of the MDGs reforged water policy, its policy directions and their political consequences: many countries are focusing their efforts on these targets on which access to financing often depends.

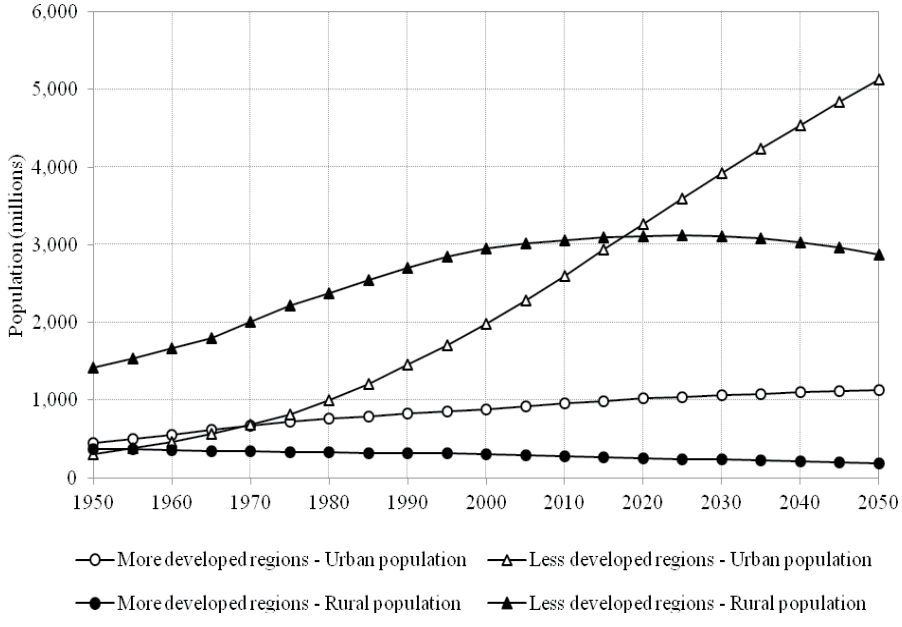
Progress in the Notion of Public Services

Many countries, particularly African ones, have adopted, at least in principle, a conception of "French-model public services". Questions can thus be asked about the impact of this conception on the different policies implemented in DCs. We shall return to these aspects in more detail in the workshops. The notion of public services constitutes a benchmark for the evaluation and analysis of national policies. The vision in which it was the State's role to provide access to a service for the general benefit of all has been brought into question by market logic. From a terminological viewpoint, we have gone from a public service to an economic service of general interest, which is testimony to the integration of market logic. This has resulted in the implementation of policies, management methods and new organisations in developing countries. Despite the failure of these management methods in the 1990s, this market logic has not been fundamentally challenged.

Rapid Growing, Socially Segmented and Widely Spread Out Urbanisation

Urbanisation in developing countries, characterised by its rapid growth, social segmentation and its wide geographical spread, creates new conditions for water demand. How can a network keep up with this urban sprawl, both on a technical level and in terms of financing?

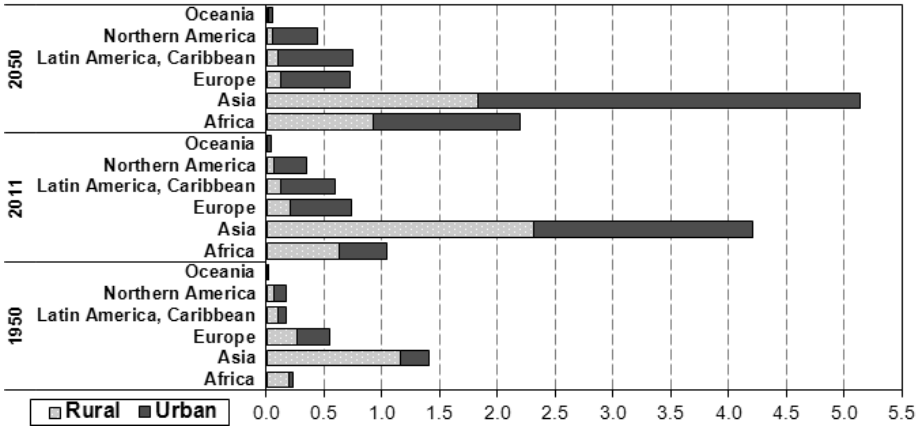
Figure 4 Urban and Rural Populations by Development Group, 1950-2050



Sources: United Nations Department of Economic and Social Affairs, Population Division: World Urbanisation Prospects, The 2011 Revision, Page 3, Figure 1.

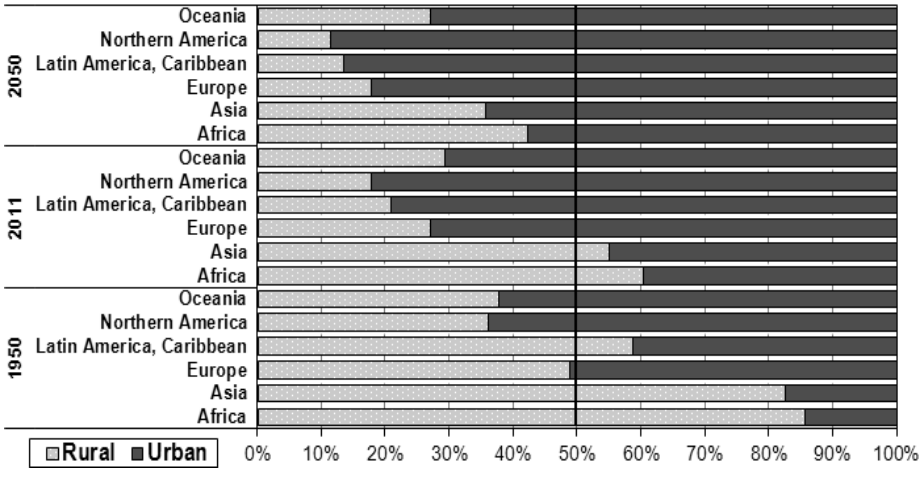
On this graph, the exponential growth of urban populations in DCs and its projection appear clearly.

Figure 5 Rural and Urban Population by Major Regions, 1950, 2011 and 2050 (billions)



Sources: United Nations, Department of Economic and Social Affairs, Population Division: World Urbanisation Prospects, The 2011 Revision, New York, 2012, Figure 2a.

Figure 6 Urban and Rural Population by Development Regions, 1950, 2011 and 2050 (per cent of total population)



Sources: United Nations, Department of Economic and Social Affairs, Population Division: World Urbanisation Prospects, The 2011 Revision, New York, 2012, Figure 2b.

The highest rates of urbanisation concern Asia. Urban concentration is all the more dense as it takes place around a few cities that dominate the territory.

The urbanisation process of these developing countries is characterised by fragmented and segregated cities and the expansion of urban fringes. The urban sprawl has two different aspects within the same agglomeration:

- The forming of large peri-urban zones predominated by precarious land rights where the inhabitants do not possess formal property rights, even though they sometimes have the right of land use. These neighbourhoods are characterised by their absence of infrastructures, insufficient public and basic services, and the public transport system is often badly developed or inexistent with inadequate roads that result in the isolation of the population from the rest of the city. These neighbourhoods are in the process of becoming self-sufficient in relation to the centre;
- Expansion of a different type of urban fringe, in which residential zones group together different categories of high and middle-income earners and easily accessible business centres are situated. Gated communities are also on the rise in a great many developing cities.

The urban sprawl accentuates the urban divide, favours social segregation, and results in a gap between the rich and the poor and in living standards in various parts of the city, between dilapidated city centres and rich suburbs, and between the diversity of urban fringes. In the African context, the poor live further and further out in areas where there is a high demand for water, but where the service is more expensive because of diversified modes of access, such as buying water from informal sellers who demand high prices depending on the distance carried, the season, etc.

This urban stretch engenders high costs that may become exponential. Asking questions about the demand for water of the population taken as a whole, or the demands of the population living in precarious conditions in particular, entails discussing the very notion of needs: how is this difference between service needs and demands defined and evaluated?

Demand for water is only the first step in a lot more complicated process that covers a demand for liquid sanitation, purification of sewage water, evacuation of rainwater, etc. Political considerations also play a central role, as supplying water to populations living in precarious conditions implies the political recognition of the neighbourhoods they live in.

Innovative solutions are progressively appearing in order to provide poorer quarters with access to water, such as the springing up of small private operators who take charge of water services that may cause an even greater self-sufficiency of these fringe areas and thus a further parcelling of the city.

1.5.2. The Offer in Drinking Water

Claude de Miras, IRD

This demand table shows well the lie of the land and all its complexities. The theme of water and sanitation are not free floating entities, but are on the contrary embedded in the problematic of urbanisation that is linked to habitat. This agglomeration of individuals,

riches, poverty and information has need of access to services.

We shall now see more precisely how offer attempts to reply to these complex and protean demands. This offer is multi-faceted, with, for example, the participation of small operators. It is no longer homogeneous, linked to a unique service provider, the reference point of a natural monopoly imposed by the management of the network. Indeed, it was difficult to imagine several operators with their own networks on the same territory. Competition is a notion that deserves to be treated carefully in the context of access to services.

The notion of service comes back to the complex issue of the offer for its conveyance and distribution. In certain contexts, such as in Morocco, there is a decoupling of production – the National Office of Drinking Water – from distribution (public enterprises and delegated management); this is not the case in Việt Nam where water companies are both producers and distributors.

Furthermore, the collection of wastewater and its treatment can be added to the complete cycle. We thus have a sequencing process in the structure of the service. If the rainwater sector is taken into account, its evacuation also becomes an issue. Speaking about water entails referring to the water cycle and its specific characteristics in an urban domain. The management of the existing network may also involve extensions that must be taken into account. This target is a major problem in the agglomerations of emerging countries that are generally experiencing demographic growth superior to 2%; this has repercussions in terms of spatial expansion and infrastructure. Beyond the maintenance aspects, it is also necessary to reinforce or renovate the networks when, on a given territory, the distributed volumes increase because of an increasingly dense population.

Choices and strategic constraints are considered for the offer of services. The range of forms, management methods and operators widened between 1980 and 1990, a period during which we saw the establishment of different classical model partnerships in public technical services. The typology proposed by the Organisation for Economic Co-operation and Development (OECD) shows a growing complexity in the ways the networks are financed.

What's more, governance has become a major issue, particularly because of the presences of many different players, implementation difficulties and institutional complexities. Distributing water does not only imply digging trenches and laying down pipes, it is also a political choice made within a framework of multi-institutional arrangements linked to decision-making and executive processes. A relationship has to be developed between habitat and service, that is to say the construction of the city and the extension of its networks.

Legal Forms of Management for Enterprises Operating in the Public, Industrial and Commercial Services Sector

There are different legal management forms for enterprises operating in the industrial and commercial public services (ICPS) sector:

- National public establishment – centralised management methods;
- Direct State control, self-governance, and personalised governance. These are

models of autonomous public structures that depend on decentralised structures. The president of the management board is in principle the mayor of the community;
- Semi-public company (associating private and public capital) and joint ventures (association of national private and foreign capital);
- Service contract, management contract, delegated management (lease contract and concession contract); Build Operate Transfer or Build Own Operate Transfer contracts;
- Privatisation by sale of public assets to a private operator.

We shall discuss these different management forms in the workshops.

Methods for Financing Water and Sanitation Networks

Methods for financing water and sanitation networks can be enumerated using the OECD's "3Ts":

- Taxes: they concern the State or/and territorial groups that finance the networks through national or local taxes, it can sometimes also be a question of fiscal exonerations;
- Tariffs: products of water and sanitation bills, financial contribution for initial establishment, connection charges, meter rent charge;
- Transfers that are not-refundable: national or international subsidies, such as the Oudin law in France that allows developed countries, through international aid, to give their support to developing country communities *via* a levy on their bills. There also exist several types of adjustments, whether it be between "sectors" (electricity towards sanitation), cross-sectoral (cement tax in Morocco) or between tariff bands (the richer clients financing the poorer ones).

I suggest adding to these "3Ts" time, which is the adjustment variable of these resources. This variable is a means of smoothing the multi-year distribution of financing. Financial intermediaries – banks – also constitute a use of the "time" resource through the staggering of loan repayments.

Quality of Multi-Player Governance in the Rain, Drinking Water and Sanitation (RDWS) Sector

The third point evoked concerns the quality of multi-player governance. Financial constraints, that is to say resource mobilisation, are not the main problem. It is necessary, but not sufficient, to deal with the problem of universal service access. It was in this sense that in 2002 Michel Camdessus[11] and his team produced work that proposed innovative financing ways to seek methods for the improvement of available resources. According to his experiences, it appears that the situation remains complex, particularly inter-institutional relations.

This is what I experienced in Morocco with the implementation of a project to connect poor neighbourhoods where 80 000 households live. Overcoming blocking factors is in itself a task that must be undertaken. Mobilising finance is even less binding/restrictive/difficult as the quality of governance and inter-institutional efficiency

[11] World panel report on the financing of water infrastructures, Financing Water for All, World Water Council, 3rd World Water Forum, World Partnership for Water, Michel Camdessus & James Winpenny, March 2003, 62 pages.

are present. There is some improvement work to be done using new governance tools, so as to push forward this necessary dialogue. The result of this is a great need for coordination and synchronisation between the relevant stakeholders. Imperfect governance and regulation will result in delays and considerable extra costs that will weigh heavily on the need for financing and the attractiveness of the projects to investors.

Relationship between Construction of the City and Network Extension

The relationship between urbanisation, urban morphology and networks is complex. In the long term, on the fringes of big cities and in contexts of rapid urbanisation, it is not networks that shape the urban fabric, but the dynamic of spontaneous real estate exemptions and derogations and unofficial – or regulated – neighbourhoods: a master plan for development and urban planning; urbanisation that structures the web of networks, "The city constructs the networks".

However, once the RDWS networks are in place, the integrated urbanisation process accelerates with the appearance of other urban services, and the densification of urban structures along the axes of these networks.

It is possible to renew the water and sanitation services problematic and go beyond a "project" approach. All too often, we tend to consider that access to these services involves projects with financing, deadlines and targets. This is true in an operational sense, but in reality the notion of triggering factors is paramount – what makes a project happen? Of course, there are international factors, but national factors are going to induce national strategies that will be set out through public action and will take on specific shape on an urban territory scale.

It is important to see, in terms of research and understanding, that the departure point is a social contract with its implicit conception of public services. Different modes of access to water will depend on the nature of this contract and its degree of development. There exists a country typology depending on this social contract and level of development that will influence their financing capacities, but the richer countries do not always have the strongest political will. For example, oil-producing countries do not necessarily have urban services corresponding to their financial capacities. Conversely, non oil-producing countries with a stronger political will launch significant strategies. The issue is also to take the strategy forward through a mastery of urban planning, that is to say an authority on the scale of the territory capable of arbitrating all the complicated factors we have spoken about. This is the whole difference between an agglomeration and a city. It is a matter of politically organising cohesion and coordination in order to reduce the costs of transactions and act with all the players involved.

This reflection leads us to a reviewed and corrected public-private partnership (PPP): the participation of the stakeholders (State, ministries, communities, populations, operators, donors) who must move forwards by working together in the most efficient way.

To conclude, the contribution made by research allows us to renew our approaches by putting some distance between ourselves and this telescoping of successive projects. Innovative ideas must be developed, such as

those that consist in not thinking in terms of cities and urban networks, but by considering urban fringes more as being at the centre of the problematic. The peri-urban becomes essential and the fringes central, if one wishes to understand the issues surrounding water. Often, the passage from rural commune to urban commune, in the absence of authorities to supervise the metropolitan area, results in a no man's land completely out of step with the political, technical, social and environmental issues being played out on city fringes.

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Exchanges…

Lương Ngọc Thảo, Institut de Recherche sur le Développement (IRD)

The volume of per capita daily consumption rises according to progress in living standards; could you explain to us why this is?

Doctorate student from the Ecole Normale Supérieure 1 Hà Nội

Is it desirable for a State to socialise these services while preserving administrative management? Have you had any experience of this in Africa, Europe or Việt Nam that you can share with us?

Claude de Miras

There is an almost proportional ratio between increase in revenue and increase in conventional water consumption (distributed by the network), whether it be in volume or value. Other types of leisure-linked consumption, such as swimming pools or golf courses, also raise consumption that may also be non-conventional with the use of private wells.

In order to conserve equitable universal access to water, pricing must be optimised and take into account the scarcity of the resource. A free water supply creates infinite elasticity – since it is free, consumption may result in total wastage

Catherine Baron

The link between the fight against poverty and access to drinking water makes it first of all necessary to define poverty and specify what is the priority of water for local populations by taking local realities into account.

Claude de Miras

The model of delegating public services appeared in France at the time of industrialisation in the XIXth century. The big cities called upon private operators in order to allow them to manage water services. Since then a model of pure public management, in the form of an authority and a model of delegated management to a private operator, exist side by side. The debate is still open, and today there is a new call for re-municipalisation, with a return to the public sector in certain cities. Beyond the choice of management methods, it is necessary to find a power-sharing balance, between technical capacity and political authority in order to avoid monopoly traps. The main thing is to improve the quality of the service in acceptable economic, social and environmental conditions and to raise the quality of the implementation and monitoring of operational systems. It would be short-sighted to consider that there exists an ideal model to be transferred from one country to another.

1.6. Methods for Agent-Based Computer Modelling

Alexis Drogoul – IRD, Benoit Gaudou – University of Toulouse

The aim of this plenary session is to present the family of computer modelling methods grouped together under the term "agent-based modelling". Indeed, the use of these methods has been developed over the last twenty years in a growing number of academic disciplines and scientific fields of study, particularly in social sciences. They allow us to envisage reproducing and studying a part of the real world's complexity by carrying out veritable *in silico* experimentations, called "simulations", in which the individual and collective dynamics of computerised entities called "agents" are programmed, observed and analysed in as many details as necessary. These simulations can confirm the appearance of phenomena concerning the emergence of complex dynamics of a "whole" from the behaviours of "parts", suggest cause-effect relationships, allow us to test different scenarios of evolution, or to scientifically prove, by experiment, different hypotheses. They above all allow us to make concrete, in the form of easily manipulated abstractions, the multi-disciplinary exchanges about a same object within common models that can be verified thanks to their expressive power, in direct relationship with observations of the real world.

This general presentation will be followed by the presentation of the *Multi-Agent for Environmental Norms Impact Assessment* (MAELIA) project in which a simulation platform is developed of the effects of the implementation of norms for management and governance for water resources, territories and the environment. This platform has been chosen because it offers an excellent illustration of the couplings that allow us to realise agent-based models, between, for example:

- The geochemical and hydrological dynamics on the scale of a catchment area;
- The occupation and use of land and its incidence on resources;
- The human activities linked to the exploitation or management of resources;
- The effects of climate change, particularly on water resources.

The aim of the project is to evaluate the direct/indirect, expected/unexpected effects of the implementation of norms on a territory where renewable resources such as water, which depend on complex physical processes, are at the same time submitted to competitive uses by heterogeneous social players.

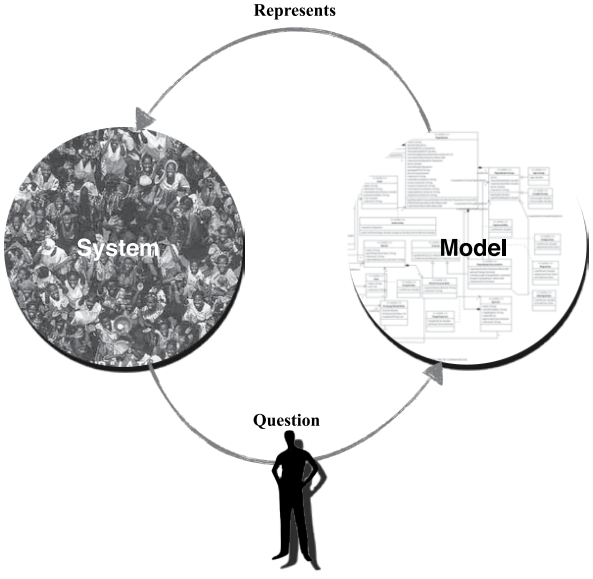
(Retranscription)

Alexis Drogoul

I shall begin this presentation with an introduction that will raise awareness of the field of analysis, and then Benoit Gaudou will illustrate the use of these techniques within the framework of an application of the MAELIA project concerning water management by a certain number of players involved. I hope to obtain a lot of feedback and questions in order to help make our presentation clearer, in full knowledge that many other points will be addressed next week during the workshop, where we will see how to build models using these techniques.

I shall begin with a few definitions that might seem extremely simple, but it is essential to clarify vocabulary that is often polysemic.

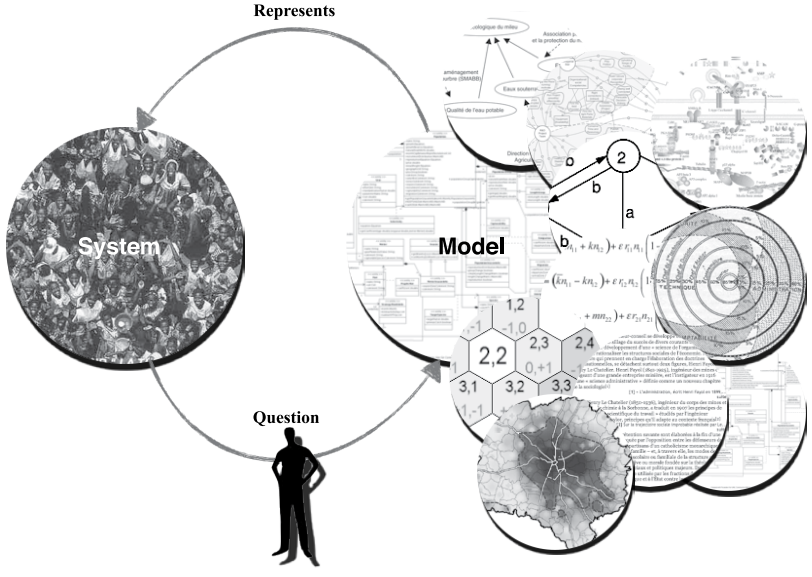
Diagram 6 Model



Sources: Authors' construction.

A model is a simplified and abstract representation of a demarcated system of reference that helps reply to a question, or support discussion and reflection in a more simplified framework. This representation can be communicated and shared.

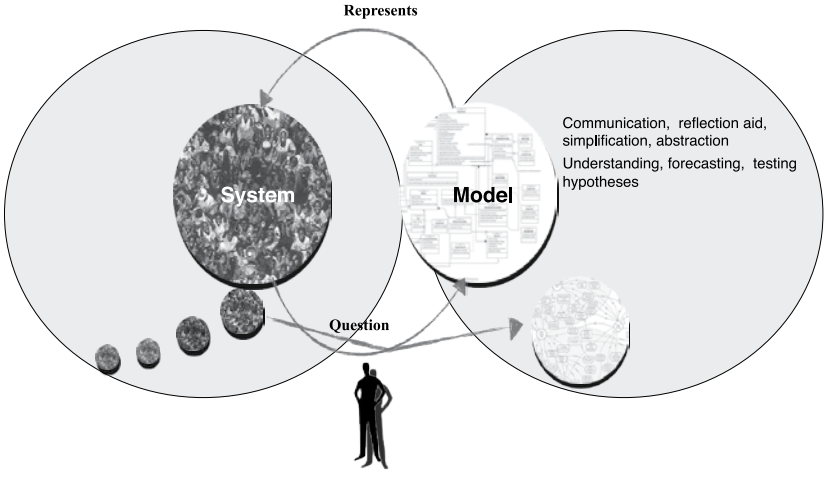
Diagram 7 Representation(s)



Sources: Authors' construction.

A model can be written by using any imaginable formalism. There exist purely literary and mathematical models, and between the two exist a whole range of models based upon production tools, interpretations and traditions. We have, for example, domains in social sciences which are based upon certain traditions and which use at the same time mathematical tools or statistics depending on the question and the inherent traditions of this discipline. If you are more interested in a spatial question, you are going to need systems of analysis such as geographical information systems (GIS); if you are interested in equilibrium mechanisms, you are going to use dynamic systems, that is to say a mathematical representation, etc.

Diagram 8 Static Models, Dynamic Models



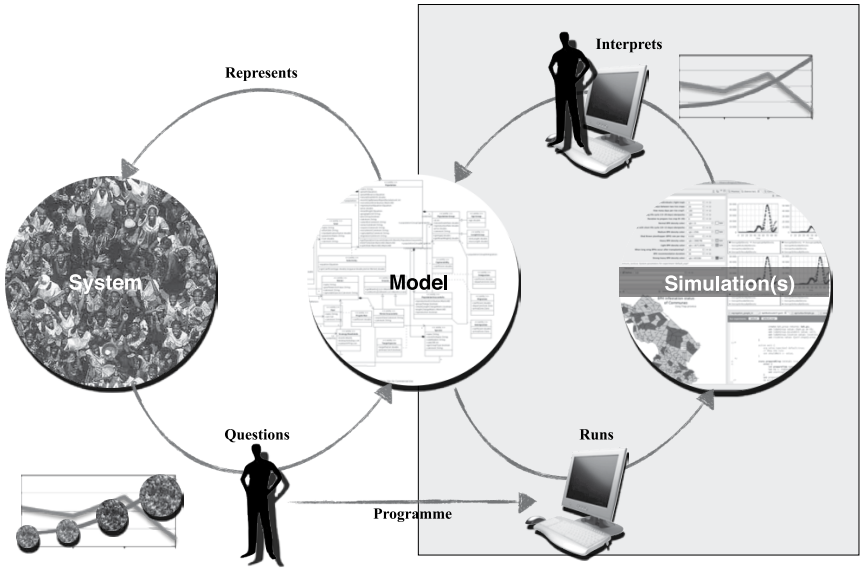
Sources: Authors' construction.

In an artificial manner, I distinguish static models, which are the representations at a given moment of a system, from dynamic models.

Static models are not supposed to refer to any kind of dynamic of the system: they are used to expose and simplify what the system is, to communicate it and aid reflection. A model presenting the institutions of the French Fifth Republic is a static model of how the institution functions. The question asked is one of representation.

Conversely, dynamic models concern the dynamic of the system and are linked to its evolution. This may be a temporal evolution – the most common case – or it might well be a structural evolution. We may be interested in variations of the system that are not necessarily variations in time. There are, for example, predictive models that are supposed to report back: the model predicts and anticipates in time how the system will evolve.

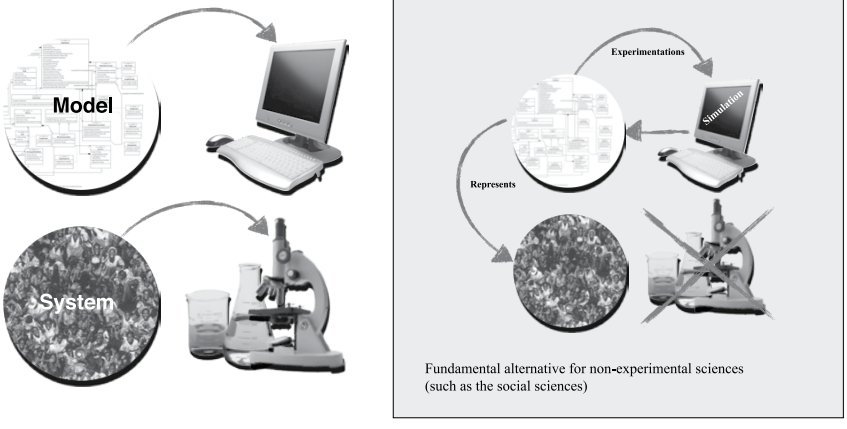
Diagram 9 Computer Model and Simulation



Sources: Authors' construction.

The computer models are very closely linked to dynamic models. A dynamic model in computer science is called a simulation. For example, when we cause variations in a model, we run that model. We have a system, with on the one side an agent, or a group of human agents, who ask a specific question about a reference system that is demarcated in reality. This may be a social system. The players are then going to build an abstract model and at the same time programme it. This abstract construction is made to become something executable within the simulation, which unfolds in time and provides information in time.

Diagram 10 Computational Experimentations



Sources: Authors' construction.

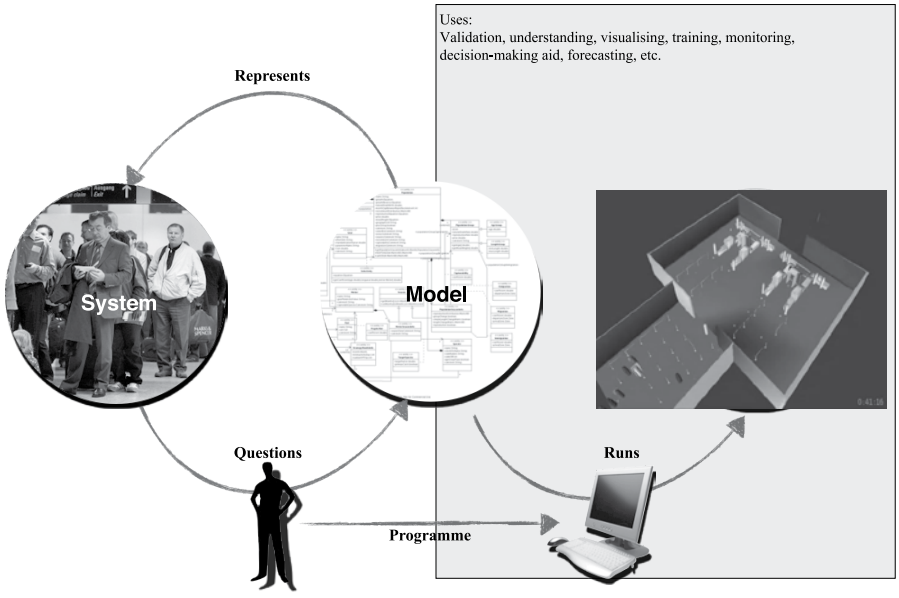
In the same way that we can write models on a piece of paper using different languages, we can write computer models by using different languages, representations and abstractions.

In what way are simulations interesting?

If you observe a simulation compared to a model, you will see that the definition is similar to that of an experiment in relation to a real system. A simulation is the perturbation of a model in order to provide answers to questions. In the same way, in an experiment in experimental sciences (chemistry, biology and others), we upset a model in order to push it to its limits and understand its way of functioning. Simulation allows this reproduction for its models. We can modify them, perturb them in a controlled manner, have particular variables changed, explore parameter spaces, etc.

Nowadays, we can remark that there are some experimental domains that can no longer be the object of experimentations such as nuclear physics, for example. Thus, the only solution is simulation, with all that that implies in terms of problems of representations and validity. Thanks to progress in computer science and its powers of calculation, new domains are becoming accessible to experimental options. It is the case for a certain number of scientific domains belonging to the social sciences. We can deal with these domains by using an experimental approach. We can now build models that are complex enough to be simulated, in order to reproduce relatively complex dynamics on computer and explore a certain number of possible trajectories, particularly by modifying the system's inputs.

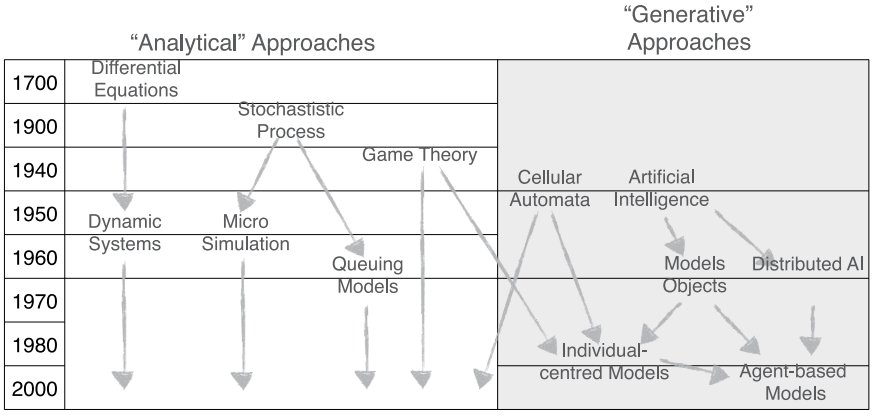
Diagram 11 Dynamic Models, Simulations: The Best Approach?



Sources: Gilbert, N. and K. Troitzsch (2005).

The uses of simulation can be scientific. We can for example verify a certain number of properties regarding people queuing in a place, but this may also have a purely commercial use – how to implement the "right" sort of queue to avoid crowding and lengthy queues. The current uses of simulation, all applications considered, concern the validation of models; it is a real case of experimentation. We build a model of a reality, and then we validate it by observing all its possible futures. The understanding of a model and its visualisation are important points. Models can also be used for training, monitoring, decision-making aid, forecasting, etc. Two domains of application carry a heavy financial weight in the world: the military domain, which is the biggest consumer of simulation, and that of video games – the majority of progress in simulation over the last twenty years stems from the world of video games and its needs.

Diagram 12 Structure of an Agent-based Model



Sources: Authors' construction.

Within dynamic models we can distinguish two big families: one that is related to so-called analytical approaches and a more recent one that is very closely linked to progress in computer science and related to the so-called generative approach.

What differences can we remark?

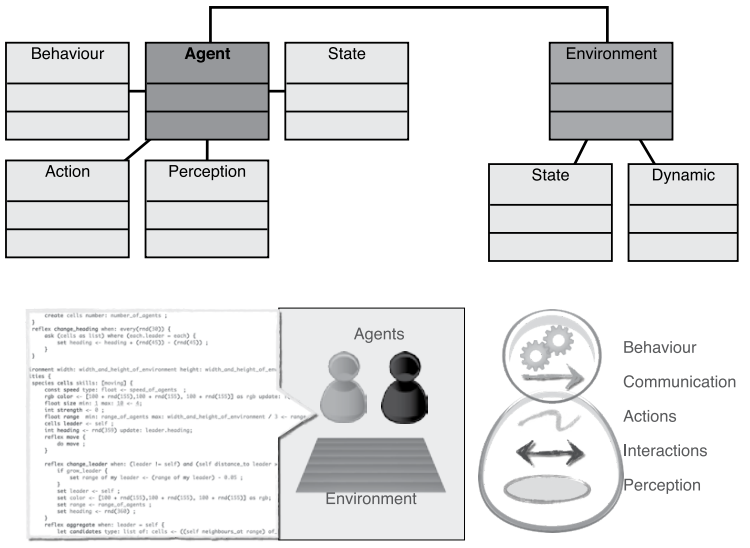
The analytical approaches are used to characterise the states of balance of a system, to describe it in such a way as to perturb it in a controlled manner.

Conversely, the generative methods allow us to generate these equilibriums and understand the conditions of their emergence.

From the components and constituent parts of a system, we are going to make them act and interact in order to attempt to find the equilibriums in a way which will help us to understand how they are formed – such as, for example, a social group, an equilibrium in a negotiation. If you are interested in the dynamics of a population in an environment, analytical approaches will represent these states of equilibrium by equations so as to obtain a simplified, macro and global image which ignores the constituent parts of the system. As for generative approaches, they will represent each element of the population and the environment in order to attempt to reconstruct states of equilibrium by using hypotheses about the individuals. These two approaches are not necessarily opposed and may cohabit within the same system.

The generative approaches date back to 1945, with the first computers and the first attempts at simulation that were used for the atomic bomb. The first approaches to simulation corresponded to a certain number of domains and techniques: cellular automata and artificial intelligence.

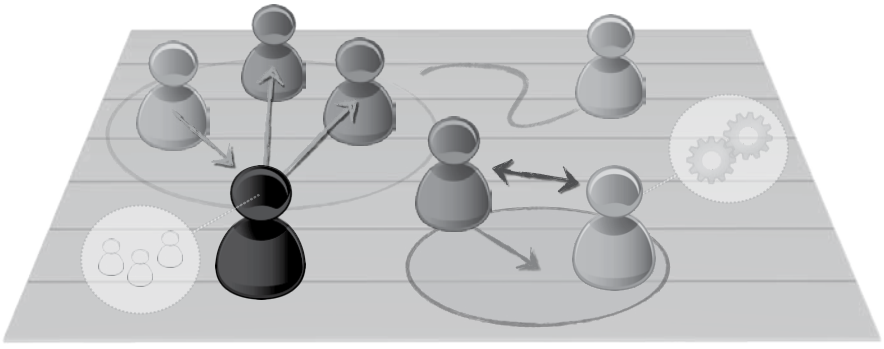
Diagram 13 Agent-based Models



Sources: Authors' construction.

Agent-based models constitute a way of representing a system. In order to represent this system, we are going to use a small number of concepts that are both rich and polysemic when taken individually into account. These models group together two important concepts: the agents and the environment. An agent is a computer programme which can be executed and which includes behaviour, communication (the sending of information to other agents of the system), and actions (modification of other agents, of the environment or oneself), interactions and perception (ability to perceive other agents' vicinities). We are here within an anthro-centred approach from a vocabulary point of view. We construct computer programmes to which we give attributes that are almost human and living. In computer science, we have systems that allow us to say *"I want to create an agent, its behaviour, its communications, etc., and I am going to programme it in such a way"*. All of the programmes we have built in this way are then placed in situation in the environment, which is also a computer programme; this can be something distributed on the web, a grid, a table, a matrix from the moment when we are in possession of characterisable states, when we can perceive phenomena and recuperate information.

Diagram 14 Agent-based Models



Sources: Authors' construction.

These agents are placed in situation and we have an experimental system. In an agent-based modelling approach, we give ourselves the means to create small virtual worlds. We create a virtual world over which we have complete power. The problem no longer lies in what we can and cannot put in, but in the way in which we are going to use it. How are we going to interpret, validate, and experiment with it? In terms of expressivity, we shall see during the workshops that it is possible to construct troubling things in terms of realism.

These micro-worlds have no imposed structure. We can use data stemming from very different sources, quantitative or qualitative. Programming an agent can also be "literary" even if the vocabulary differs from that of a book. A programme is not only constituted of algorithms, it can also be in the form of a description of behaviours.

I looked for a very simple model about water, but I didn't find one. I preferred to opt for a segregation model. We take a very demarcated and simplified system and we interest ourselves in questions of social segregation. Segregation designates any evolving phenomenon or any state of separation of social groups on an infra-urban, urban, regional or national scale, eventually confirmed or favoured by law, socially legitimised, and which leads to the forming of segregated areas, heterogeneous territories and frontier spaces. The challenge that we often encounter in urban environments is to analyse the mechanisms at work in the forming of segregation. How and why does it appear when it is not imposed by law and does not result from any personal preference (according to survey results)?

Box 6 Schelling Model

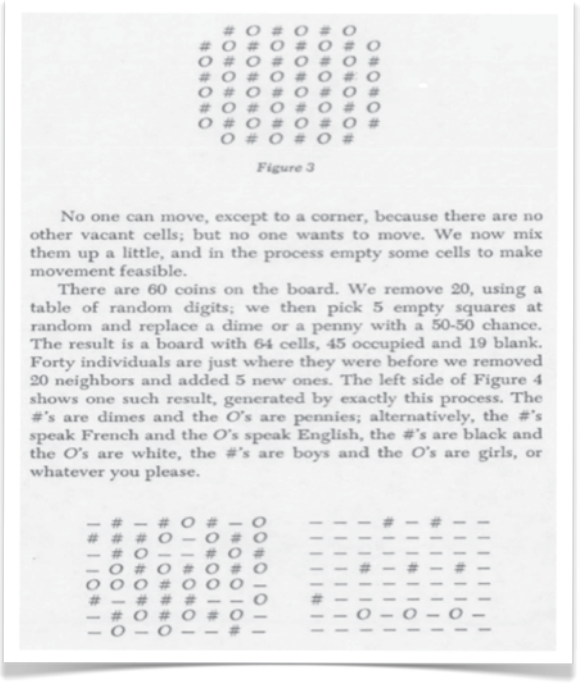


Figure 3

No one can move, except to a corner, because there are no other vacant cells; but no one wants to move. We now mix them up a little, and in the process empty some cells to make movement feasible.

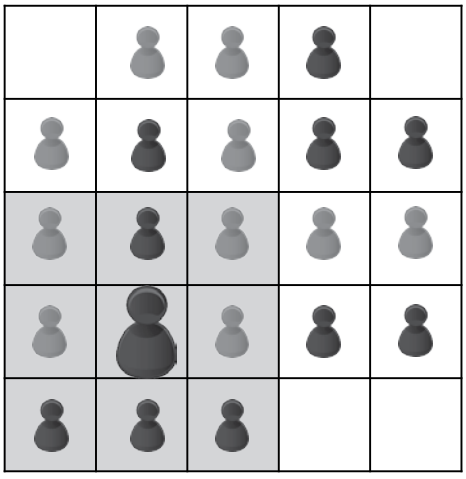
There are 60 coins on the board. We remove 20, using a table of random digits; we then pick 5 empty squares at random and replace a dime or a penny with a 50-50 chance. The result is a board with 64 cells, 45 occupied and 19 blank. Forty individuals are just where they were before we removed 20 neighbors and added 5 new ones. The left side of Figure 4 shows one such result, generated by exactly this process. The #'s are dimes and the O's are pennies; alternatively, the #'s speak French and the O's speak English, the #'s are black and the O's are white, the #'s are boys and the O's are girls, or whatever you please.

Sources: Schelling, T.C. (1969).

These questions are at the base of the Schelling model that was later used to construct more complex models. In 1969, Tom Schelling in his article Models of Segregation asked these two questions in the context of a black/white report in American suburbs. How was it that when individuals replied to questions in surveys stating that they had *"no problem living with 70% blacks although I am white, or with 70% whites although I am black"*, reality showed a case of almost 100% segregation.

What forces and dynamics are at work that can explain this situation? How can we reproduce this situation in order to eventually anticipate it in the framework of urban planning for example?

Diagram 15 Model Description



Sources: Authors' construction.

Tom Schelling had an extraordinary intuition: he took as his starting point the simplest of systems. Maximum simplification means avoiding taking into consideration the particularities of the city and the profiles and complex preferences of the individuals.

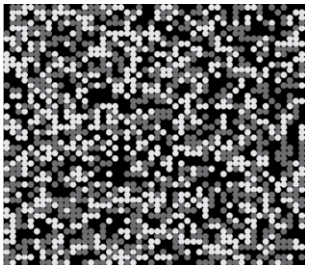
Agents of both colours live on a chequerboard. Independently of any other activity and of what they can do elsewhere, they are going to be happy or unhappy in this habitat according to an individual preference expressed by the number of neighbours of the same colour, or a different colour, that they wish to have around them. *A priori* everybody has the same preferences. For example, *"if the percentage of neighbours of the same colour is inferior to 30%, I will be rather unhappy; if this percentage is higher than 30%, whatever the percentage, I will be rather happy".* The model is childlike in its simplicity! This approach is prototypical of an agent-based one. You can see that the notion of population does not appear. Individuals are capable, locally in a particular environment, to spot particularities, pick up information, and they are to make a decision depending on this perception. The only thing global is constituted by environmental constraints. As far as behaviour is concerned, to avoid any bias in the model, the movement of agents when unhappy is totally random.

They randomly choose a square and go there. We have time advance; at each step in time, the agents will decide whether to move or not.

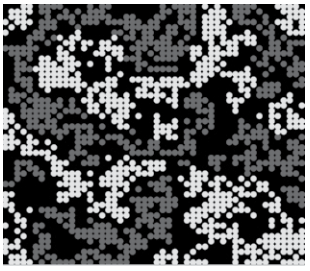
Diagram 16 Results of the Model

Initial situation
Grid : 50 x 50
1 200 agents
Individual preference: 35%

Segregation rate (∑similar neighbours/∑ neighbours) : 49.9%



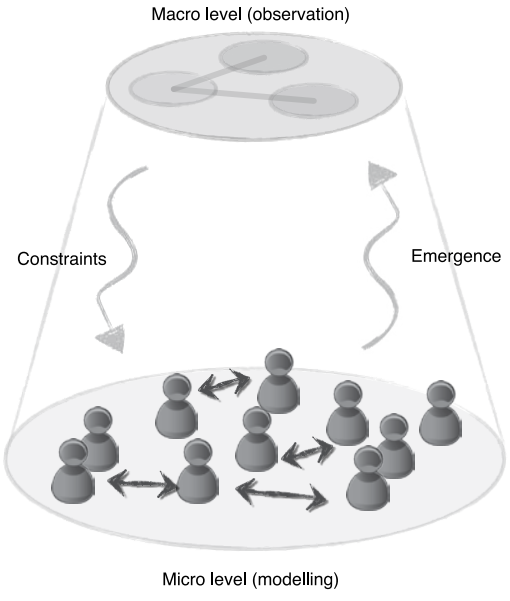
Final situation (equilibrium)
Segregation rate: 94%



Sources: Authors' construction.

All the simulations made on this model show that with rather weak individual preferences – such as accepting to live with only 35% of people of the same colour – we arrive at segregation rates of near to 100%. This is subsequently explained by almost physical phenomena. However we interpret the results, it is interesting to see that we have an example of what we seek to obtain: the emergence of properties and equilibriums, at a population or given group level, which are not inscribed in the agents which compose the population or the group. This state of equilibrium is not programmed, it is not given, and it is not an input of the model. It is simply the case that after a certain time and a certain number of iterations, the model reaches equilibrium. Experimentation and simulation are indispensable steps in order to be able to obtain such properties.

Diagram 17 Generative Aspect of Agent–based Models



Sources: Authors' construction.

These simple models take into account two scales: the micro scale (individual) and the macro (population) one. Of course, it is possible to take a lot more scales into account, for example meso scales in which other agents will be constituted, which will themselves have interactions. Agent-based approaches, or individual-centred approaches in biology, are based on a micro-level modelling and the simulation and interpretation operate on a macro level – whereas most analytical models are situated on the same scale.

The other advantage of this approach is that an agent can take on multiple forms: individuals, households, social groups, etc. In other domains, the avian flu virus, towns and even ducks can be agents. The level of analysis depends upon the question posed; it is neither static nor fixed.

Another advantage is the representation of this environment. Explicitly, we are going to require the agents to be situated, even in cases when this may appear a little artificial. The notion of environment is not really well specified. Scientific research related to agent-based models shows great diversity. We are going to use databases – geographic ones for example – to represent the environment of realist models. But you can also represent grids, environments without any particular metric or topology. An environment can also be a social graph, a social network in which agents are situated, which gives them a perception of their neighbourhood.

The Schelling model that we saw on a grid can be made spatially clear so as to take into account particular topologies. We have here two examples with data taken from Google

Maps™. The agents are going to use the colours of the map in order to know where to place themselves (roads, buildings, etc.). It is an example of an environment in which the agents use information.

Maps 9 and 10 Spatially Explicit Segregation, Example of Hà Nội

Sources: Authors' construction; Crooks, A. T. (2010).

Here, we go a little further by directly using a GIS. We have, in this case, a district of Hà Nội in which we make the agents act. Evidently the notions of neighbourhoods are no longer the same, we must redefine them, but the agents' behaviour does not change any more than their capacity to make decisions. What changes is their perception and their way of moving.

How can we describe an agent's behaviour?

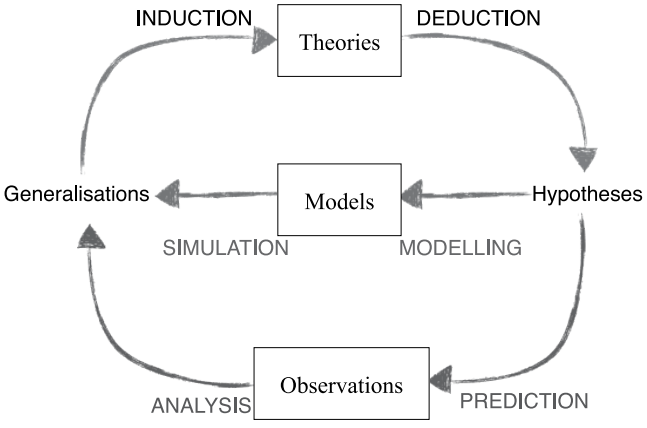
The principal metaphor of agent-based models came at the end of the 1980s from social sciences, and those that we are going to principally use to programme agents come from either ethology – science of animal behaviour – or psychology, which has had a sometimes incestuous

relationship with artificial intelligence over the last thirty years. Here, we have metaphor transfers. We can use neurone networks, rule-based systems. As computer scientists, we are used to this diversity of representation. We juggle between representations and metaphors. You can see here that, at the end of the day, the world I present with an agent-based model is a world that is a little more complex than the world of maths-based analytical systems in which the vocabulary is relatively finite and well defined.

You are going to invent a model of behaviour and a way of representing these behaviours; what is most important is that it makes sense for you and the others in the interpretation.

Once the virtual world has been constructed, a new world opens up in the domain of the interaction between the user of the model and the model. From here, we have access to things that belong to the domain of visualisation: we can play with the model, modify its parameters at any moment, have users intervene within it, and create learning dynamics, for example. The user is going to learn things from the model that will constitute a good part of the informal validation. Laboratories are created which allow us to scrutinise and dynamically modify these worlds.

Diagram 18 Social Sciences, Simulation, Agents



Sources: Authors' construction.

In social sciences, simulation offers the possibility of implementing controlled computational experimentations. Its objective is not to construct theories, but to generate, in a controlled manner, data that can then be analysed, which has the specificity of coming from experimentations and not from observations of the system.

In this system, agent-based models, because of their flexibility and versatility, already occupy an important place, which will no doubt become progressively more important.

This zoology of artificial experimentation on the models is a new way of carrying out research, particularly because it creates data that does not really belong to a system but to models of a system, then we will build theories from this data. Yesterday we spoke about climate change and scenarios that are often built on this type of model and data that do not stem from reality, but from projection and models of reality.

Agent-based models present multiple advantages for social sciences:

- Possibility of representing qualitative and quantitative data;
- No constraint on the type of formalisation;
- No constraint on the level of representation;
- Possibility of an experimental approach on micro-worlds;
- Possibility of participative approach (immersive micro-worlds);
- Possibility of representing heterogeneous players;
- Possibility of basing oneself on spatial data or real statistics (for calibration and experimental research).

When do we use agent-based models?

- When it is difficult to test hypotheses only from observations;
- When the players in a system are very heterogeneous;
- When it is possible to identify relationships or intermediary organisations that influence the dynamics of the system;
- When the level of analysis is not fixed and may fluctuate;
- When macro level changes must be the results and not the input of the model.

Benoit Gaudou

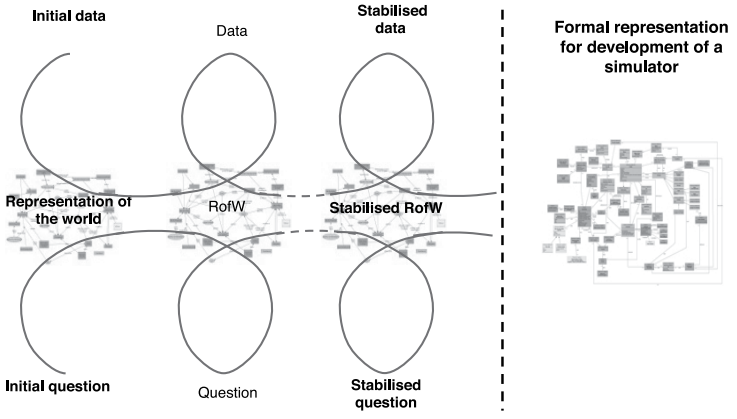
I am going to present the MAELIA project that is being carried out in Toulouse. This project began in 2009 and will finish in 2013. Consequently, the results are not yet definitive; we are still in a prospective phase.

The aim of the project is to develop an integrative modelling and agent-based platform to study the socio-environmental impacts of the norms (social and legal rules of the organisations) implicated in the management of renewable natural resources (particularly water). We are more precisely interested in the "Bassin Adour Garonne". One of the particularities of this zone is a lack of water, particularly in summer during the period of low water and of user conflicts – for example between irrigation for corn crops, swimming pools, or water for the city of Toulouse. The drop in the water level implies ecological problems and crises, particularly for farmers.

In the framework of low water management, there is a whole system of laws and norms implemented from the European to the local level. We are interested in the ecological, economic and social consequences of the implementation of these new policies. This involves three major initial issues:

- What are the economic, social and environmental impacts of the different alternatives of definition/management of the volumes of water to be used?
- What is the technical/social feasibility (acceptability) of the different alternatives?
- What is the robustness of the different options?

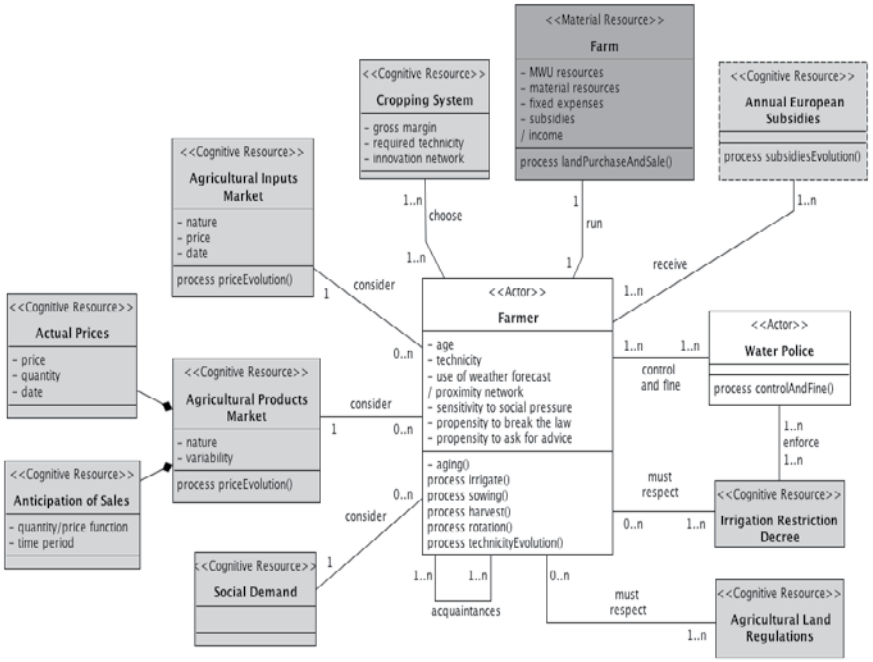
Diagram 19 MAELIA: An Interdisciplinary Modelling Project



RofW = Representation of the World.
Sources: Authors' construction; production of the MAELIA project (non-published).

The difficulty and interest of this project is to integrate – *versus* juxtapose – the knowledge of researchers from different subjects, particularly from social sciences, hydrology and agronomy. We had a certain amount of initial data around which we built and represented a "world" in order to implement it, run it and test several hypotheses. What I call "representation of the world" identifies a model of all the agents and their dynamics implicated in the system in which we are interested. At the launch of the project, sociologists, hydrologists, agronomists and computer modellers, etc. were involved in the project and the different discussions about it. The fact of establishing this representation allowed us to agree on the vocabulary. A certain number of iterations were necessary to arrive at a stabilised representation. It is important to note that these iterations represent a coevolution of the necessary knowledge and data, of the representation of the world and of the question to which it is hoped the model will provide answers.

Diagram 20 Principal Agents: The Farmers

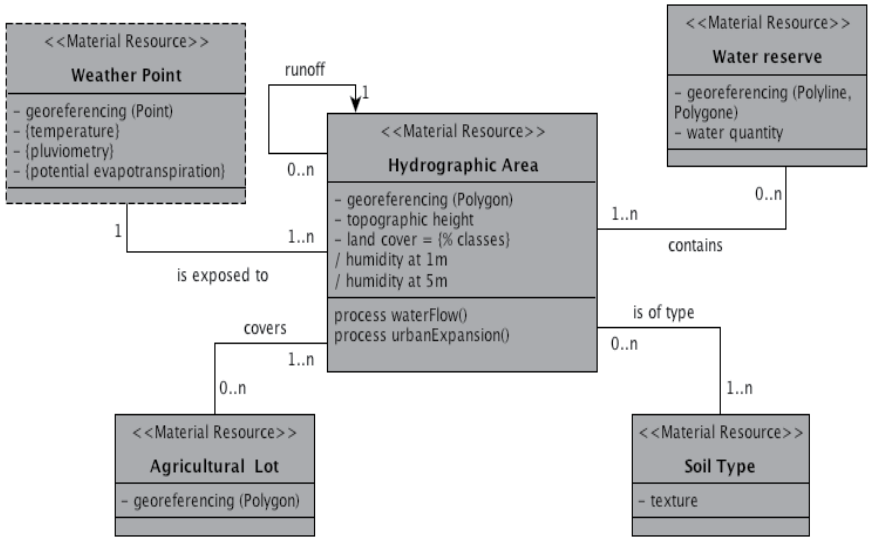


Sources: Authors' construction; production of the MAELIA project (non-published).

One of the principal players of the model is the "farmer" entity with a certain number of associated characteristics. The links between the farmer and the different related boxes represent the relationships between the farmer and other concepts that we wished to mobilise in the model (for example, the size of his farm or the agricultural product market).

The hydrological zone is a second example of an agent considered in our model. It is the principal entity of all the hydrological processes. The hydrological zone is situated at a superior level (in terms of spatial scale) to all that is agricultural. The type of soil is taken into account because, according to its nature, water evidently does not infiltrate it and flow in the same way. These two diagrams are a part of the static view of the model.

Diagram 21 Principal Agents: Hydrological Zones



Sources: Authors' construction; production of the MAELIA project (non-published).

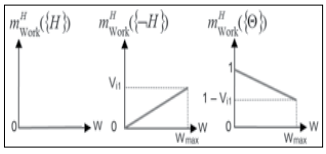
We have identified twenty or so dynamics that we wish to implement in our model. The five principal ones are:

- The flow of the water (hydrological zones);
- Plant growth (plots);
- Choice of crop rotation (farmers);
- Execution of crop rotation plans (sowing, fertilisation, irrigation, harvest, resulting from the farmers' choices);
- Formal framework (irrigation restriction decree issued by the prefect).

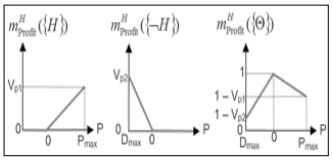
We worked with the *Institut National de Recherche Agronomique* (INRA), which had undertaken studies about farmers' strategies concerning crop rotation plans. Four principal criteria stood out: hours of labour, profit, similarity with the last crop rotation plan and loss risk.

Once these criteria had been identified, we became interested in the influence they have on the farmer's decision: for example, by considering the other identical criteria in two plans, the plan that minimises hours of labour will be preferred to the one requiring longer hours of labour. The chosen formalism to describe the decision-making process is that of the multi-criteria decision using Dempster-Shafer belief functions: for each of the criteria, an evaluation function relating to this criterion and three functions referred to as "belief functions" are associated. The first belief function describes the weight that this criterion has in the decision to consider the considered plan as being the best, the second belief function the weight to consider it as not being the best, and the last one indicates the farmer's inability to determine whether it is the best or not.

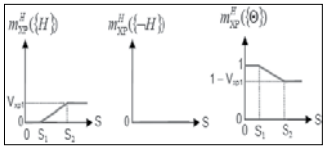
Diagram 22 Example of the Process: Choice of Crop Rotation



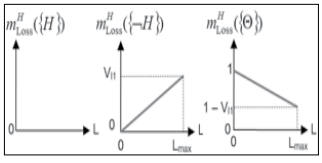
Criterion: Labour time



Criterion: Profit



Criterion:
Similarity with the last cropping plan



Criterion: Risk of losses

Weight of each criterion in the decision to consider plan H as not being the best and to not know if it is the best or not depending on the evaluation of the plan according to this criterion

Sources: Taillandier et al. *(2012).*

We have presented the static model that describes the different objects and their relationships and the different processes linked to the dynamic of the system. From these two elements we can implement a computer model. The following work stage considers the execution of this model and the observation of its results.

Most of the processes involved in this model are going to necessitate a certain number of data in order to be executed and produce interesting results. A big task, and one of the project's major products, has thus been the constitution of a database (and particularly of a GIS) adapted to our model. We have, for example, cross referenced data coming from diverse GIS, as well as beneficiary tables, in order to produce an aggregated GIS containing rivers and reservoirs, irrigated zones and the watering points associated with each zone.

We are now ready to execute our model (launch simulations) and evaluate a certain number of scenarios considering the indicators. The two scenarios that for the moment have been identified are linked to the two following factors of change: the definition of the volumes of water available and climate change (in terms of rainfall and temperature).

There are three types of indicator considered:

- Bio-physical: water flow at the control points of the Low-Water Target Flow *(Débit Objectif d'Etiage, DOE)*, pollution, production of irrigated crops;
- Economic: production of agricultural holdings; cost of the implementation/

functioning of the alternative management method;
- Social: frequency, date and gravity of crisis situations, acceptability (respect or non-respect of norms).

Thank you very much.

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ACE: Agent-based Computational Economics: http://www.econ.iastate.edu/tesfatsi/ace.htm

GisAgents: GIS and Agent-Based Modelling: http://www.gisagents.blogspot.com/

OpenABM: Open Agent-Based Modeling Consortium: http://www.openabm.org/

Three free agent-based modelling and simulation platforms:

NetLogo: http://ccl.northwestern.edu/netlogo/

Repast Simphony: http://repast.sourceforge.net/

GAMA: http://gama-platform.googlecode.com.

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Exchanges…

Claude de Miras

I didn't understand the assertion according to which the individual scale did not interfere in the final situation. I understood your presentation as being the contrary demonstration of the impact of implicit individual choices that, once collectively aggregated, produce the result you have described. You insisted on the scission in the passage between the individual and the global, as being a rupture, whereas the demonstration is founded, on the contrary, on the continuity of these two scales.

Catherine Baron

Which social sciences and which approaches are you evoking when you speak about the implantation of social science metaphors in

computer science? Would a change in your social sciences assumption have an impact, and if so, what?

How do you integrate the new work and research in economics into the rationality of the agents? Finally, in relation to MAELIA, how do you integrate the conflicts that often modify existing rules and result in the emergence of new ones? How does this modelling allow us to account for these aspects in a dynamic fashion?

Alexis Drogoul

In the results obtained at simulation level, there was something which was not intuitive: the individuals with a preference rate of only 35% for neighbours of the same colour finished by creating a system which was 100% segregated. The relationship between individual preference and the result obtained was not intuitive.

Claude de Miras

It is an assumption to affirm that it is not intuitive. Is there not an implicit understanding that means that in societal practice, we know that if we have one neighbour in three of such a colour, we are going to have a phenomenon, a perception and a representation of an exceeded limit? There is perhaps a societal intuition that determines this type of evolution. What bothers me is the affirmation of the assumption, that this is not intuitive. This needs demonstrating. Consequently, this raises the question of hypotheses, which has not been addressed. The hypotheses in the choices that allow us to go from the system to the model, determine what the model will produce; however no allusion has been made to this.

Alexis Drogoul

The construction of a model always necessitates hypotheses. They are everywhere, even if they are not necessarily explicit. I believe that in computational approaches we tend to spell them out better, and they are all the more necessary in computer science as they are part of operational constraints.

Regarding the social sciences metaphor, in the 1980s there was a very big influence from the individualist, actionist approaches, from the sociology of organisations. A certain number of representations of economic systems were perfectly attuned to the vision of the neo-liberal wave of the 1970s and 80s. We nevertheless have to qualify this, as the vision computer scientists have of social sciences is extremely blurred. Groups of researchers have built concepts that we later use by questioning and "twisting" them.

Let us take another example from computer science. The networks of neurones are particular representations that allow a computer system to learn from examples. This is called a network of neurones, but has got nothing to do with the biological metaphor of the original models that were themselves a simplification of reality. The metaphor allows us to construct the concept or the meta-concept, that is to say the element that will allow us to construct the concept of the model. We can then represent any theory of the social, since the scale is not fixed and we are interested in emergence phenomena, but not exclusively: in Benoit Gaudou's example, the institutional system in all its richness, and with a certain number of norms, is imposed on players in an absolutely non-emergent manner. Expressivity is not limited by the initial use of the metaphor.

How can we integrate the envisaged rationality in economy? Implicitly, the initial players belonged as much to artificial intelligence as they did to economy. A large part of the theory, concerning the rationality of agents in economy, stems from artificial intelligence. Then we moved away from this because we cannot assume the rationality of players, in the same way as we cannot assume the homogeneity of their representations. Rationality is not necessarily an assumption or an original hypothesis. If we begin, for example, to build systems that contain qualitative data of individual narratives about the way people perceive the world, this may not be rational. We can perfectly imagine a player who makes random decisions. The models that we are building are not models that we must believe. They are models that are used as a support for discussion or negotiation between players. Very few predictive models exist.

Benoit Gaudou

Let us return to conflicts. Our model only proposes a prefect who issues a decree forbidding irrigation when water levels drop beneath a certain threshold. All the prior negotiation processes between the different players about the quantity of water to be used are not modelled. We would have to be able to determine a process that generates decisions. The catchment area council is made up of about two hundred people who have to get together and discuss things, which necessitates a certain knowledge that we have not yet modelled.

Trainee

Is the model a decision-making aid that helps farmers choose the most economically viable crop?

Benoit Gaudou

For this model we need geographical data to know the location of the holdings, which are those that use irrigation and which don't, and the type of crop. We also have data about crops that have been grown on a plot over the last ten years. We implement our farmer agents and calibrate over this ten-year period. We try to find coherent results by using the preceding results. Next, after this calibration phase, we consider that we are going to let the model evolve. This model in particular will not predict what it is necessary to plant or harvest on the fields. It will, however, indicate what will happen if water supplies dwindle.

Jean-Pascal Torréton

Just a remark that goes in the sense of what Alexis is saying about the limits of simulations and their capacity to reproduce complex phenomena. In the domain of experimental sciences, I see simulations as the representation of an experimental system used to test hypotheses. In biology, in oceanography or in science of the environment, we are led to carry out experimentations that are extremely simplified and criticised for this: for example, when we wish to evaluate the influence of climate change on the way oceans function. Therefore, I cannot see any fundamental difference with the definition of an experimental system by simulation.

Catherine Baron

However, it seems to me that when we are studying human societies and the economic stakes linked to them, the questions we ask are of a different order.

Alexis Drogoul

Regarding the difference between a simulation in marine biology and a simulation in social sciences, a macro model that represents a population is not only interested in individuals. We ignore any heterogeneity of the population, any individual choice or decision. On the contrary, I see all the approaches I have presented here as attempts to bring to the fore the dignity of all points of view. Models simplify and reduce, but is that not the limit of all models?

1.7. Synthesis of Plenary Sessions

François Roubaud – IRD-DIAL

As is our custom, it is time for the half-time restitution of our work; an on-the-spot summary of the plenary sessions, one of the many aims of which is to put into perspective what we have heard, in order to shed some light on the coming week of workshops at Tam Đảo. Let me first thank the JTD organising team, particularly Stéphane Lagrée, who has given me the honour of making this short speech. It is an honour, yes, but also a challenge given the quality of my predecessors in this role. Ever since this tradition began in 2009, those chosen have been in order: Philippe Papin in 2009 speaking about poverty, Olivier Tessier in 2010, who spoke about the concept of transition, and finally my colleague Jean-Pierre Cling, to whom I send my regards as he is absent for the very first time since the creation of these Summer School Days, who spoke about social differentiation and inequalities (the official title) in 2011, but also about the underlying, more sensitive problem of discrimination.

The time has come for me to *throw myself in the water,* and in spite of the pressure, I remain optimistic about the outcome of this foretold shipwreck, under the famous scientific principle that has been time and again reaffirmed during the previous editions of JTD, according to which *"any object immersed in a liquid will eventually be pushed back up to the surface"*. I must confess that I was all the more worried to "have pulled out of the hat" this year's topic about "Water and Its Many Issues" as not only am I far from being a specialist in the subject, but I was also initially very sceptical about this theme which seemed to me to be too specific, not very attractive and, in my opinion at that time, lacking any real development issues. I must say that for me, who am above all a citizen of a developed country, water is nothing more than a liquid that flows out automatically when you turn the tap to drink, wash or water your plants.

Of course, I had heard about it as one of the Millennium Development Goals (MDGs), or again at the IRD, where more than a third of the laboratories are carrying out research into this question from one angle or another, as Jean-Pascal Torréton, representative of the IRD pointed out in his speech; but here it is above all "hard" science and only very marginally human and social sciences. Since then, a lot of water has flowed under the bridge and I've had to water down a few of my opinions.

First of all, and a bit by chance, I was asked by the AFD to study the feasibility of the

implementation of a statistical protocol assessment for the evaluation of a water adduction project in the peripheral neighbourhood of Kinshasha, capital of the Democratic Republic of Congo (DRC). I was much more interested in the scientific question of impact assessment, which as you know is in fashion at the moment and presents some frightening methodological challenges (experimentation, sample groups/ treatment groups, etc.). So, in June 2012, I went there on a mission and had a revelation.

The project in question consisted in drilling holes, installing pumps, and building cisterns and public water fountains to provide drinking water to impoverished populations who had been used to getting water from the river, deep in the countryside, far from their homes; in order to manage the system, water user associations – one of the most common schemes found in rural zones in developing countries, but a lot rarer in cities – had been created. I first of all remarked that the field of possible impact was extremely wide and diversified. Let me give four examples:

- Impact on maternal and infantile health, particularly through the reduction of diarrheal illnesses;
- Impact on violence towards women: indeed, when going far to get water at its source in the early morning or late at night, women and girls were often attacked;
- Impact on household economies and alternative activities: the many hours not spent going and queuing for water could allow the girls to go to school and the women to start working (probably in the informal sector);
- Finally, an impact on local governance and social cohesion in the neighbourhoods, through the structuring of inhabitants by water user associations around issues of general interest.

I even went a little further in my reflections and came to the conclusion (a hypothesis that needs testing) that in the context of a failing State, as is the case in the DRC – in the areas I'm talking about there is not only an absence of water, but an absence of public services, schools, basic health centres – the association of water users was the best means of triggering a process of general basic development that went well beyond a simple question of water. Indeed, I can think of no other object that everybody needs in everyday life, whatever their age. A school project will interest above all the parents of children of school age, a health centre, the ill, etc. Water, however, is life, not only from a physiological point of view, but also a social one. Once the associations are up and working for questions of water management, they can serve as a springboard for other activities: waste management, access to electricity, microcredit, social and recreational activities, etc.

I was already completely convinced of this when I arrived at the JTD, but after these two days of plenary sessions I am even more convinced. Let us have another look at what the participants have revealed to us. Let us begin with Olivier Tessier and his *dive into the deep waters* of eight centuries of hydrological developments in the Red River Delta. Beyond the superb illustrations which impressed us all very much, I see here the proof of the central role of water in the construction of the Vietnamese State, and thus the indisputable relevance of the theme for this country, and probably for the whole region. Water is not only an issue reserved for the desert zones of the Sahel, the Middle East or elsewhere.

Việt Nam was built around the mastering of water, here the Red River and its swellings. It was true during the imperial and colonial period, and tangible traces are still visible today. To understand the current economic success of Việt Nam, one most probably has to go and look at the foundations of that strong State – understood in the positive sense of a structured State, an endogenous State and not an imported one, as it has manifested itself in other regions of the world; and not in the sense of a repressive State – forged around this question of water mastery, accompanied by this accompanying body of civil servants, the "celestial bureaucracy", which Etienne Balazs[12] referred to when talking about China and which Marx had used for one of his foundations in his "Asiatic Production Model".[13]

What's more, I made the reflection, using my modest linguistic talents, that in Vietnamese the word "nước" not only means "water", but also "country" or "State", which seems to confirm the importance of this element in this country. Tiến, one of the faithful JTD interpreters, someone who is very cultivated and with whom I spoke during the break, confirmed to me that this link to water went much further than that: *It is an intimate part of the Vietnamese soul, and of the language and culture of every one of its citizens.*

Jean-Philippe Fontenelle's presentation is directly linked to Olivier Tessier's as it speaks about the same thing – the Red River Delta – but moves forward in time to the post-colonial period, and focuses more directly on one of water's multiple uses: agricultural management. I shall single out two salient points in his presentation.

First, the complexity of the institutions, of the players and the social interaction associated with water management. Even when the collectivisation period is excluded – which incidentally appears to me to be superficially treated in a uniformly bland, black and negative way, and which deserves to be treated in a way that goes beyond the typical stereotypes in order to give it all the subtlety granted to later periods – the following period and the one that brings us up to today show us to what extent the multiplication of decision-making bodies, both at national and local level, renders obsolete the traditional bipolar division of the State-Market debate. How this Russian doll of decision-making bodies (polder, district, commune, village, farmers) succeeds in coordinating itself, up to what point the central State intervenes before delegating responsibility, is a key question to be answered if we wish to understand the alchemy (more or less successful) of the system's functioning. It also clearly shows that the technical constraints, which must have been his initial angle of approach as an agronomist, are embedded in a social environment, which finally fashions and conditions the parameters that will decide whether the final outcome, here irrigation, is a success or a failure.

The second point, which appears essential to me, concerns the research questions Jean-Philippe Fontenelle raised in his conclusion. If they are probably partly due to the fact that his research dates back a few years, which

[12] Balazs, E. (1968), La bureaucratie céleste. Recherche sur l'économie et la société de la Chine traditionnelle, Editions Gallimard, Library of Human Sciences, Paris.
[13] See for example, Marx, K. and F. Engels (1853), Trois lettres à propos du mode de production asiatique [Letters presented and commented by Bert J.-F.ERT], La Phocide, 2010.

might appear to be a weakness, they can on the contrary be considered an asset in the JTD framework. Is it not the very aim of this summer school to present new research perspectives to the younger generations, that is to say those present here today? In the presentation by Jean-Philippe I can see in certain areas as many doctoral subjects as the issues he raised, and I only hope some of them will be taken up.

For the sake of balance, the organisers also gave us a glimpse of the South, anticipating the question raised by Alexis Drogoul, with Nguyễn Manh Hung's presentation of the development of the Greater Mekong and the potential conflicts it might cause. Here too, for the sake of balance and concision, I shall single out two salient points.

While the two preceding presentations made us familiar with the subtle and sometimes violent games played between the central government and local powers, the Mekong issues are on a completely different scale, that is to say they have a regional dimension. It is only on this scale that a whole load of questions linked to water – energetic, with dams, fishing, water supply for man and agriculture, etc. – can be addressed. With six neighbouring countries, the strategic and geopolitical stakes, in short "high politics" in the community of nations, are entering on the scene. We fully understand here that the power stakes surrounding the river, both upstream and downstream, one superpower (China) and five "small" Southeast Asian countries, begin to have a real meaning. Even though the abundance of the resource seems until now to have limited the conflicts, the metaphor of a balance, which weighs heavier on one side than on the other where all five countries are together, escapes nobody.

Secondly, Nguyễn Manh Hung was the first to offer us a sea voyage and it was no pleasure cruise. Global warming is most probably going to have a devastating impact on the Mekong Delta. A few figures have been put forward: 30% to 50% of the area will disappear under water; several million people will be displaced, and this will become tens of millions on a regional scale. We were reminded that Việt Nam will be, along with Bangladesh and a few other countries, one of the five most affected countries in the world. Therefore water, even when in plentiful supply, is a threat and a combat. Here again, there is a mirror effect with Olivier Tessier's presentation. There is nothing new here. The fight against natural catastrophes and the taming of nature has been a constant theme in the region, the big difference now being the intensity and nature of the threat: this time man is wholly responsible for the threat – nature thus plays no part at all. Debates have for the most part been about forecasts. The sea level will rise how many metres, and by when: 2050, 2100? What are the underlying hypotheses? Can they be believed? What might their implications be and what action can be taken to prevent them? The very question of method that lies at the heart of the founding project of the JTD. The "facts" are never facts.

Olivier Tessier had to delve into the archives to count one by one the floods, famines and rebellions. Jean-Philippe Fontenelle had to establish an inventory to deconstruct the official web of polders. Catherine Baron voiced her doubts about official figures on the evolution of the MDGs: What is meant by "drinking water", "disinfected sources", a questioning that is also valid for urbanisation (how can we define a city)? Finally, Alexis

Drogoul alerted us about the necessity of breaking down the hypotheses behind the figures and the margins of uncertainty. They have convinced us that there is no purely technical solution to development, but that it is above all a question of man-nature or man-climate interactions.

The AFD film, which was shown about the reconstruction of a polder in Cambodia, and especially the commentaries by José Tissier and Jean-Philippe Fontenelle, magnificently illustrated this subject. One key conclusion seems to emerge from the screening and our debate: that of the question of time, and the fundamental gap between the time of the project – short, a few years – and that of social change, which is counted in decades. Finally and paradoxically, the absence of any prior technical feasibility study, even though it may have delayed work, is perhaps the reason behind the project's success, as it allowed them to give time for the consolidation of the CPU in order to tackle head on the management of the totality of works undertaken by the project, a condition which was paramount for the balance of the system.

With Jean-Pierre Beurier's presentation, *World Maritime Issues,* we not only *really set sail,* but once again we changed scale, going from Nguyễn Manh Hung's sub-regional level to a scale that is truly global. From this rapid overview of the history of maritime law, from its birth at the end of the Second World War, and of its principal contemporary challenges, I shall again single out two salient features.

On the one hand, the issue of potential conflicts on the Mekong became a real threat with tensions rising to breaking point in certain areas – skirmishes and the beginnings of armed conflict – and that international law did its best to defuse; but this was accomplished with only limited efficiency, given the lack of supranational coercion power at its disposal.

On the other hand, what clearly appears in Jean-Pierre Beurier's presentation is the intrinsic interaction between "hard" science, and economic and political stakes. I was impressed to see that two of our legal experts had to try their hand at geology and mathematics in order to calculate the official limit of economic exclusive zones and the continental shelf. Finally, this sally apart, Jean-Pierre clearly stated that international law is still lagging behind: it is always necessary for crises to appear for it to react. He concluded on a pessimistic note by speaking about the demise of the merchant navy, because of the pressure of international finance and cupidity. However, his message is also one of hope when he says things are progressing. Whatever the case, and from the point of view of the JTD, this intrusion into the domain of "hard" science (climatology, genetics, marine fishery and prospective science) continues with, for the first time, the participation of a team of computer scientists from the world of mathematics, both in the plenary sessions and in the workshops. Just one more thing about Jean-Pierre Beurier's presentation, what seems to me to be lacking perhaps, is the more active implication of social sciences in this maritime equation, as for example sociology and political sciences, to understand better the huge hiatus between the *de jure* (what the law says) and the *de facto* (the way in which it is applied, depending on the power relationships at work).

After these incursions into inland waters and then maritime ones, Catherine Baron

and Claude de Miras addressed another big issue, that of urban waters, and then more specifically peri-urban waters. They shared the task in a rather classical manner: Catherine expressed the demand, and then Claude proposed the offer. Of course, I feel very close to their subject, as I mentioned while on the subject of my recent experience in the field in Kinshasa.

What struck me about their introduction to the workshop is the idea of turning upside down the classical approach – first there was the technical issue, and then, optionally, that of governance – by postulating that governance, the social management of water, must be apprised first of all, against the backdrop of the following principle: *"describe or forge the social contract around water, and I will tell you what technical solution may emerge"*. I will go a step further by suggesting that their paradigm shift is double: that from what I have just spoken about, but also from the point of view of research, it is through questions linked to peri-urbanisation and not to the established city that new problematics, and perhaps even a theoretical reappraisal, will emerge.

Finally, I'd like to remark that the African experience – the north for Claude and Sub-Saharan for Catherine – will be, as it has been proved during the preceding editions of the JTD, a great asset for the workshops to propose a comparative study of the situations in the region.

Alexis Drogoul and his team are undoubtedly the American stars of these JTD! What they so brilliantly demonstrated appears to be in some way the miraculous solution to the complex questions we have been asking. Thanks to his agent-based models, stemming from his artificial intelligence research and cellular automata, he and his team seem capable of taking into account all the concepts we have put forward. We have spoken about "dealing with the complexities" and here we believe that we can do so by continually pushing back frontiers, thanks to the power of computing and our powers of conceptualisation. Furthermore, and this is a very attractive idea, we can really deal with these questions together, thematicians and computer scientists. We have attached much importance *to the role of the players* and here precisely we can model an infinite number of agents of all types, by attributing to them more or less complex behaviours, evolving with time, with possible learning mechanisms, and we can do this at different levels of analysis (micro, meso, macro).

What more could we wish for? We get that heady sensation that anything is possible, that we can solve all our problems. This is what you will undertake next week in Workshop Four. An exciting prospect! For me, it is evidently progress, but at the same time, I'm worried about the mad hopes it might inspire. We should avoid this, as we have just demonstrated that science is not the answer to everything, and that governance and social interaction are at least as important as science. We could thus get stuck in the same rut by believing that technique (here computer science, after engineering) is going to solve all our problems: a return in some ways to scientism. Nonetheless, I think Alexis Drogoul was very clear. He claims that the models have two uses: prediction (for which it is best known), but also (and for me, perhaps especially) feeding and stimulating scientific debate. We do not think about this often enough, and yet it is the central

role of simulations, which implies discussing the hypotheses while sitting around a table, which is what we are about to do in Tam Đảo. The issue of water is well adapted to this exercise.

Here we are at the end of this overview, the pertinence and the suitability of the theme of water to the JTD scientific project seems today to have been perfectly demonstrated. More broadly, these plenary sessions and the workshops, which are visible on the horizon, reinforce the idea that these JTD about water fulfil the founding mission to which they have been assigned. They fall under the seal of a methodological approach; in order to manage the complexity of development, only a diversity of approaches to research will enable us to respond:

- Through multidisciplinarity: agronomists, economists, historians, political scientists, anthropologists, legal experts, geographers, and even this year computer scientists and modellers. In this domain the JTD always goes a little further, as we are progressively witnessing a blending of genres. The plenary sessions and the workshops are not only the juxtaposition of mono-disciplinary sessions, but different points of view cross paths within them: legal experts and economists (workshop 1); anthropologists, historians and economists (workshop 3), to mention but a few;
- Through the mobilisation of different types of development player and research: titular researchers from principal research institutions (universities, IRD, CNRS, etc.), researchers from the world of NGOs (this year GRET) or even donors (AFD). In this regard, I should like to congratulate the AFD for its significant participation, not only in financing the JTD, but also for its implication through the mobilising of its experts and its products (the film shown to us this year follows others which were shown during previous JTD editions), and for doing this without straying from the basis of scientific deontology principles – guaranteeing the independence of research. This is something rare enough to deserve mention;
- Through the multiplication of scales of analysis: micro-social and local, national, regional and global.

In a world where the division of labour and specialisation is becoming more and more sophisticated, beyond the initial excitement, in particular in the world of research, we are clearly rowing against the current. However, it also seems to me that, thanks to its five years of success, the JTD serves as an important example and will continue to do so.

In this second to last edition of the contract between the JTD partner institutions, it is now necessary to look to its future, its continuation and institutionalisation. I think I am right in saying that a reflection in this sense has already been initiated, and I shall add that the "Pépinière doctoral" project that is currently being set up and about which Olivier Garro, the director of the AUF for the Asia-Pacific region, spoke during his opening speech, is a project that goes in this direction, as the JTD have been asked to play a pivotal role in this regional project.

In conclusion (almost), though we are quick to say a whole range of things about structures and institutions, at the heart of these lie individuals. Yes, it's men and women who count! On this point, without a shadow of a doubt, Stéphane Lagrée and Bui Thu Trang, who are the lynchpins, the masterminds

behind the JTD. Let us not be scared of saying it: without them these JTD would be *taking in water* and *would probably sink to the bottom*. A round of applause is called for.

Here we are, it is now time to prepare to *set sail for* Tam Đảo. You are going to separate into four groups that stem directly from the plenary sessions. The latter have allowed you to become familiar with the issues, and the methods to respond to these questions will be developed there. From this point of view, nothing is yet decided. Water can constitute a threat. Let me remind you that in classical mythology, it was a river, the Styx, which led to the gates of Hell. Water can also be a blessing: do we not bathe in happiness in Heaven? Between these two paths, it is man who will make the difference, that is to say you starting next week!

Conférences & Séminaires

Part 2
Workshops

2.1. Sea, Risks and Governance

Jean-Pierre Beurier – Honorary professor, University of Nantes,
Pierre Cariou – Euromed Management, Marseilles Business School,
Patrice Guillotreau – University of Nantes,
Yves Perraudeau – University of Nantes

Multiple human activities are increasingly dependent on the sea (fishing, aquaculture, transport and trade, marine energies, etc.) and man-environment activities must be better understood in order to envisage governance that both attenuates the risks run and renders activities more sustainable. This workshop sets out to analyse the legal and economic issues of the exploitation of resources and maritime space by seeking indicators of sustainable development, real life situations and the analysis grids of some maritime activities (bio-economic models, competitive analysis, effects approach, contingent valuation, etc.).

In the case of the management of fisheries and aquaculture, basic notions of bio-economic modelling are introduced and completed by the search for indicators of the sustainable management of resources. Aspects of international trade and framework policies for the exchange of ocean produce are also discussed. In the case of maritime transport, a game simulating competition in the network of regular sea routes, with groups composed of student teams, allows us to better understand stakeholders' strategies and particularly the implementation of strategic alliances in this sector. In the case of the study of the marine environment, the Driver-Pressure-State-Impact-Response (DPSIR) model serves as a framework for the analysis of man-nature interactions and contexts of environmental change; this model is applied to several cases of local ecosystems by the trainees. Indirect methods of evaluation of non-market environmental goods are proposed. The uses of the sea are analysed with regards to the multiplying effects engendered by local economies.

(Transcript)

Day 1, Morning of Monday 16th July

Introduction of trainers and trainees (see trainers' biographies, list of trainees inserted at the end of the chapter); explanations by Yves Perraudeau of Saturday's feedback objectives.

[Patrice Guillotreau]

From the introductions and expectations of everyone here I have singled out three thematic inputs: coastal populations – means of subsistence, coastal activities, fishing; climate change and sustainable development; issues of conflict and regulation.

Talking about risk means addressing both natural risks – such as climate change – and man-made risks that may be linked to tensions that have not yet boiled over in a domain of competition related to the use of a resource for example.

From a governance point of view, we are going to look at institutional and regulatory issues. How can we create institutions that are adapted to dealing with natural and man-made problematics including climate change?

2.1.1. Sustainable Management of Fish Resources

[Yves Perraudeau]

Fishing and aquaculture correspond to two different types of behaviour and economy. In the first case, we traditionally talk about the gathering economy, which refers back to the traditional activity in which man took what he found. In this type of behaviour nothing is anticipated, as man, like a hunter when he sets out, does not know what he is going find and take away.

With aquaculture we find ourselves in a different production logic of rearing animals; behaviours are then traditionally those of producers and enterprise managers. We are first going to restrict ourselves to fishing, and we shall return to aquaculture tomorrow.

Yves Perraudeau succinctly describes the different fishing gear used in France – the trawl, drift netters, seine net fishing, trap fishing, lines and pulleys, dragging –, criteria of size and number of days per year they are allowed to take to the sea. By referring to the case of Europe, the distinction between four types of fishing is highlighted: small-scale fishing – carried out along the coast for period generally shorter than one day; coastal fishing – three days at sea; off coast fishing – between fifteen and three weeks at sea; deep-sea fishing – boats longer than forty metres.
Finally, several types of fishing economy are identified, notably according to the statute of the head of enterprise: owner, non-owner, aboard, not aboard. The objective here is to differentiate artisanal fishing – boats of less than twenty-five metres in length, owner aboard – from semi-industrial and industrial fishing for which bigger boats are used, more than twenty-five metres, and on which the owner is not aboard.

Can you, using these few criteria, characterise fishing in your country or region?

[Patrice Guillotreau]

We must also take into account the criteria of engine size, which are often the criteria used to measure fishing capacity, or again organisational criteria, such as the duration of tides.

Are you aware of the existing classifications in national fishing systems? What would be the relevant criteria to subdivide the different categories of activity?

Huỳnh Thị Bích Phụng

To my knowledge, in Việt Nam, the local population identifies two types of classification: industrial and artisanal fishing, where fishermen use simple, rudimentary tools, such as large baskets.

Phạm Tuấn Anh

Artisanal fishing occupies a large place in Việt Nam. Industrial fishing makes use of medium-sized boats and less than one month is spent at sea. Could you specify for us the weight of the French maritime industry in the economy?

[Yves Perraudeau]

Fishing is of minimal weight in the French economy. Most of the French fishing sector is artisanal; industrial fishing concerns very few vessels and its economic weight is very light. One exception is tuna fishing carried out in the Indian and Atlantic oceans, off the coasts of Africa.

If we consider France, or Europe, its contribution remains below 1% of the Gross National Product (GNP). Notable regional differences may exist. Industrial fishing represents few boats and few jobs, but produces 20% to 25% of fishing volume. There is also, of course, the impact of valuation, the value of the catch: in value, industrial fishing produce is clearly less valuable than fish caught by artisanal boats (10% to 15%).

Phạm Trương Hương Giang

Artisanal fishing has long been a tradition in Việt Nam, firmly anchored in the lives of coastal populations. This activity is progressing slowly.

Võ Hữu Hòa

In countries where the fishing economy is developed, industrial fishing is in the hands of big enterprises, and the produce caught will serve the transformation industry. In Việt Nam this is not the case. Enterprises are family ones. However there are cooperatives that support this system.

For offshore fishing, the criterion of classification is engine power: less than 90hp, equal to or more than 100hp, and a maximum of 430 or 450hp.

[Yves Perraudeau]

Here we shall suppose that boats of less than 100hp are artisanal.

[Patrice Guillotreau]

Are there any polyvalent fishermen, that is to say fisherman who also have other jobs?

Furthermore, do they fish one or several different species? We must bear in mind that it is possible to classify fishing activities according to modes of human organisation.

Huỳnh Thị Bích Phụng

In the coastal city of Nha Trang, in the centre of Việt Nam, fishermen only carry out this one

activity; they do not specialise in catching one type of fish.

[Yves Perraudeau]

Do fishermen benefit from State aid for the construction of their boats, in industrial or artisanal fishing? Is there any direct aid from the public powers, be it the State or territorial communities?

Nguyễn Xuân Lâm

Banks offer loans at special rates with long reimbursement periods, aimed at industrial fishing in the high seas. But this system came up against the difficulty of reimbursements. Grants account for between 30% and 35% of the sector's GNP.

[Patrice Guillotreau]

This figure also corresponds to fishing subsidation rates throughout the world.

Lê Thị Hằng Giang

We can also mention a decision by the Prime Minister in 2004 concerning grants for poor households, where fishermen are explicitly referred to. This decision granted aid to fishermen for the purchase or building of a vessel – vessels whose engines are bigger than 90hp. The grant amounted to VND 70M per vessel, per year – that is to say about EUR 2 500.

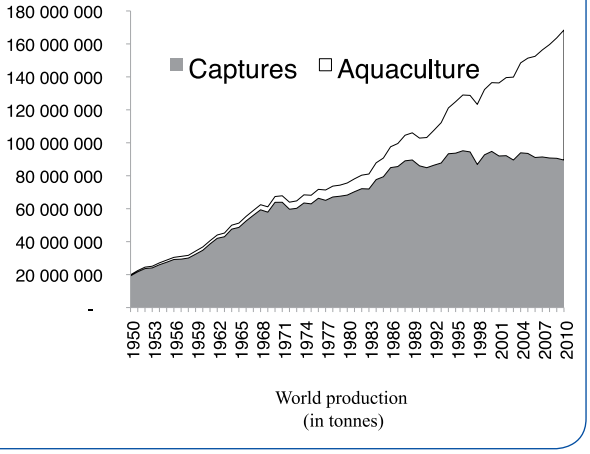
[Yves Perraudeau]

Let us take a look together at the main trends surrounding categories of fishing by using international data.

Figure 7 Sustainable Development of Fishing Resources (1950-2010)

Share in the world supply of aquatic products

	Fishing	Aquaculture
1950	97%	3%
1960	95%	5%
1970	95%	5%
1980	90%	10%
1990	84%	16%
2000	69%	31%
2010	53%	47%



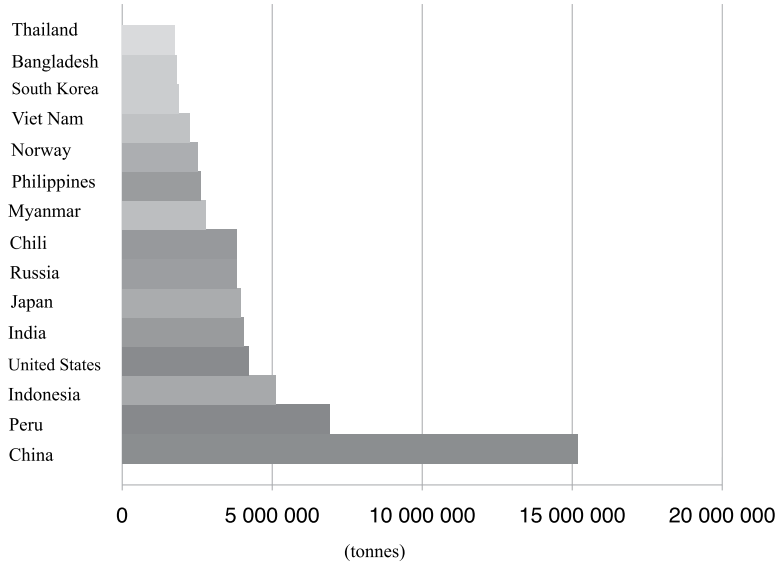
Source: Food and Agriculture Organization (FAO).

Many fishing zones came out of a period of biological rest following the Second World War as many countries resumed fishing activities. Catch increase dates back to 1980-1990s – around 85 to 90 million tonnes – after which it began to stagnate. On the other hand, aquaculture, which was totally inexistent after the war, began to progress in the 1970s, especially from the 1990s when aquaculture helps explain the continuation of catch-farming production growth. We can of course see this progress when we look at the respective shares of fishing-aquaculture in 1950 and today, in 2010.

[Patrice Guillotreau]

When we refer to worldwide consumption, we quote an annual consumption of around 17 kg per inhabitant.

Figure 8 Principal Fishing Countries in 2009



Source: FAO.

[Yves Perraudeau]

Which countries have the biggest fishing fleets?

Of course, China is one of these, but we also find many countries situated on the Pacific Rim, particularly Asian countries.

Table 5 Catch by Species Group in 1950 and 2009

	1950		2009	
	Tonnes	%	Tonnes	%
Cephalopods	580 535	3	3 458 410	4
Shellfish	713 345	4	5 878 202	7
Demersal fish	5 819 219	**31**	18 814 507	**21**
Diadromous fish	2 455 543	13	10 812 293	12
Other fish	1 345 048	7	9 906 876	11
Molluscs	844 048	5	3 101 860	4
Pelagic fish	6 923 065	**37**	36 541 118	**41**
TOTAL	18 680 803	100	88 513 266	100

Source: FAO.

Demersal (deep-sea) fish live at the bottom of the sea; pelagic fish are found at mid-depth, relatively close to the surface. The diadromous species makes up the third group. The latter lives both in salt and fresh water – and includes salmon, eels and certain types of shrimp.

A decrease in the weight of the demersal catch is currently being observed, while pelagic fish – such as the anchovy or sardine – are the biggest catch. This points to a phenomenon of overfishing of demersal fish.

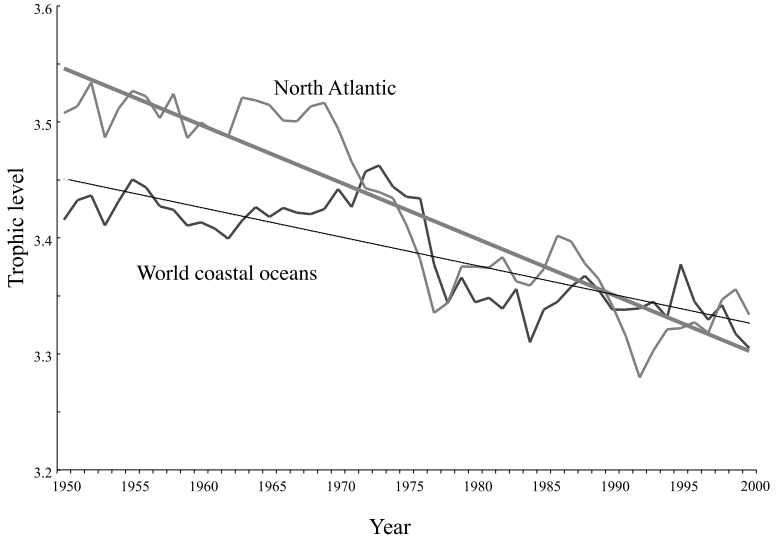
[Patrice Guillotreau]

Generally, demersal fish are predators of the pelagic species, which are considered to be forage fish. Here we can observe a relative decline of the demersal species, and a relative rise in the pelagic species.

The expression of the alimentary chain, or of the trophic one, would show the bigger predators down to phytoplankton, passing by forage fish and species of zooplankton that serve as food to these forage fish, and which themselves feed on phytoplankton.

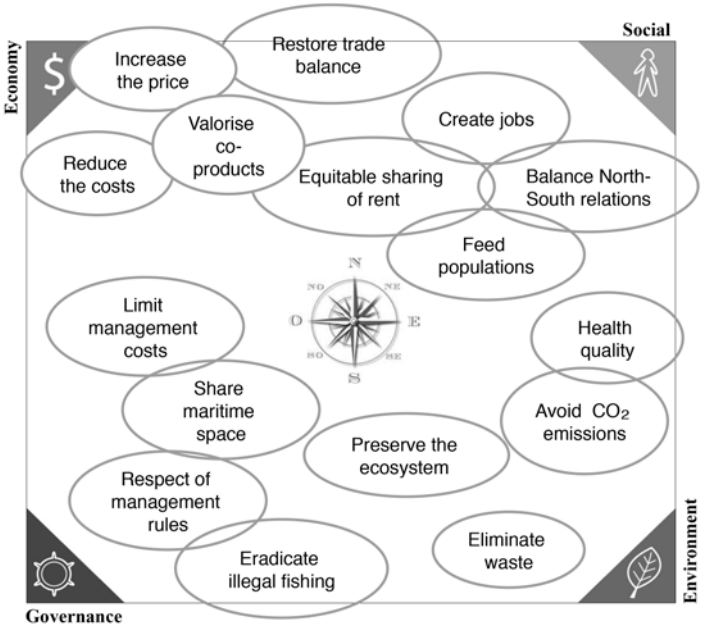
The work of Daniel Pauly and his colleagues has demonstrated deeper and deeper fishing in the trophic chain (Pauly *et al.*, 1998). Generally superior fish have a higher value and are the priority target of fishermen. We can then observe a trickle down effect the length of the food chain as fishing becomes more intensive. Today, this dynamic leads us to consider the eco-system rather than the management of fish stocks species by species. The average fall in the trophic index is estimated to be between 5% and 10% every ten years.

Figure 9 Analysis of the Trophic Level: World Catches are Being Carried Out Deeper and Deeper in the Trophic Chains



Source: Pauly et al. *(1998).*

Diagram 23 Fishing and Sustainable Development



Source: Author's construction.

What constitutes sustainable fishing? What indicators can be defined to measure the sustainability of fishing?

We can refer to the three traditional pillars of sustainable development: the economy, the environment and society, and integrate questions of governance. As far as sustainable development is concerned, objectives can be centred on a rise in living standards: price increases to allow fishermen to earn higher salaries, cost-margins, valuation of co-products and the commercial threshold for exporting countries such as Việt Nam or Thailand for example. In the social domain, we shall examine the distribution of profits – that is to say the surplus created by the fishing sector, the creation of jobs, subsistence problems when fishing is a food source, balance in North-South relations, etc. The environmental dimension may have as an objective the preservation of the eco-system, the maintaining of the state of the resource, but also the monitoring of the health quality of produce or the control of carbon dioxide emissions emanating from sea vessels. In order to reduce the tensions linked to these objectives, aspects of governance are crucial: rules for the access of populations to resources, sharing of maritime space between different users, management of running costs at various levels (community, national), eradication of unreported and unregulated fishing.

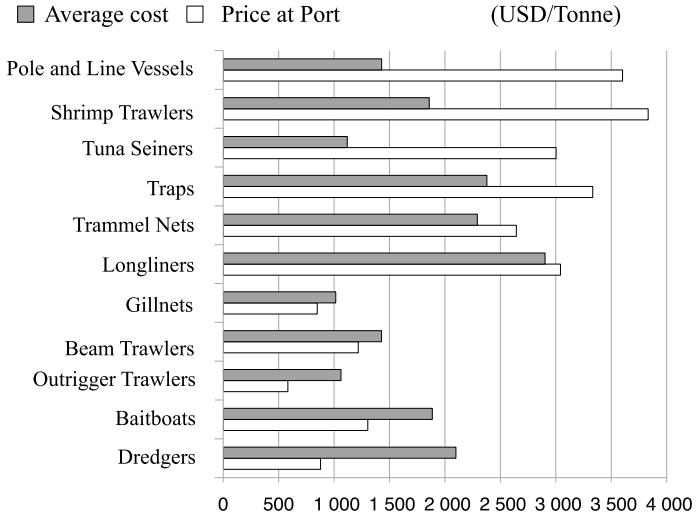
The aim of this day for us is to reflect together on the indicators that correspond to the different dimensions of the sustainable development of fishing.

[Yves Perraudeau]

Price is also an indicator of sustainable development. In terms of income, it is satisfactory on the economic level and interesting on the social one.

If high prices are interesting on an economic and social level, they can also lead to the intensification of the catch, and because of this, have a negative effect on a biological level for example. Until the beginning of the 2000s, the price index for caught fish was inferior to that of aquaculture, then the gap between the two price indexes narrowed. The fall in price of farmed produce created difficulties for fish farming in Europe – which explains the difficulties of maintaining fish farming in Europe.

Figure 10 Price-Cost Margin by Fishing Method in the World



Source: Lam et al. *(2011).*

Wide gaps can be observed between certain activities. Landed costs greatly exceed the average cost, and for other activities the opposite is true. This sometimes necessitates intervention, a sort of compensation. Whatever the system, tuna fishing appears to be particularly profitable.

Table 6 Table / Indicators "Sustainable Fishing" in France (2009)

Flottilla (nb of boatsO)	diesel/kg fish (litres)	jobs/ 1000 t fished	Eco result/t fish (€)	Catches (t)
Crab boats 10-12 m (58)	**0.21**	21	240	8 429
Dredgers 10-12 m (79)	**0.39**	23	260	11 240
Pelagic trawlers 18-24 m (33)	**0.78**	15	90	**12 952**
Netters 18-24 m (42)	0.94	**47**	480	6 221
Bait bats 10-12 m (47)	1.04	**56**	**1 010**	2 078
Demersal trawlers 10-12 m (157)	1.13	**41**	**540**	9 079
Demersal trawlers 18-24 m (203)	1.27	20	330	**51 179**
Demersal trawlers 12-18 m (192)	1.61	30	**570**	**19 242**

Source: Réseau d'informations comptables et économiques sur la pêche (RICEP), using data from the Data Collection Framework (DCF), the Direction des pêches maritimes (DPMA) and the Centre de gestion de la pêche artisanale (CGPA).

[Patrice Guillotreau]

You have a first indicator that shows the average energy consumption per kilo of landed fish. The less energy consuming specialties will be better positioned than others. This indicator is interesting because it allows us compare the price of a litre of diesel with a kilo of fish; this indicator gives us information about profitability and greenhouse gas emissions caused by fishing. The number of jobs per thousand tons of catch reveals another reality, another performance level, this time relative to the social level of sustainable development. Another reading of the activity is again given by the economic result per tonne of landed fish. The last indicator concerns food safety issues, which is an essential point when it concerns the sustainable development of a society dependent on fish proteins.

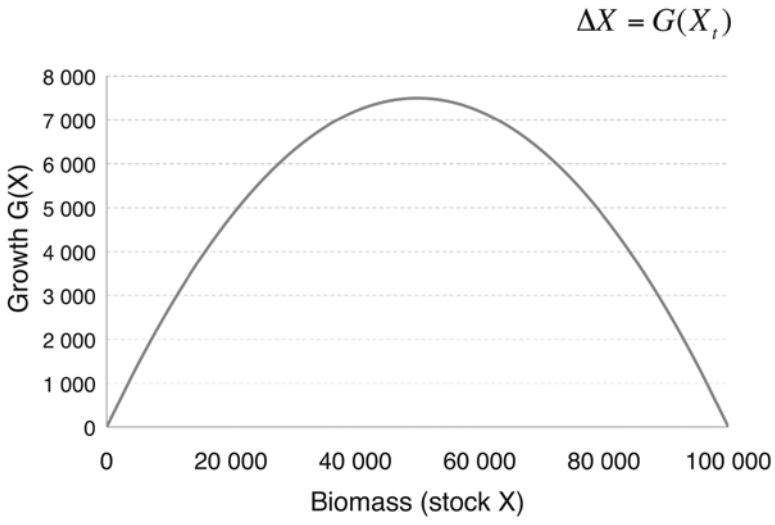
Let us note that the least virtuous fishing gear on an environmental level will best cater for needs in food.

We are going to ask you to fill in the grid of indicators, by subdividing the workshop in groups according to the three main pillars of sustainable development and aspects of governance. To help you to do this, you have articles that have already been handed out (*c.f.* articles quoted in reading texts). Part of the data is accessible for everyone on the FAO site by downloading the *FishstatPlus software programme*.

Patrice Guillotreau introduces the software programme to the workshop.

Let us pursue our aim by using what is perhaps a more conceptual approach and taking a look at fishing theory. The evolution of stock in a virgin area can be simply represented, stock can be seen as an invasive species colonising a new environment that will develop before reaching maximum capacity in its milieu.

Figure 11 Growth According to Stock



Source: Schaefer (1954).

Growth depending on stock is represented as a mathematical function, to which can be given several forms and which is represented by "*ΔX*" – "X" being the biomass, the stock of fish. Two clearly marked points identify zero growth: when the population stock is exhausted and is no longer capable of reproducing; when the global growth of the stock, which can be measured in tonnes of biomass, is also zero – the maximum possible volume of a species has been reached, like the growth of vegetation on an island for example, which has no more space to spread. The biological objective consists in reaching the maximum growth rate of the stock, which corresponds to half the maximum possible stock volume: this point is referred to as *Maximum Sustainable Yield (MSY)*, and will represent a target decided at the Earth Summit in Johannesburg in 2002, where an MSY for 2015 was anticipated.

Box 7 Evolution of the Population with Catches

Let H_t be the level of catch, $G(X_t)$ the fonction of growth and X_t the population level at the moment t:

$$X_{t+1} = X_t + G(X_t) - H_t$$

Growth of stock with catches:

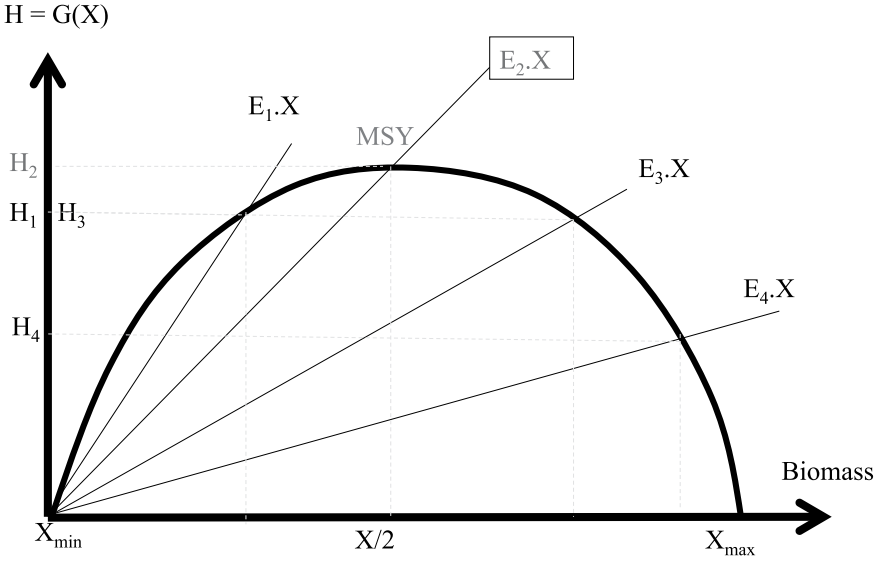
$$X_{t+1} - X_t = G(X_t) - H_t$$

Desired balance (sustainable):

$$X_{t+1} - X_t = 0 <=> G(X_t) = H_t$$

To maintain the stability of a stock, that is to say constant from one year to the next, a per period catch level may thus be targeted (H_t) that equalises stock growth [G (X_t)] at each period.

Figure 12 Relation Catch (H) / Fishing Effort (E)

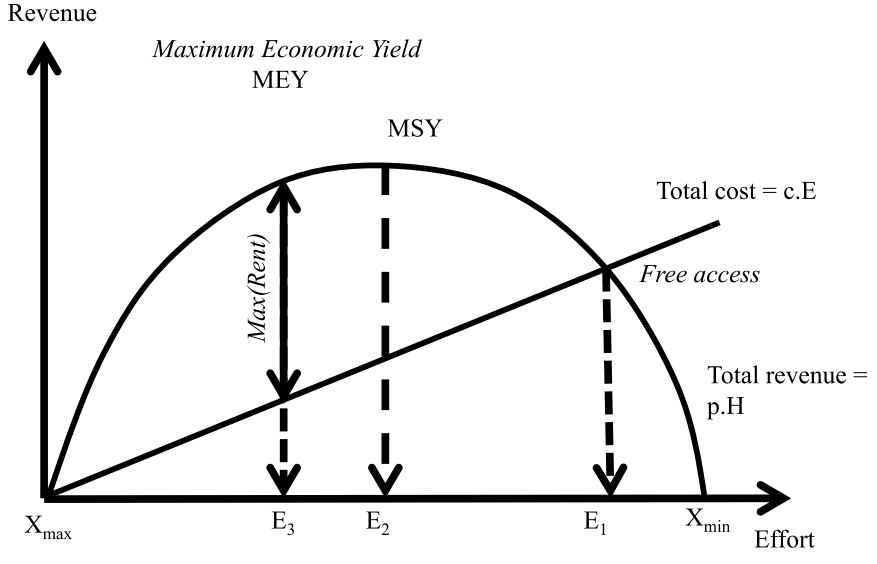


Source: Author's construction.

Here the curve is represented with the maximum and minimum levels of stock. We apply different levels of effort to the stock itself: the greater the level of effort, the steeper the line X will be. If we make this level of catch coincide with the notion of growth, we shall obtain the level of sustainable catch. On all the points on the curve, the catch level will be sustainable. However, two different levels of effort may correspond to the same level of catch, with consequences on the biomass that will be different – E1, level of high consequence, E3, less consequent level, etc.

In E1, the effort level is high and the biomass level is near to its minimum, that is to say the biological extinction threshold. And then, on the right of the graph (in E_2), with a higher catch level but with perceptibly less effort, the stock level is higher. If effort is further reduced (in E_3), we can observe that we find ourselves at slightly inferior catch levels, but these will be achieved with much superior biomass levels. Effort may be measured in different ways: number of days at sea, number of boats, etc. There is thus a given level of effort such that the MSY level will be reached; this theoretical level corresponds to maximum capacity divided by two. There we have the management target set by most major international conventions: an above all biological target to once again maximise the amount of the resource that can be caught, while allowing its permanent renewal over a theoretically indefinite period.

Figure 13 What Target(s) for Sustainable Fishing?



Source: Author's construction.

Let us move on to the economic sphere to compare the catch level (vertical axis) in relation to fishing effort. The further to the right of the graph we are, the more we are looking at depleted levels of stock. At zero effort, we find a maximum biomass in the water. To enter into the economic sphere, let us multiply some physical data: tonnage of fish by a price. Let us introduce the cost of the effort. I know the cost, for example, of a day at sea fishing, or of a boat, or thousands of hooks. I will now be able to consider this cost proportional to effort with a line that will represent the total cost of fishing. By doing this, we determine an economic target: maximising the difference between the revenue that can be earned from fishing and the total cost, to fix a maximum economic yield. What is interesting is that the effort level is lower than that of the MSY, and thus with levels of stock higher than necessary for biological balance. This balance is only possible if access to resources is regulated – if we had just one owner for example, it would be the only target they would seek to achieve. In the absence of regulated access, the profit incentive is going to encourage others to enter the fishery, which will, progressively dissipate profitability. The whole tragedy of common goods is represented here: profit is individual but the cost is social; it is shared by all the members of the community.

There are three possible targets: ecological, in which case a level of effort at point E2 is recommended, the MSY is targeted; economic, here we are at the point E3, as long as we can regulate and limit access; social, if this time the target to be achieved is the maximisation of the number of jobs in fishing, here we are at the point E1 allowing everyone to enter the industry, hoping that we will not approach stock extinction.

Lê Thị Hằng Giang

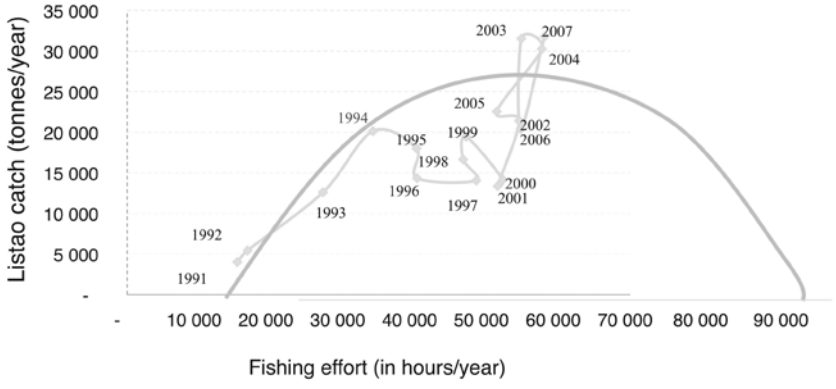
Why doesn't E1 represent a higher target?

[Patrice Guillotreau]

Because that would be anti-economic: rent would be entirely dissipated. We could thus produce more using less of both human and natural capital. The fishermen would not be encouraged to enter the fishery. We can go as far as rent depletion, and not necessarily as far as stock extinction, except if fishing is subsidised, greatly reducing operation costs (*see* 1st Graph next page).

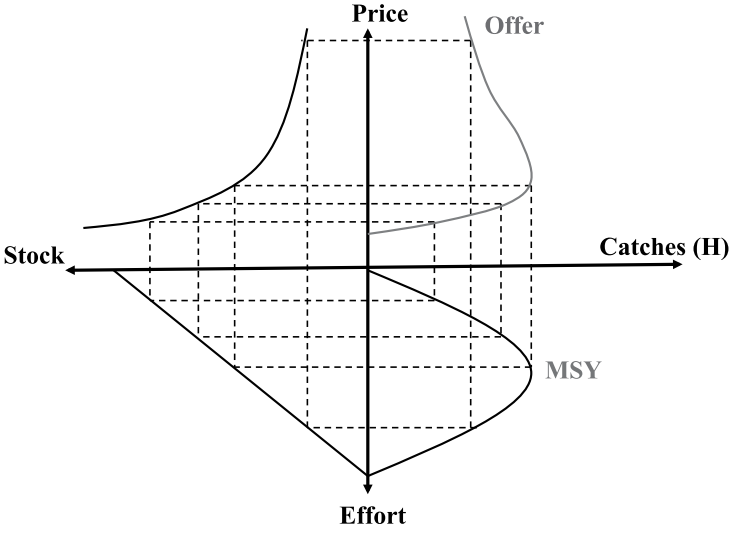
If we represent a *listao* tuna catch level in tonnes fished per year and compare it to the fishing effort measured in fishing hours per year, we obtain a curve that allows us to situate the intensity of effort in relation to available stock. An abundance indicator would consist in dividing catch level by unit effort – catch per unit effort. This can provide an approximate estimate of the available biomass. Catch level will depend on effort, on stock, but the parameter of the catchability coefficient makes the situation more complex. Biologists often distinguish nominal effort, that we can measure using the number of hooks, boats, baskets, fishing time, etc. and effective effort (F) that corresponds to this nominal effort multiplied by a fishing power coefficient. We can thus have the illusion of maintaining catch per unit effort simply because fishing gear is becoming more and more efficient. For example, electronics onboard vessels allow us to detect fish wherever they are; this is going to increase fishing power using the same nominal fishing effort level (*see* 2nd Graph next page).

Figure 14 Estimation of the Relation Catch-Effort in the *Listao* Fishery by European Seine Fishermen (Atlantic Ocean)



Source: Author's construction according to data from the Tuna Observatory – Centre IRD, Sète (France).

Figure 15 Free Access Offer Curve

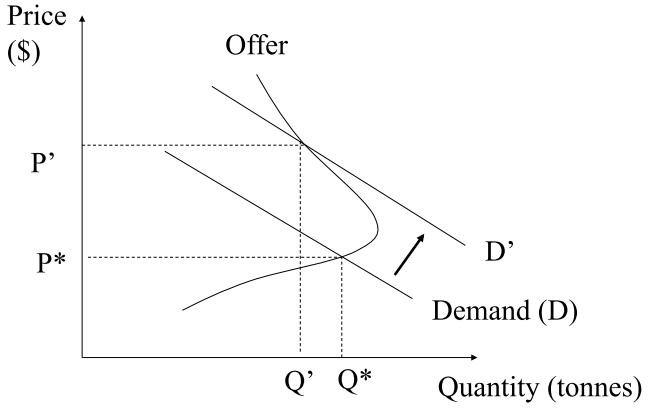


Source: Copes (1970).

Economists reason using a price/quantity diagram to consider the supply and demand balance. Here you can see the catch/effort diagram. The relation between stock and effort will have a negative aspect: the higher the effort, the more depleted the stock. There is also negative relation between price and stock: the more abundant the stock and production cost, the lower the price. From these three diagrams an offer curve can be constructed that is very special in fishing theory. Generally in economy, offer curves are constantly positive. The higher the price, the bigger the quantities offered will also be.

The problem of unregulated free access is that you can incite fishermen to enter the fishery in greater numbers, constantly improve their fishing effort, and go beyond the MSY level for example, where the offer curve will begin to return: the price will continue to rise, but the quantities beyond this point cannot physically increase and will even decrease because there are too many and an excessive fishing effort.

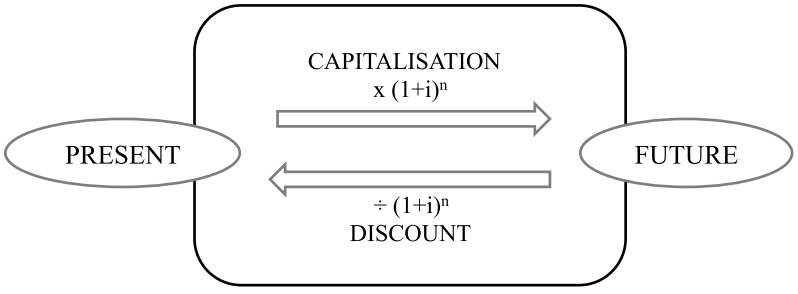
Figure 16 Free Access Offer Curve and Market Balance



Source: Author's construction.

When consumer demand increases – because the price of meat has gone up or consumer incomes have risen – the demand curve moves towards the right and the risk of a market balance beyond the MSY increases.

Diagram 24 Dynamic Management: The Update Principle



Discount a future value (amount or periodic flux) = opposite operation of capitalisation (interest rate)

What is \$10 000 in 5 years?

Example 1: if V_0 = \$10 000, i = 6% then V_5 = 10 000 x 1.06^5 = \$13 382

Example 2: if V_5 = \$10 000, i = 6% then V_0 = 10 000 ÷ 1.06^5 = \$7 473

Source: Author's construction.

We have remained in a static balance; let us now introduce an updated principle. Dynamic management is also linked to the interest rate, which serves to reveal sustainable development in so much as it shows a more or less large current preference – and thus a more or less big concern for the future of natural resources. The principle is to ask what value should be given today to the fishing revenues of future generations. From a selfish standpoint, it could be considered that this is of a totally zero value. In a sustainable development approach, we consider, on the contrary, that future values have as much value as present ones. In a first approximation, we can consider the discount rate as equivalent to the interest rate. Let us take an example. If I ask one of you to lend me \$100, and I say that I'll give it you back at the next JTD, you are going to say: "Why not?" Naturally, I'll give you back a bit more than this amount: I remunerate the sacrifice that you are making by renouncing this \$100 today. What will be the price of this sacrifice? If you are rich, it won't cost you much, you will accept that next year I'll pay back \$5 more. On the other hand, if this sum of money is important to you now, you are perhaps going to ask me to give back \$20, \$30 or \$50 more next year. This interest rate represents your preference for the present compared with the future value. The more you attach a preference to the present, the more you refer to a high interest rate.

[Yves Perraudeau]

Customer risk, credibility, as well as the currency of the loan, evidently have an influence on this rate.

[Patrice Guillotreau]

Getting back to the fishing issue, we need to be able to compare sums at different periods

of time; the easiest way to compare them is to set them in the present. For example, for a banker who lends $10 000, what will $10 000 represent for him in five years' time? You simply have to multiply this sum by the interest rate at a power equal to the number of years. If the interest rate is 6%, $10 000 will be the equivalent of $13 382 in five years. When a future value is represented, things are done in the exact reverse order. Instead of multiplying, you are going to divide by this same value. What will $10 000 of fishing revenues be worth that I am going to earn in five years' time still using a 6% discount rate? The answer is $7 473 today. Depending on the discount level, a high rate reveals a degree of impatience and a preference for the present; the nearer the rate is to 10%, 20%, 25%, the lower the current value of the sum that will be collected in five years' time.

Phạm Tuấn Anh

Could you specify the bases according to which the sum collected in five years' time will only represent $7 000 in today's money?

[Patrice Guillotreau]

There is a pure preference for the present, which incites you to buy a computer today, even though you can buy one cheaper in six months' time; you need one today and you are going to buy it right now. There is also a riches effect: we may suppose that you will be richer in five years than you are today, as well as the fact that in five years a dollar will have less relative value than it does today.

Box 8 Optimal Management Dynamic: The Golden Rule

The solution for the dynamic exploitation of a stock of fish takes the form:

$$G'(X) = i \quad \text{with } H = G(X)$$

This equation is referred to as the "basic equation of natural resources" or the golden rule:

- If $G'(X) < i$, then depletion of resources

- With a high discount rate i, if $G'(X) = i$, at a level inferior to X_{lim} then extinction

The golden rule in optimal stock management in this dynamic is to equalise marginal stock production with the discount rate, this means comparing natural resource yields with capital yields. What will the natural resource produce tomorrow if I leave the capital to the sea, that is to say allow the resource to reproduce and multiply in the sea? I am going to compare this marginal yield of natural capital with what I could earn in capital markets. If this stock productivity is below the interest rate or discount rate, this means that it is in my interest to deplete stock now and place my money in a bank where it will earn me more. Certain stocks in the world have low productivity because fish growth is slow – longevity is sometimes 150 years and sexual maturity arrives after 30 years.

[Yves Perraudeau]

Commercial species in deep water, such as the scabbard and emperor fish, are almost in this situation.

[Patrice Guillotreau]

We can thus imagine situations where the golden rule is respected. But if the discount rate is extremely high, then we can find ourselves at exploitation levels that are too close to the biomass limit and correspond to extinction thresholds.

Let us now take a look at the issue of governance.

What institutional solutions have been identified?

Let us consider that effort – that is to say fish mortality – is the principal factor of pressure and species depletion. We are going to try and eliminate all these levels of effort higher than the maximum level "E" for example. A regulation policy by effort is going to allow us to attain the MSY. The problem is that this effort is nominal, that it does not take into account technical progress and fishing power that may increase this effort. An effort "F", such as fishing power, catchability and nominal effort is difficult to control: the number of boats is limited, but if they become too individually efficient, the curve shifts and the question is not resolved; the level of effort is going to be insufficient to address the problem of overcapacity. The other solution is to fix the total amount of total allowable catch (TAC), and forbid boats from catching more than this maximum authorised level. Thus two solutions appear: an effort control policy or a policy of quantity produced. Through which institutions can we attain this target?

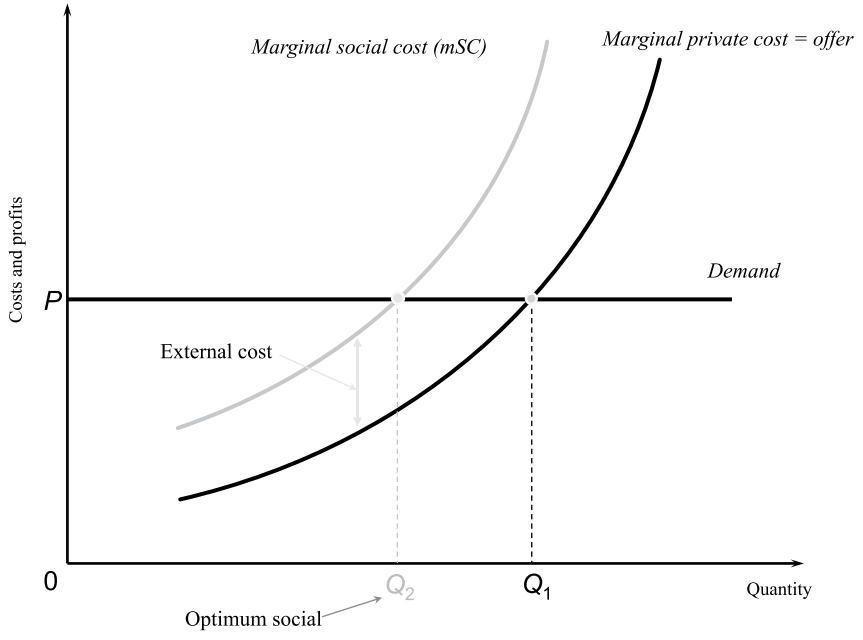
We are now addressing issues of regulation, governance, and institutions that will allow us to resolve this problem of free access. It is a general problem in economy that concerns many more environmental matters than just fishing. Economists are used to opposing two institutions to regulate the problem of externalities – externalities are the impacts made by certain activities on other activities, without offering any compensation for the damage incurred.

Example: one industry that pollutes a river upstream and another downstream that suffers the effects of this pollution. In economy it is said that private cost does not correspond to social cost, and that this difference may be corrected by State intervention and the imposition of a tax on polluting activities to incite them to reduce this activity or force them to reduce pollution levels. We can also imagine subsidising activities that have positive effects on the environment – typically, a forestry activity resulting in carbon dioxide capture. Another solution consists in organising meetings between the polluters and the polluted in order to strike a bargain and foresee compensation for the polluted activity – this is what Ronald Coase, a Nobel Prize winner in economics who considers that the profit from one activity corresponds to the damage inflicted on another, proposes. The cost of exercising a right always corresponds to the loss suffered by someone else subsequent to the exercise of this right. The challenge is to find the person with whom to negotiate, to inform him, to establish a programme and to verify that the latter is respected.

Fishing is a special case: the beneficiaries and those who suffer the externalities are the fishermen themselves; the externalities

take place within the same community. That which is fished by one, cannot be fished by the other. Individuals thus meet on a market of individual property rights where the most efficient are going to buy the rights to produce from the least efficient, who will receive compensation in counterpart. It is thus possible to equalise all the profits of fishermen belonging to the same community.

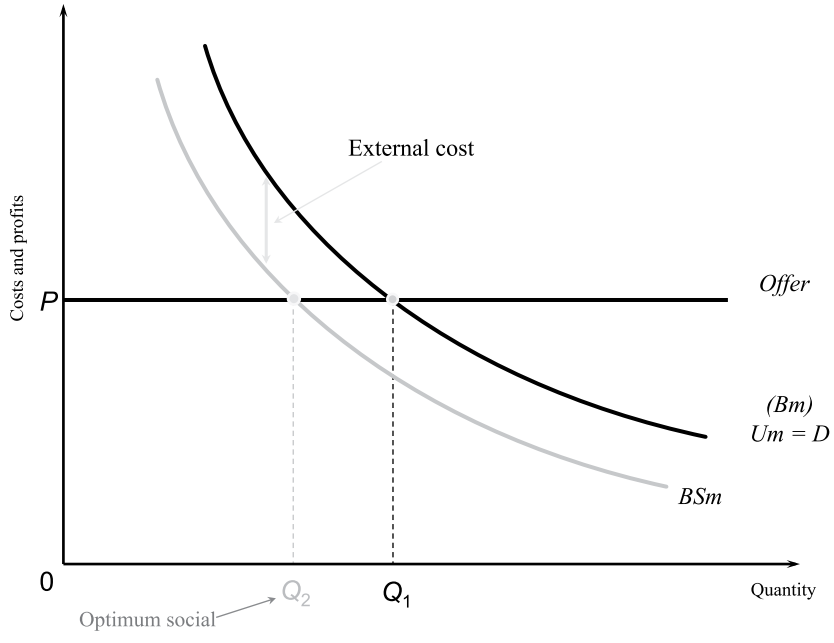
Figure 17 External Cost of a Polluting Production



P: Production
Source: Author's construction.

Above you have a private supply curve that corresponds to the equalisation with a demand curve. The level of output at equilibrium intervenes in Q1. But the private cost (CmP) is lower than the social cost (CmS), as it does not include all the social costs engendered by the output activity (for example, pollution costs for society). The external cost must thus be internalised, included, either by a tax – solution proposed by the State – or by bargaining. The target is to bring output to a lower level in order to eliminate a part of the negative external effects. It is on this condition that we can obtain perfect equality between the private cost and the social cost, a new optimum corresponding to the social optimum.

Figure 18 External Cost of a Consumption



Bm = Bénéfice marginal privé *(private marginal profit); BSm* = Bénéfice marginal social *(social marginal profit); Um* = Utilité marginale privée *(Private marginal utility).*
Source: Sloman (2009).

This time, it is the profit extracted from a private consumption that exceeds the marginal social benefit (BSm; that is to say the benefit of the last consumed unit), as for example the egotistical pleasure of a smoker engenders damage not only damage to his health (and society will have to pay the cost), but also to the health of others. At the intersection, the marginal profit that corresponds to the interest we are going to get from consumption, for example, is going to be equal to the marginal social cost at a consumption level that will be too high (in Q1). It is necessary to be able to reduce this consumption level by a taxation policy, for example, in order to have the marginal social cost coincide with the marginal social profit.

In the same way, we can determine the optimal levels of pollution emissions. It is not necessarily interesting to eliminate all pollution, as the marginal cost of the action may be high (*e.g.* eliminating new traces of oil pollution on a beach when cleaning work is already well advanced). There thus exists a tolerable pollution level that corresponds to market equilibrium, to the equalisation of the social marginal cost and social marginal profit gained from the depollution.

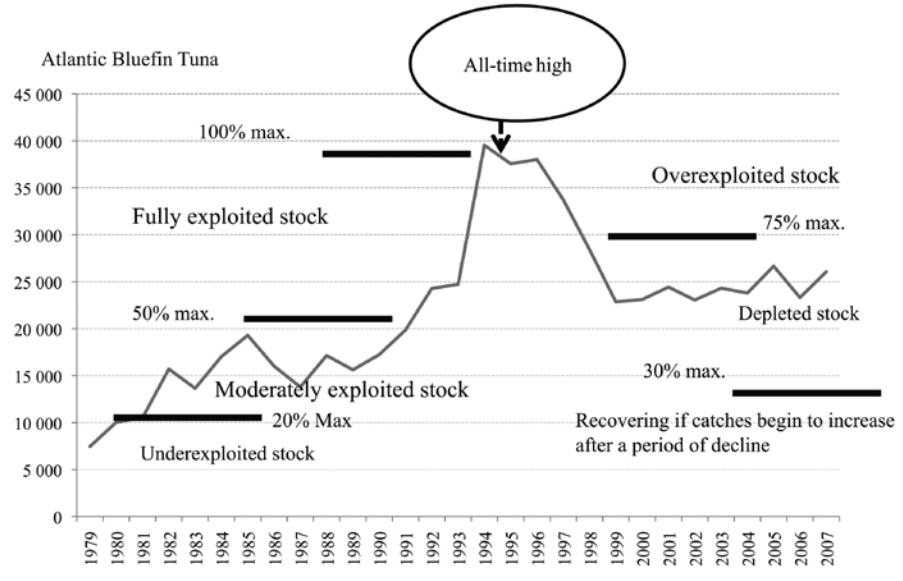
Let us return to the case of fishing. Two extremely different problems appear:

- The common good: in order to avoid rent dissipation, a maximum level of output is fixed;
- Rent maximisation (minimising costs) – a theoretical solution proposed by economists in the example of the carbon market, but also exchangeable individual rights for fishing.

  Between these two institutional solutions, "all State" or "all market", there is a continuum of "common ownership" solutions. These solutions have been studied by Elinor Ostrom, a Nobel Prize winner in economics in 2009 (Ostrom, 2009) who envisages three levels of intervention in the appropriation of common natural resources:
  - Level of constitutional choice: fix the legal framework – owner State, international organisation;
  - Level of collective choice: definition by user associations, producers' organisations, rules of access to resources – power transfer, delegation, concessions: management rights (modes of access, improvement of environment), exclusion rights (right of access, transfer conditions), right of alienation (to sell or concede one or two preceding rights);
  - Operational level: access and extraction by users (referred to as "appropriators" by Ostrom).

Let us examine how these rules work out in fishing management committees, and the means implemented to achieve these targets.

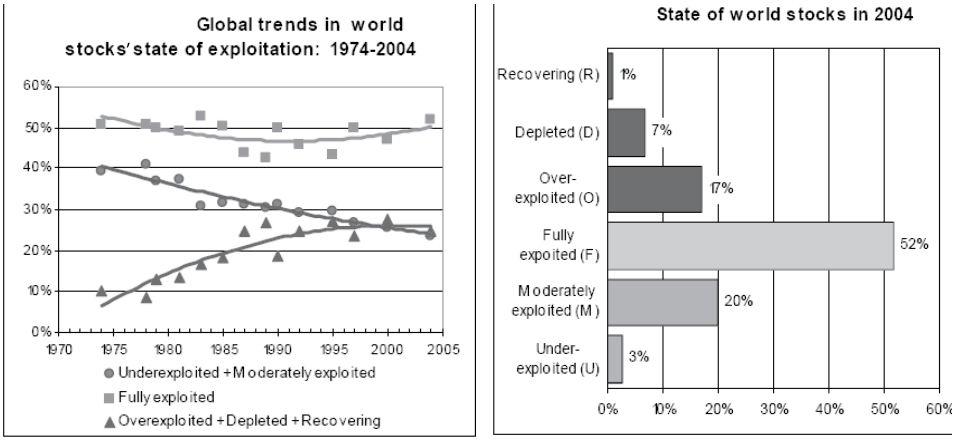
Figure 19 State of Stock in Practice



Source: FAO (2005).

The FAO has a classification of the exploitation level of stock from fully exploited or stock depleted – or recovering after a strong decline – passing by overexploited, or newly exploited stock (even underexploited). In this precise case we have the example of Atlantic bluefin tuna. Depending on the catch percentage in relation to the historic maximum, we can consider whether stocks are more or less exploited. We can see that since the beginning of the 2000s, the figures lead us to believe that bluefin tuna stock is becoming extinct and is in need of regulatory measures. Remember the target from the Earth Summit in Johannesburg in 2002 – *c.f.* fishing stocks at MSY in 2015, and note the gap in 2005: 75% of stocks are declared fully exploited, overexploited, exhausted or recovering from depletion; only 23% of stocks are moderately exploited or underexploited. This classification concerned a sample group of 500 stocks.

Figure 20 MSY Target in 2015



Source: FAO (2005).

One reason for optimism: increased awareness of the degraded states of stocks has greatly inverted the trend; the number of stocks underexploited or moderately exploited is in decline in Europe.

[Yves Perraudeau]

We have seen that it was necessary to regulate fisheries, but how was this possible?

In the marine domain there are, as in the rest of the natural world, two big types of resources:

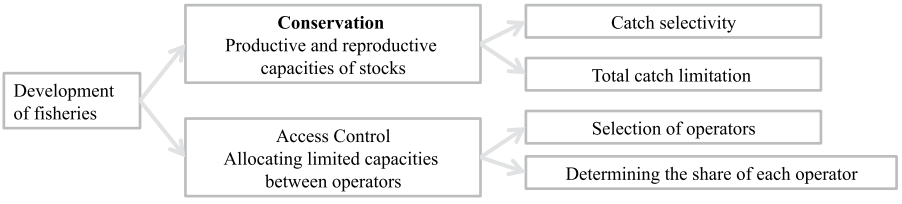
- Non-renewable resources for which exploitation corresponds to a fall in stock (petrol, gas, minerals, etc.). The intensity at which they are used gives us globally the duration of their exploitation, subject to a correct evaluation of the stock

(example of oil and offshore exploitation in particular);
- Renewable resources (forest, fish, etc.) for which management and reproduction aspects are essential. These common resources have specific characteristics, they are at the same time subtractive (what is taken by some is not taken by others) and undivided (difficult to share among users).

If the private resource is dividable, it is easy to obtain exploitation efforts; however, if the resource is undividable, efforts made for one resource may evidently affect the other resources.

These characteristics lead to different approaches. The classical approach has attempted to manage each resource and, more recently, ecosystemic approaches have defined global management in order to preserve the links between diverse resources.

Diagram 25 What Targets and What Tools?



Monitoring fishing effort or catches

Monitoring of fishing effort: principal problems	Catch monitoring: principal problems
Multi-dimensional character of fishing effort, with high substitutability between its components	Often insufficiently able to efficiently monitor what is brought to port
Constant progress in effort parameters because of technical progress	Risk of increase in discards in the case of low interspecific and intraspecific selectivity of fishing gear

Source: Author's construction according to Boncœur and Troadec (2003).

Beyond these characteristics that indicate to you the orientations of fisheries' management, you need to know what the targets are and which tools we are going to use to manage fishing. Fisheries management can be globally carried out according to either the conservation of resources, or productive capacities with, in both cases, specific problems.

Table 7 Typology of Resource Access Regulation Instruments

Monitoring method		Monitoring variable	
		A. Fishing efforts	B. Catches
1. Administrative (norms)		Non-transferable fishing licences	Non-transferable individual quotas
2. Economic (incentives)	2.1. Taxation	Fishing effort taxation	Landing taxes
	2.2. Legal-based methods	Transferable fishing licences	Transferable fishing quotas

Source: Boncœur and Troadec (2003).

From these characteristics, diverse strategies and targets, it is then possible to propose a typology of regulation tools, with, globally, two main categories: regulation that fits into a rather normative framework or, an economic framework with incentives. These tools necessitate a framework, it is the reason for which there exist fishing organisations that group together a large number of countries and that can be found on all the oceans – The Commission for the Conservation of Southern Bluefish Tuna (CCSBT), Southern Indian Ocean Fisheries Agreement (SIOFA), etc.

[Patrice Guillotreau]

That is one way to resolve conflicts linked to fishing: finding a consensus about policies, management measures and conservation. These organisations are often composed of a scientific committee and a political one, and the political opinion that is given does not necessarily follow the scientific recommendations that have been made.

[Yves Perraudeau]

Let's take an example from the European Common Fisheries Policy (CFP) that is based upon four distinct pillars:

- The conservation of resources with evaluation work regarding the situation of fish stocks. In this axis the characteristics and limitations of fishing gear, the TACs and quotas allocated to each country based on "historical rights" are specified. This axis corresponds to the will to preserve stocks;
- The Common Market Organisation (CMO) has a more social and economic aim *vis-à-vis* the producer and the consumer and the fisherman's family. In the Common Market Organisation, the rules for a common identification of products are fixed. Rules are issued about quality, the specific nature of the product (price and revenue policy with a system of withdrawal prices in order to maintain a guaranteed revenue for sea fishermen). The effect of price caps can be seen here;
- A foreign policy: Europe imports more than half of its consumption, so we here define fishing agreements concerning fishing

areas outside the European maritime zone, through negotiations with the countries concerned. There are also trade agreements with reduced customs duty and other General Systems of Preferences (GSP) that are also part of EU development aid policy.

- A structural policy to help sea fishermen organise their fishing activity: this is essentially aimed at investment, that is to say subsidies granted to fishing vessels/ or aquacole enterprises; this policy may encourage or discourage the activity.

The institutions that regulate fishing are totally integrated at a European level.

Box 9 Indicators of Sustainable Fishing

- *Level indicators: Absolute values of some key indicators (fishing capacity, biomass, revenues, job, number and seriousness of conflicts, etc.)*
- *Indicators of change: indicate the direction and variation rates of the key indicators*
- *Indicators of structure (or institutional ones): Functional elements of the system (management targets, management measures, control and monitoring)*

[Patrice Guillotreau]

You are going to have to think about sustainable fishing indicators and compare them, for example, with sustainable aquaculture. Given the characteristics of your country, of your region, what would the criteria regarding the sustainability of the exploitation of fisheries or aquaculture be?

With the help of a document by Serge Garcia (*c.f.* reading text), the indicators are classified into three categories, and this analysis grid will be used to appreciate the effects of climate change on a coastal population or a coastal activity. We can imagine some indicators of pressure, of state, and of the response by those accountable for these modifications.

Table 8 Example of Matrix of Overfishing Indicators

Indicators	Pressure (effort)	State (biomass)	Response (management)
Level	E > Emsy	B < Bmsy	Effort reduction plan
Change	E + 5%/year	B – 4%/year	E – 5%/year for five years
Structure	Three interacting flottillas		Fishing rights

E = Effort
Emsy = Level of effort corresponding to Maximum Sustainable Yield
B = Biomass
Bmsy = Level of biomass corresponding to Maximum Sustainable Yield
Source: Garcia (1996).

Indicators of level, change and structure are often distinguished. Indicators of level will be indicated in absolute value, but we may also imagine ratios with relative values – for example, the current biomass level compared with the biomass level before exploitation may be an interesting indicator.

If you wish to appreciate the level of governance of your system you can use the rate of fines imposed on fishermen who violate the rules. But does a rise in this rate reveal a better control of the system, or on the contrary a multiplicity of infractions? We must remain prudent in our analyses.

The indicators of change are at the same time going to indicate the direction and speed of change.

Are we approaching or moving away from the fixed target?

Finally, we have structural indicators, institutional indicators about management targets, and indicators of measures and existence of controls, etc. The efficiency of these indicators raises questions, and not their existence. For indicators of structure, let us quote the reduction of effort procedures, (non)-limitation of catch and the (non)-regulation of projects.

Try to be imaginative in the choice of your indicators while experimenting a reality principle according to what you know about the statistical system, about what it is possible to collect in order to understand if a reference system can be implemented and monitored in the long term.

The workshop is divided into four thematic groups: society, economy, ecosystem/ environment, and governance.

Day 2, Tuesday 17th July

2.1.2. Indicators of Sustainable Development in Aquaculture

Feedback on group work on indicators of sustainable development.
The exposés trigger debate on the following thematic areas/indicators:
Group 1 - Society: level of debt, revenue of inhabitants, distribution of sales, distance from the family sphere, local cultural traditions, personal job satisfaction (education, number of holidays), etc.;
Group 2 - Economy: resistance to risk, etc.;
Group 3 - Environment: on board retention rate, quantity of pollutants, accessory catches, selectivity of fishing gear, quality of water (aquaculture), conversion index, etc.;
Group 4 - Governance: bodies for conflict management, legal means of control and monitoring, judicial consequences, control of the sanitary quality of the produce, cost of managing and publication of indicators over time.

2.1.3. Competition in Maritime Transport

[Pierre Cariou]

Not a lot is known about maritime transport, even though it represents 80% to 90% of merchandise exchanged in the world. I now propose to describe to you the characteristics of this maritime transport, to examine the principal trends, then focus on maritime container transport.

Just like for fishing and aquaculture, for maritime transport decision centres are shifting towards Asia (see Map next page).

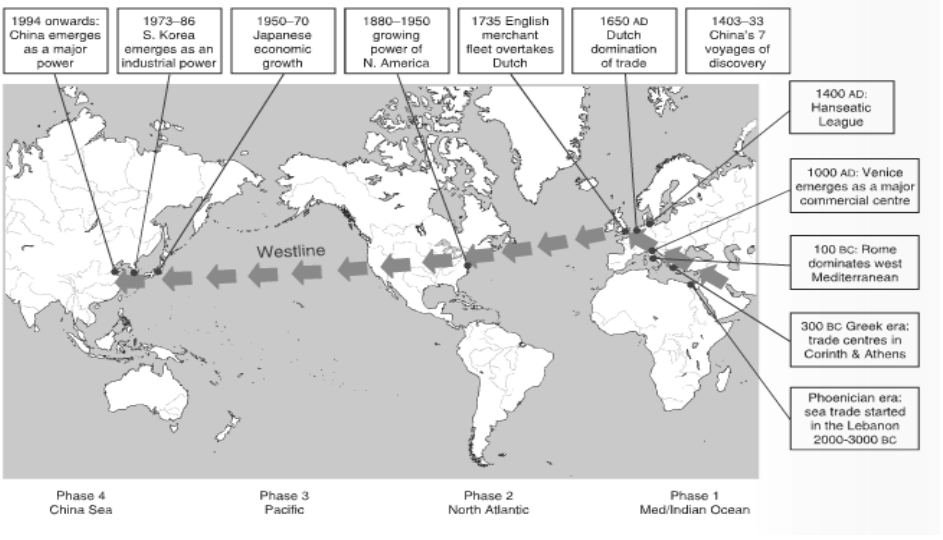
This shift has been particularly strong over the last twenty years, and corresponds to the evolution of international trade. (see Diagram next page).

In terms of value, the most transported merchandise in the world is oil conveyed in tankers (43% of world volume). In maritime transport this merchandise is referred to as "liquid bulk", it is followed by "dry bulk". This family groups together notably iron ore, coal and cereals. Next are containers, which represent about 10% of the volume in weight conveyed by the sea.

The classification expressed in trade value is very different: in world trade, oil now only accounts for 22% and containers 52%. It is the reason for which the bulk segments are generally measured in volume and container segments in value.

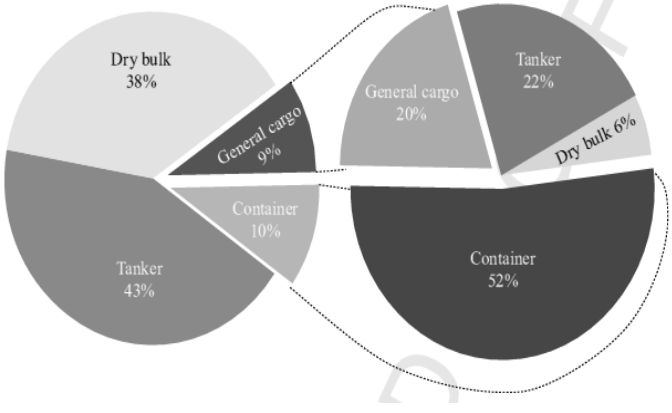
The organisation of maritime markets is another classification. To simplify things, we identify bulk transport markets – or demand markets – and those referred to as regular routes that essentially transport containers.

Map 11 World Maritime Transport



Source: Stopford (1988).

Diagram 26 Maritime Transport Markets



Source: Mandryk (2009).

For example, you wish to transport petrol in large quantity from the Persian Gulf to Việt Nam, you seek to procure a vessel on your own behalf. The system is similar to that of a taxi that you use to go from point A to point B. You pay for the use of the taxi for a given period, ten minutes or one hour. This market is called the charter market. In the other case, you wish to transport a dozen TV sets from China to Europe. You simply wish to use a space inside a vessel. The ship-owner offers a service, with boats that leave at given times – just like railway trains. Here we talk about regular routes transport.

An intermediate system would correspond for example to the transport of cars, where the carmaker works with a ship-owner who exports from Asia to Europe. He implements a semi-regular system.

Today we are going to focus on the regular routes market that represents 50% of international trade value, then we shall present to you the Tralin game that will allow you to apply strategies to regular routes just like ship-owners do (the rules of the *Tralin* game can be found on the site www.tamdaoconf.com). The container is not merchandise, what is important is what is found inside the container.

Diagram 27 Regular Route Maritime Transport

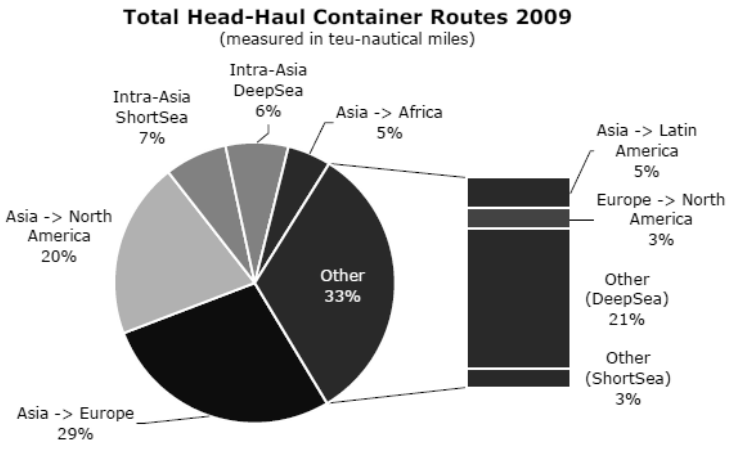
Typical Ocean Freight Costs (Asia-US or Asia-Europe)

	Unit	Typical Shelf Price	Shipping Costs
TV Set	1 unit	$700.00	$10.00
DVD/CD Player	1 unit	$200.00	$1.50
Vacuum Cleaner	1 unit	$150.00	$1.00
Scotch Whisky	Bottle	$50.00	$0.15
Coffee	1 kg	$15.00	$0.15
Biscuits	Tin	$3.00	$0.05
Beer	Can	$1.00	$0.01

Source: Author's construction.

What are the markets of the regular routes?

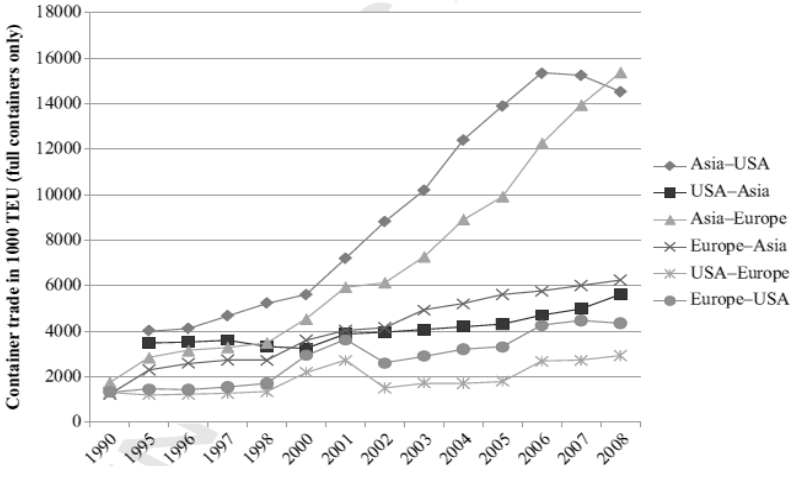
Diagram 28 Regular Route Maritime Transport (2)



Source: Global Insight, Danish Ship Finance.

In 2009, about 30% of the market concerned exchanges between Asia and Europe; the second largest market is the transpacific, especially from Asia towards North America.

Figure 21 Regular Route Maritime Transport (3)



Source: Author's construction according to reports from Drewry and the United Nations Conference on Trade and Development (UNCTAD), Review of Maritime Transport.

In the graph above we can observe that two markets have particularly taken off: the Asia to North America market and the Asia to Europe one. The unit is important, thousands of Twenty Equivalent Units (TEU) – the standard container size. At the beginning of the 2000s, six million containers were counted each year; in 2008 it had risen to sixteen million containers.

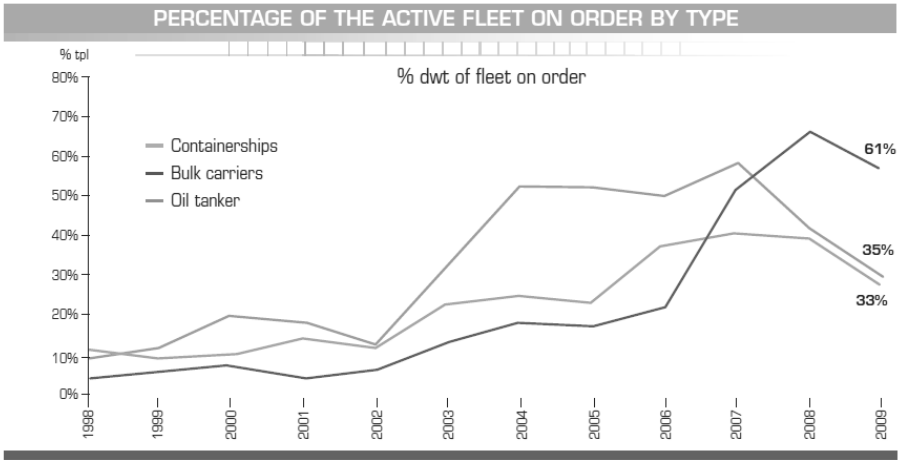
How can we explain the big reduction in the cost of transport? The principal explanation lies in the growth in the size of vessels. In 1972, the biggest container carrier in the world could carry a maximum of 1 500 containers; at present vessels can convey 16 000 containers

The advantage of investing in vessels twice the size, for example, is that the rise in petrol consumption is not proportional; you also do not need twice as many sailors. It is expected that maritime transport costs will continue to fall, which might further encourage a delocalisation to Asia.

The logic is clear but the implementation poses certain problems:

- Ports must be adapted to receive vessels – a new terminal in Hồ Chí Minh City in 2009;
- This logic holds if markets are growing. However, since 2008, we are experiencing a particularly strong economic crisis in Europe and the United States, which has led to a big reduction in imports.

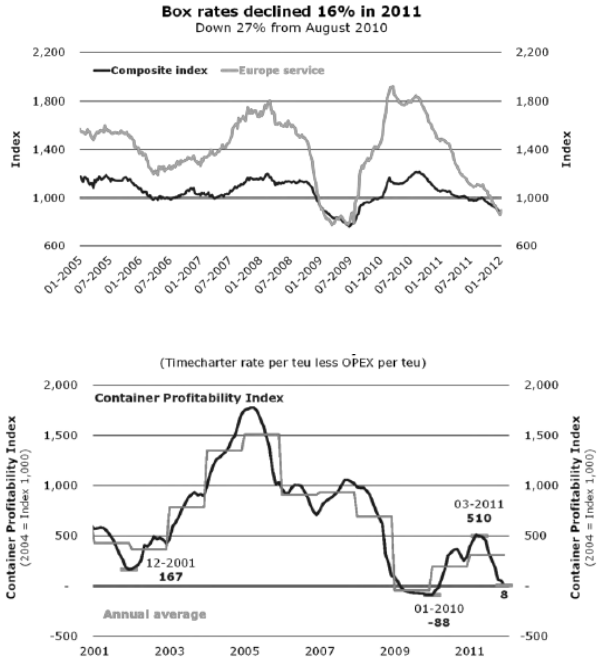
Figure 22 Regular Route Maritime Transport (4)



Source: Author's construction.

This crisis is today driving regular route ship-owners towards bankruptcy – a crisis of overcapacity. The crisis was all the more severe in the maritime sector as no one predicted it. On this graph, in 2008, 35% of the world fleet was on order: demand has contracted and, at the same time, many new vessels have arrived on the market.

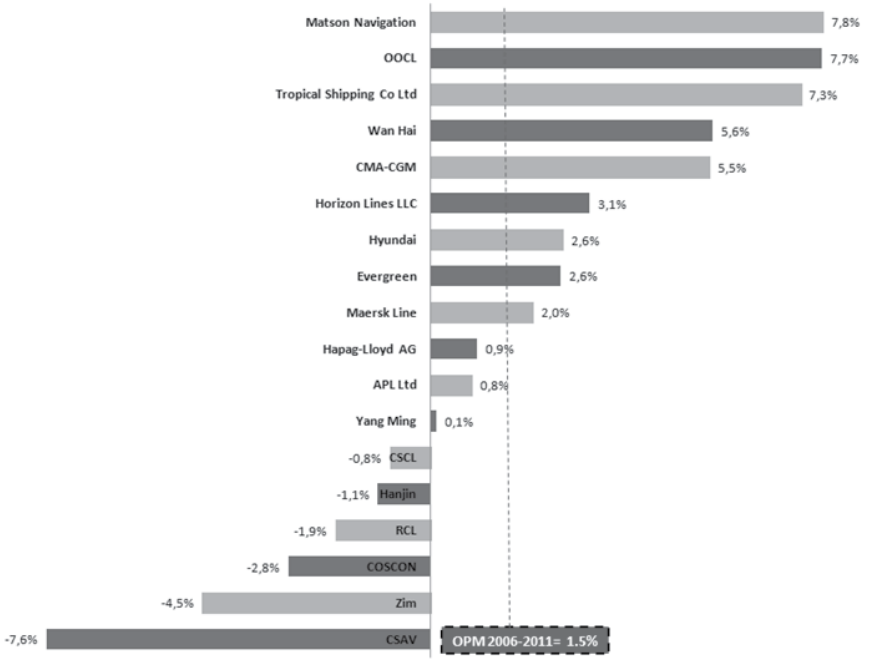
Figure 23 Regular Route Maritime Transport (5)



Sources: China's Ministry of Commerce, Danish Ship Finance; Clarkson, Danish Ship Finance.

This crisis can be seen in the reduced profit margins of enterprises. In 2005, ship-owners had high profit margins that reached level zero in 2009.

Figure 24 Liner Shipping Operating Profit Margins, 2006-mid 2011

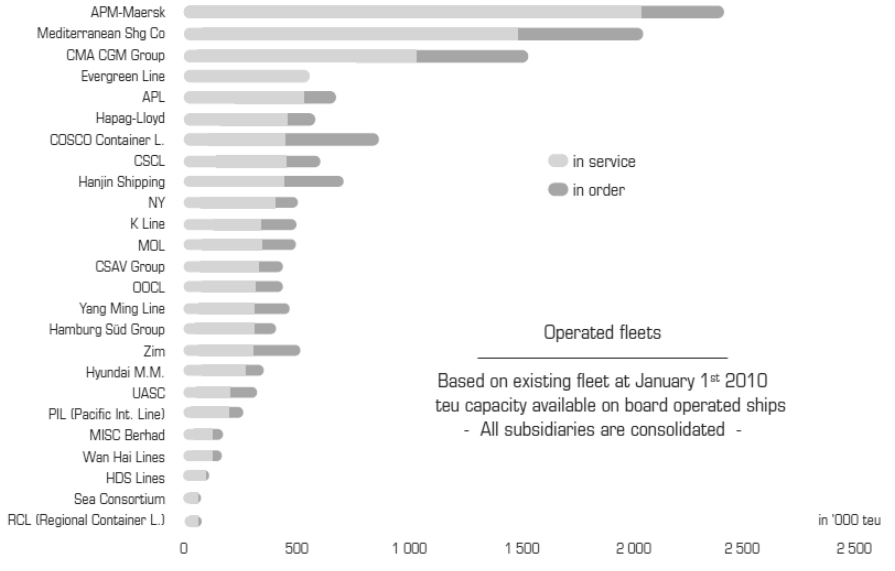


Source: Author's construction.

The big Chinese company, Coscon, has been particularly affected, just like Hanjin in Japan. Since 2008, all companies have been losing money. The CMA-CGM group in Marseilles, announced EUR 500M of debt for 2012.

Who are the big ship-owners that dominate regular maritime transport routes? What strategies have they adopted to cope with the crisis?

Figure 25 Regular Route Maritime Transport (6)

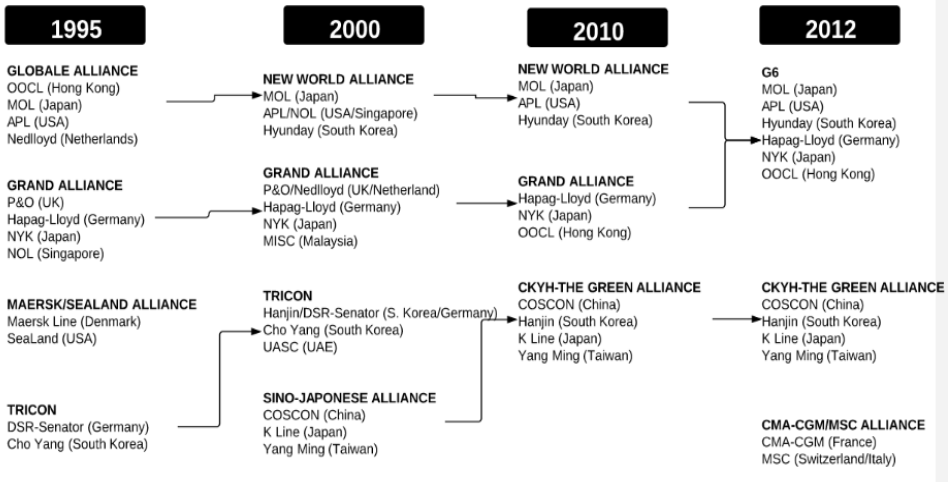


Source: BRS – Alphaliner.

Although the market's centre of gravity has swung toward Asia, transport control remains in the hands of European operators. The first world operator, APM-Maersk, is Danish; the second, MSC, is Swiss-Italian, CMA-CGM is third. Next we find Chinese, American and other Asian ship-owners. The Vietnamese operator Vinalines with its maritime branch, Bosco, is not yet visible. Maersk operates 500 vessels, Bosco only 30.

How do small operators survive? As is the case for airlines, strategic alliances are being developed.

Diagram 29 Strategic Alliances



Source: Author's construction.

Since 2010-2012, new strategic alliances have been implemented – an example is the formation of the G6 in 2012: a grouping together of New World Alliance and Grande Alliance. One of the strategies is to thus form alliances with partners who were once competitors.

In 2009, in full crisis, Maersk, for its part, redefined its strategy along three axes: "Be On Time"; make trade easier; and environmental excellence:

- The strategy "Be on Time" is based upon punctuality. You need to know that only 40% vessels arrive on time; however, about 20% of vessels arrive a day late. This implies that the operator must take greater control of port terminals in strategic countries. In 2009, out of 500 port terminals, nearly 400 were controlled by private operators. Among these is Cái Mép in Hồ Chí Minh City. This raises the question of governance, since investments are above all covered by the country while the port terminals are granted as a concession to private operators from Denmark, France, etc. Since 2011, because of the crisis, the trend has been for ship-owners to leave, consequently a large part of the investment financed by taxes in Viêt Nam is being underutilised.
- Making trade easier. The idea is to follow the example of air transport: on-line systems (internet booking) where the Vietnamese importer, for example, might directly reserve space on vessels without using his local agent;
- Environmental excellence. The strategy is to reduce speed to lower fuel costs.

Table 9 New Strategies. Reducing Costs

	8 ships			9 ships			10 ships		
Service Fundamentals									
Round Voyage Distance (Miles)	21,000			21,000			21,000		
Speed (Knots)	24.0			20.1			17.3		
Sea Days	36.5			43.5			50.5		
Port & Canal Days	19.5			19.5			19.5		
Round Voyage (days)	56.0			63.0			70.0		
Nominal Capacity	8,000	10,000	12,000	8,000	10,000	12,000	8,000	10,000	12,000
Fuel Consumption (tpd)	215	221	257	126	130	151	81	83	96
Ship Cost per day (long term time charter)	$48,500	$53,000	$57,500	$48,500	$53,000	$57,500	$48,500	$53,000	$57,500
Estimated Voyage Costs per Round Trip (US$ million)									
Fuel price per tonne (Q3 2010, Rotterdam)	$441	$441	$441	$441	$441	$441	$441	$441	$441
Fuel*	3.48	3.56	4.14	2.42	2.49	2.90	1.60	1.65	2.14
Ship Cost	2.72	2.97	3.22	3.06	3.34	3.62	3.40	3.71	4.03
Port & Canal Costs	1.40	1.66	1.90	1.40	1.66	1.90	1.40	1.66	1.90
Total	**7.58**	**8.19**	**9.26**	**6.87**	**7.49**	**8.42**	**6.60**	**7.22**	**8.06**
Annual Total (52 round voyages pa)	**394**	**426**	**481**	**357**	**390**	**438**	**343**	**375**	**419**
Annual Saving v 8 ships				**37**	**36**	**44**	**51**	**50**	**62**

* Excludes MDO costs

Source: Author's construction.

In this table you have three configurations, with eight, nine or ten vessels that apply to service between Asia and Northern Europe. In the regular routes market, there is a weekly service rule. If you slow your speed while keeping the same number of vessels, you will no longer be capable of being in each port of call every week. Thus, if you have a fleet of eight vessels travelling at 24 knots, and you reduce speed to 20 knots, you have to add one vessel. The strategy is to decide if the gain is higher than the cost of adding a supplementary vessel. Since 2008, all vessels have reduced speed; it is a common strategy of all ship-owners.

The effect for countries is not neutral: if you are a Vietnamese exporter to Europe, you must now count on about 35 days for your container to arrive in Europe compared to 25 before the crisis.

By slowing vessels down, the ship-owner gains in fuel consumption while the vessel is at sea. For long routes, such as Europe-Asia when the vessel spends most of its time at sea, the gains are high and justify the adding of one more vessel to the fleet. On the contrary, for transatlantic routes, this strategy does not make sense as the ship-owner saves less than the cost of adding an extra vessel. About 80% of Europe-Asia services are slow steaming, whereas this figure is only 20% for Europe-North America.

Day 3, Wednesday 18th July

The first part of the morning is devoted to the Tralin *game (see reading texts, www.tamdaoconf.com).*

[Pierre Cariou]

In the *Tralin* game, if demand is reduced by half on all the routes, you are all going to lose money. Furthermore, if you wished to sell vessels, nobody would want to buy them. This virtual situation is today the reality for all ship-owners. We are currently in an overcapacity crisis that will certainly continue for some years to come, as demand will not increase in the near future. The second interest of this game is to help you understand the importance of strategic interactions: the advantage of being able to cooperate to manage capacity.

You have a great deal of interest in the environmental impacts of maritime transport; I, for my part, was surprised to hear you all talk about the impact of climate change on maritime activities. An example is the opening of passage routes in the North-West Artic or the increase in insurance premiums for port activities, because of the risk of a rise in sea level.

2.1.4. Environmental Impact of Maritime Transport

I should like to talk a little about the impact of maritime activities on climate change. In the framework of the IMO, a lot of debate has taken place over the last ten years, notably about the impact of maritime transport and greenhouse gas emissions.

I propose to present these debates to you, as well as some existing solutions.

The principal effect of maritime transport on the environment is linked to its use of fuel. When you consume fuel, you are going to emit a whole series of gases that may take the form of fine particles or carbon dioxide. The latter has a global impact that tends to affect the ozone layer (see Table next page).

Maritime transport, just like aviation, represents about 3% of carbon dioxide emissions – globally, 20% of emissions come from transport. Let it be emphasised from the outset that maritime transport represents 80% of worldwide trade: the ratio tonnes-distance travelled represents very low emissions (see Graph next page).

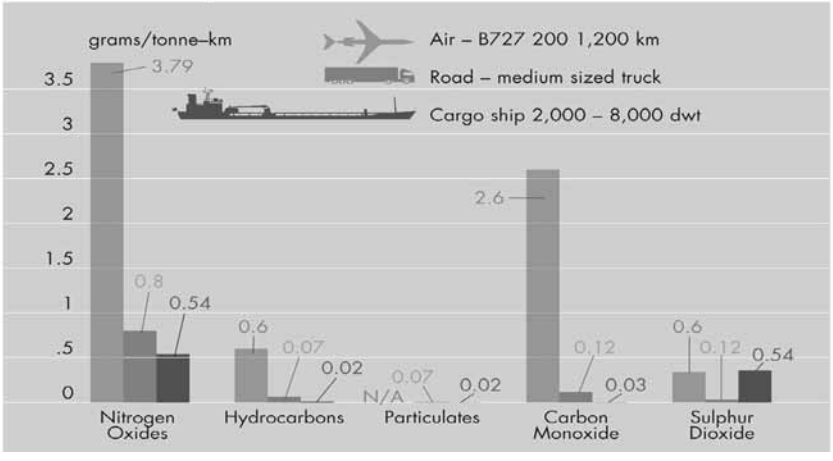
The most polluting mode of transport is by far the aeroplane. That is one of the reasons why the IMO has been having difficulties finding a solution over the last ten years: ship-owners argue that maritime transport pollutes little, and it is thus, above all, necessary to find a solution for air and road traffic.

Table 10 Greenhouse Gases

Effects	PM	HM	NH_3	SO2	NOx	NMVOC	CO	CH_4	CO2	N_2O
LOCAL										
REGIONAL										
Acidification										
Photochemical										
GLOBAL										
Greenhouse - indirect										
Greenhouse - direct										

PM – Particulates; HM - Heavy metals; NH_3 – Ammonia; SO_2 - Sulphur Dioxide; NOx - Oxides of Nitrogen; NMVOC - Volatile Organic Compounds (hydrocarbons); CO - Carbon monoxide; CH_4 – Methane; CO_2 - Carbon dioxide; N_2O - Nitrous oxide
Source: Author's construction.

Figure 26 Comparaison of Exhaust Gas Emissions



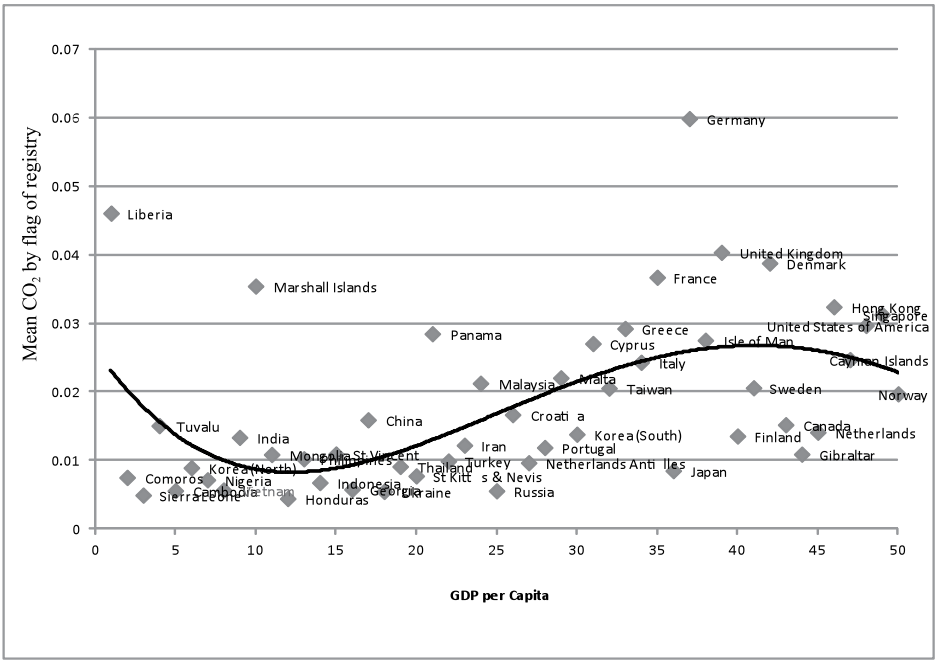
Source: Swedish Network for Transport and the Environment.

A study by American, Japanese and Norwegian researchers has calculated that because of maritime activities and the emission of fine particles, about 60 000 people die each year from cancers and heart disease (Corbet *et al.*, 2007). A distribution map of such cases shows that most of the people affected live along the coast, particularly near to big ports or big maritime routes. It is clearly seen in Asia, with the high number of deaths in zones such as Shanghai for example.

Studies of this type have led the IMO over the last decade to try to understand which activities and which vessels were at the source of these carbon dioxide emissions: container ships consume the most and it is evidently the fastest of these that pollute the most.

Which countries are the sources of this pollution? Who monitors container ships?

Figure 27 Graph / Average Carbon Dioxide Emissions by Flag Carrier



Source: Cariou and Wolff (2010).

Germany is the country that controls the vast majority of container ships and is, because of this, the source of large carbon dioxide emissions.

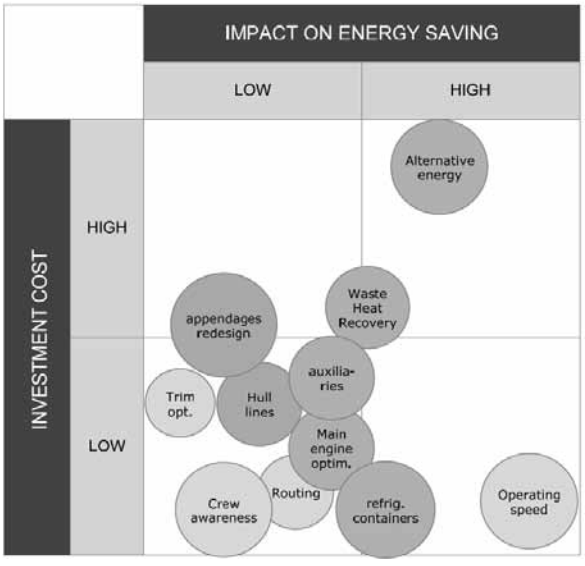
The Vietnamese and Cambodian fleets count about 1 000 vessels each. The structure of these two fleets is relatively similar: few container ships and lots of small-sized bulk

carriers. The two countries logically emit very little carbon dioxide because of the small size of their fleets. It is above all developed countries: France, England, Germany, and Denmark ,etc. that emit the most.

How can we limit these emissions? There are two options: technical solutions (Pigouvian tax) and market taxes (introduction of a carbon dioxide market – Ronald Coase's thesis).

What is the cost of the technical solution and what is its impact in terms of energy efficiency? The best solution has already been implemented: reducing the speed of vessels. We can also think about substituting petrol with bio-fuel or gas: the impact here would be great, but the economic cost is not yet certain. The IMO recommends favouring research into these new types of fuel that will eventually allow us to reduce consumption.

Table 11 Different Methods of Reducing C02 Emissions



Source: Gérard (2007).

Let us take a look at two different economic alternatives.

The idea of the tax is to artificially increase the price of fuel in order to oblige the ship-owner to adopt other methods of production. The difficulties of implementing this system are numerous:

- What should the level of the tax be? Given that this is a fuel tax, each ship-owner will have to pay an additional tax, whereas the price of fuel tends to fluctuate – in 2008, a tonne of fuel cost around $700; if you set a tax at $20, there will be very little impact;
- The cost of the transaction. It will be necessary to find an agency responsible for the collecting of taxes. However, if the cost

of collecting the tax is higher than the sum generated by the tax, the tax has no sense;
- What should be done with the money collected? There exists a certain consensus that it should be used to finance the research into and development of new technologies;
- Who should collect this tax? *A priori* the IMO, but certain countries do not recognise UN agencies.

The second solution is that of Ronald Coase in 1960 (Coase Theorem), which it is possible to summarise in the following form: *"If trade in an externality is possible and there are no transaction costs, bargaining will lead to an efficient outcome regardless of the initial allocation of property"*. The regulator will say *"I estimate that your activity has generated 80 tonnes of carbon dioxide, if next year you can reduce this to 70 tonnes, you will be able to sell 10 tonnes to someone else who needs it"*. This solution is also complex to implement for two reasons.
- How can we calculate the number of tonnes of carbon dioxide that each operator is going to receive, given that a private operator will tend to underestimate his needs in number of tonnes;
- In case of conflict, a management tribunal is necessary. Here we find the transaction costs problematic: if the cost of creating these agencies is higher than the expected profits, the mechanism has no sense.

A role-play game is prepared within the workshop to be carried out the next day about the operating model of the IMO. Four groups are created. Groups 1 and 2: "You are representatives of Việt Nam or Cambodia, your option is to do nothing". The groups prepare arguments presented in plenary sessions in order to demonstrate that economic type solutions cannot be implemented; Group 3 and 4, solution propositions: introduction of a tax, possible extension to the introduction of a market. The idea is to build a convincing argument about the importance of finding a solution for the reduction of carbon dioxide emissions.

Day 4, Thursday 19th July

Presentation and debates about the arguments presented by each group.

[Pierre Cariou]

I should like to come back to two essential points that stand out from the debates and presentations of the different groups:
- A great scientific uncertainty remains about the effect of transport on climate change, and its impact on human activities. This uncertainty is found when we have to determine the amount of the tax and quotas, even though we are not yet capable of measuring the emissions generated by transport.
- It is necessary to emphasise the difficulty in reaching an agreement about questions of equity and development. The logic

defended by groups 1 and 2, *"We are victims and we demand that you pay"*, is a powerful argument. Sidestepping this position is going back to the principle of a common but differentiated responsibility: it is not a question of accusing one country more than another; the response will be differentiated depending on the development of the country. The difficulty for developed countries, of which the most part presently wish to act, is that an agreement must be established, and to do this a majority is necessary to agree on the principle. If an agreement is reached on a resolution, it is then a question of ratifying this agreement. This may take a long time. The last stage is transposing this agreement into national law.

[Jean-Pierre Beurier]

Let us be careful in distinguishing between the signing, ratification and implementation of an international text, or a treaty.

A government sends an official delegation to an international conference, to the UN for example, with a mission. This delegation is composed of at least one plenipotentiary minister, generally an ambassador who, in agreement with his government, is going to sign the convention text at the end of the discussions. Let us imagine that he signs it: he returns home with the signed text that has in a certain way committed his government. However, in order for this agreement to commit the said country, it is necessary for the parliament representing the people of this country to ratify the signed agreement. From the moment the agreement is ratified, it must be published in the government journal of the country. But if the text is not in force, it cannot be applied: it is necessary to await a sufficient number of ratifications for the States participating in the convention to make it enter into force. At the IMO, 75% of the world tonnage must have ratified it, or, if I take the example of the United Nations Convention on Sea Law, 60 ratifying States are needed for it to enter into force. Once the text is in force, it is handed to the General Secretary of the United Nations and becomes part of international law. The States that signed and ratified it must implement it. This implies that each ratifying State should promulgate the laws, decrees and orders necessary to include the articles in the substantive law of that State – and not just be satisfied to have published the text of the convention in the government journal.

Phạm Tuấn Anh

Is there a time limit for ratification for States having signed an international convention? Can a State go back on its agreement to sign?

[Jean-Pierre Beurier]

There is a fixed time limit for the signing of a text that has just been proposed, in general one or two years. Signed documents can be handed to the General Secretary of the United Nations, or to an authority, to the General Secretary of the IMO for example for maritime affairs, or the FAO for agriculture. Once this time limit has elapsed, a new State cannot sign. The State is sovereign; there is no time limit for ratification. There is a moral obligation of committal since the State has signed, but there is no legal obligation. As far as the United Nations convention on sea law was concerned, we shall have to wait twelve years for sixty States to ratify it.

Can a State change its mind? Yes, but it must then adhere to the convention. By adhering

to it, it cannot modify it in any way nor submit any reservations.

The Principle of Legal Responsibility and the Notion of Ecological Prejudice

[Patrice Guillotreau]

We are going to take a look at the problem of the incidence of climate change, particularly on coastal activities, but also the damage suffered of either a human or environmental nature by coastal populations.

What value can we give to the environmental "good" in general?

When we talk about valuation, we are talking about attributing a monetary value to environmental assets. Why do we give a monetary value to these goods, or objects from a legal point of view, which are not the object of commercial exchanges?

- Avoiding zero values. Absence of value and not charging at all is often the cause of the degradation of environmental goods.
- Tragedy of pure collective goods. Here we think of air and water quality and absence of noise. Several causes are at the origin of this tragedy: indivisibility; non-exclusion (it is difficult to exclude anybody from using air for example; non-rivalry (what I consume of this collective good, a landscape for example, is not going to deprive anyone from enjoying this beauty, nobody is individually worried about the preservation of this good).
- Converting into the same unit of measurement different units (numbers, tonne, volumes, spaces), costs are easily established, profits a lot less. If water quality is degraded, the cost of the cleaning of a water catchment area can be estimated, for example. On the other hand, putting into figures all the profit that can be made from the sea, beyond the simple resources that can be extracted from it, such as carbon sequestration services, is a lot more difficult to give a monetary value to.
- Compensating for damages. Once legal responsibility has been established, we must decide the amount of compensation for the damage suffered. How much money can compensate the damage suffered by coral reefs or the destruction of sea birds following an oil slick? We shall see how this awareness of damage and the necessity of compensating the damage suffered by nature are becoming more and more part of the principle of law.

[Jean-Pierre Beurier]

Faced with the degradation of the environment, and a retreat of States regarding environmental degradation, illustrated by the successive failures of Copenhagen 2002 and Rio 2012, States are more than ever intervening too quickly and then not doing enough.

Let us address the problem of compensating for environmental damage. I shall introduce my argument by reminding you of the difference that exists between a subject of law and an object of law and, on the other hand, what are the objectives of law.

- Natural and legal persons are subjects of law. The law has been established by them and for them, and they can ask a judge to apply these rights to defend their position or impose an obligation on a third party. They are stakeholders of law.

- The object of law will receive a certain legal regime that will be imposed upon it, created by man. There is a regime for property, for pets, or for wild animals. However, these objects of law can obviously not defend themselves.
- The aims of the law are to resolve relations between individuals, or relations between individuals and society as harmoniously as possible. If in spite of this there is a conflict, then there will be compensation for the damage suffered by a victim. This victim, a subject of law, will then be able to go before a judge and demand compensation for damage suffered on condition that s/he has a personal interest in acting and s/he can prove the damage suffered. This is the problem with compensating environmental damage. How can justice be rendered since in the legal system invented by man, the only possible compensation is financial?

For a long time in France, before environmental laws were established, only anglers could go to court if river water was polluted: not because the river was polluted, but because the anglers had bought fry to populate the river and fish in it, and the fry had died. Because these anglers had a bill, they wished to seek compensation for the financial damage they had suffered!

The first phase of progress took place at the end of the 1960s, in the 1970s, and at the beginning of the 1980s, depending on when individual States adopted important laws for the protection of the environment. Thus the French law is that of 10th July 1976, which recognises in its Article 2 that nature is of general interest. Not only can the State attack the river polluter in the name of the general interest of the national community, but so can the Loire or the Garonne hiking clubs for example, because the aim of these associations is to protect nature and enjoy it.

On an international law level, the prior situation was even worse. Indeed, the State is sovereign; it does what it wants on its territory. A fundamental decree by the International Court of Justice in 1949 concerning the affair of the straits of Corfu dramatically changed this way of thinking. States are legally equal; State A is sovereign and does what it wants with its territory; State B is also sovereign. A does not have the right to do something that might have harmful effects on B, even if A's activity is legal.

Imagine a cement factory that emits smoke that is carried away by the prevailing winds. The offending State is going to say: *"It is perfectly legal to make cement, I need it for my economy. It is not my fault if the wind carries the smoke away"*. The polluted country will go to State A's legal court to ask for compensation – cleaning of polluted roads, loss of hotel clients, etc.

In maritime matters, things are more complicated as, on the one hand, maritime transport, which is considered a risky activity, is granted the limits of responsibility of the ship-owner; on the other hand, the damage generated by vessels, particularly those transporting petrol or chemical liquid bulk, are so serious that they go beyond the financial means of the enterprise. The international community thus adopted the Brussels Convention in 1969 regarding compensation for civil damages suffered by victims of oil slick pollution. The convention focuses responsibility on the ship-owner. Beyond this limit, the States party to the Brussels convention created an International Oil Pollution Compensation fund for the

victims of oil pollution (IOPC). Any economic player transporting, receiving or refining oil – more than 150 000 tonnes per year – must contribute to this fund that will be then used, as second player, to compensate any damage exceeding the amount the owner is asked to pay.

This system of cooperation and insurance unfortunately has a very low ceiling. It is perfect for small events at sea, as the victims are immediately compensated without any legal process. However, when faced with major maritime disasters, the effects are disastrous.

Example 1. The Amoco Cadiz was an American-owned oil tanker flying the Liberian flag. The vessel legally belonged to the Amoco Transport Company whose headquarters were in Chicago, Illinois, but the real owner was the limited company Amoco, that is to say Standard Oil, Indiana.

- 18th March 1978, there was a storm of the coast of Finistère in France.
- The Amoco, which was sailing up the North Sea, passed by the French coast, laden with 220 000 tonnes of crude. A hydraulic cylinder in the vessel's steering system failed. The vessel was no longer steerable even though its engines were working well.
- The vessel immediately put beam to the wind and swell and floated towards the French coast.
- The captain did not warn the French authorities. He negotiated a contract with a German high-sea tugboat, which offered him a rescue contract that he asked the Amoco Limited Company to pay for.
- Amoco refused to sign the contract.
- When the vessel's owners realised the gravity of the event, in the middle of the night, it was too late: the vessel attempted to weigh anchor, the chains broke one after another, and the vessels finished up running aground on the Brittany coast.
- 220 000 tonnes of crude oil spilled out into the sea and onto the shore, polluting 300 km of coast.
- It took months of work for the French authorities, the army, the fire brigade, the police, farmers and volunteers, etc. to clean the environment.
- Fishermen were unable to take to the sea, shellfish farmers were put out of work, and hotels were empty. It was an economic and environmental disaster.
- The French authorities realised the cost for the clean up and the damage caused was higher than the IOPC. It was necessary to deviate from the conventional framework and not ask for immediate compensation, but to go before the courts to convict the ship-owner. However, there was no convention for the enforcement of judgements between France and the United States. The representatives of all the aggrieved parties left for the United States to enter an American legal procedure, which caused *de facto* additional costs.
- The trial lasted ten years.
- The Chicago federal tribunal delivered two judgements.

  1984. The responsibility of the Amoco Limited Company was established, and not that of the front company, Amoco Transport Company. In response to the argument regarding the limit of available compensation funds, the tribunal ruled that there had been a gross fault nullifying this limit – national authorities not alerted, non-respect of captain's orders, absence of tugboat.

  1988. The tribunal asked for the amount of financial loss incurred. Although the

State, the communities and economic stakeholders easily justified this sum, the situation for environmental associations was a lot more complicated regarding ecological damage, as the marine ecosystem had no commercial value and could not for this reason be taken into account.

Example 2. The Erika was a small 35 000 tonne deadweight oil tanker that was transporting petrol from Dunkerque in the North of France to Livorno, Italy. The voyage was to last several days.

- Fuel oil is a lot more dangerous product than crude oil, which eventually self-destructs. Fuel does not disappear over time and it is highly carcinogenic.
- The French company Total was selling more than 35 000 tonnes of fuel to Italy. Total did not possess any vessels; it had chartered the ship to transport the cargo.
- The Erika was a substandard vessel. The real owner, who was Italian, hid behind six levels of front companies, and was using a vessel that should have been destroyed several years earlier.
- The crew was Indian and not familiar with the North-Atlantic.
- The expedition took place in December 1999 and was hit by a terrible storm during the whole of the voyage.
- On 12th December the vessel broke in two. 35 000 tonnes of fuel came to the surface and polluted 400 km of coastline.
- Contrary to the Amoco case, some of the victims asked the IOPC for compensation. Of course, the IOPC ceiling could not cover all the damages and some of the victims went to court to seek justice.
- For the victims who asked for direct compensation, the IOPC decided not only to take responsibility for the compensation of economic damage, but also accepted to take responsibility for repairing damage to nature – replacing vegetation along the coast, for example. It did not, however, compensate ecological damage. The fund paid about half of the bill of the victims asking for compensation.
- The other victims went before the tribunal de Grande Instance in Paris.
- 2008. The tribunal compensated the economic victims and accepted to take responsibility for the restoration of the natural habitat. For the local communities, the tribunal announced: *"You set out to protect the environment, the fruit of your work was destroyed by the event, not only will the bills be paid, but we are furthermore going to grant you a lump sum for the damage incurred to the natural habitat in your commune or department"*. For the first time in France, a lump sum was granted to repair the natural habitat.
- Total appealed against the ruling. The designated administrative court of appeal in Rennes confirmed most of the lower court's judgement. As far as compensating ecological damage was concerned, the court went even further: even for the communes or departments that had not invested in the protection of the environment, the coastline had been polluted. They too would receive a lump sum in compensation, irrespective of their bills.
- A new refusal by Total, which did not accept the appeal verdict. A challenge was put before the Court of Cassation, the highest court in French law. The general prosecutor delivered his verdict in June 2012. Everyone was stunned. The Total Company was not responsible, for technical details that I

cannot go into here. All this demonstrates all too well the complexity of the situation and the number of obstacles that must be overcome in order to obtain justice.

Other countries have made progress in the domain of dealing with ecological prejudice – the United States and Italy. Even the IOPC has granted, without saying so, compensation higher than what was asked for by certain parties for small events. But there is still a long way to go before ecological damage will be taken into account. In our societies, the environment remains in second place.

Economic Value of Environmental Goods and Presentation of the Driver-Pressure-State-Impact-Response (DPSIR)

[Patrice Guillotreau]

The classical conception of the value of goods is linked to the incorporation of labour in this value, in the fabrication of goods – a conception of the pioneers of economy such as Adam Smith, David Ricardo and Karl Marx, who considered the labour content of goods as the strong component of their value. Towards the end of the XIXth century, with the rise of the utilitarian current, the satisfaction that goods provide was considered more when giving them a value; then, in the XXth century, the neo-classical conception of a good was adopted by the community of economists. They considered that the value of a good stemmed directly from the meeting of offer and demand. It thus depends on commercial mechanisms, a market process.

Environmental goods are not part of this market; they are not the object of an offer or a demand – think about free goods such as air or water. These goods are not, however, devoid of value, in spite of their being free.

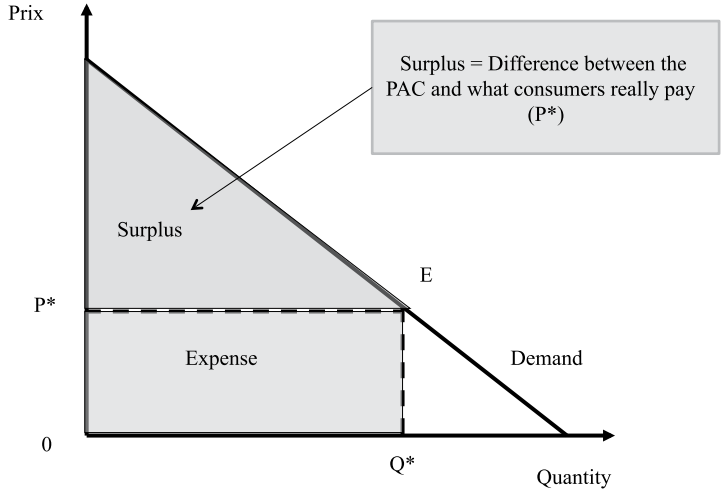
And today, the recognition of the value of the services provided by ecosystems has been adopted by the branch of economics concerned with the environment. The value of an environmental good is usually broken down from:

- Use value. It is easy to conceive uses for extracted resources, but we cannot think of more indirect use values such as coastal and seaside tourism;
- Non-use value. Existence value that is difficult to quantify. You can live 500 km from the sea and simply be happy that the sea exists in its natural state, unsullied by oil pollution;
- Heritage (legacy), such as the conservation of flora and fauna;
- Option or quasi-option value. This refers to the irreversibility of certain damage that natural goods might suffer. This value is a cost of information (cost of opportunity) that is not generally taken into account in the value of a good: for example, the construction of an upstream dam on the Red River; if demand at term is not sufficient, it represents a cost by the non-possibility of another activity.

These values overlap and cannot be aggregated. When we speak about environmental change, and, for example, of an alteration in the quality of a good, for an anthropogenic reason or other, the variation of well-being caused by the alteration of this good is measured. The concept of consumer surplus is introduced, which reflects the well-being of consumers.

The notion of surplus is introduced in order to identify what value society attributes to the environmental assets, such as a marine landscape, for example.

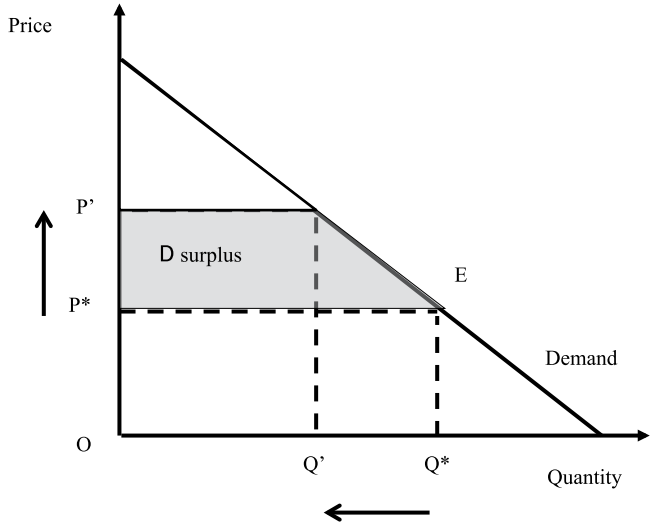
Figure 28 Surplus and Consumer Well-Being



Willingness to pay (WTP) or to receive (WTR) to obtain (or avoid) a modification of an environmental good (notion of social benefit = surplus = sum of individual preferences).
Source: Author's construction.

It is necessary to have revealed to agents their preference and the utility gained from the existence, for the use of a good, of agreements to pay or receive, depending on the modifications in quality of an environmental good. Let us ask ourselves what we are willing to pay for high quality water or receive as compensation for a future degradation of a natural habitat following the building of a dyke or a port, for example. The notion of surplus is the sum of the individual preferences of the population concerned by the quality of an environmental good. The global gain for consumers is the aggregation of the differences between willingness to pay for a good and what we really pay for it.

Figure 29 Surplus and Consumer Well-Being (2)
Variation in well-being = modification of surplus



Source: Author's construction.

Estimating variation in consumer well-being. If the price rises from P* to P', consumer well-being is reduced by as much – if a beach is polluted, we ask individuals how much they are willing to pay to depollute it; if we imagine off-shore drilling that would force fishermen to depart, how much are they willing to receive in compensation for the harm suffered?

This has a direct impact on the construction of works at sea.

The difficulty now consists in reformulating demand curves.

This may be established by direct methods – by asking individuals for their agreement to pay from a proposed scenario – or indirect ones based on observation and behaviour.

- The damage function approach. It is necessary to establish a quantitative link of causality between two phenomena. We have seen for example that the passage of container ships had a direct influence on the health of coastal populations, with a quantification of the number of deaths. We thus first established a dose-response function, then a monetary value to the preceding link. What are the supplementary costs incurred on individuals in response to this public health problem?
- Coverage provided following environmental degradation. If the water supplied by public authorities becomes undrinkable, we have to buy bottles of mineral water instead of drinking tap water. What for example is the price of sound quality? If an airport is built near to residential zones, the

cost of soundproofing homes is calculated – the value of the noise can be directly calculated in relation to these protection expenses.

- Hedonic price method. We assume that there is a direct link between the price of a good and its environmental characteristics. Imagine two houses of identical surface area, number of rooms and interior comforts, which are only different because one has a sea view. The price of this sea view can be calculated by the price difference between the two houses. A two-stage approach is followed: the part of the environment in the gap between the two prices is calculated – the implicit price of the good, the cost of the variation in well-being, in the form of a willingness to pay by the consumer for the environmental characteristic.

A study calculated sound quality of life in Geneva (Switzerland) through its impact on rent prices. 12 000 apartments, each with a different degree of exposition to noise, were sampled. It is possible to statistically measure that ten decibels more will reduce, on average, rent prices in Geneva by 6%. We can thus construct a fictive demand function, referred to as the hedonic price function, to determine willingness to pay for noise reduction (Baranzini and Ramirez, 2002).

- Transport costs method. An individual wishing to consume an environmental good is also obliged to consume other complementary commercial goods. For example, in order to benefit from the beauty of a place like Nha Trang, an individual living in Hà Nội must buy an air ticket, a hotel stay, etc. The importance and value of a site can be evaluated from the total transport costs and the number of people visiting the resort. From a questionnaire, we can establish people's willingness to pay to visit a site that corresponds to the cost of each visit multiplied by the number of visits. The responses are aggregated to the questionnaire to obtain a rate of visits coming from zone Z compared to the population of zone Z. If we replace the additional cost of the trip with an admission fee, it is possible to measure total consumer well-being as the sum of the visitors' willingness to pay.
- Example assessment of damage caused by the pollution linked to the running aground of the Exxon-Valdez in Alaska in 1984. 118 fishing sites, 94 pleasure boating sites, 70 hunting sites, 70 hiking sites were considered and 4 200 people surveyed. The agents calculated the number of visits to the different sites in question. The implicit price of the environmental quality of each site was calculated using a demand function reconstituted from transport costs. The oil slick prevented individuals from visiting these sites; it is thus the well-being variation that constitutes the damage suffered by nature. The sum attained by the total amount of willingnesses to pay was $3.8M. However Exxon-Mobil was fined $1bn, of which $308M was to cover just ecological losses! We have here an illustration of the limits of these economic methods used to assess the value of nature; the economy cannot replace law as far as ecological damage is concerned.
- Contingent evaluation method. Assuming that we seek to explain to the individuals questioned, we estimate willingness to pay so that the scenario may happen or not.

Table 12 Method of Contingent Evaluation

Proposed change	Measure taken
Well-being gain	CAP for the change to take place
Well-being gain	CAR if the gain does not result
Well-being loss	CAP to avoid the change taking place
Well-being loss	CAR if the loss takes place

CAP: Willingness to pay ; CAR: Willingness to receive
Source: Author's construction.

Phạm Trương Hương Giang

Let us imagine that a house has both a sea and a mountain view. How can we differentiate the share of the mountain view from that of the sea view?

[Patrice Guillotreau]

In the demand function we have to take the maximum number of arguments to isolate the environmental component that we seek to emphasise. Generally this involves sophisticated statistical techniques – econometry – where we will select a sample of 5 000 or 10 000 houses of which we shall describe all the characteristics that we believe to have an influence on the price of accommodation.

[Yves Perraudeau]

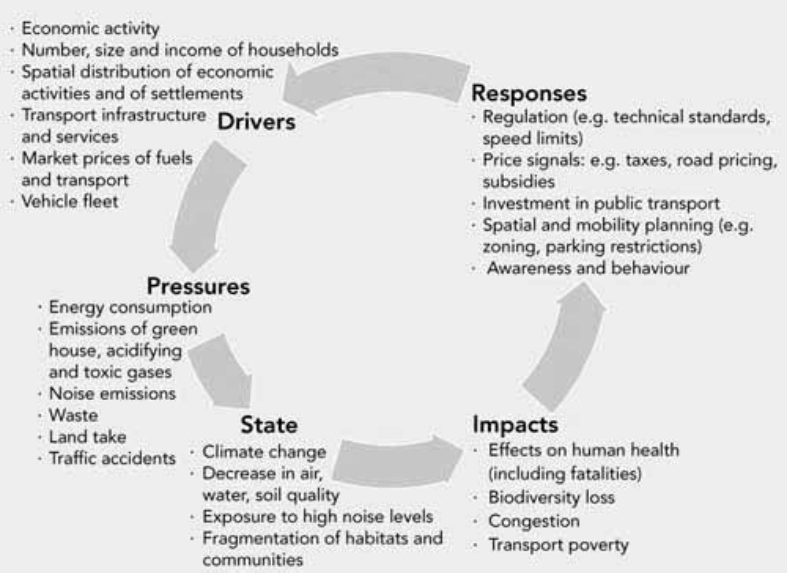
In this example, we can also specify the quality of the sea view: do we have to stand on a chair to see it, do we see it through the bay window in the living room? This will have an influence on the price.

[Patrice Guillotreau]

Let us apply the DPSIR model to the vulnerability of the coastline and the populations that live there. This vulnerability presents three characteristics:

- The exposure of a territory to risks;
- The sensitivity of activities to risks. What is the economic and social dependency in relation to an activity that would be threatened if the risk became reality?

Diagram 30 The Driver-Pressure-State-Impact-Response Model (DPSIR)



Source: Burkhard and Müller (2008).

- Capacity of adaptation to a new situation inherent to climate change. We enter the domain of governance and the capacity of institutions to propose a response proportionate to the risk run or suffered.

The utility of the model presupposes at the outset a good scientific knowledge of the environment. Next, you have the "drivers" phenomena of anthropic origin that will serve as a trigger to a series of cause-effect phenomena throughout the analysis – examples: the rise in price of a species, densification of the coastline, increase of maritime traffic, etc. These driving forces will be reflected in pressure on the ecosystem, with an increase in fishing ports, emissions of effluents, etc. These pressures are going to cause a change in the state of the system – degradation of the state of waters, increase in the capture of resources. These changes will also have a feedback influence on changes in the system – on human health, greater poverty in the case of increased effort and a reduction in the size of captures, with a greater number of bankruptcies, etc.

These impacts have a financial consequence on populations and responses to these changes will be linked to the system of governance. Are there any examples of institutions responsible for the management of fisheries, or more largely, responsible for the integrated management of coastal zones? This may involve management plans for fish stocks in order to adjust to a variation in environmental conditions. But sometimes

climate change problems go beyond the framework of the action of these institutions. The DPSIR method was refined by the United Nations Sustainable Development Commission. The framework has been extended to situations where man's actions influence the system. Beyond the different components, it is possible to construct indicators to monitor "drivers": pressures, changes in state of the system, impacts and responses.

- "Drivers" can be of human or natural origin, direct or indirect. An example of a direct "driver" is demand for goods and services; an indirect "driver" is demographic change that causes a rise in demand for these goods and services for example. It is difficult to put these changes in one box or the other, but what characterises "drivers" is the fact that they have low reactivity and have little flexibility to changes in the system.
- Pressure indicators are the first indicators used to describe man's action on the natural environment, the price of property, or the utilisation rate of maritime or coastal space. Geographers offer tools such as geographical information systems to assess this influence. They are easily quantifiable using economic or environmental databases.
- Changes of state of the system. We can measure the proliferation of green algae linked to increased volumes of nitrogen for example. These algae destroy the oxygen in the sea. We can also monitor the extent of the acidification of the environment by the examination of the potential of hydrogen (pH) or the frequency and intensity of storms. What counts is that these changes in state are relatively reactive to pressures in order to establish a direct causal link between the pressures and changes in state. These variables must be able to be used for mitigitative measures to responses – the example of carbon dioxide emissions in maritime transport and speed reduction.

Let us look at a case study of oyster growing in France. The study concerns individual risk perception. Oyster farming has existed since at least the XIXth century, and produces about 100 000 tonnes of oysters per year, or 90% of European production. 36 500 concessions, plots of coastline, are rented out to producers by the State. This represents about 10 000 jobs, or 2 500 farms. In the preceding decades, numerous crises deeply affected this traditional activity: three oil slicks, the sudden disappearance of oyster stocks following diseases that decimated the whole of the species (1920, 1971, and between 2008 and 2011) and the storms Lothar and Xynthia on the Atlantic coast in February 2010.

The Japanese oyster *(Crassostrea gigas)* is currently replacing the Portuguese one *(C. angulata)* that was entirely wiped out in 1971. Rising sea temperatures may be the cause of the multiplication of viruses. The drop in pH over the last decades also plays a big role since the calcium shell is being attacked by the acidification of the environment (see Box next page).

Box 10 Impacts and Responses

Impacts:

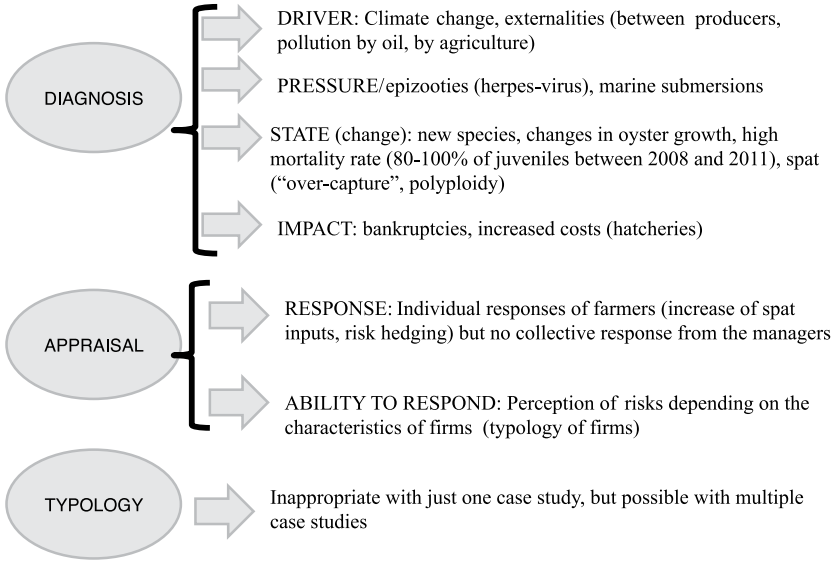
- *Erosion of the shoreline and less protection of dykes*
- *Over-capture of spat of farmed oysters (= additional costs)*
- *Epizooties (e.g. OsHV-1 mVar: increased vulnerability of juvenile larvae due to the poor quality of shell and epizooties*
- *Increased costs (hatchery, over-capture)*
- *Bankruptcies*

Response:

- *Introduction of new species (Crassostrea gigas)*
- *Technical Innovations (triploid hatchery spat)*
- *Overstocking of young farmed oysters*
- *Basins protected against swelling*

I shall conclude with this recapitulative diagram of drivers-pressure-impact-state, regrouped in another analytical framework, consisting in a socio-economic diagnostic and an evaluation of the given responses.

Diagram 31 Assessment/Diagnosis-Appraisal-Typology (ADApT)



Source: Author's construction.

Day 5, Friday 20th July

Group practical work on the DPSIR model. Thematics dealt with: salt production in the coastal zone of centre Việt Nam; overcapacity conflicts between fishermen in Cambodia, Thailand and the Philippines; aggregates production activities in Central Việt Nam (extraction of sand, granulates etc.); economic activities in the Thu Bồn river basin and the coastal zone of Quang Nam Province.

2.1.5. New Uses of Maritime Space

Legal Briefing about Access Rights and New Uses of the Sea

[Jean-Pierre Beurier]

Before obtaining recognised frontiers on land, States waged war with each other to obtain territories as vast as possible. At sea, many conflicts have been resolved by diplomacy.

In order for a human entity to be recognised as a State, three elements must be put forward: a territory, a nation, and an administrative organisation. The territory is then recognised as a State by the UN, which furthermore does not ask any questions about the economic viability of its new partner. Within proven and guaranteed frontiers, this State has the right to all the competences recognised by international law in terms of sovereignty.

To acquire territory on land, the State must prove its will to be master of a territory – philosophical dimension – and its effective occupation of this territory – material dimension. The legal frameworks concerning territory attribution accepted by the international community can be summed up as:

- Discovery of new lands;
- Adjacency: the occupation of a territory without master that is adjacent to territory A;
- Exchange of territories. Thirty years ago, Switzerland asked for an extension of its airport runway on French territory in order to be able to receive larger aircraft; an identical surface area of territory was given to France as compensation;
- Purchase of territory. For example, under the First Empire, the United States purchased Louisiana from France.

Whatever the case, the will expressed and the legal act promulgated by the State must be followed by the effective occupation of the territory: a military occupation is not enough, a normal human activity must be carried out – settlers, agriculture, trade, administrative mechanisms housed in buildings, etc.

Phạm Tuấn Anh

France possesses overseas territories, how does it govern them?

[Jean-Pierre Beurier]

These are former colonies that wished to remain French and whose statutes were transformed either into department – like in continental France, they are part of France and are just like any other part of the territory from a legal point of view – or into overseas communities – such as Polynesia, and New Caledonia that have far-reaching autonomous regimes since the two territories have parliaments. The territories that do not have permanent inhabitants are governed

by a senior administrator who is responsible for scientific bases – such is the case of the French archipelagos in the Southern Ocean, Adelia land. These territories are going to become extremely important with the development of sea law.

International law is more comprehensive about the occupation of a territory with difficult meteorological conditions. For example, the International Court of Justice has recognised the full sovereignty of Norway over Jan Mayen island on the 75th parallel North, to the East of Greenland, even though its presence is limited to weather stations.

Let us take the example of Clipperton Island for France, located in the East Pacific at 1 500 km from the Mexican coast. The French took possession of this island in the second half of the XIXth century. The island is 9 km wide and devoid of any resources; effective occupation is difficult. However, phosphates and wrack seaweed were discovered. France decided to exploit it using Mexican workers. It was at that moment that Mexico announced, *"The only permanent inhabitants of this atoll are Mexican, we claim Mexican sovereignty over Clipperton"*. The two States sought arbitrage. The decision was announced in 1931: *"What counts is the will to be master of a territory. In an area that is difficult to accede to, a State can make do with minimum occupation. If there is no wish to occupy the territory, a State cannot lay claim to it"*. Mexico having never shown willingness cannot lay claim to this territory. Ever since, each time a vessel of the French navy passes by, the sailors present arms before a flagstaff on a hill on the island. The French flag is raised and a commemorative plaque has been cemented in place. The symbolic is considerably important in the attribution of territories.

Whatever the conflict taking place between two or several States – but mainly for border conflicts – the UN obliges States to use peaceful means of resolving the conflict. There are five ways, separated into two modes.

Diplomatic modes of resolving differences:
- Negotiation. The ambassadors of both States in conflict meet and attempt to negotiate. The conflict is either a minor one, and following negotiations the two ministers responsible will meet and resolve the problem, or it is a serious one and it will be resolved by heads of government or heads of State;
- If diplomacy fails, the States go to a third party for conciliation – the General Secretary of the United Nations, a well-known international legal expert, etc. Thus, for example, the former American president, Bill Clinton, has helped resolve numerous conflicts throughout the world.

If the conflict is of a more serious nature, a jurisdictional approach must be adopted. States do not much appreciate this method as it attracts a lot of media attention and the result, whether it is an arbitral award or the verdict of a court, is published. Three possible modes emerge:
- Arbitrage. Either a single arbiter (most commonly preferred until the beginning of the last century), or a system of three arbiters is chosen. This method consists in each State involved designating an arbiter, the two latter then designate a third who will be master arbiter. All three will attempt to seek a solution in international law to

resolve the conflict, they will then deliver the sentence which must be obeyed;
- The International Court of Justice. This court, whose headquarters is at The Hague, is not there to sanction a State. Its role is to announce applicable international law; it thus refers the application of its decision to an agreement between the two parties. Up to now, it has resolved fifteen or so conflicts concerning maritime affairs;
- International Tribunal for the Law of the Sea. It is composed of twenty-one judges representing all the territories in the world, all specialists in maritime law. The tribunal has jurisdiction to make sure the convention is applied, whatever the cause of the conflict – territories at sea, fishing, pollution, etc.

Let us now take a look at the drawing up of borders.

Contrary to common belief, natural frontiers such as rivers and mountains are rarely used. Any system, including meridians and parallels, may be used on condition that States reach an equitable agreement. Two phases can be distinguished in the drawing up of a border:
- Delimitation, which is a legal operation and decides how the border will be drawn up;
- Demarcation, which is a material operation to physically trace the border by placing markers.

At sea, great-circle coordinates are used – parallel to the meridians, and the coordinates are plotted on recognised marine charts. States are obliged by the Montego Bay convention to draw up their borders on a marine chart in good faith; for nations that do not have naval hydrographical services, States can ask for this to be carried out in the big hydrographical circuits of marine States – the three most reputed nations for world maps are the United Kingdom, the United States and France.

What is an island in law? The consequences of recognising an island are so big in the new convention that an entire article is devoted to this subject. Article 121 announces, *"An island is a natural stretch of land surrounded by water that remains above sea level at high tide"*. Just like continental land, an island has the right to territorial sea, a continental shelf and an economic exclusion zone (EEZ). However, the group of 77 countries, in an attempt to limit the extension of maritime zones of the great powers, had subparagraph 3 added that states *"Rock that cannot be inhabited or have their own economic life do not have an economic exclusion zone, nor a continental shelf"*. In reality, once the convention was implemented, States sought the smallest "rock" where they could claim sovereignty and say that it was an island.

The drawing up of a sea border is relatively simple; let us imagine a coast and a frontier between a State A and a State B:
- In the case of two bordering States, the simplest solution is to extend the land frontier out to sea, by plotting the equidistance line at sea;
- In the case of two States facing each other, there are not two territorial seas, a median line is used: that is to say equidistant points in the distance of the territorial sea between the two States.

As for the economic zone, this is more difficult to manage as there may be an area of shallow water where fishermen from State B have been fishing since time immemorial, but where State A, that is not a maritime State, does not go. A and B may decide to extend

the logic of a terrestrial border to a certain point. B will make a proposition to have the frontier circumvent the shallow water by up to 200 miles; A may or may not accept.

As for delimiting the continental shelf and then the EEZ, the International Court of Justice has developed its jurisprudence to have, on the one hand, just one EEZ and continental shelf frontier, and on the other, to find an equitable solution in the same spirit as for terrestrial borders. The origin of this development dates back to the famous verdict of the International Court of Justice in 1951 concerning the affair of Norwegian fisheries on the Lofoten islands. Norway had – by decree and thus unilaterally – extended its maritime border to the Northwest, chasing foreign fishermen from the fish rich waters, arguing that the inhabitants of the Lofoten islands were isolated during the winter and that fishing was their only means of subsistence. An economic and social dimension entered the issue of border delimitation for the first time.

Let us go now to the Mediterranean: to the south of Libya and to the north of the island of Malta. There happens to be a large terrestrial mass between the two countries. For Malta, the natural extension stretches to the thalweg. For Libya, its maritime territory thus becomes too small in relation to its terrestrial territory. The two States could not reach an agreement and went before the International Court of Justice that delivered its verdict in 1982. *"The notion of a natural extension of terrestrial territory does indeed prove the existence of a continental shelf, but a basic principle is that land dominates sea. It is because a State is sovereign on land that it can claim an extension of its sovereignty at sea. We must take into account in all fairness the continental mass of territories"*. Henceforth, the notion of an extension of terrestrial territories is no longer the only basis and the relation between terrestrial masses is also taken into account.

Jean-Pierre Beurier concludes his presentation with a few examples in the Oriental Sea, notably the islands referred to as the Paracels of marine charts that are claimed by Việt Nam and China, and the Spratleys, also claimed by these two countries, but also by the Philippines, Malaysia, Indonesia, Brunei and Taïwan.

The end of the day is devoted to group work in order to prepare Saturday's feedback.

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2.2. Urban Growth, Social Needs and Water and Sanitation Service Offers

Catherine Baron – University of Toulouse, Aymeric Blanc – AFD, Christophe Cluzeau – Expert-Consultant, Clément Frenoux – GRET, Claude de Miras – IRD

(Retranscription)

Day 1, Monday 16th July

Introduction of trainers and trainees (see trainers' biographies; list of trainees included at end of the chapter)

[Catherine Baron]

The week's programme will be adjusted depending on your progress; here is an outline of the programme we would like to develop with you:

- This morning: a look back at the plenary sessions and the role of the AFD in the water and sanitation sector;
- Afternoon: introduction and definition of different methods and modalities of management – delegated management, governance, etc. – illustrated by case studies in Senegal and Cambodia.

> Thursday: group work. Feedback and debate about weaknesses and strengths of each of the models presented; case studies; concrete development situations.

> Wednesday morning: in-depth look at case studies; concrete development situations.

> Thursday and Friday morning will be devoted to a household survey and water and sanitation survey methodology.

> The last afternoon will be devoted to the preparation of Saturday's feedback presented by two trainees from this workshop.

The trainees will list the interesting ideas addressed during the plenary sessions and the points that they would like to take another look at:

- *Reinforcement and optimisation of water management process*
- *Elaboration of rules for domestic water management in an urban environment.*

- *Correlation between consumption of drinking water and rise in living standards, thresholds*
- *Water pricing, interest and substitution. Competition between urban and peri-urban areas. Equitable prices*
- *Water shortages for natural reasons, absence of operators and because of consumer behaviour*
- *Public monopolies and privatisation*
- *Distribution and internal management of water in collective places*
- *Human and spatial constraints linked to urban development and urban infrastructures*
- *Governance and the role of public, private and non-governmental economic stakeholders*
- *Examples of Public-Private Partnerships (PPPs), issues and difficulties*
- *Management and governance*
- *Environmental management and reuse of sewage water*
- *Using rainwater*
- *Demographic pressure and water management*
- *Cost of water treatment, of its use and methods of monitoring wastage usage*
- *Management exclusively by the community.*

[Claude de Miras]

You have well understood the importance of pricing that is linked to financing and which is one of the first conditions for the implementation of these infrastructures. You have also, when discussing governance, spoken about the major role of institutional players and their relations with operators in an increasingly complex urban environment.

2.2.1. The Role of the Donor

[Aymeric Blanc]

What is the role of the donor in an institutional context? In the plenary session, Claude de Miras presented you with the "3Ts": tariffs, taxes and transfers. In the last category we find Official Development Assistance (ODA). There are immense needs in the water and sanitation sector: 2.5 billion people have no access to sanitation; 900 million have no access to water. It is within this framework that ODA aims to contribute to the reduction of this gap.

Box 11 Water: An Underfinanced Sector

ODA largely insufficient
- Assistance to sector: USD 5bn
- Estimated needs: USD 70bn
Political disengagement
Decrease in the weight of this sector in ODA
- 6% in 2000
- 4.5% in 2010

The water sector is underfinanced. We speak about a financing "gap" and, furthermore, we can observe a political disengagement and a decrease in the weight of water and sanitation in the global ODA budget – 6% in 2000 compared to 4.5% in 2010. It is necessary to find new sources of financing, either local ones through the other "Ts" (tariffs and taxes) or by Public-Private Partnerships (PPPs).

Box 12 Agence Française de Développement

- *AFD: main operator of the French State's ODA and financial partner of French Overseas Departments and Territories*
- *AFD missions: accompanying sustainable development in developing countries: poverty reduction (MDGs); in emerging countries: global public goods; in overseas departments and local authorities: support for public policies*
- *EUR 6.8bn of commitments in 2011: 40% in Africa; 11.5% in Asia*
- *Presence in 90 countries (70 agencies)*
- *1 680 employees (700 in agencies)*

The AFD is the main operator in the French State development policy, not only abroad but also in the Overseas Departments and Territories. Its mission is to encourage sustainable development, using a differentiated positioning according to the zone in question. In developing countries, it is a question of a mandate for poverty reduction, linked to the MDGs. In emerging countries, it is a mandate for the preservation of global public goods. The sum committed in loans and grants stood at approximately EUR 7bn in 2011.

The water sector represents EUR 600m of annual commitment, with an increased share reserved for sanitation (40%), which is slightly behind the MDGs. Contrary to ODA on a world scale, AFD commitments in the "Water and Sanitation" sector are constantly increasing, and represent approximately 10% of its activity, which is higher than the average share of other ODA sectors. Each year this represents: 1.6 million people who gain access to water, 0.6 million who gain access to sanitation and 4 million whose service is improved.

Our strategy concerning water can be broken down into four points:

- Support for State public policies to help build a relevant framework and an efficient sectoral strategy. Besides physical investments that are being financed, the AFD is developing capacity building activities thanks to technical cooperation with its university and private partners – support for Masters' courses in public works, training with the *Centre d'études financières, économiques et bancaires* (CEFEB) in Marseilles and academic production with publications and research work;
- Managing and protecting the resource in a sustainable manner, notably fragile aquatic environments. To do this, the AFD is applying an integrated water resources management through an integrated vision of river basins. The strategy is implemented

upstream of projects so that all partners can share a qualitative and quantitative diagnostic of available resources and ways of using them. The diagnostic must favour debate between actors about water usage – domestic, agricultural and industrial. We are seeking solutions to optimise demand and fight against wastage – technical and commercial losses can be as high as 40%. Finally, the AFD is promoting the use and optimisation of non-conventional resources: recycling of wastewater, desalination – particularly in countries on the Mediterranean coast suffering from a lack of water;

- The AFD is contributing to the permanent supply of water for all, by seeking to both reduce the average cost of supply and optimise a certain number of levers, such as collecting money owed for bills, price offsetting, etc. It supports long-term investment plans through the coordination of the global institutional environment so that projects are not abandoned after a few months or years;
- Finally, the last strategic area concerns the urban environment and the strengthening of sanitation infrastructures for waste and rainwater, particularly through the conception of canals.

The AFD's mission in emerging countries is to preserve global public goods. The development of water management can have positive consequences on a worldwide scale in the fight against climate change, against communicable diseases and in the protection of biodiversity, which also represents global public goods. Thus, all measures that allow us to improve energy efficiency or make good use of gas emanating from sewage plants, such as methane, have beneficial effects on the climate. Furthermore, sewage treatment will have an impact on both on health and biodiversity – the reduction of stagnant waters to reduce the risks of malaria, and the monitoring of wastewater so as not to pollute wetlands.

How is a development project designed? What are the different cycles of its construction?

Five principal stages have been identified:

- Identification of the project. A permanent dialogue is put in place between those responsible for the project – this may be the State, a local community, or a public enterprise – and local agencies. The target is to determine needs and investment projects. The project must comply with the sectoral policy of the contracting authority for the works and the AFD's sectoral policy;
- Then, a formal request is formulated to the AFD that examines the project and decides whether it is feasible. Feasibility is a study phase that defines financing needs in order to obtain fixed targets and is often conducted in partnership with consultancy firms. The AFD contributes to the financing of these preliminary studies in the form of standard local invitations to tender. These can be institutional and describe the regulatory and/or technical environment and concern demand, population, resources and financing. In order to study economic feasibility, a economic rate of return is calculated to decide whether the project is viable. Often, the AFD finances projects that are not profitable enough for a private bank, but are nonetheless profitable because they include non-market economic benefits – for example, the preservation of global public goods. Donors thus facilitate the

financing of communities that might experience difficulties when faced with the constraints of commercial banks. Another key point of these studies lies in the study of the technical and financial capacity of the construction project, in order to guarantee the continuation of the project. Another element is the social and environmental study in order to evaluate the project's effects, for example, financially compensating displaced populations;

- The evaluation validates the project's viability and its risks and identifies measures. These risk mitigation measures are sometimes accompanied by conditions that must be met at different stages of the project, such as at its signing or at the disbursement of funds. It is, for example, possible to make aid conditional by asking a water purification station to be capable of meeting running costs, so as not to go bankrupt and to assure the continuity of the infrastructure. Thus, in Egypt, the tariff is two cents per cubic metre, or one tenth of the running costs that would be necessary to break even financially. In this hypothesis, AFD aid can be accompanied by a condition of rate increases. These conditions are negotiated with, and not imposed upon, partners. There are several levers on the "3T" that allow a certain room for manoeuvre, and cross-subsidies with other services such as electricity and telecommunications, etc. may exist. To get back to Egypt, the context of the Arab Spring does not allow the AFD to envisage a price increase; it has asked the government to commit to subsidising the operating deficit of the water company with which the AFD has a contract;
- The fourth step is the presentation of the project to AFD's Board of Directors, which may or may not approve it, then a loan or grant agreement is signed;
- Finally, the project is implemented and the works, which are divided into several lots, are subject to invitations to tender for construction enterprises. At each stage of the procurement process, there are controls to verify that procedures for local invitations to tender are respected and check that the requirements concerning transparency and competition are complied with. The AFD follows each stage of the project's progress that leads up to a final *ex post* evaluation in order to verify that initial targets have been reached.

2.2.2. Service Management Methods

Throughout the world, water is a sector for which public authorities are responsible – the State or local authorities. There are two main legal forms: either the public authority is directly responsible for the management of the service, or it is delegated to a public or private enterprise. Delegation to a private stakeholder is not the same as privatisation, as the water sector always remains a competency of the public services. In the case of delegating to private enterprise, it is essential to regulate its "natural" monopoly – economic theory demonstrates that a multiplication of networks and players reduces efficiency and profitability – as it might be tempted to maximise profits to the detriment of public and community interests. Historically, this State and public authority monopoly is not so straightforward; PPPs did not first appear in the 1990s. Indeed, in the XVIIIth and XIXth centuries, first in London then in Paris, private enterprises conceived networks of water distribution for private

houses – the case of *Veolia* or *Lyonnaise des Eaux*. When these regulatory issues arose, water management became public in most countries, except in France where it remained for the most part private. In the same way, when DCs became independent they reappropriated responsibility for water services for reasons of national sovereignty.

The first management method is governance, which is direct management by a State ("sovereign" level) or a territorial public authority ("sub-sovereign" level) that directly manages water services. There are three types of governance:

- Direct governance: general budget, no legal personality or financial autonomy, staff under public contracts;
- Autonomous governance: annexed budget, financial autonomy, no legal personality, staff under public contracts;
- Personalised governance: annexed budget, legal personality, financial autonomy, staff under public contracts;

In all cases, it is an emanation of a State or public territorial authority that directly provides the service.

The second method is delegated management. The State or municipality remains responsible for the community but asks a third party (a private, public or private/public company) to carry out the mission with which it is entrusted, often on the basis of a contract in which a certain number of targets and responsibilities are specified. Often, when a mission is delegated to a private enterprise, formalising targets and the means of achieving them in a contract clarifies the mission, gives it a certain autonomy and protects it from political influences.

When delegated management is entrusted to a private enterprise, it is a case, in a wider sense, of a public private partnership, the public authority entrusting all or part of the management of a service handed over to third parties.

Box 13 Role and Assets of Partners

Public authorities	*Enterprise*
Prescriber and regulator	*Taking investment risks and/or running risks that it can control*
Definition of main targets of public service	
Programming of public service investments	*Management efficiency motivated by profit*
Choice of management methods	
Protection of consumers	*Choice of methods*
Protection of the environment	
Capacity to share risks and support exceptional risks	

Source: Author's construction.

There is no one model for management or regulatory methods. An Anglo-Saxon vision of regulation adopted by the World Bank recommends that it be an authority different from the one responsible – so that it may be autonomous and not influenced – but there are also efficient examples without autonomous authority. France opted for regulation by contract without any external regulator – contrary to the case in other sectors. The models must be adapted to local and national contexts in order to avoid any rejection; French models or Anglo-Saxon ones may be a source of inspiration, but must be adapted to suit the local context.

On the other hand, an enterprise manages the service and takes risks, which justifies profit. The idea is to spread out water management risks between the public authority and the private sector, so as to strike a balance and equitably reward the private stakeholder.

This delegated management is entrusted to private stakeholders to attract new capital, such as direct foreign investment, in order to collect revenue from "privatisation" (or rather from delegated management), to benefit from the operator's know-how – who might be a professional in the sector – and place his technological innovations at the service of the community, or clarify relations between the authority and the operator and limit public interference in the water sector. Given that it is often a contract that fixes obligations to produce results, this makes it possible to obtain performance indicators and more accurately follow the performance of the service. It is, however, possible to establish performance indicators with a public enterprise. Choosing between a public and private enterprise is rather determined by ideological considerations.

The private stakeholder is motivated by the prospect of generating profit through the intermediary of the enterprise that signs the contracts and its subsidiaries which may be involved in sub-contracting activities linked to the contract. The arguments that are sometimes used against PPPs are the loss of national sovereignty – particularly when it is a question of foreign operators – or job cuts to reduce production costs, private capital costs, the complexity of financial schemes, etc.

Five principal types of contract, sometimes hybrid, and more or less risky for the private operator – and conversely for the public operator, can be identified. Logically, the greater the risk, the longer the contract will be so that the enterprise will have the time to profit from its investments.

- Service contract. Here it is a short contract for very limited services, such as specific tasks (pipe repairs, installing meters, etc.). This contract is not for improving a service suffering from inefficient management. An enterprise is paid in exchange for a service it provides, but the administration and public authority continue to supply the main service and to finance it through taxes.
- Management contract. This carries a greater part of responsibility for the private stakeholder; the length of the management contract is longer than the service contract. The private stakeholder occupies the key posts in the enterprise in order to run and maintain it. The remuneration of the enterprise is linked to performance targets that lead to an optimisation of performances unlike the service contract. Commercial risk is borne by the public authority. To transfer commercial risk to the private stakeholder, it is necessary to opt for a lease agreement.

- The lease agreement. The private partner pays a rent for public services' infrastructures and runs and maintains them. On the other hand, the main part of the investment comes from the public authority – except in the case where the lessee makes small investments, such as for renovation or the purchase of small equipment. Commercial risk is shared. The private operator pays a licence fee to the public authority: either a lump sum or a sum proportional to the volume sold (lease contract). The private enterprise is generally responsible for billing and collection; it is in direct contact with users. Today, lease contracts are widely used in France, contrary to the XIXth century when the model of concession contracts predominated. There is a separation of roles between the public authority, which makes the investments, and a private stakeholder who manages it to the best of his ability.
- The concession contract. The risks are greater for the private operator because investment risk is transferred. The assets are granted for a determined period. The financing of investments is provided by the private enterprise. The bank is often a partner because the enterprise must raise capital. The private stakeholder hopes to be "reimbursed" through the tariff imposed on consumers for the use of the service. The question of pricing is central to this type of contract. The challenge is to find a just method of regulation, so that the price is sufficiently profitable for investors and satisfies both State and consumers.

The Build Operate Transfer (BOT) is a variant. Just like for a concession, investment is made by a private partner, but it is generally reserved for the development of specific works (Greenfield) – power plants, water treatment plants, sewage works, etc. Often the works are accompanied by a buying-in contract with the public authority. Thus, for example, the private stakeholder builds a plant and sells the water to a private producer; this is supported by the "tariff" or the "transfer" (a direct subsidy from the State).

Here is a summary table of the distribution of commercial risks, investment, maintenance operations, as well as the ownership of assets between public and private partners. The contracts range from 1 to 2 years to up to 30 years.

Table 13 A *Continuum* of Contracts…

Types of Contracts	Asset Ownership	O&M	Private Equity	Commercial Risk	Duration (Yrs)
Service Contract	Public	Private & Public	Public	Public	1-2
Management Contract	Public	Private	Public	Public	3-5
Lease	Public	Private	Public	Private	8-15
Concession	Public	Private	Private	Private	25-30
BOT/BOOT	Private & Public	Private	Private	Private	25-30

O&M: Operation and Maintenance.
Source: Author's construction.

Nguyễn Hải Loan

You said that pricing was the most important element in the concession. How do you deal with the contradiction of a tariff that must be sufficiently high to cover investment and attract investors, and a price that has been fixed in advance by the State, as is the case in Việt Nam?

[Aymeric Blanc]

We have realised that in DCs where households often have limited revenues, the concession is not the best adapted model, contrary to leasing contracts. Today there are almost no concessions.

Sapphud Mit

Where are we with community management?

[Aymeric Blanc]

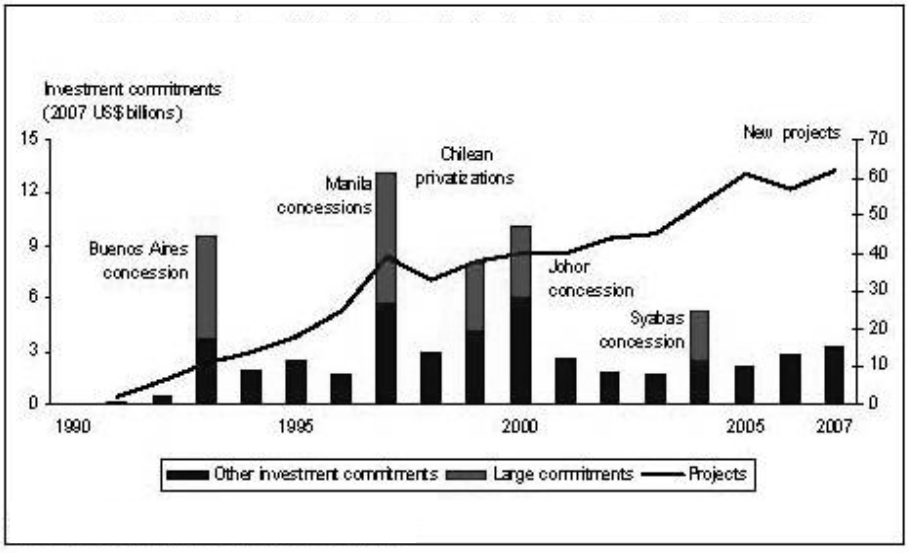
The enumerated models are highly represented in the North. There are, however, other modes of management in DCs, notably management by user association committees. Sometimes, States that have few means of intervening in this domain allow the private sector and associations to fulfil this mission. This can raise questions concerning equity and control of responsibilities.

These models are applied to the water sector, but also to those of electricity, transport and other public services.

Let us now address more specifically the water sector in DCs.

What results can be established from the dissemination of these models over the last twenty years in DCs?

Figure 30 Private Participation in Water in Developing Countries 1990-2007



Source: FAO.

On this graph, the black line represents the number of new projects per year that have been signed in DCs. Near to zero in 1990, it reached almost 60 new projects in 2007. The histograms represent the amounts of private investment in billions of dollars. Thus in 1993, around USD 10bn was invested in PPPs, of which nearly six were devoted to just one project in Buenos Aires.

Public

We can note a contradiction between a reduction of the investment amounts, around USD 3bn in 2007, and the development of a number of projects. More and more contracts are being signed, but investment commitments are lower and lower. Why?

Nguyễn Thị Thanh Tâm

Are contracts divided up according to specialisation – a contract for regulation, construction, running, etc.?

[Aymeric Blanc]

That might be an explanation, but the histograms represent the amount of all the investments of all the contracts in a given year.

Phạm Hoàng Phước

At the beginning, investments are higher and correspond to the heavy infrastructures, then comes the construction of complementary networks or auxiliary services.

[Aymeric Blanc]

In the first contracts, private partners were asked to massively invest in order to develop new infrastructures. In the new projects, the public stakeholder often takes responsibility for new infrastructures. Concession contracts decrease and leasing contracts rise. The private stakeholder manages the running but does not invest.

At the beginning of the 1990s, big concession contracts were signed, but were destabilised by the crisis and the devaluation of the peso (the case in Buenos Aires). The breaking of this contract triggered the loss of confidence of private operators for heavy investments in high-risk countries, such as developing countries. The current trend is to sign less risky contracts, such as leasing contracts, with public majority investment or BOTs. The 1990s theory according to which the financing gap for the water sector could be filled by the international private sector is an illusion that has come to an end. It is significant that many PPPs are today signed in China where the public authorities have large sums of money for public investments.

The national operators market in DCs has developed a lot because of the pulling out of international investors from Northern countries. In 2000, their share represented 10% of the market compared to 40% in 2007 – this is notably the case in Latin America where many local enterprises have signed PPPs.

The percentage of the urban population served by private operators has been constantly increasing over the last twenty years. It now represents 200 million inhabitants in absolute terms, which is rather low when compared to the total population of DCs.

The number of private operators is situated at between 5% and 10% of the water market in DCs, and is higher in developed countries; the private sector is present in every country and is not really linked to political regimes.

In certain cases, PPPs have allowed us to improve access to water and performances concerning service quality, particularly where technical and commercial losses – which at the outset were often very high – are concerned.

However, there have been mixed results. For half of PPPs, it is difficult to give an opinion because of the lack of data or because the contract is too recent. For one quarter, performances are good and for the last quarter failures have been observed (contracts terminated and not renewed, etc.).

As far as pricing is concerned, it is true that they have increased, but this also corresponds to investments that have allowed the continuity of water services.

The more global issue of access for the poor seems to me to be more interesting, especially in developing countries where there was very little access to water at the outset. However, we can often observe that the poor lose out because of underinvestment in relation to what is expected in terms of extension. For the new generation of contracts founded on a "Pro Poor Policy", we make sure the private sector is not "discouraged" from serving the poor, notably in terms of extension – so that we can be sure that the social benefit of the partnership does not benefit those who are already connected to the network.

[Claude de Miras]

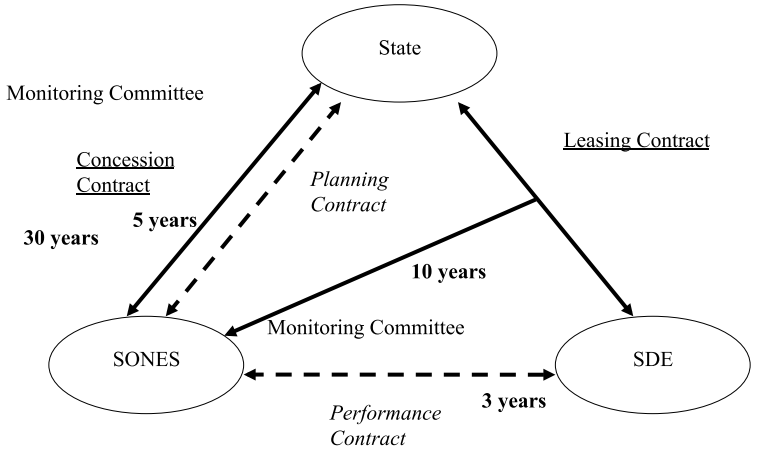
There is no ideal recipe. For every target assigned in the contract, the choice is defined by length of time, level of public investment, level of implication of the private sector, etc.

Case Study: Water Service in Senegal

Senegal is a West African country where, at the beginning of the XXth century, a private company managed water services. Then, national management was handed over to the *Société nationale d'exploitation des eaux du Sénégal* (SONES). In 1993, the Senegalese government began a reform in order to relaunch an investment dynamic in the water sector by respecting a rise in pricing limited to 3% per year, increasing the number of customers and linking the poorest households to the network. The State opted for a leasing contract leaving the management to a private stakeholder – based on an invitation to tender where the private enterprise had to propose the lowest "lessee tariff" to win the contract.

The enterprise chosen had 25 000 subscribers, produced 100 million m^3 of water and served fifty or so urban centres with 4 million inhabitants. They chose to implement the same pricing on a national scale so that there would be "equalisations" between the big cities and small ones. In this framework, a public asset holding company was created, SONES.

Diagram 32 Institutional Systems : SONES, State, ASDE Regulation "By Contract". Existence of a Public Asset Holding Company Distinct from the State



Source: Author's construction.

SONES signed a thirty-year concession contract with the State for the delegation of public management. At the same time, a leasing contract for a ten-year period was signed by the State, SONES and the ASDE, a private enterprise that was selected in the framework of the invitation to tender. There is no autonomous regulatory entity; regulation is done by contract.

The average public tariff is collected by the ASDE, which then shares it out: one part is kept for the operation – "lessee price" on which it based its offer at the time of the invitation to tender, another part is transferred to SONES so that it can recoup its investments.

After more than 10 years of operation, results show a rise in the level of supplies, of the number of subsidised connections, an improvement in performance indexes, notably the index for cubic metre water loss per kilometre of network, etc. The fixed targets in the contract in terms of loss have always been reached, but can be improved. Yield has improved, although it still remains below the target fixed.

However, the consumption of public administrations can be problematic as the latter do not pay and may become a source of high overdue rates. Since 2002 however, the consumption of water by administrations has remained relatively stable and its overall weight has been in constant decline. In 2008, their consumption represented 8% of the total billed volume.

Certain categories pay more and subsidise other classes of the population. This system of pricing by increasing block tariffs emphasises political willingness to create solidarity between consumers. Not all consumers pay the same price for their water; internal financial transfers take place between different classes of users.

Fifteen years after the beginning of its contract, which also signals its end, the private enterprise has succeeded in putting the sector back on its feet by connecting a large number of new subscribers, with a water access rate of 98%, while at the same time limiting price increases.

The financial equilibrium of the sector over the first years was satisfying, with a controlled rise in pricing. From 2003 however, several factors have contributed to destabilising this equilibrium:

- The operator tariff has risen (+13%) because of energy running charges – no productivity gain;
- The asset tariff has slightly risen (+6%) as a result of an increase in the administration tariff and an increase in the running tariff: pressures on investment capacity.

In 2011, new tensions appeared. Because of the high number of households connected, the average tariff fell and the lessor tax rose: adjusted to the cost of energy. The financial equilibrium of the public asset holding company was threatened. Instead of increasing tariffs, the Senegalese froze them for electoral reasons, and made the administration bear the brunt of the rise: the price of a cubic metre was multiplied by ten in 2009, whereas before that administrations did not pay anything. This resulted in unpaid bills and a cash flow crisis for SONES.

The State, the operators, and the donors renegotiated a contract to save SONES from bankruptcy. Today still, this contract is being renegotiated with readjustments in pricing that might guarantee the continuity of

SONES, of the ASDE and of the public asset holding company.

These contracts, which constituted a model of leasing in Africa, still need to be adjusted and need to have a regulation mechanism flexible enough to allow institutional stakeholders to find a solution. This illustrates the role of policies concerning tariffs. In Senegal, a solution is in the process of being found. However, in Mali for example, although there were commitments made during the presidential elections concerning tariffs, this resulted in the breaking of contract and the departure of private partners who could no longer intervene. The institutional environment is a major condition; a mechanism is needed to install mutual confidence between partners.

Case Study: Phnom Penh Water Supply Authority (PPWSA)

[Clément Frenoux]

The PPWSA is a public company with an atypical form as it is a State enterprise.

Context

Cambodia is a country with thirteen million inhabitants. Its economy is driven by the textile, tourism and construction sectors. Since 1998, it has experienced a growth rate of about 11% per year; however, the financial crisis of 2008 was greatly felt in this essentially rural country – 78% of the population lives in rural areas.

There are two autonomous State public enterprises (SPE) in Phnom Penh and Siem Reap, eleven state structures managed by the ministry, nine PPPs – principally BOT and privatisations; two cities have no water supply.

The capital, Phnom Penh, has 1.4 million inhabitants. The story of the PPWSA State company is remarkable. In 1993, it was in a critical state with very low water quality; there were few official connections. In twenty or so years, spectacular progress has been made:

Table 14 The PPWSA in a Few Figures, 1993-2008

	Units	1993	2008
Service hours	h/d	10	24
Pressure	bar	0.2	2
Coverage rate	%	25	90
N° of connections	u	26 881	176 000
Production	M^3/d	65 000	300 000
Technical and commercial losses	%	72	6,2
Illegal connections	u/year	300	8

Source: Author's construction.

System: An Example of 3T

Let us get back to the 3T and the strategy of the State enterprise. We are faced with a double price adjustment. We have an increasing block tariff depending on consumption – the higher the consumption, the higher the tariff. This is an example of a social tariff; poor families that have little money pay a tariff that is below the production costs of the enterprise. Profits are used to refinance the cash component of poor households. Furthermore, a second transfer takes place between commercial and domestic tariffs.

In 1999, the enterprise created a programme to connect poor villages across the entire city – 20 000 functional connections. At the outset, the operation was carried out without State intervention, and then subsidies were progressively granted to the poorest families.

In transfer terms, the State water company benefitted from the high level of involvement of international donors over time. Loans were also granted, notably from the AFD, the World Bank and the Asian Development Bank:

Table 15 Sources of Financing, 1993-2009

Donor	Amount (in USD)	Type of fund	Status of loans
UNDP/WB	2,803,001	Grant aid	Does not arise
JICA	84,929,815.04	Grant aid	
AFD	21,160,810.14	Grant aid	
	14,099,882.67	Loans	Grace period (13/12/2010 to 31/12/2018)
WB	28,654,894	Loans	100% repaid
ADB	12,638,749		Currently, payments made twice a year
Total	164,287,152		

Source: PPWSA 2009 Status.

How does financing work?

In 2008, 86% of PPWSA clients were domestic consumers and 14% were commercial consumers. Commercial users consume 35% of the total volume and domestic ones 59%. The double equalisation functions thanks to this differential. It is not enough to establish a pricing grid; you also have to embed it in your customer database (client profile) depending on numbers and volume.

The city of Phnom Penh is rapidly expanding, which will have consequences on the customer base in the near future because more and more investment will be necessary.

What are the keys to success of this State enterprise?

- Strong public leadership with a management style inspired by the world of enterprise and a policy of exemplarity (s/he who does not pay is disconnected, whatever the person's status). Contrary to the situation in Senegal, all administrations pay;

- Staff restructuring and training;
- Financial and technical standardisation accompanied by an in-depth rethinking of commercial and financial policy prior to a technical long-term investment strategy;
- Financial support in donor time;
- A "comprehensive" State attitude to autonomy and the choice of enterprise.

Phạm Hoàng Phước

In Senegal, a single tariff is applied to poor and rich households. Is there not a pro-poor social policy?

[Aymeric Blanc]

In Senegal, a single price is applied in cities, but in tariff bands. There is a social band that is applied for a consumption of less than 10 m^3; the tariff is lower than production costs. Furthermore, subsidised connections have been made thanks to State aid. The perfect policy does not exist, thus compromises always have to be made. The increasing block rate is often applied, but it is based on the presumption that poor people consume less, whereas in reality it is not so simple. Large poor families consume large quantities of water and find themselves in the higher bands. Other social policies may be adopted: in Columbia, tariffs are divided according to six strata defined by income.

Nguyễn Hải Loan

In Phnom Penh, what measures have been taken to reduce the rate of technical and commercial loss from 72% to 6%?

[Clément Frenoux]

In 1993, clandestine consumption was counted as technical loss. The strategy of the State enterprise was to entirely change the network in the city centre. They opted for a particular technological choice and a telemetry system and a monitoring of the management of losses to dissuade clandestine consumption.

Vũ Thị Thu Hương

In Việt Nam, certain households let the water drip drop by drop so it will not be registered by the meter.

[Clément Frenoux]

This practice is not efficient as it allows air to enter into the pipes that will cause the meter to accelerate when the tap is turned on. However, this can create damage to the network and is not good for the operator.

Nguyễn Thị Hoài Hương

You explained that there are several types of management in Cambodia: State structures managed by the ministry, EEs (environmental enterprises), PPPs. Is any one model more efficient than the others? Can the Phnom Penh model be applied in other cities? The double equalisation works but it might not be relevant in other cities – too few rich to compensate the consumption of the poor. What are the other policies of the Cambodian government to help the poor?

[Clément Frenoux]

It is not possible to transfer this tariff grid to all the other cities – the second city in Cambodia only has 200 000 inhabitants, there is no industry. Now these cities represent the principal source of revenue. Next, the management capacity of small cities is not comparable to that of the State enterprise and the multi-tariff bands demand a certain number of specific competences. Different models exist together.

Day 2, Tuesday 17th July

The day is devoted to practical work around the following thematics:
Is there a management method we should give priority to that will allow access to water to the greatest number of people? Facilitator: Catherine Baron
Historical evolution of management methods for drinking water services, Facilitator: Aymeric Blanc
Synthesise all the forms of equalisation that have been spoken about, Facilitator: Claude de Miras
What is the current water management method in Tam Đảo? Facilitator: Clément Frenoux
Two case studies are also being subjected to the analysis and reflection of the workshop:

Case n° 1

Context
You are responsible for a delegated management that signed, ten years ago, a thirty-year contract for the management of public water and sanitation services with a big agglomeration of four million inhabitants.
The results of the delegated management are in line with the service indicators, although you have difficulty financing 100% of investment needs (annual average finance at 90%).

- *Bulk purchasing of drinking water from a national operator who raises a surtax for the State (50%) and represents a cost of 70% of your annual turnover*
- *95% of the urban population is supplied water 24/24, 7/7*
- *20% of water not billed*
- *Turnover: USD 400m - 1% non-recovery of sums.*

What strategy?
The local authorities ask you to include this national programme in your delegated management contract and to respect deadlines.
The authorities decide to fix a social participation investment tariff for the inhabitants of the informal zone, which brings their contribution to 10% of the total amount of investment to be made over five years.
You must prepare an interview with the mayor who wishes to meet the national authorities with you to discuss operational methods that must be taken into account and possible financial aid.

Case n° 2

Context
You manage an asset holding company that signed, ten years ago, a fifteen-year contract with a private lessee for the water service to a capital with two million inhabitants.
The results of the PPPs are disappointing.
- Service not far-reaching: only 25% of the city
- Water 10-12 hours per day
- 56% of water non-billed,
- 30% not collected
New private stakeholders have appeared in the city over the last twenty years, today there are 500 of them.
- Drilling at 30 to 60 metres
- Water tower
- No water treatment
- Household connections in PEHD "spaghetti network"
- Meters
- 23% of the peri-urban population covered
What strategy?
The government supervising your company has committed itself to attaining the target of providing water to half the city.

You have been contacted by the association of small private operators who wish to negotiate a licence to operate and obtain subsidies and technical training
You must define three strategies to prepare this interview.

Day 3, Wednesday 18th July

[Claude de Miras]

What is the difference between management and governance?

Schematically speaking, we shall say that management only concerns one entity, such as an operator.

The target of this operator is to provide a quality service, but it must satisfy conditions of equilibrium and the long-term continuation of this equilibrium, investment conditions and the amortisation of its systems.

Governance implies a multiplicity of stakeholders that appeared twenty or so years ago. The management of the city set in motion a group of stakeholders such as the State, decentralised State powers (general departments of ministries, local authorities), agencies, donors, private operators, international cooperation (decentralised, bilateral or international), lobbies, civil society (associations, NGOs). The water and sanitation sector rises to the challenge of making this governance work. There is all the more at stake in this sector because of the size of its environmental, social and real estate footprint. It is interesting to see how this governance is implemented in diversified urban contexts. There are simple and complex models of governance. It is necessary to be capable of organising this governance through innovation and instrumentalities. Inefficient governance may delay the efficiency of the structures and stakeholders, postpone a certain number of decisions and incur recurrent expenses.

Small Operators in Periurban Zones: The Case of Maputo, Mozambique

[Aymeric Blanc]

The data from case n° 2 on which you have worked are real and stem from the city of Maputo.

In 1999, a leasing contract between the FIPAG and the company AdeM (Aguas de Moçambique) was signed; an independent regulator (CRA) was identified. AdeM was the source of a group of enterprises composed of Aguas de Portugal and Saur (France). After some years of functioning, the performances were not satisfactory: not enough connections, network only available 10 to 12 hours a day, 56% of water services not billed, 30% non-collection. FIPAG asked Aguas de Portugal to leave and proceeded with a redemption of shares; the structure then became both donor and service manager, which made it a very special PPP.

The results have been spectacular. In 2012, we could count almost 500 small private operators (SPOs) – compared to 100 in 2002 and 250 in 2006.

Maputo is located by the sea and has two million inhabitants grouped together in two connecting municipalities, Maputo and Matola. The treatment plant is located at Eta Umbeluzi and most of the network is found in the historical colonial quarter – the

city centre – that is inhabited by a relatively rich population. This neighbourhood grew because of high demographic growth and the arrival of immigrants subsequent to the civil war. SPOs are omnipresent in peri-urban areas, even though they are sometimes in competition with AdeM. There are no SPOs near to the sea because of saline intrusions in the groundwater.

The tariff per cubic metre is homogenous – about USD 0.8. There is more variability at the connection level, which is the object of competition between SPOs. The SPOs water tariff is 50% higher than that of the AdeM, which is a reasonable price when compared with certain SPOs that can ask for ten times more than the tariff imposed by the main operator.

Is dealing with SPOs a relevant alternative model?

In term of economies of scale, it is more efficient to have one big enterprise than several small ones. In terms of sustainability, 30% of the refill capacity of the groundwater is used; this is reasonable, but calls for careful monitoring. In terms of quality, there are some bacteriological problems and nitrates, notably in the centre of the city, because of the low quality of the drilling.

After having been ignored for a long time, SPOs were recognised in 2005, that is to say fifteen years after their first appearance through the intermediary of associations that established links between the authorities; the position of the authorities has progressively developed and has been inspired by the research of international experts who demonstrated the interest of cooperating with the SPOs to achieve the MDG target of between 32% and 50% of the population.

In 2008, the minister declared that SPOs had to be made official and no longer fought against. After identifying and registering these operators, the latter must be able to prove within one year that their water quality is good (laboratory analyses) in order to be granted a one-year licence.

Finally, negotiations did not succeed: the SPOs considered the one-year period granted was insufficient given their investment – they had asked for five years. They thus preferred to remain within the current (informal) status rather than confirm a one-year licence. Tensions and power struggles followed, the SPOs stopped supplying water for several days in order to put pressure on the government. Today, the issue of regulating SPOs has still not been resolved.

At the same time, an AFD project consists in building new systems in line with FIPAG (asset holding company) standards, and then handing them over in leasing contracts to the SPOs on the basis of an invitation to tender and a selection according to price – prices are regulated and standards are good. The principal difficulty concerns investment. Today twenty or so new systems have been implemented in the north of the city that is not served by FIPAG. In ten or so years time, on the outskirts of the city, good quality networks will be recuperated by FIPAG, according to the alienability of contracts principle.

A component relative to poor populations was also foreseen in the framework of the project. Part of the AFD financing was destined to give a USD 80m subsidy, out of a total of USD 120m, to the cost of connecting poor families – to new systems but also to the old SPO systems in the city centre, in order to increase connections. This

system has worked well for connections to new systems. However, regarding the old systems, the SPOs did not benefit from the subsidy, either because FIPAG did not wish to make these systems without an official licence or because certain SPOs were not capable of producing for the new systems. The whole of the subsidy was used to cover the neighbourhoods equipped with new systems.

SPOs constitute a transitory solution while the principal network is developing, but their regulation raises questions that have still not been resolved, such as the case described in Maputo.

Reabsorption and Restructuration Programme of Informal Neighbourhoods in the Greater Casablanca Region

[Christophe Cluzeau]

Case n°1 is also inspired by a real situation, but with some different statistics, however, that bring together social, urban and governance issues.

On the 18th May 2005, King Mohammed VI launched the *Initiative Nationale du Développement Humain* (INDH), which made the eradication of insalubrious housing and social exclusion a national priority. The INDH aims at bringing together, in these targeted neighbourhoods on Moroccan territory, different targets of environmental, social and economic development. Thanks to this initiative, it is in a political and institutional context that is favourable to an intervention in insalubrious neighbourhoods that, in each of Morocco's regions, the public and private stakeholders concerned have launched action plans aimed at meeting the targets of the national programme, under the monitoring and control of local authorities.

Here is an extract from the royal speech of 18th May 2005: "Efficient and sustainable development can only be made concrete through integrated public policies". Three principal axes were fixed:
- Access to basic social services and equipment;
- Activities providing stable revenues;
- Help to the most vulnerable.

2005 constituted a major year of transition for Morocco. Before this date, poverty in urban areas was addressed only through relodging – and not by the building of new dwellings. After 2005, all stakeholders had to consider resettlement (allocating serviced plots to be built upon) and the maintaining populations in place that implied recognising poor populations.

Casablanca has around five million inhabitants; 20% of the population lives in insalubrious conditions. The challenge for the operator was to bring water to the distant neighbourhoods on the outskirts and treat sewage water.

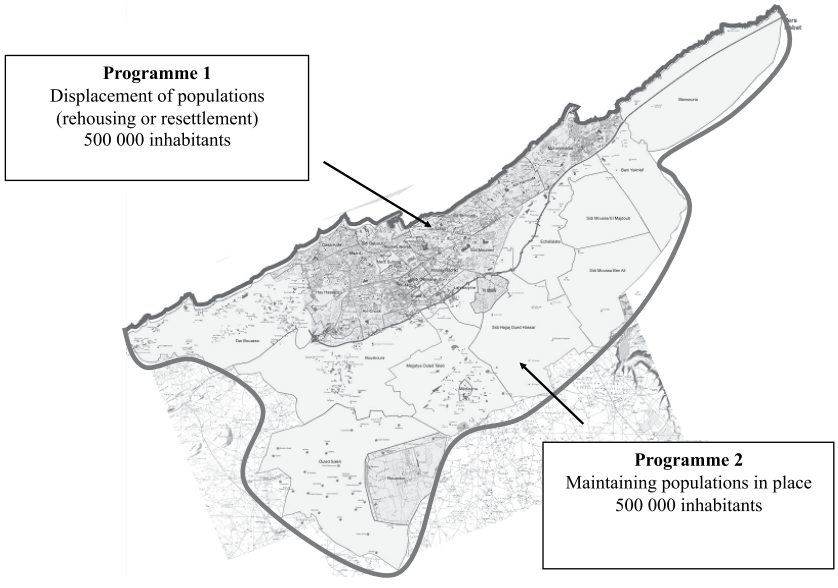
Since 2005, in the region of Greater Casablanca, the reabsorption of insalubrious dwellings has been carried out according to two complementary programmes.

The first is a population displacement programme through relodging and resettlement – construction by the population, by the inhabitants. This programme concerns about 500 000 inhabitants. In the framework of the INDH, at the end of 2005, local authorities decided to create the IDMAJ SAKAN limited company with State

capital, which has a mission to fight against insalubrious living conditions, give social assistance to the households concerned by this programme, support and monitor reabsorption operations initiated by public and private promoters and assist land owners for the liberation of their land occupied by informal dwellings. The programme is costly, an investment of USD 1 285m for 500 000 inhabitants, 40% of which is funded by the beneficiaries and 60% by the State.

The second system is a programme to maintain communities in place and provide access to services (water, sanitation and electricity). This programme concerns about 500 000 inhabitants and was the subject of the signing of an INDH framework agreement between local authorities and the operator of public services in water, sanitation and electricity (Lydec delegated management). The delegated management created the INDH-INMAE project management, which is responsible for monitoring and has a mission to find financial and technical solutions to bring services to the households of the communities concerned. Investment is USD 200m for 500 000 inhabitants. Financing is defined by the operator.

Map 12 INDH Greater Casablanca: Two Programmes



Source: Author's construction.

The city centre is composed of urban shantytowns on expensive private land, it is the subject of the rehousing and resettlement programme; to the right of the map is the peri-urban part and the maintaining in place programme.

The principles of the framework agreement of 13th September 2005 are fixed as follows:

- The object is access to water, sanitation and electricity for households;
- The authorities validate each operation beforehand (perimeter, beneficiaries, etc.);
- The operations benefit from the support and follow up of clients by the operator and a specific framework for financing. It anticipates a contribution from the beneficiaries of USD 214m per service with payment facilities granted from four to seven years, and part of the work subsidised. Furthermore, the project's management costs are met by the operator of the delegated management, an exemption from payment of dividends is instituted, and the pre-financing of the beneficiaries' contribution is to be borne by the operator.

The total amount of the maintaining in place programme was estimated 31st December 2010 at USD 200m, including taxes of which:

- USD 142m for the treatment of dirty water;
- USD 57m for drinking water;
- USD 1m for electricity.

The management of the project for the maintaining in place programme is based upon a structured method for the three sectors with:

- A contractual framework with the authorities (based on an agreement);
- Defined technical choices;
- Specific clientele norms;
- A controlled financial framework.

There are three consequences of this package: a permanently well-defined project-based approach with partners; commitments corresponding to the areas of expertise of the operator; all exogenous constraints identified, periodically monitored and referred to the authorities concerned.

31st December 2010, 31 540 households out of a total of 79 170 (40%) had already been or were in the process of being connected; 56% of operations had already been the subject of studies and were about to be launched.

Several constraints were identified concerning governance (see Table next page).

The key factors for success are principally based upon four principles:

- An institutional framework and political willingness;
- An integrated approach;
- A participatory approach with the population;
- Governance and permanent coordination between stakeholders.

Billing and collection among the poorest is good (see Box next page).

The payment method makes it possible to foresee whether a household will remain in place or not, notably for land conditions. No operation is launched before this aspect has been addressed.

Every semester, a report is transmitted to all authorities (ministerial, regional, local, communal), administrations (urban and social) and other partners, this report presents: the context, the principles, the salient points, financing agreements signed by donors, maps, key figures, movements, etc. Finally, an evaluation of constraints and blocking factors is carried out prior to the drafting of a note about their consequences and financing developments.

Table 16 Programme of Maintaining in Place. Governance of Project

Constraints identified 31st December 2010		Impact on number of beneficiary households (1)
1 – Non-validated intervention modes		3 277 households
2 – Non-available restructuring plans		5 200 households
3 – Land acquisitions for works		33 310 households
4 – Works dependent on the completion of off-site works by partners	ONEP	39 640 households
	Al Omrane	Currently being resolved
5 – Associations / Communes – On-site financing of networks		12 000 households
6 – Validation process of lists of beneficiaries		679 households
7 – Financing deficit		47 630 households

(1) The same household can be concerned by one or several constraints.
Number of households in the maintaining in place programme 31st December 2010: 79 170.
Source: Author's construction.

Box 14 Maintaining in Place Programme. Billing and Collection

Connections billing: collection rate after 30 days - 95%
Method of payment for connections:
- *Cash: 40%*
- *Over 4 years: 50%*
- *Over 7 years: 10%*

Consumption billing:
- *Average consumption: 7 m³/month*
- *Average billing: USD 4.5/month*
- *Collection rate after 30 days: 90%*

Day 4, Thursday 19th July

2.2.3. Conception of a Questionnaire for a Quantitative Survey

[Clément Frenoux]

Quantitative surveys are largely used in the drinking water domain, notably for the diagnostic and evaluation of the project. There are three principal forms of survey.

Before the survey, it is necessary to observe and question the context and then formulate hypotheses. There are often reference works (anthropological surveys, geographical surveys, etc.) and studies relative to the zone in question and/or studies already carried out in the sector. Two types of information are available:

- Primary information: this is specific to the study zone and allows us to carry out statistical breakdowns or gather together different social groups;
- Secondary information: collection in diverse reports previously produced on the subject, which gather together sources of hypotheses and questions. This data may be found in national institutes of statistics and in ministries, etc.

Surveys are tools that are conceived in different ways depending on the academic discipline, the purpose, the objective and the work hypothesis:

- Economists study capacity/willingness to pay: analysis in terms of revenue, costs, subsidies;
- Engineers evaluate the quantity or volume in order to give dimensions to the system;
- Sociologists and anthropologists study perceptions and expectations (gender dimension, equity, conflicts, latent and voiced needs) through semi-structured interviews – direct observations – and/or classical interviews.

Before conceiving the questionnaire and structuring the questions, it is necessary to determine and identify the research hypotheses. A survey is constructed – itinerary of questions – around a few central questions. There are several types of questionnaires and interviews:

- Surveys about practices and usage of water and hygiene;
- Surveys about demand analysis;
- Surveys about willingness – what tariff does the interviewee wish to pay? – and the capacity to pay (based on revenue or other services such as electricity);
- Satisfaction surveys (much used for evaluations).

Quantitative surveys allow us to measure opinions, behaviours, budgets, revenues, and prices relative to a particular research objective. They allow us to describe the characteristics of a population having a particular opinion or behaviour.

In terms of collection method, the entire population is not interviewed, but only a representative sub-group (sample). The law of averages provides the statistical representativeness of results. Several statistical processing tools may be used: basic sorting, cross-sorting, data analysis, etc.

In qualitative methods, the semi-structured interview is currently used; it allows us to verify hypotheses and illustrate theories by bringing a reservoir of opinions and anecdotes. It is not a question of knowing the characteristics of a population, of measuring majority opinion or studying socio-

demographic determinants of practices and representations, but of gathering together detailed and individualised testimonies.

These two types of approach are often complementary.

The surveys identify an intellectual attitude that presupposes causal effects and the hypothesis of neutrality and objectivity. There are always some imperfections of measures and indicators – is a poor person someone whose monthly income is less than USD 200 (50% of the population) or USD 30 (5% of the population)? Furthermore, the survey is instantaneous; it does not take history into account: it gives the state of things with measurement indicators at a given moment in a particular context.

An analysis of water consumption must take into account two indissociable components:

- Observable practices (new and old);
- Factors influencing these practices such as the socio-economic level of households: revenue, living conditions, expenses, price of water, convenience, proximity, availability of service and system, perceptions and representations of water quality, etc. Often, in DCs, it is difficult to evaluate both formal and informal income. For water surveys, it is not of capital importance. In Cambodia for example, we use the type of dwelling and expenses that are easier to measure than income. We assume these choices that simplify reality; the level of error remains acceptable.

The different sources of water must be demonstrated as they partially determine its usage, which may be multiple. The main questions to be raised are:

- When? Do supply modalities change according to seasons or the time of day? In Cambodia for example, there is a production difference of 50% on a network of drinking water between the dry and the wet season – households mainly drink rainwater. In Laos, production is a lot more stable (15%);
- In what quantities? What is the volume of consumption according to the source of water?
- Hygiene practices. Which water sources are used for washing clothes, showering, etc.?
- What motivates households to connect up to the network?

It is essential to identify influencing factors:

- Geographical influences: seasons, available water resources, position of the household in the neighbourhood;
- Influence of economic level on choices of supply and quantities used: Who consumes what? How and why? (Seasonal or constant revenue, social level, etc.);
- Influence of water quality on the choice of access mode to the resource. What place has chlorified water in consumption? What are the criteria of quality? It is important to emphasise the real quality and the quality perceived by stakeholders. Upon what criteria do households qualify water quality? (Taste, smell, colour?);
- Influence of the level of service on the choice of mode of access to the resource (ease of use, distance, convenience, saving time);
- Influence of the price on the choice of supply.

Another aspect concerns the measurement of demand and its impact:

- Consumer satisfaction: service, quality, relation with investors;
- Health: epidemiological surveys. Today, more than a direct link between water and health, we study the link uniting water and the environment;
- Changes in practice;
- Everyday life: saving time, etc.;
- Local trade: what becomes of the other water sellers?;
- Other resources: abandon or not of certain resources;
- The beneficiaries: who benefits or who will benefit from the presence of the network?
- New needs: such as sanitation for example. This is not yet entirely integrated; the volume of ODA is not yet equally shared between water access (80%) and sanitation (20%).

How can we formulate the questions?

- Remain simple, even if this entails adding more questions at the beginning, that will be subsequently discarded at the moment of testing the questionnaire or interview;
- Evasive questions such as "What do you think about that?" are to be avoided;
- In the case of a question about appreciation or satisfaction, it is better not to go into too much detail at the beginning – are you satisfied, rather satisfied, completely satisfied?

At the time of a questionnaire's conception, it is important to avoid the bias induced by the questionnaire itself – questions including the answer. In order to avoid this pitfall, starting at the conception phase, it is advisable to be careful not to begin asking too hastily questions about water. From the beginning of the interview, it is preferable to ask "open" questions about representations, new needs, quality and satisfaction.

Finally, it is indispensable to test the survey in the field before developing it on a larger scale. A few questionnaires are enough to notice problems of layout or formulation. Often, it is not the questioning but the formulation that does not make sense for the interviewee.

The workshop is divided into work groups in order to begin work on the conception and analysis of a questionnaire about household water consumption at the Tam Đảo hill station.
The trainees are familiarised with the Sphinx Plus software programme.

List of trainees

Surname and first name	Institution	Field	Research theme	E-mail
Boun Phet Vang	Academy of Social Sciences, Laos	Sociology	Urban society	phetvang@ymail.com
Bùi Văn Lập	Centre of Community Development	Management	Engineering and management of water supply works in rural environments	tulap44@gmail;com
Hoàng Kim Oanh	Institute of Research and Development of Hồ Chí Minh City	Management	Water supply and sanitation in Hồ Chí Minh City	oanhhk.hids@tphcm.gov.vn
Lê Thành Nam	Service of Culture, Sports and Tourism, Lao Cai	Socio-anthropology	Urbanisation in rural zones	tnamxhh77@gmail.com
Lê Thị Thoả	Institute of Anthropology	Anthropology	Usage and management of water sources in the border provinces between Cambodia and Viet Nam	lethoatq@gmail.com
Lương Ngọc Thảo	Institute of Research and Development of Hồ Chí Minh City	Urban management	Water management in Hồ Chí Minh city	ngocthaoluong@gmail.com
Nguyễn Hải Loan	Institute of Research and Development of Hồ Chí Minh City	Sociology	Management of water supply networks in Hồ Chí Minh City	loannguyenhai@yahoo.com.vn
Nguyễn Thảo Hương	*École Normale Supérieure*, Hà Nội	Urban planning	Water supply in new urban agglomerations	thaohuongsphn@yahoo.com.vn
Nguyễn Thị Hoài Hương	Institute of Research and Development of Hồ Chí Minh City	Culture, society	Water supply and usage programmes of the Khmer population in An Giang province	hoaihuong732002@yahoo.com
Nguyễn Thị Thanh Tâm	Institute of Research and Development of Hồ Chí Minh City	Anthropology	Clean water needs of the population in the peri-urban zone of Hồ Chí Minh City	thanhtam74003@yahoo.com
Nguyễn Tuấn Anh	Institute of South-East Asia Research	Economy	Cooperation in the Greater Mekong	nguyentuananh_ct@yahoo.com.vn
Phạm Hoàng Phước	Institute of Research and Development of Hồ Chí Minh City	Urban planning	Access to water and the poor population in Hồ Chí Minh City	phamhoang-phuoc87@gmail.com
Phạm Quang Linh	Institute of Anthropology	Anthropology	Impacts of urbanisation on water resources usage	pqlinh@yahoo.com
Sapphud Mit	Ubon Ratchanthani University	History	Urban zones in the Greater Mekong	sapphud.mit@gmail.com
Thái Thị Lan Phương	University of Hà Nội	Sustainable development	Clean water and sanitation	thailanphuong@gmail.com
Trần Thị Thu	Institute of Highlands Research	Economy	Water management in Việt Nam	tranthu.tl88@gmail.com

Surname and first name	Institution	Field	Research theme	E-mail
Trần Văn Kiên	*École Normale Supérieure*, Hà Nội	Economic history	Water sources and management in the city of Hải Phòng during French colonisation	trankienedu@gmail.com
Vilayvanh Oudom	Academy of Social Sciences, Laos	Economy	Foreign investments in Vientiane	urear2005@yahoo.com
Vongnakhone Sayalath	Academy of Social Sciences, Laos	Linguistics	Urban populations	vnk_1972@hotmail.com
Vũ Thị Thu Hương	Institute of Research and Development of Hồ Chí Minh City	Urban management	Pollution of waterways, perception of the population in Hồ Chí Minh City	vuthuhuongnh03@yahoo.com

2.3. Training for Field Study: Social and Economic Management of Water

Pascal Bourdeaux – EPHE, Christophe Gironde – IHEID, Mireille Razafindrakoto – IRD; Olivier Tessier – ÉFEO

The objective of this workshop is to familiarise participants with the tools and methods of inquiry specific to socio-economic and anthropological research by carrying out a short field study that follows the main steps of scientific method: construction of the objective and research questions, data collection through semi-structured interviews, daily synthesis of these interviews, processing and analysis of data collected at the end of three days, and the oral restitution of the study. The surveys are conducted in the village of Làng Hà in the Hồ Sơn commune, situated at the foot of the Tam Đảo hills.

The workshop takes place over six days. The first day is dedicated (1) to the presentation of key concepts and notions for the study, (2) to the presentation of the problematic of the economic and social management of water thanks to two presentations:

- Pascal Bourdeaux: "Depiction of the 'Fluvial Civilization' in the Mekong Delta through the Study of a Village Founded Subsequent to the Excavation of the Rach Gia-Ha Tiên Canal in the 1930s";
- Christophe Gironde: "Transformations of the Rural Economy".

A summary of the presentations highlights the key concepts, indicators and criteria mentioned, which might be used during the field survey phase. The day ends with a presentation by Olivier Tessier, whose aim is to introduce you to interview techniques.

The objective of the research common to the four working groups, subdivided into pairs, is approached from four unique and complementary angles:

- "Economic Management and Financial Constraints of Local Hydrological Agriculture", two pairings supervised and monitored by Mireille Razafindrakoto;
- "Social and Political Management of Hydrological Systems Using a Multi-Scalar Approach (Village To District)", three pairings guided and monitored by Olivier Tessier;
- "Water Usage and Progress in Agricultural Systems During the Colonial, Collectivist and Post-Renewal Periods", three pairings

guided and monitored by Christophe Gironde;
- "Water and its Uses in Popular Culture and Practices (Literary Depictions, and Symbolic Rituals of 'Water' in the Social and Natural Environment)", two pairings guided and monitored by Pascal Bourdeaux.

During the following three days (July 17th -19th), the different groups, divided into pairs, conduct investigations in the village of Làng Hà under the supervision of one of the field trainers. Each trainer is in charge of a group that accompanies them throughout the three days; each group is divided into two or three pairs followed in turn by the field trainer. The objective is to follow step-by-step progress of the work that culminates each evening with the organisation of a synthesis meeting.

The fifth day is dedicated to the processing and analysis of the data collected during the three days of surveys and to the preparation of a restitution of the study for the benefit of the participants and trainers of other workshops (plenary session). This day is organised as follows:

- In pairs: i) inventory of collected data, ii) classification of data according to a common grid with 2 or 3 pairs from the group;
- By group: i) synthesis of data, ii) grading of the data sets according to research topic;
- Finally, the four groups come together for: i) a brief presentation by each group of the main graded results, and ii) identification of coherent cross-cutting links between the themes addressed by each of the four groups, and of any discrepancies and contradictions.

The work of the trainers is organised in three phases:

- Before the three days of survey: identification of concepts, of the analytical framework and of theories and debates related to research;
- During the three days of survey: observation of and assistance to trainees/ interviewers in the carrying out of their surveys (choice and control of investigative techniques, interacting with the people surveyed, etc.). Daily monitoring of one or more pair(s) and the end of the day meeting allow a progressive construction/ reconsideration of the research subject as the interviews unfold (preliminary, confirmed, different, contradictory results etc.) and the identification of overlaps from brief daily feedback by each pair. The aim is to show participants that the fieldwork phase involves simultaneous data-processing work on the information gathered. At the end of the daily meetings, the elements collected help the research objective to advance without having to wait for the field phase: the relevance of the initial assumptions and frames of inquiry are evaluated at these daily meetings. The purpose of the research is thus gradually built using a dynamic inductive method;
- Use of the results: involves the putting to use of the field survey results by having the pairings interact within a group to familiarise the participants with how a cumulative process works.

A special feature of this workshop is thus to share the trainees' data and analyses within the framework of a summary report, and to integrate the trainer into the group as

an active member and not just as a mere observer. The interaction between groups is not a priority during the field phase, but is the objective of the day devoted to the preparation of the feedback – seeking to establish links between the data and the analyses of the four groups. The result is a real-time rendering of the participants' own judgement of their approach and progress over the days spent in the field: introspection and evaluation of the understanding of the methods and investigative techniques.

(Retranscription)

Day 1: Morning of Monday, July 16th

[Olivier Tessier]

For five years now, we have been organising this field-study training workshop within the framework of Tam Đảo social sciences summer school (JTD). Four trainers will lead our workshop. I shall present briefly the structure of the workshop and then everyone around the table will briefly introduce themselves.

The challenge consists in breaking down all the phases of a field study in six days, so the aim is to introduce you in a very short time to an exercise that usually requires several months of work.

This morning, two presentations, discussions will be led by Pascal Bourdeaux and Christophe Gironde around the theme of water management. They will be based on field studies carried out in Việt Nam in order to take a look at the different types of data from the field. We shall take time to discuss the form and content of these presentations, focusing on the specificities of the field researcher's report. Then we shall separate into four groups of four to six people to develop the field of investigation and the content of the study that we are going to develop during the week. These sub-groups will themselves be divided into pairs to conduct the investigations in the village that will begin tomorrow morning. We shall spend three days in the village of Làng Hà, located in the foothills of the mountain range. Each sub-group will meet in the evening to discuss the information collected during the day; the aim being to adjust our assumptions and generate new avenues of research based on the information collected. At this stage, the objective is not to compare the results obtained by each of the four sub-groups; indeed, the work-sharing phase will take place upon our return to the station. There we shall summarise the data collected to assess those which still remain hypotheses and those that show themselves to be certainties, to compare the results obtained by each of the sub-groups and prioritise the key elements of answers that feed and enrich our initial problematic.

The main objective of the workshop is to teach participants how to build and adjust the object of research according to survey data, to acquire a certain autonomy *vis-à-vis* the research objective, that is to say, not to hesitate in transforming or expanding on this objective in consequence of what was learned during the day, it is indeed important to have our study progress over the course of the field phase.

Introduction of trainers and trainees (see biographies of trainers, and trainees' list inserted at the end of the chapter)

2.3.1. Evocation of the "Fluvial Civilisation" in the Mekong Delta Through the Study of a Village Founded Just After the Excavation of the Rạch Gía-Hà Tiên Canal in 1930 and the Issue of Hydrology in the Literary Work of Sơn Nam

[Pascal Bourdeaux]

I should like to mention a field study that I conducted in the province of Kiên Giang five years ago. This study was devoted to the development of hydrological agriculture in the Mekong Delta, and to migration and the simultaneous and consecutive foundation of new villages. I shall present some aspects of this monograph. My presentation is based on a summary of the surveys I carried out, and two papers presented in 2004 and 2005 in Hồ Chí Minh City and Siem Reap.

Olivier Tessier and I organised a workshop on hydrological agriculture in Paris a few days ago, at the end of June. It aimed to lay the foundations for a research programme that we want to be part of the framework for the launch of an EFEO project initiated in Hồ Chí Minh City. This project is devoted to the study of the culture and history of the Mekong Delta viewed from the angle of hydrology and water management issues. Finally, the last element on which this presentation is based is a meeting with the writer and researcher Sơn Nam, who spoke to me about his perception of the Mekong Delta and from whom I learned a lot. I used as keyword and concept of reflection a neologism he created in his writings, "văn minh sông nước" that can be translated "fluvial civilisation". I should like to emphasise the importance of history when reflecting on theoretical developments and attempting to understand the evolution of contemporary world issues. Finally, it is by using a concrete case study concerning the founding of villages in the former province of Rạch Gía that we shall discuss qualitative interview techniques and the relation that history and anthropology have with oral surveys. Two avenues for reflection will be developed: popular culture through the reading of the landscape and environmental history particularly that specific to climate.

Box 15 Summary of Case Study

The study presents the results of research conducted in the main Vietnamese coastal province on the Gulf of Siam. It is devoted to the study of the "village" in the Mekong Delta during the colonial era, and focuses specifically on the history of the founding of Sóc Sơn, renamed Nam Thái Sơn subsequent to diverse administrative boundary changes (District Hòn Đất, Kiên Giang Province).

A series of surveys allowed me to collect the testimonies of the first migrants who came to settle on the banks of the Rạch Gía - Hà Tiên canal (excavated between 1926 and 1930), more precisely at its junction and along one of the secondary canals (Tri Tôn canal) between 1927 and 1942. These interviews allow us to trace the foundation process (irrigation schemes, migration, land clearance, hydrological agriculture) and examine the shaping of the material and spiritual culture of Sóc Sơn (solidarity networks, rice, forest and river activities, popular forms of worship).

After recalling the role of water as a vector of migration and the singularity of the migration process - the "simultaneous meeting" of spontaneous local peasant (Mekong Delta) and planned inter-regional (Red River plain) migration - the presentation discusses the specificities of the development of the village until 1945 (transfer of agricultural techniques, adaptation to ecology and to the local economy). It finally speaks about the concept of the "fluvial civilization" that characterises Mekong Delta society, specifically in this coastal area where it is a continual determining factor in the development of the region.

Sources: Bourdeaux (2004).

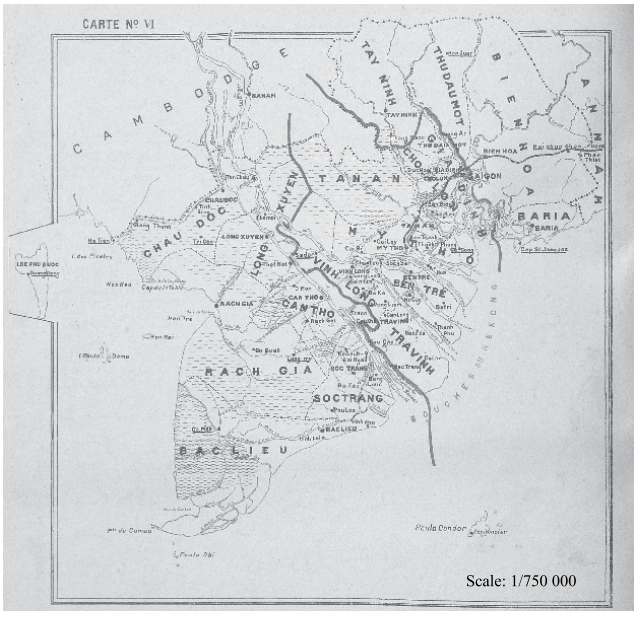
Presentation of the Monograph: The Foundation of a Village at the Junction of Two Canals created in the Province of Kiên Giang (1930)

The monographic survey aims to trace the foundation of a village in the colonial era, it consists in tracing back the origins of the village of Nam Thái Sơn in order to:

- Study the causal link between the foundation of the village and the excavation of the *Rạch Giá - Hà Tiên* Canal in 1930;
- Understand how the current development of Nam Thái Sơn is directly related to the public management of hydrological agriculture, in other words, how it is linked to the effectiveness of the plan against flooding in the "Long Xuyên Quadrangle" (Tứ giác Long Xuyên).

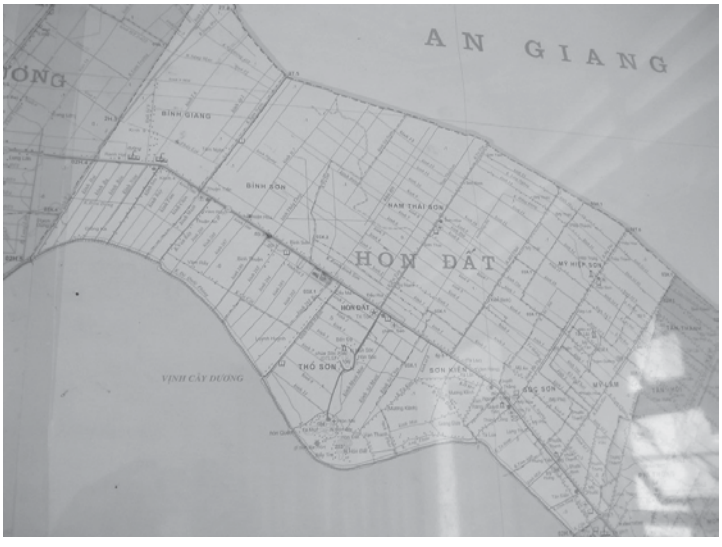
The foundation of the village allows us to understand how the waterways, namely the Tri Tôn Canal and its junction with the Rạch Gía-Hà Tiên Canal, were, and still are, a structural element of the local society and an essential vector for development.

Map 13 Cochin China (Administration)



This map indicates the provinces: their capitals and administrative posts. The bold lines indicate the approximate limits of the three regions: East, Centre, and West.
Sources: Brenier, (1914).

Map 14 Administrative Map of the Hòn Dất District



Sources: Map photographed in 2006 in the office of the head of the popular committee of Nam Thai Son commune Kiên Giang province (by Pascal Bourdeaux).

This old map shows the Rạch Gía-Hà Tiên Canal, the mangrove and tidal zones.

The current map of Hòn Dất District presents the trunk canal and all its feeding canals, which were excavated in the 1930-1940s. The development of canals has structured the different villages. There are villages here that have a very specific morphology, which is greatly different from the social realities of villages in Central and North Việt Nam and even in certain parts of the Mekong Delta.

What are the historical and cultural specificities of this monograph?

The village was essentially founded in the early 1940s through the voluntary and political settlement of migrants from the North of Việt Nam, especially from the provinces of Thái Bình and Nam Định. In 1941, ten years after the creation of the trunk canal and its deversing canals, 750 families settled in the still virgin area to found new villages with the initial help of the colonial authorities.

Surveys in this village, named "The Tonkin Polder" during the colonial era, were an opportunity to discuss with the first migrants, the children of this first phase of migration, and migrants from the South who settled near the village and ended up by founding an original village culture – at this period, it was the only noticeable case of contacts between farmers in the North and South. This creation of a special village culture can be found in many domains, such as cooking, singing, rice growing and, of course, in the relation between rice and hydrology.

Let me say a few words about hydrological agriculture as a vector of migration.

The first major hydrological projects in this region began in the 19th century – this including the excavation of the Thọai Hà Canal linking Long Xuyên to Rạch Giá (1818) and the Vĩnh Tế Canal linking Châu Đốc in Hà Tiên (1824), which played a very important historical role. However, the improvements were not intensive, particularly in the area of the Long Xuyên quadrangle: the containment of the marshy plain was not followed by a drainage plan to develop irrigated agriculture on land, except on the dewatered land *(giồng)* and along the riverbanks and the arroyos *(rạch, vàm)*. It is true that during the colonial era the region remained under-populated due to natural swamps and sanitary conditions.

Table 17 Summary of Population Growth in Rạch Giá Province, 1878-1926

Year	Population (thousands)	Non Cochin China Annamites
1878	35 000	-
1893	90 000	-
1901	102 389	-
1921	233 987	611
1926	244 399	273 (195 adult men, 31 women and 47 children)

Sources: Population census for Rach Giá Province in 1926 (ANVN-II, SL-313), Viêt Nam National Archives, centre n° 2 in Hô Chi Minh Ville, Local services fund, dossier 313.

A slow rise in the population followed by a faster one can thus be observed in the former province of Rạch Giá from the 1920s. In this region, the issue of water is treated in a totally different way than in the north of the country where the population density reached record heights and where the policy of containment of the Red River was an imperative. In the Mekong Delta, however, the environment had to be controlled, the population increased and water was not channelled but, on the contrary, evacuated.

Here are some benchmarks for the Rach Gia-Ha Tien Canal project and excavation:

- 1924: preliminary study for the widening of the Rạch Giá-Hà Tiên Canal;
- 1926: the project is approved - delay due to technical and financial issues;
- September 15th, 1930: Inauguration of the canal.

Different aspects could be studied in the context of the hydrological development of the region: for example, who are the workers who came to dig the canal? How much were they paid? Did the people who went to work there stay?

Once the canal had been excavated – that is to say the trunk canal and four perpendicular running canals used to evacuate water into the Gulf of Siam – the question of polders, independent systems of irrigation or drainage that fixed the limits of homogeneous rice-growing spaces, arose.

Within the framework of this territorial development using peasant migration from the North, a clearly defined space between the canals emerged. An enclosed space would define the foundation of the village. On the virgin land, on the other side of the canal, farmers in the South settled spontaneously and came into direct or indirect contact with these migrant populations, especially when

small market – factors of economic and social exchanges began to appear.

At the end of 1942, 750 families, that is to say about 3 000 people, half of whom were children, left the two provinces of Nam Định and Thái Bình. Two polders were defined: the Sóc Sơn and Thổ Sơn (referred to as the "Reserve") polders identifying the origin of the migrants in both provinces. The desire to re-found villages using village traditions and tutelary spirits was affirmed. The geographical locations that depended on the canal thus resulted in different modes of living that faded away with population movements and the underlying social and cultural diversity.

Tri Ton Canal, A Place of Convergence and Exchanges

Heads of families continued digging secondary canals - arterioles between each plot cleared. All started planting rice with the seeds, tools and draft animals supplied to them.

At the intersection of Tri Tôn *(nga ba Tri Tôn,* the junction of the Rạch Gía - Hà Tiên Canal) a hamlet, a floating market, an administrative post and a mooring point for boats sprung up.

Economic life then started around the Tri Tôn Canal:

- Cochin China farmers continued cultivating rice in clearings in the middle of the tràm forest and on lands containing low levels of alum. They sowed rice by hand, and burned stalks and reeds to form a layer of ash. They recovered the charred wood to sell it;
- In the Tonkin Polder, each family first received seeds (1943), agricultural tools, as well as oxen and buffaloes to be shared by several families to plough individual plots of about two hectares. The Cochin China farmers shared their seeding methods with the new arrivals, offered them new varieties of rice (including *lúa nổi* or floating rice) and informed them about the agricultural cycle;
- Migrants from the North may have noticed that they didn't use a sickle *(liềm)* but a wishbone shaped tool *(lưỡi hái)* that was much more efficient;
- For husking, southerners used a hand held pestle and a wooden mortar that were also more convenient than the foot pestle and mortar made of stone or clay used in the North.

In summary, the rice-growing process, from the planting of seedlings to consumption, was homogenised using the rural customs from two distinct regions.

Migrants also diversified their activities following the example of the inhabitants of the province: logging in the tràm forests (timber) and bundles of wood for fuel, keeping of honey bees, hunting and river fishing; *nước mắm* enterprises, pepper plantations, basketry crafts (making mats from rushes) and pottery *(cà ràng)*. Conversely, migrants began growing market vegetables (sweet potato, squash, beans) on individual plots of land and introduced new cultural practices into the region (songs, tutelary spirits, particularly private ceremonies).

Water Management

In the Tonkin Polder, an organisation was quickly set up to run the secondary networks:

- Extension of the ten canals running perpendicular to the Tri Ton Canal;

- Excavation parallel to the Tri Tôn Canal of a supply canal three kilometres away *(kênh ba ngàn);*
- A network of small arteries *(mương)* and arterioles *(mương phèn)* between the plots of land for rice cultivation.

Contrary to what was happening generally in the floodplain of the Red River, migrants found themselves not having to contain waterways, but rather having to create a network of flow canals to facilitate the evacuation of rainwater and the flow of fresh water using the ebb and flow of the tides.

There remained to be settled the question of the supply and storage of drinking water for everyday consumption, especially during the dry season. The canal water was brackish and ferruginous and the inhabitants dug ponds on their land or went into the forest to fetch water that they stocked in locally produced earthen pots.

Tri Tôn Canal was the site of intercultural relations and had a very specific local culture

Hydrological Issues in the Writing of Sơn Nam

Biographical Elements of a Writer Researcher

Sơn Nam is from this region. The fact that I mention him today is not only because of my interest in his work, but also because he lived and worked in Hôn Đất, in Rạch Gía province's economic service in the late 1930s – before his hasty departure for the maquis.

In his memoirs, he recounts his travels in the Mekong Delta and takes a whole section of oral history – sayings, oral traditions, place names, names related to historical events and popular customs. The writing and "popular ethnography" is found in his novels and short stories - "Hương rừng Cà Mau, tập truyện", a collection of 66 short stories.

In addition, through his impregnation of the culture and daily life of local people, he was able to incorporate into his writings a number of elements of popular culture to finally present historical processes and cultural constructions.

The writing of Sơn Nam may therefore be relevant and useful to our understanding of what the Mekong Delta is, and it seems relevant to emulate this method to describe and analyse the original region.

The Notion of "Văn Minh Sông Nước"

This concept may constitute an element of reflection if we are to understand what a "fluvial civilisation" is. It can be used as input to study specific historical, cultural, social and technical aspects of South Việt Nam. In other words, how do hydrology and the network of piping systems play a central role in the economy, communication, daily life, and material and immaterial exchanges? How does this definition of space bring this delta closer to exchange dynamics and to Southeast Asia's networks?

Methodological Developments: Some Thoughts on the State of Research into the History of Climate and Environment in France

I should like to conclude with some reflections that allow us to connect history, as an academic discipline, to environmental and climate issues.

The French historian Emmanuel Leroy Ladurie is one of the founding authors of

climate history, he wrote at the beginning of the 1970s a history of climate since the year one thousand. This work raises a number of methodological questions: how can we think about climate change and the environment in a historical way? Can a field of study that looks at climate from a historical point of view be created? Can we create an autonomous field of research? If so, by using which sources and in what way? How reliable are the analyses? What does "environmental history" mean?

The answers to these questions generate methodological and ideological divisions between the U.S. studies that were very innovative as early as the 1950-1960s, and later studies in Europe, where the appearance of a clear sensitivity to ecology, even political ecology can be observed. In the journal "Modern and Contemporary History", published in 2009, an article by Frédéric Thomas about the Indochinese Forest opens with the following question: to what extent can this type of research be adapted to and developed in Việt Nam? What sources are available? Can elements that allow us to forecast major monsoons, floods or natural disasters be found in the annals? The historical study of these natural events provides us with fundamental elements to better understand the underlying political dynamics and socio-economic transformations. In short, it is a field of history that has still not been explored and that could help us better understand the issues and challenges of water management in the Mekong Delta, as well as in any other region of Viet Nam.

2.3.2. Transformation of the Rural Economy

[Christophe Gironde]

The objective of this presentation is to familiarise you with some concepts and definitions and to reflect on the surveys that we shall conduct together. My presentation is based on research that I conducted in the Red River Delta between 1996 and 1999, then more intensively in 2009/2010 in the province of Hưng Yên. I shall not spend much time discussing the historical dimensions so as to focus more on the economic and productive aspects of the contemporary period, from the *đổi mới* reforms.

The peasant economy can be defined as a mode of production (land, labour, tools, etc.) that is organised around the family from an initial transfer of capital and know-how (social reproduction through parents to children inheritance). Agricultural activities are at the centre of the family economy; they are supplemented by trade or crafts, for example.

Nguyễn Tuấn Minh

Migration dynamics must also be considered.

[Christophe Gironde]

This indeed shows that there are other dynamics as well as agriculture. For migrants, the issue of water is then perhaps not central.

Vũ Thị Thu Hằng

Has the cultural dimension of the village had an impact on agricultural practices? The central issues around water may gradually disappear with the process of urbanisation of the countryside.

[Christophe Gironde]

This dimension will indeed be studied during our surveys. As an economist, my first question would be: "Why do you continue to grow rice when this activity generates so little profit?"

Nguyễn Thị Thu Thúy

I suggest that we also take an interest in the emergence of new services in rural areas, the dissemination of new agricultural techniques and their impact on practice.

[Christophe Gironde]

This question concerns agricultural production systems: what is produced and how? We also need to look at the issue of State services, such as those related to irrigation. We need to ask, "Who works in the rice field?" There is a tendency in periods of agricultural transition towards a feminisation of work because the husband goes to work away from the village. Another trend is the ageing of farmers. This poses practical problems in connection with the physical hardship of the work. The demographic dimension is fundamental.

Let me say a few words on the relationship between agricultural production and water. The soils and micro-terroirs are the first thing to identify. We must go to the field to understand concretely how the hydrological network is organised. Families identify types of land according to altitude, slope, but also according to containment ("land outside dykes").

What effect does water usage have on production? And in return, what is its impact? Water may become scarce and polluted due to the use of chemicals, for example. Have farms still got enough water in this period of urbanisation, which is accompanied by the construction of golf courses, hotels, etc.?

After decollectivisation, producers began to devote more effort to their crops: more work of a better quality. They also took more initiatives: diversification of crops and livestock, development of non-agricultural activities and activities outside of the commune. As far as the local authorities are concerned, at the municipal level, efforts have focused on improving hydrological equipment – repairs, maintenance, purchasing of pumps, etc.

During my surveys in Hưng Yên, I discovered that a major constraint for farmers was the uncertainty about their ability to sell their products: guaranteeing outlets for agricultural products – knowing where to sell, knowing the buyers, being able to trust them for deferred payments, etc. Water availability is another constraint. Finally, there are financial constraints for advances to buy crops and livestock, increased land prices and social spending, such as health or education.

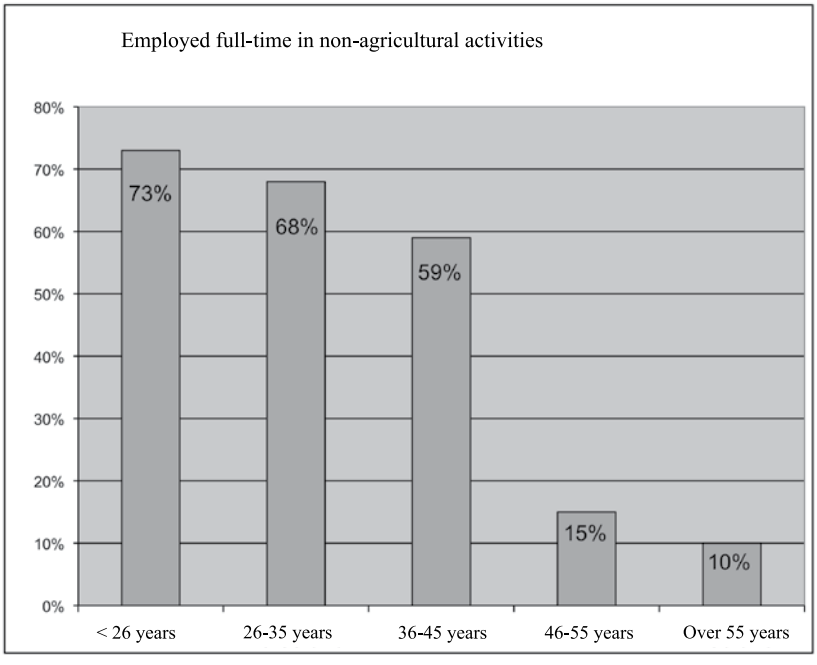
I carried out about 270 surveys for this research that allowed me to establish a typology. I calculated how the total cultivated acreage under cropping systems during the year was divided out: two rice crops, diversified crops, medicinal plants and fruit trees. At the end of the 1990s, 80% of agricultural production was devoted to rice; farms had already begun an "exit" strategy from agriculture (specialising in non-agricultural activities). Annual revenues were about 1 000 dollars per hectare, and rose to between 2 500 and 3 000 dollars for homes that were "out of agriculture".

Table 18 Division of Cultivated Surface Areas According to the Cropping System (Tân Dân, 1997)

	Two rice crops	Diversified system: rice and other crops	Medicinal plants	Fruit growing associated with other crops	Pure fruit	Total
Group 2	15%	15%	15%	37%	18%	100%
Group 3	34%	18%	9%	8%	31%	100%
Group 4	79%	5%	6%	10%		100%
Group 5	78%	16%		6%		100%

Annual income per hectare (USD): group 2 = USD 2 761; groups 4 and 5 = USD 1 000.
Sources: Author's construction.

Figure 31 Rise in Non-Agricultural Work 1997-2009, Tân Dân Commune



In 2009, one out of two active workers was employed full time in non-agricultural activities. Two thirds of 26-35 year olds and 36-45 year olds; three quarters of under 26 year olds.
Sources: Author's construction.

I returned in 2009 to one of the towns where I had conducted surveys for my thesis in 1996. I renewed the same surveys. In 1997, all homes had arable land - except those of certain officials or families specialising in trade. In 2009, nearly half of the households had no cultivated land. 18-25 year olds and 26-35 year olds were mainly occupied in non-agricultural activities; a large part of them lived outside the village. There had been an important social transformation: for young people in the country, one no longer becomes an adult by becoming a farmer, but by migrating and working years outside agriculture. Respondents explained to me that they had sometimes lived ten years in other provinces and only returned to live in their native village "upon retirement".

Table 19 Permanent Residence of Parents in 2009 and in 1997

	2009		1997	
	Tân Dân	Outside Tân Dân	Tân Dân	OutsideTân Dân
Total	65%	**35 %**	95%	**5%**
> 55 years	96%	4%	90%	10%
46-55 years	77%	23%	100%	0
36-45 years	68%	32%	89%	11%
26-35 years	54%	**46%**	100%	0
18-25 years	36%	**64%**	100%	0

Average age 2009 sample: 40 years; in 1997: 44.4 years.
Sources: Author's construction.

Surveys show that for one third of the population, the principal place of residence is outside the village of origin; for the youngest, this figure was between half and two thirds.

Day 1: Afternoon of Monday, July 16th

[Olivier Tessier]

2.3.3. Survey Techniques: Advice and Recommendations

Olivier Tessier introduces the elements of technical surveys presented at workshops in 2010 and 2011: common base of all interviews, two levels of data recording, canvas of questions and avenues of research, adaptation of the researcher's questions to questions asked in the field, attitude to adopt during the interview, outside intervention. For these developments, we refer the reader to our edition Bourdeaux, D, E. Pannier, O. Tessier (2011), "Training in Methods of Investigation and Field Practice in Social Anthropology: Issues, Tensions and Conflicts Over Appropriation and Use of Land", in S. Lagrée (Editor), Op cit., P. 277-281. Also available on the website of the AFD, EFEO www.tamdaoconf. com

A half-day is devoted to preparing for fieldwork. The trainees are divided into four groups of four to six people accompanied by a trainer. The theme of "water" is addressed from four different angles:

Economic management and financial constraints of the local running of agricultural hydrology – two pairings guided and monitored by Mireille Razafindrakoto;

Social and political management of hydrological systems using a multi-scalar approach (village to district) - three pairings guided and monitored by Olivier Tessier;

Water use and changes in agricultural systems during the colonial collectivist and Renewal periods – three pairings guided and monitored by Christophe Gironde;

Water and its uses in popular culture and practices (literary evocations, and symbolic ritual of the "water" element in social space and the natural environment) - two pairings guided and monitored by Pascal Bourdeaux.

The work consists in identifying an initial problematic specific to each sub-group's research axis, in defining hypotheses and avenues of research related to the themes of each sub-group and in reformulating the researcher's questions into questions to be asked in the field.

Days 2, 3 and Morning of the Fourth Day

The workshop moves to the village of Làng Hà in the Hồ Sơn commune to conduct the surveys prepared in class and collect the data necessary to address the common problematic and the specific research axes of each sub-group. Interviews with local authorities and villagers are conducted in pairs; trainers accompany the pairs for whom they are responsible.

2.3.4. Organisation, Classification and Data Analysis

Day 4: Afternoon of Thursday, July 19th

Return to Tam Đảo Hill Station. The afternoon is devoted to work in small groups in order to identify, classify and organise the data collected in the village. Each group accompanied by their field trainer performs a first level of processing of the information gathered according to the theme and the specific problem. The objective is to prepare a synthetic oral restitution for the next morning in order to present the results obtained to the entire workshop.

Day 5: Friday, July 20th

Presentation of the information collected by each sub-group: a designated person in each group will present an oral summary of the data.

[Olivier Tessier]

I have been impressed by the ability you have shown in mastering and reformulating the research objectives. You have shown that you are capable of continually adapting throughout the fieldwork by allowing the initial problematic, focusing on the issue of water management, to transform itself into a more unexpected but central problem for farmers: the production and marketing of Susu.

Việt Nam "Susu"

The plant Sechium edule Sw belongs to the Cucurbitaceae family. Originally from Mexico, this robust monoecious vine is now cultivated in many other tropical countries. It produces pear-shaped fruits that mainly go by the name of christophine, chayote or chouchou. Low in calories and rich in minerals, these fruits are interesting from a diet point of view. Under certain conditions, the plant also develops starch-rich tubers. Production: Christophine is generally grown under an arbour in humid zones and at moderate temperatures. It is not difficult to grow and gives a high productive return. Fungal and worm attacks can be avoided by applying the necessary treatment. Development: the principal block to its export and industrial exploitation is its conservation after harvest. If packed under a plastic film at a temperature of close to 10°C, it can be conserved for 40 to 50 days. These results can be further improved by using irradiation λ. Conclusion: nowadays the different parts of the plant are used on a homegrown basis for cooking and medicinal purposes. The transformation to an industrial scale of christophine production would require research into the varieties producing homogeneous quality fruits that are resistant to illnesses and give a good yield of fruit, young stalks and roots.

Sources: Dornier M., M. Reynes (2001).
See also: Tran, T. T., M. Figuié, L. Sirieix, P. Moustier (2012).

We have been "inundated" with data over the last three days and you have had the experience of research work, which consists in selecting principal ideas and abandoning others. You have learned how to organise your data in order to give form to it. This was a learning target that was essential to this workshop.

The session is devoted to the collective identification of the cross-cutting axes of the different sub-themes, with the view to beginning a critical analysis of the data and establishing a plan for the restitution of the essential results. Through a dialogue between the trainees led by the field trainers, four cross-cutting axes have been identified:

- *The current functioning of the hydrological system and the irrigated perimeter: description, observation and current state of affairs;*
- *The conditions and modalities of the system's implementation: role, presence and weight of the State and the State-society dialectic;*
- *Progress in the system from its construction in 1992 up to today: presentation of the different groups of players (State, semi-private management company, peasants, traders) and analysis of the conditions having favoured this progress (which conditions favoured this progress?)*
- *Conclusions: question of the economic, technical, ecological and social (development of inequalities) sustainability of the system.*

[Christophe Gironde]

You implicitly referred to the question of knowing about who is profiting from the current economic development, which raises the big issue of inequalities: are inequalities growing? Are they changing? At this stage of the training we have not yet enough material to answer this question, but it is part of the social sustainability and development mode question. You also raised questions about the links between technique/infrastructure and the social management of water. We could enlarge on this by asking: what are the levers of development in this commune? Here we find the question that was also raised about the State's role. To what extent is development linked to the technical dimension and to infrastructures and institutions, and to the social dynamism of the State? This question is part of the problematic concerning the relationship between the State and local populations.

Đỗ Thị Ngân

Concerning the social management of the irrigation system, you emphasised the central role of the State in assuring the sustainability of these works, but I am puzzled by the place occupied by the farmers, who were absent during the construction of the dyke, in the works and their supervision. Is it not important to have the local population participating in order to assure their sustainability?

[Olivier Tessier]

This strong and directive State intervention and absence of participation by the farmers in the decision-making process and in the carrying out of the works, is indeed an important aspect. The farmers were not associated with the decision-making process, they were not asked their opinion. During the surveys we got the impression that they were very unconcerned about the works. They use the system but let the State takes care of repairs and even the cleaning of the

secondary canals. They adopt a very passive approach.

The abolishment of taxes for the use of the irrigation system has made the system totally free of charge; it is the "welfare" State that takes charge of everything and the consumer pays nothing.

[Pascal Bourdeaux]

We are in a multi-ethnic situation about which we have been able to single out a few innovative elements relating to cultural life, that is to say collective activities. We also have some data concerning the existence of a temple and a tutelary deity linked to the source. It would be interesting to look deeper into this aspect. As a complement to this, we could study in greater detail the cultural dynamics and practices linked to the communal house (Đình).

[Christophe Gironde]

The families surveyed do not want their children to follow their example and become farmers; all the more so as the new generation has the opportunity to make big profits through the sale of Susu.

[Olivier Tessier]

As for the question of the social organisation of farmers, an observation needs to be made: the central intervention of the State and the non-participation of the users in the running of the hydrological system and the financing of the service do not go in the same sense as the structuring of a farmers' organisation capable of managing the system; the dam and the irrigated perimeter have not resulted in the emergence of any social organisation. The farmers' association is passive and does not have a clear stance *vis-à-vis* the running of the dam. We can thus wonder to what extent social organisation constitutes an essential element for the sustainability of the system.

Nguyễn Tuấn Minh

I think we should also be interested in all the other challenges and opportunities created by economic development. As for opportunities, we could talk about the production and sale of Susu and tourist development; as for the challenges, we could talk about demographic growth, especially the pressure it is creating on land, the problem of outlets, capital, and workforce and development strategies for the commune, which aims at reducing the share of agricultural activities. Consequently, questions concerning the role of farmers and the authorities are raised.

[Mireille Razafindrakoto]

We have just carried out pre-fieldwork over the last three days. We have discovered a village and redefined our research objective. This aspect of the training is essential and is part of the exercise. This work has raised a certain number of research questions to which we have no answer and might in the future be the subject of a Ph.D. or Master's thesis. It is necessary to point out the importance of this stage in the scientific method that consists in finding the right questions.

By basing ourselves on the results of the trainees' confrontations and exchanges, an initial feedback plan is suggested:

- *Presentation of site, of the hydrological system, of the dam and the irrigated perimeter (groups 2 and 4);*
- *Factors and conditions of the implementation of the system: description of its running and the State's intervention (group 2);*
- *Factors and conditions of the system's development from the 1990s till today by confronting the positions and points of view of the different players (groups 1, 3 and 4);*
- *Ecological, socio-economic (sharing of profits, social inequalities, State control, outlets, product labelling, land pressure, etc.) and technical (maintenance and repair, management services) sustainability of the system, including future reflections and research on this theme.*

The objective is to start a process of collective analysis for the final restitution.

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2.4. Practical Approach To Agent-Based Modelling

Alexis Drogoul – IRD, Benoit Gaudou – University of Toulouse, Arnaud Grignard – University of Paris 6, Patrick Taillandier – University of Rouen, Võ Đức Ân – MSI-IFI

Representing a real system in all its complexity in order to measure its possible evolutions, or to conceive development solutions that are adapted to it, is one of the challenges of current computer modelling, particularly of agent-based modelling. This approach, which complements classical analytical methods, allows us to incrementally conceive models whose dynamic is the result of interactions between computer representations of the entities in a modelled system (players, institutions and environment, biological or abiotic entities). These models are then used to support a "virtual" experimental method – making use of simulations – where the resulting dynamics can be studied with all the necessary details, and where interaction with the user is encouraged.

This workshop is organised around the GAMA modelling platform, *Gis and Agent-Based Modelling Architecture*, see http://gama-platform.googlecode.com, developed by the IRD and its partners and a tutorial developed from a role-playing game about water management, "Wat-A-Game", developed by the CIRAD, see http://sites.google.com/site/waghistory/home. Its aim is to allow trainees to discover agent-based modelling and its potentialities, by conceiving and progressively improving a group of more and more complex models whose subject is water management, by a team of players: administrators, water-using activity managers, monitoring services, etc.

Different subjects are progressively addressed, from the installation of GAMA to the conception of different "realist" human behaviours, against a background of the coupling of heterogeneous social and environmental data, allowing us to generate rich and complex scenarios. A part of the workshop is devoted to the conception and writing of these models, but a large part is reserved for debate, particularly about the choices of conception and representation made during the proposed tutorial. The last day allows participants to propose, test and compare different representation solutions of the decision mechanisms in the model.

(Transcript)

Day 1, Monday 16th June

2.4.1. Modelling Applied To Water Management

[Alexis Drogoul]

We are going to work together on the building of agent-based models devoted to an application of water management. We shall take some time explaining our objectives to you and how we are going to achieve them. Next, we shall ask you to introduce yourselves and specify your research/study objectives and the reasons for your participation in this workshop. We should like to know which situations you would like to model, and whether or not you have had any previous computer programming experience.

Presentation of trainers and trainees (see trainer biographies, list of trainees inserted at end of chapter)

Your experience and expectations in modelling terms are particularly varied, but few of you are familiar with this technique.

We are going to accompany you gradually so as to allow you to call upon your own research problematic. To do this, we are going to follow agent-based methodology that allows incremental modelling. It entails building models by beginning with basic entities and progressively adding to them: component additions and modifications for existing components in order to obtain more complex models.

After a general presentation, we shall start building our models this afternoon. Our ambition is to immerse you directly into the practice, so that you will become autonomous as the week progresses; you are going to have to learn to use computer tools and language.

You can imagine that the model is a play with scenery, actors, scenarios and interactions. The two first days will be devoted to the building of the scenery. Next we shall introduce the actors who will have their own behaviour, autonomy and maybe knowledge. The roles of these actors will not be completely written; you will intervene on the models using computer tools to describe the actors' behaviours, for example, planning and strategies, in such a way as to be able carry out experimentations and compare them. At the end of this workshop, you will certainly not all have the same play or the same scenario.

Two volunteers amongst you will be responsible for the feedback on your work on Saturday: taking notes of the training content, collecting of other trainees' impressions and particularly problems that may not have been voiced.

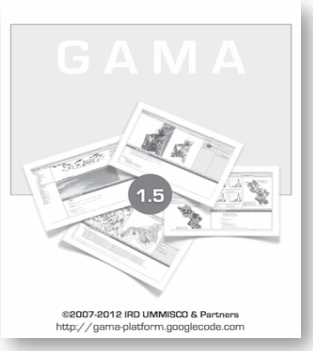
The GAMA programme is installed on the trainees' computers. The training sheets and the geographical information dossiers are transmitted to the participants.

Benoit Gaudou is now going to give you a succinct presentation of the GAMA programme and the "Wat-A-Game" model, which was not originally a computer model.

Box 16 Introduction to GAMA

Software platform dedicated to building spatially explicit agent-based simulations

- Generic: can be used for a wide range of applications
- Developed under GPL/LGPL license: free
- Integrates a complete modelling language (GAML) and an integrated development environment: allows modellers (even non computer-scientists) to build models quickly and easily
- Developed in JAVA: easy to extend in order to take specific needs into account
- Integrates tools to analyse models: parameters space exploration and calibration of models



Sources: Authors' construction.

[Benoit Gaudou]

The MAELIA project, previously spoken about in the plenary session, also uses the GAMA platform, which allows us to carry out agent modelling using spatially explicit models. It is a generic platform that may be used to deal with diverse types of problems: Alexis spoke about issues of segregation; I presented a questioning of water flows, but we could also have spoken about problematics concerning land development or the propagation of illnesses for example. We are going to focus upon water management.

One of GAMA's characteristics is that it is an "open source" programme. You can download the source code, that is to say the whole programme that allows the elaboration of the software. You have the possibility of adapting and improving it depending on your needs. This software programme was developed to be used by individuals who have not yet completely mastered the classical programming languages; it contains a simplified language adapted to the construction of multi-agent models: GAML *(Gama Modelling Language)*.

You are going to write your own model and try to make it match reality as much as possible.

Box 17 Introduction to GAMA (2)

Strengths of GAMA

- Supports the development of quite complex models
- Seamless integration of geographic data and GIS tools with agent-based models
- Integrates a methodological approach to define multi-level models
- Integrates high-level tools: multi-criteria decision-making tools, clustering functions, statistical operators…
- Easily extensible thanks to its open architecture, which relies on two legacy Java technologies: OSGI plugin framework and Java annotations

Sources: Authors' construction.

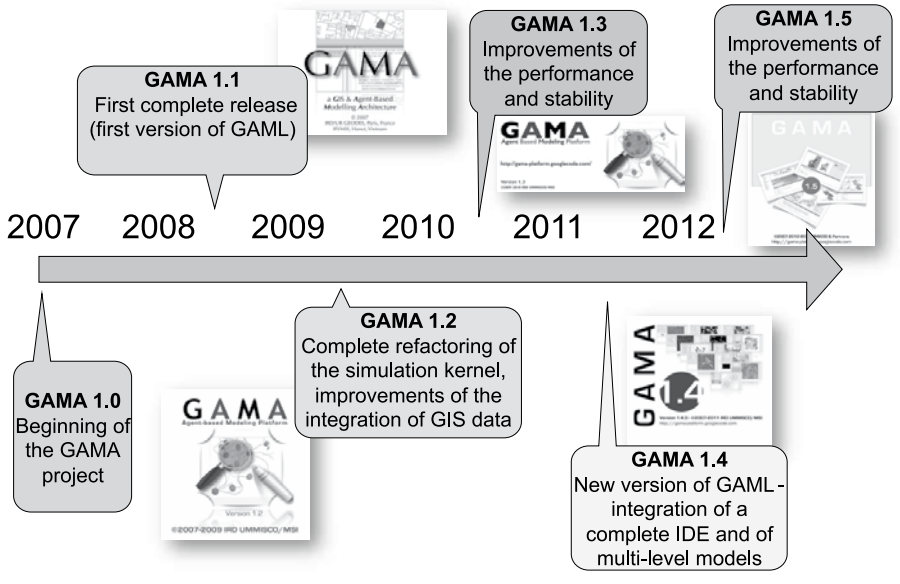
What are GAMA's strong points?

One of the targets of the programme is to build complex models that allow us, by taking on board numerous data, to appreciate the behaviours of the developed agents and observe the realist models.

The integration of geographical data and the method for developing the multi-scale models remain relatively simple – each level can correspond to agents or to entities endowed with behaviours. GAMA allows us to easily manage the interactions between these different levels.

With the aim of making more complex and expressive models, the programme is endowed with tools from mathematics, statistics and artificial intelligence. It notably includes *clustering* and decision algorithms.

Figure 32 Brief History

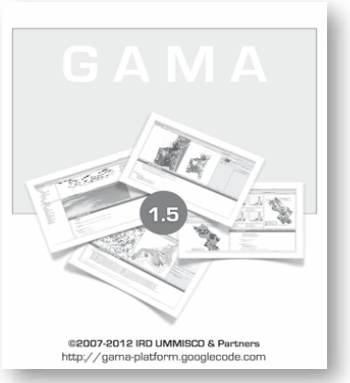


Sources: Authors' construction.

A first version of GAMA was developed in 2008-2009 with a more structured and less intuitive language. The Geographical Information Systems (GIS) were added in 2009-2010, and the multi-level approaches and new modelling languages in 2011.

To conclude this introductory part, let us indicate a certain number of available resources where you can download different versions and recuperate GAMA sources.

Box 18 More Information



- Blog
  http://gama-platform.blogspot.fr
- **Web site of the project**
  http://code.google.com/p/gama-platform/
- Documentation
  http://code.google.com/p/gama-platform/wiki/Documentation
- Mailing lists
  - General mailing list
    https://groups.google.com/forum/?fromgroups#!forum/gama-platform
  - Developers mailing list
    https://groups.google.com/forum/?fromgroups#!forum/gama-dev

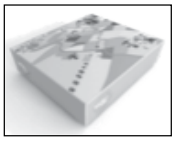
Sources: Authors' construction.

The aim of this tutorial is to make you familiar with GAMA by modelling a water catchment area, the water dynamic and interacting human activities. It will then be possible to evaluate the influence of these activities from a quantitative and qualitative point of view, particularly in terms of pollution. In this water catchment area scene we shall imagine different water management, activity management and policy strategies, etc.

To do this we have chosen a rather simple model, "Wat-A-Game", https://sites.google.com/site/waghistory/wag-courses.

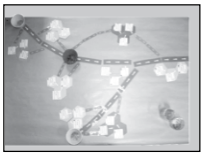
Box 19 WAT-A-GAME: Introduction

WAT-A-GAME (WAG) is an open toolkit and a method based on simple bricks for designing and using participatory simulations (*i.e.* role playing games) for water management, policy design and education.



Adaptable to:

- Represent any kind of basin and any kind of situation
- Various actors for various types and levels
- Sessions can be self-designed by the players



Sources: https://sites.google.com/site/waghistory/wag-courses.

"Wat-A-Game" (WAT) is a game that allows field players to represent their catchment area and to interact, to see how the water flows and examine how to implement management policies. The game consists of schematic elements: streams and rivers, multiple activities, etc. The idea is to have a base on which any catchment area may be represented and to allow a representation and a use of the game at different scales: farmers, associations, institutions.

Box 20 WAG: Ideas and Objectives

Experiences of GEAU and ComMod: simulation tool to help water resource management
(role playing game + computational simulation models)

Aim at capitalising on this experience by designing a "reusable" game

"Upscaling Commod": UMR GEAU working group (2008-2009 - Ferrand, Farolfi, Abrami)

- Extend spatial and institutional scales of the ComMod process
  - Involve higher-level stakeholders
  - Open to larger groups
  - Use of abstract representations
  - Process that can be transferred to local partners

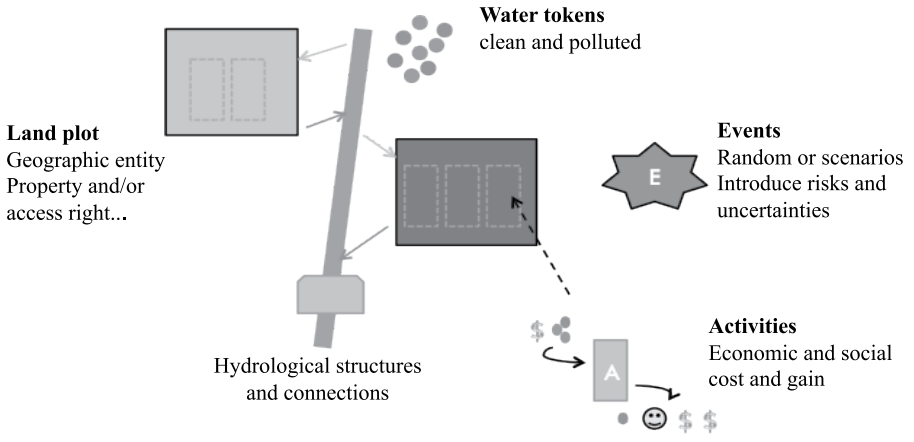
Sources: https://sites.google.com/site/waghistory/wag-courses.

This game stems from the participative modelling approach *ComMod* – a method used by researchers at the *Centre de coopération internationale en recherche agronomique pour le développement* (CIRAD) who gathered together people from the same commune in which there were, for example, conflicts surrounding land use. This entailed having the different players participate in the building of their model so that they could become aware of the management issue dynamics of their environment – creating a game on paper or blackboard for example.

The aim is to be able to generalise this approach through the development of an expressive tool, so that it may be used in a great number of situations with bigger groups of participants: allowing local people to make the tool their own by building themselves their own catchment areas in order to discuss it together.

Diagram 33 WAG Principles

A set of flexible and adaptable bricks to design specific "playgrounds" (artificial drainage basins)



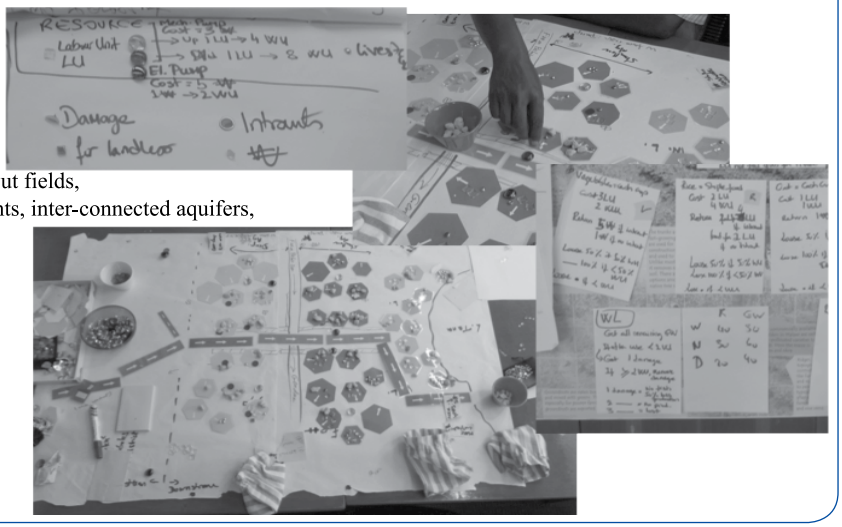
Sources: https://sites.google.com/site/waghistory/wag-courses.

There is a great deal of symbolical representation work with numerous activities. The idea is to build an abstract base into which individuals can integrate their own modelling concepts concerning the catchment area in question.

Surrounding a stream or river for example, there will be geographical areas in which specific activities will be identified: agricultural zones, industries, etc. These activities are also the source of profits for their owners and are going to be more or less socially accepted.

The participants are going to play on the structure after having built it. This stage is important in obtaining a common structure of the catchment area. The principle being that according to different human activities, water will be drawn from the source of the catchment area and a certain quantity of more or less polluted water will be rejected.

Diagram 34 Application Examples of WAG: Fogera Basin, Ethiopia



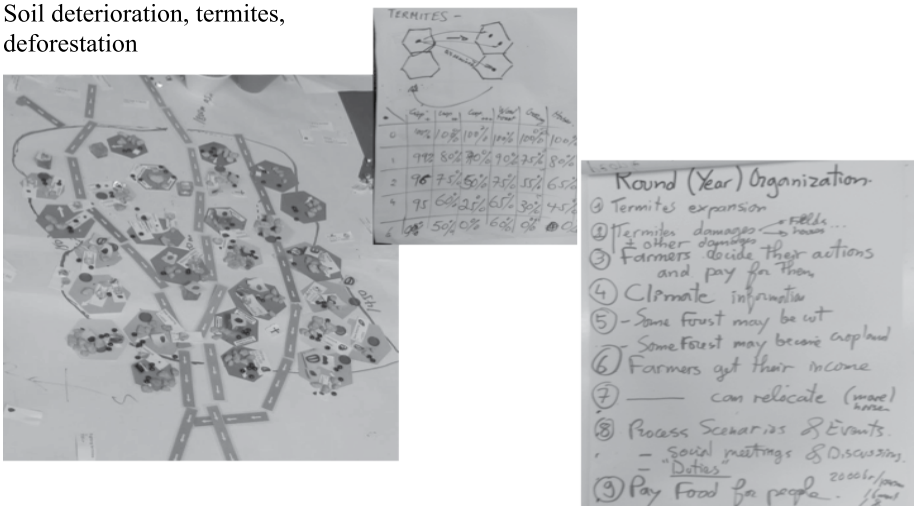
Farmers without fields,
work constraints, inter-connected aquifers,
humid area

Sources: https://sites.google.com/site/waghistory/wag-courses.

Here is a catchment area created in Ethiopia. The streams and rivers and all activities can be recognised. Other than basic concepts, the problems faced are: lack of cultivable zones, presence of underground water. This example illustrates the possibility of including concepts to make the catchment area closer to reality.

Diagram 35 Application Examples of WAG: Diga Basin, Ethiopia

Soil deterioration, termites,
deforestation

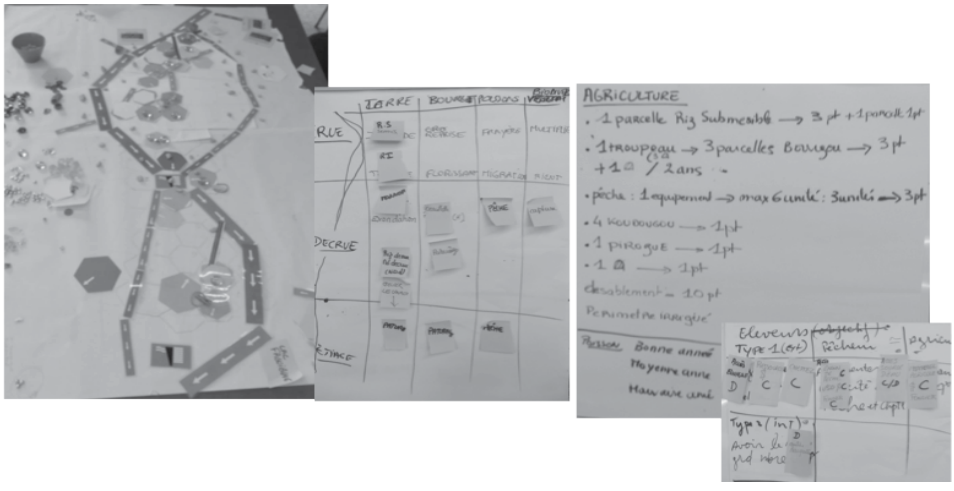


Sources: https://sites.google.com/site/waghistory/wag-courses.

In order to take into account their local problems, the participants included in this example many supplementary stages linked to the propagation of termites, their development, etc.

Diagram 36 Application Examples of WAG: Niger Central Delta, Mali

❖ Multiple usages over time and space



Sources: https://sites.google.com/site/waghistory/wag-courses.

Here, the problems associated with the catchment area were linked to land use.

How is the water catchment area managed with WAT?

The manager(s) must manage the water catchment by taking multiple aspects into account: social dialogue (equity), environmental practices, economic data (viable policies).

Some people will represent farmers, others will be responsible for policies – concretely, the catchment area manager may manage the dams according to the current and future situation he/she anticipates; he/she proposes or imposes management policies.

The manager may measure the water used, impose taxes, propose financial incentives, etc. To sum up the different informal measures, it is necessary to start a debate to advise the participants by proposing alternatives to crops that consume too much water, for example.

Phan Đinh Phước

I clearly remarked the brick diagram representing water quantity. In order to determine the quantity of water consumed by each of the activities in a water catchment area, you base yourselves upon statistical data, but on which information do you base yourselves for rejected water in order to measure the quantity of water and whether or not it is polluted?

[Benoit Gaudou]

To begin with, a quantity of water is placed at the catchment area's source and this quantity may vary. These models are made with the collaboration of field players who wish to study their catchment area, they have a good knowledge of the quantity and quality of the water used and rejected by different activities.

[Alexis Drogoul]

You are quite right to point out that data are not always available, especially when it's a question of pollution. One of the model's important parameters is the perception society has of an activity. Part of the decision in the models is based on perceptions rather than on real data.

We are developing an economic tool that will allow us provide an equitable technical management of the environment. How can we measure the quantity of water used by consumers and the quantity rejected? For households this is easy to calculate thanks to water meters, and as for rejected water we calculate it as 10% of consumed water. It is difficult to obtain reliable statistics for industry, as there are two supply sources: the supply company and direct drilling to consume underground supplies. It is therefore impossible to obtain exact data for the quantity of water used and for the quantity and quality of water rejected.

[Alexis Drogoul]

Regarding this access problem and the reliability of data, I wish to specify that it is possible to diverge from these models and add a hidden water abstraction point for any interested group. An abstraction that does not exist and whose data we do not possess, but which is going to have an impact on general water resources. This is not difficult to integrate. We can take interest in activities that have both a hidden and a visible part in terms of abstraction and rejection of water. It is possible to estimate them and even calibrate them depending on our knowledge of groundwater.

Nguyễn Ngọc Minh

Is there any way of testing whether the model gives an accurate picture of reality?

[Benoit Gaudou]

The diagrams are very far from the real environment. The strength of these models is that it is the field players that represent the catchment area depending on their perceptions and according to the issues in question.

Võ Quốc Thanh

When you measure the density of branches of rivers and streams, do you use statistical data or a hydrodynamic model? It seems to me that WAT is more a water resources equilibrium model. Does this model evolve with time *versus* the rhythm of the seasons?

[Alexis Drogoul]

Hydrodynamic and statistical water flow models depend totally on the participants' perceptions. Technical knowledge and thus a precise hydrodynamic model may exist. It is also possible to obtain measurements about the flow of water according to time and periods of high and low water.

Before the training, we discussed with the JTD's organisers in order to decide whether we were going to use a real water catchment area with real data, identified players, etc., or depart from an abstract base. We have chosen the abstract base with the idea that you can more easily generalise what you have learned. Our objective is that you leave here with a vision that is above all methodological.

Box 21 Steps to Build the Complete Model

1. Building a hydrological network using agents (a): nodes
2. Building a hydrological network using agents (b): network
3. Addition of water on the network
4. Modelling the dynamics of water flow
5. Tracking the quantity and quality of water (a): definitions
6. Tracking the quantity and quality of water (b): user monitoring
7. Adding different sources to the network
8. Modelling of "human" activities
9. Modelling of the interactions between activities and the hydrological network
10. Modelling the owners of activities and a simple economical system
11. Addition of several activity types
12. Adding charts and output files
13. Differentiating the sources in the network
14. Calibration of the model
15. Modelling the basin administrator and its management actions
16. Addition of management actions to the activity owners

Sources: Authors' construction.

The presented stages correspond to sixteen different models. There is a progression in modelling and technical terms. Each of the models allows us to introduce GAMA functionalities. Each stage is an exercise: a particular objective is set, a certain number of functionalities that allow this objective to be represented are introduced, the model is then implemented allowing a verification of the understanding elements before we move on to another model. Our objective is for you to become autonomous when using this tool so that you will begin to raise questions concerning your future practices.

2.4.2. Practical Works And Methodological Input

The practical work took up the first three and a half days, from Monday morning to midday Thursday. Days 1 and 2 allowed for the implementation of the "scenery" of the model serving as a base for the training, that is to say the creation of a minimal water catchment area with a simplistic flow dynamic; this was the moment for the participants to get acquainted with GAMA and more generally with computer programming. Because of their varying profiles, many of the trainees had embarked upon this workshop with a certain apprehension concerning the "computer tool" in general, and this led the trainers to devote an entire afternoon (Day 2, Tuesday afternoon) to explanations in Vietnamese, so as not to add linguistic difficulties to computer ones. From Wednesday onwards, the modelling work became more interesting for most of the trainees, as the modelling of human behaviours began to be addressed (those of the managers of activities within the catchment area, those of the area's administrator), which triggered numerous discussions about the best way to tackle this issue. This sequence finished at midday on Thursday when all the participants had succeeded in obtaining a same basic "neutral" model capable of being used for the study of more concrete questions closer to everyone's concerns – that is to say only describing certain dynamics considered to be "objective": the water cycle, pumping and rejection of water through activities, their economic cycle, their water needs, etc. The incremental construction of more and more complex and finalised models is one of the fundamental methodological inputs of agent-based modelling methods as it allows us, amongst other things, through the use of a same basic model enriched with "new" agents (economic, social, environmental, etc.), to evaluate and measure the impacts of these additions on the dynamics of the global system. From a didactic point of view, this was reflected during the workshop by a clear separation between the construction of the basic model – used to also introduce GAMA and its concepts – and a second, shorter part in which participants were encouraged to individually carry out their own additions to this model in response to a particular question. A list of questions that could be addressed with the help of such a model was thus submitted to the participants to choose from, whom were then asked to form four independent work groups, each working on one question within the framework of a specific scenario.

> Group 1 - scenario "home owners are confronted with a rise in sea level". The rise of sea water along the river is a potential source of activity disruption. Here it is necessary to model owners' behaviours in response to this disruption.

> Group 2 - scenario "the owners are free to not pay taxes, water police service is integrated". The catchment area manager's strategy is modelled to face this problem.

> Group 3 - scenario "additions of social behaviours for owners". The owners make decisions according to their activities but also according to other owners' behaviour. Defining in which order the different agents are going to act is an important aspect, at which moment the decisions are made will be defined.

> Group 4 - scenario "floods as a source of disruption". How the floods affect owners' activities is modelled. The question about owners' behaviour when faced with the risk of flooding is raised.

The trainees are divided into four groups with the support of a trainer. Practical work is constructed following two distinct stages: an analytical and reflective phase concerning the scenario with a first feedback discussed (synthetic approach by identifying how to integrate the data into the existing models; the computer is not used); after validation of each approach by the whole workshop there is a phase of technical implementation on the GAMA programme. A methodological briefing is proposed about these two stages of the work.

Group 1

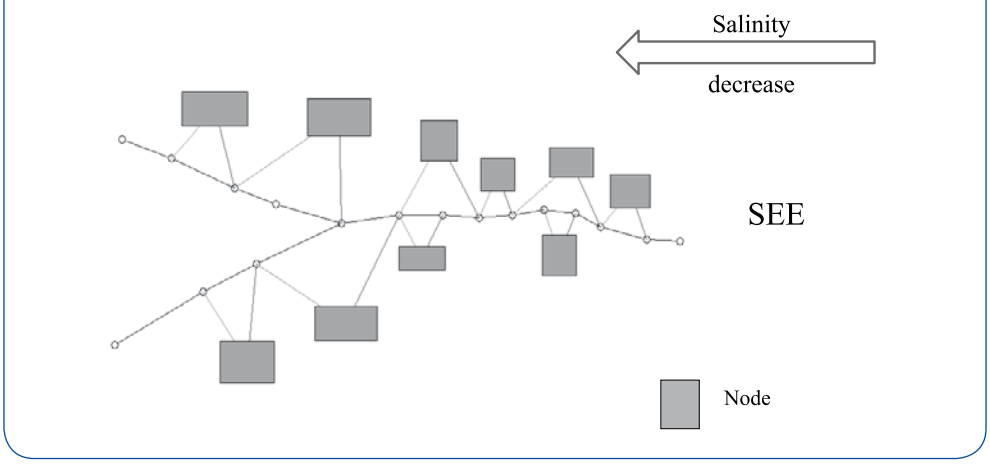
Which modifications need to be made to this model?

First, we are going to add the characteristic "salt water" to the unit of clean and polluted water, and then we shall model the intrusion of salt water in the modelled hydrological network by using the sea as a starting point (see next diagram).

A new activity based on the growing of salt-resistant rice will be defined. Finally, the catchment area's administrator may encourage owners to adopt this strategy. The building of a dyke and drainage system is judged to be too costly and complex, so we opted for a pumping system in the fields to reduce salt levels. We shall simplify our approach by only taking into account the impact of salt water on agriculture.

The implementation stages in the model are:
- Adding of salt water in the nodes: the closer the hydrological network to the sea, the higher the salt levels;
- Our hypothesis is that salt content does not change from one node to another: from an initial value of 100, we estimate the closest node will be 95, then 90, etc.;
- Introduction of a new type of salt-resistant rice;
- Two scenarios appear depending on the salt water acceptability threshold: if the threshold is higher than one, farmers can continue traditional cropping by pumping salt-free water; if the level is beyond the threshold, another activity will be envisaged;

Diagram 37 Salt Water Intrusion



Sources: Trainees' construction.

- The catchment area's administrator may grant a bonus to owners who have modified their cropping systems.

Nguyễn Ngọc Minh

How do you intend to pump water to dilute salt levels? On which source are you basing yourselves?

Group 1

We have defined two technical means for fresh water: digging of wells for groundwater and adding chemical products to lower salt levels.

Nguyễn Tân Dan

Because of salt water intrusion, the groundwater will be contaminated; the introduction of chemical products comes at a cost. Have you integrated these two aspects? Finally, it seems important to me to remain in touch with reality: in the Mekong Delta, no variety of rice is salt-resistant.

[Arnaud Grignard]

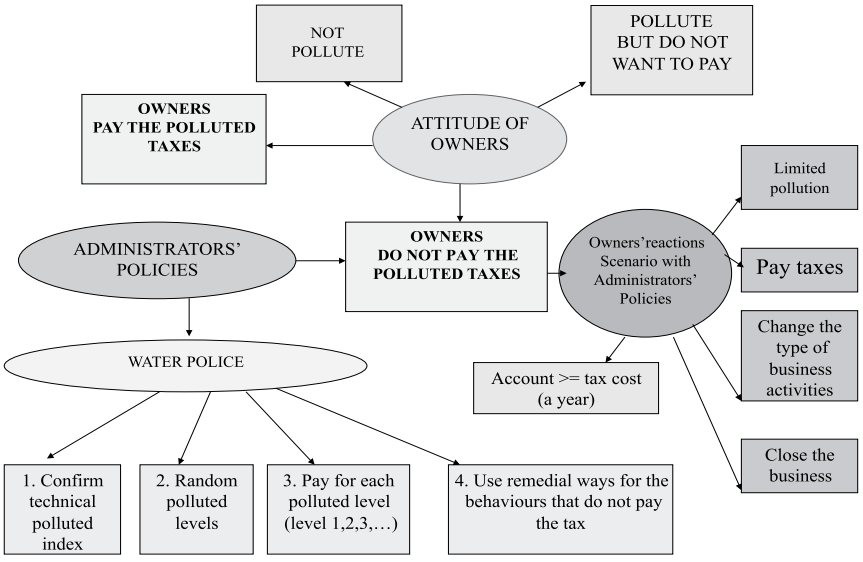
Certain varieties of rice are being developed, even though we must evidently take into account the economic dimension. Another agent might be introduced: the pumping of salt water for prawn farms.

[Alexis Drogoul]

Your two positions illustrate in a certain way the debates that have been going on since 1960 in computer modelling: is it necessary to be as realistic as possible or can we simplify reality to the benefit of induction and reflection? Everyone would like to have realist models, but we must remain aware that the computer tool has its limits; the answers supplied by the platform lead us into an abstract world.

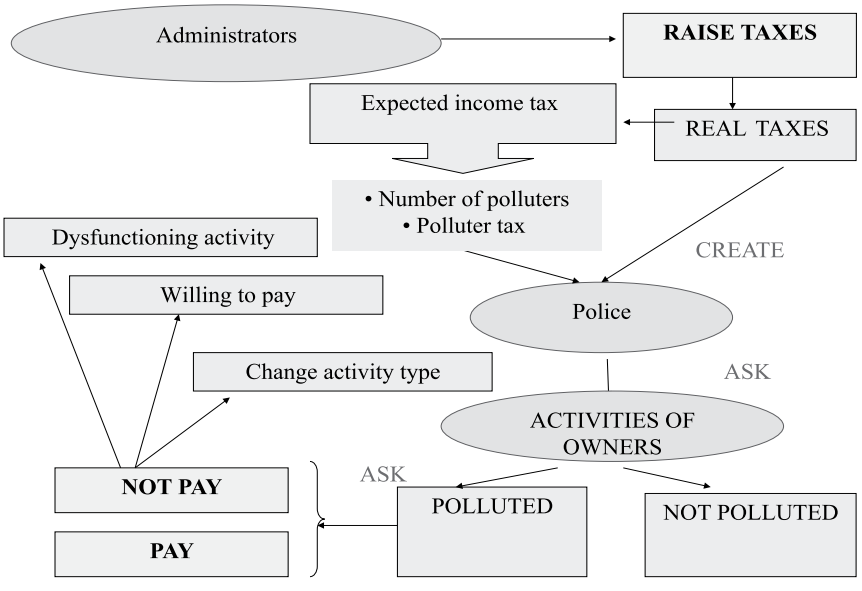
Group 2

Diagram 38 Owner's Freedom To Not Pay Taxes (1)



Sources: Trainees' construction.

Diagram 39 Owner's Freedom To Not Pay Taxes (2)



Sources: Trainees' construction.

Our module is a support tool for the decision-making of the catchment area's manager. The model is based upon owners' attitudes.

Which policies does the administrator implement? What are the attributes of the water police?

Firstly, we identify pollution levels and different levels of tax to be paid depending on pollution caused by activities. Next, it is necessary to define measures in the case where the payment of this tax is refused.

Each owner must have a bank account containing an amount of money higher than the tax to be paid.

[Patrick Taillandier]

Do all the owners behave in the same way, particularly regarding the tax payment? Which factors determine whether they pay the tax or not?

Group 2

The criterion determining the payment or non-payment of the tax is the pollution level. The higher the level of pollution, the less the activity owners will be inclined to pay the tax.

[Alexis Drogoul]

Do you envisage simplifying the model? Do you wish to represent everything in the administrator's behaviour?

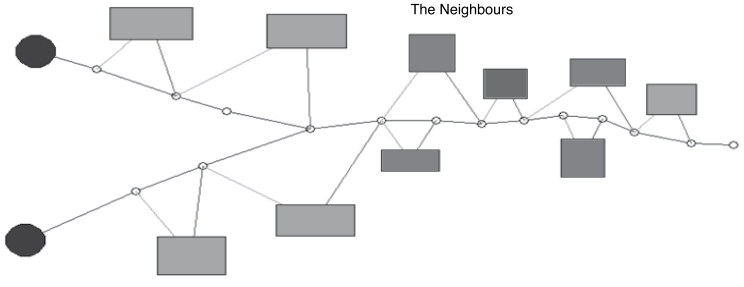
Group 2

The diagram presented gives us a glimpse of the problematic; it will be simplified when implemented.

[Alexis Drogoul]

A lot of things are not specified and are going to be difficult to model unless we opt for simplistic hypotheses. At the same time, you appear to have a clear idea of what you are doing. I think this models fits well with what has been discussed during the week.

Diagram 40 Give to Owners a Social Behaviour (Observation and Imitation of Neighbours)



Sources: Trainees' construction.

Group 3

What happens if the activity is in a state of disruption?

When faced with a disrupted situation, the owner observes his neighbours actions before making a decision. Two types of neighbourhood are considered: upstream and downstream.

Why is the activity disrupted?

Four types of information are examined: Has the owner paid his taxes? Does he receive help from the administrator? Has he got enough water for his activities? What is the nature of these activities?

The following questions are asked about the neighbourhood: What is the nature of the activities? Are the activities disrupted? If so, the envisaged scenarios are: the activity is repaired; the activity is modified – is the activity then more lucrative?

In order to make the decision to repair or change an activity, the owner bases his decision on his neighbours' situations and chooses from the three following criteria:
- Comparison of income generated by activity;
- Pollution from the activity;
- Financial capacity in case of change in activity.

Dương Hông Huê

Which agents will be created or modified in order to attain these objectives?

Group 3

We worked on the technical stages for the implementation of GAMA. We are not going to introduce new information. On the other hand, new agents are going to be defined: Who are the neighbours? What needs to be implemented by the owners?

Group 4

Our questions concern three distinct points: How can we define the impact of flooding? What measures can be taken to combat flooding? Who is financing these measures? We have defined two rates of income loss – 50% and 100%. Upstream activities suffer more damage than downstream ones. The rates of income loss for each activity owner are determined according to water flow.

The choice of adaptation measures depends on the type of activity: for industries that are difficult to relocate, dykes are built; agricultural activities may also be modified – a change to aquaculture for example.

Methodological Briefing (1)

[Alexis Drogoul]

These presentations are extremely interesting because they are situated between two worlds: the real one and that of modelling. Many constraints from the real world have been proposed even though they were not included in the suggested scenarios – for example, the cost of the building of a dyke or the relocation of a factory.

Your hypotheses identify four very different ways of approaching modelling. This is explained by the diversity of the proposed

scenarios and the profiles of the group members. I have classified the four groups:

- Group 1 has adopted a very operational approach. It is a presentation of modelling that is specific to GAMA and respects the constraints of the tool. The implementation is almost complete: we are in the tool; the model's hypotheses are so far from reality that they give rise to debate;
- Group 2 has adopted an essentially descriptive method. Hypotheses that must have been there are reflected but are not presented. Theirs is a rather normative description of the system's functioning that does not necessarily connect up with the operational constraints of the simulator;
- The presentation of Group 3 is hypothetical and hinges on questions. The link with the model's implementation is outlined. What is brought to the fore is the questioning without necessarily bringing any answers. The method consists more in asking questions about what one wishes to model than in defining technical solutions that may be implemented in the programme;
- Group 4's method corresponds to a modellers' one. There is a description of the model that is not that of the real system, which is based on the preceding model without making any specific reference to GAMA. It is an essentially conceptual model that might have been produced in any other computer tool.

Groups 2 and 3 base their model on a hypothetical method by bringing reality into question; the two other groups slipped into the world of the model.

From these four groups, we are lucky to have four different ways of conceiving modelling for a scientific approach that fluctuates between the constraints of reality and those of the computer tool.

I have no worries about your modelling abilities, as the groups which have gone the furthest in the implementation are raising questions about the relationship with reality, whereas the groups nearest to reality have better elaborated hypotheses and will thus have less difficulty implementing them.

Day 5, Friday 20th July

Implementation work of groups in GAMA

Methodological Briefing (2)

[Alexis Drogoul]

- Yesterday, Group 1 gave a very operational presentation linked to GAMA. While remaining operational, the presentation was more descriptive, making particular use of realist data from the geographical information file;
- Group 2 was very descriptive, almost normative. The presentation highlighted the functioning of the system with numerous command lines. The diagram used to represent the conceptual solution at the outset served as a support to subsequently explain the model's functioning.

These two groups started from two distinct points, but have arrived at a discourse that describes the model and shows how it was implemented in GAMA.

- The presentation of Group 3 was based on questioning that was very near to reality but far from the model. Today, the questions

have been deleted, hypotheses have been made, and lines of code describe the world using relatively advanced techniques compared to what we learned this week. The group moved from the real to the virtual world;

- The presentation of Group 4 was above all conceptual in the modelling domain but without references to any implementation. Like the other groups, they finished with a descriptive presentation. The extension is twofold: operational and realist, as only this group referred to the realities specific to the Mekong and to the behaviour of the delta's inhabitants.

Finally, in a very short time, we have here four comparable discourses in terms of representation and abstraction relating to the world and implementation. You all converged and the models are described as small, closed worlds.

There are some references to the real world, but the discourse essentially concerns the model; it is a matter of agents, environment and interactions. In spite of the virtual dimension, you have a discourse of realist interpretation, projecting on to the models' properties of the real world – *versus* the realism of measures to fight against salt, mechanisms of police control, etc. The objectives of this exercise have been assimilated: the model is used as an element on which a description or representation of what we should like to see in the world is based.

Selected Bibliography

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TREUIL, J-P., A. DROGOUL, J-D. ZUCKER (2008), Modélisation et simulation à base d'agents: exemples commentés, outils informatiques et questions théoriques, eds., Dunod, Paris 322 p.

List of trainees

Surname and first name	Institution	Field	Research theme	E-mail
Chu Thị Vân Anh	Vĩnh Phúc School Of Higher Education	Anthropology	Local knowledge of the Tày in the use and protection of natural resources in the district of Ba Bể, Bắc Kạn	vananh_dth@yahoo.com.vn
Dương Hiền Hạnh	University of Thủ Dầu Một	Anthropology	Immigration policies	duonghien1972@yahoo.com
Dương Hồng Huệ	University of the Environment and Resources, Hồ Chí Minh City	Environmental modelling	Quality of the environment in environmental management and socio-economic development	duong2111@yahoo.com
Lê Văn Tình	University of the Environment and Resources, Hồ Chí Minh City	Cartography, geography, natural catastrophes	Application of tele-detection and GIS for flood management in Hà Nội	letinh301@yahoo.com
Nguyễn Hùng Mạnh	Lào Cai services for sports, tourism and culture	Development anthropology	Urbanisation in Nghĩa Đô, province of Lào Cai	manhnguyenvn@gmail.com
Nguyễn Ngọc Minh	Polytechnic School of Hồ Chí Minh City	Mathematical modelling of the aquatic environment	Hydrology, water quality and hydrography	ngocminh@hcmut.edu.vn
Nguyễn Tấn Dân	Southern Institute of Sustainable Development	Environment	Use and protection of environmental resources	tandan1974@yahoo.com
Nguyễn Thị Tuyết Nam	University of Sài Gòn	Environment	Water and the environment	tuyetnam85@gmail.com
Phạm Thị Diễm Phương	University of the Environment and Resources, Hồ Chí Minh City	Environmental management	Risk analysis, observation, and management; evaluation of environmental impacts	phuongpham1910@yahoo.com
Phạm Thị Thuỳ Trang	University of Human and Social Sciences, Hồ Chí Minh City	Sociology	Pollution and water resources management	phamthuytrang1810@gmail.com
Phan Đình Phước	Institute of Research and Development, Hồ Chí Minh City	Urban management	Management of infrastructures: fresh water supply and sewage treatment	dinhphuoc_ds@yahoo.com.vn
Quách Đồng Thắng	Service of Sciences and Technology, Hồ Chí Minh City	GIS	Design and development of GIS, infrastructures management	quachdongthang@yahoo.com
Quách Thị Thu Cúc	Southern Institute of Sustainable Development	Community development	Aquatic environment and population subsistence along canals (Cần Thơ)	quachthucuc@gmail.com
Roeungdeth Chanreasmey	Cambodia Institute of Technology	Water resources	Hydropedology, Tank model	reasmey@itc.edu.kh

Surname and first name	Institution	Field	Research theme	E-mail
Trần Thanh Hồng Lan	Centre for the Improvement of Living Conditions	Sociology	Urban planning and urbanisation	lantran2@gmail.com
Trương Chi Quang	University of Cần Thơ	GIS	Agent-based modelling of land dynamics	tcquang@ctu.edu.vn
Võ Quốc Thành	University of Cần Thơ	Management of water sources	Applied hydrological modelling	vqthanh07@gmail.com

Conférences & Séminaires

Biographies of Teachers

Catherine BARON

Email: Catherine.baron@univ-tlsel.fr

TITLES AND DIPLOMAS

2005: Qualified for the post of university professor in the 24th section of development of public space and urban planning.

2000: Accreditation to supervise research *(habilitation à diriger des recherches, HDR),* University of Bordeaux 1.

1994: Thesis in Economic Sciences, University of Bordeaux 1.

1994: Aydalot Prize, prize for a thesis in regional and urban economy attributed by the *Association de science régionale de la langue française.*

PRESENT PROFESSIONAL POSTING

I have been a university professor of the development of public space and urban planning since 2005, and have been teaching since 1994, mostly at the University of Toulouse 2, le Mirail in the department of Economy and Management. Furthermore, I teach at the *Institut d'Etudes Politiques* (IEP) in Toulouse where I am responsible for the co-direction of the Master's course "International Cooperation and Economic Development".

SUMMARY OF RESEARCH

My research subject is about access to basic services (particularly water and sanitation) in developing countries, in towns, but also in semi-urban zones, or in the countryside. The method I favour falls within the framework of institutionalist economics and analyses in terms of local governance.

My current research into this theme is structured around three research projects:

- An ANR *Les Suds,* which I coordinate and which is entitled: "A Fragmented Public Policy. Production and institutionalisation of public policy in the water and real estate sectors. Benin, Burkina Faso and Niger", (APPI, 2011-2013). It is based upon collaboration with political analysts, development anthropologists and sociologists, particularly the Lasdel (Niger and Benin), the Citizenships Laboratory (Burkina Faso), the LAM (IEP Bordeaux), the IHEAD (Geneva) and the UMR201 (Paris 1). The ANR APPI proposes to analyse the construction process of multi-actor public policy in West African countries subject to incentive schemes, through the study of two particular sectors, land and drinking water. In order to document this process and analyse the factors that lead, or not, to the institutionalising of public policy, the field studies examine three countries: Benin, Burkina Faso and Niger. An empirical and constructivist perspective and community comparative studies are the favoured methods.
- A Canadian research project CRSH *(Conseil de recherches en sciences humaines du Canada- Université d'Ottawa, 2011-2013).* This project was set up in partnership with S. Paquerot (director). It is concerned with "Water management: how to reconcile

human rights with economic stakes". Part of the project aims at analysing the complex role of Non-Governmental Organisations in the Burkina Faso water sector and studying the participative processes they convey in their discourse and practices. Another more theoretical part addresses the problematic of rights to water.

- Another research project that I coordinate, and which is financed by the AFD (2011-2012), is entitled "Improving conditions of access to water and sanitation, and poverty and vulnerability reduction in the poorer neighbourhoods of Niamey, Ougadougou". This project is concerned with the analysis of the modes of access to water and sanitation in the neighbourhoods referred to as "poor" in African capitals (Ouagadougou in Burkina Faso and Niamey in Niger). The complex links between the fight against poverty and access to basic services are studied, particularly by using household surveys and interviews with the institutional actors, private operators and NGOs.

Jean-Pierre BEURIER

Email: jp.beurier@univ-nantes.fr

TITLES AND DIPLOMAS

2008: Professor Emiritus of Law.
1991: University Professor of Law.
1978: Lecturer of Law.

PRESENT PROFESSIONAL POSTING

I am currently carrying out research into:

- The domains of legal systems for maritime space, its exploitation and protection.
- State competences in different maritime spaces.
- Systems of exploitation of living and non-living natural resources.
- Protection of the maritime environment.
- Protection of the underwater historical heritage.
- Legal rights for professional hyperbaric diving.

Awards

Officier des Palmes Académiques, Chevalier du Mérite Maritime, Permanent guest of the Académie de Marine.

Aymeric BLANC

Email: blanca@afd.fr

TITLES AND DIPLOMAS

1994-1997: Ecole Nationale des Ponts et Chaussées.
1991-1994: Ecole Polytechnique.

PRESENT PROFESSIONAL POSTING

Project manager for the water and drainage division, Department of Sustainable Development, at the AFD.

SUMMARY OF RESEARCH

For five years (2005-2010) I managed a work programme about Public-Private Partnerships (PPPs) in infrastructures in the Research and Development Department at the AFD. The research programme attempted to assess the results of two decades of PPPs in Developing Countries (DCs) by studying the delegated management contracts, examining particularly their economic dimension (What is the optimal outline for the provision of services given the macro-economic constraints of a country?), their contractual dimension (What incentives should be foreseen, particularly for the taking charge of poor populations by the private sector?), their institutional dimension (Which regulation should be implemented to ensure an equal distribution of the resources generated by productivity gains?), and their participative dimension (How can we ensure the adhesion of civil society to these reforms?). It also transpired that a socio-political analysis was necessary to understand the reality of PPPs in so much as the latter are an integral part of political games, power struggles, and practices of political or economic domination, in the same way as they indubitably embrace a societal dimension which goes beyond the simple question of access (technical and economic) to basic services, thus raising big questions about the sense of public policies.

Pascal BOURDEAUX

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TITLES AND DIPLOMAS

2003: Ph.D. in history under the guidance of Nguyễn Thế Anh; *Ecole Pratique des Hautes Etudes* (EPHE), Department of Historical and Philological Studies, unanimously highly commended by the jury, Paris, Sorbonne.

PRESENT PROFESSIONAL POSTING

Lecturer at the EPHE, Department of Religious Sciences (since September 2007)

Teaching dispensed:

- Lessons for Master's "Initiation to the religions of Southeast Asia: an epistemological and historiographical approach";
- Seminar "Religions of Southeast Asia": socio-historical approaches to the new religious movements; introduction to the history connected to Protestantism in Southeast Asia (19th – beginning 20th centuries).

SUMMARY OF RESEARCH

The first research work by Pascal Bourdeaux concerned the history of Hòa Hao Buddhism, an expression of religious modernity and of culture in the South of Việt Nam. My field studies (particularly in the Kiên Giang province) aimed to analyse contemporary social and cultural specificities (popular beliefs, Buddhist renovation, social structures, local traditions) in the Mekong Delta in order to understand on the one hand what the "fluvial civilisation" *(văn minh sông nước)* described by Son Nam really is and, on the other hand, how the latter fits into – in the continuum of colonial and post-colonial situations – the framework of the Nation. A research mission to Cambodia allowed me to study colonial period sources (National Archives of Cambodia), which proved useful for the cultural history study of South Việt Nam.

To complement my personal research, I participated in the "Valease" (Valorisation of the Written Word in Southeast Asia) project in Hồ Chí Minh City, Hà Nội and Phnom Penh. I especially assisted in the elaboration and coordination of the FSP cooperation project "Religious Modernity and Renewal: the reconfiguration of Buddhist and Christian landscapes in Việt Nam " (EPHE, Institute of Research into Religions, VASS).

My teaching and research project, which I began in 2007, again placed the study of Vietnamese religious phenomena in the sphere of "religions of Southeast Asia". The central axis, a socio-history of contemporary religiosities, is now concerned with a comparative study of new religious movements, with diverse ways of exploiting and regulating religious practice, and with phenomena of the transnationalisation of religion.

The implementation of a Master's course ("Initiation to the Religions of Southeast Asia: historiographical and epistemological approaches") further incited me to

conceive an intellectual and cultural history of "religious sciences" (categories and representations of the religious) in the Indochinese peninsula.

In order to give back to contemporary evangelism a historic depth, I am currently devoting myself to a cross-cutting and connected history of Protestantism in Southeast Asia (XIXth - mid-XXth centuries).

Pierre CARIOU

Email: pierre.cariou@euromed-management.com

TITLES AND DIPLOMAS

2000: Ph.D. in Economy, University of Nantes, with the unanimous congratulations of the jury, entered for Ph.D. prize and awarded with a grant for publication.

PRESENT PROFESSIONAL POSTING

Associate teacher since September 2010 at Euromed Management, a Business school in Marseilles. Professor at the World Maritime University (2004-2010) in Sweden.

Lecturer (2001-2004) in Economy at the faculty of Economic Sciences and Management in Nantes.

SUMMARY OF RESEARCH

Generally speaking, my research problematic is concerned with maritime and port economy. First of all, in the continuation of a thesis about "strategic alliances in the maritime transport on regular shipping services" concerning agreements between ship owners and their impact on competition; then my six years as a professor at the World Maritime University, under the aegis of the World Maritime Organisation, led me to develop a specific expertise about issues of maritime security and safety, particularly about the identification of sub-standard vessels, as well as the analysis of acts of piracy. My latest research work concerns emissions of carbon monoxide linked to maritime transport activity. Finally, a last axis of research is the analysis of port systems.

Conférences & Séminaires

Christophe CLUZEAU

Email: cluzeau.christophe@gmail.com

TITLES AND DIPLOMAS

1990: Diploma for post graduate studies in economy and management. *Centre d'études supérieures en économie et de gestion, Ecole Nationale Supérieure du pétrole et des moteurs (Institut français du pétrole)* Rueil-Malmaison.

PRESENT PROFESSIONAL POSTING

I began my career in Madrid in the petrol sector (Elf Aquitaine) as the person responsible for economic studies (mergers and buy outs). I then joined the Groupe Lyonnaise des Eaux SUEZ in positions of exploitation management in France, Buenos Aires and Puerto Rico.

In 2006, I joined LYDEC, a Moroccan enterprise managing the public services of electricity and drinking water distribution, collection of sewage water and public lighting in Casablanca and its region (inhabitants: 5 000 000 – 17 communes – turnover: EUR 500M – 3 500 employees) as a member of the general management committee and was particularly given the responsibilities of "Contract Manager" and Director of the INDH-INMAE project. Lydec is a subsidiary company of GDF SUEZ. As "Contract Manager" I created the department of delegated management contracts and was responsible for contract management with the municipal and regional authorities (Communes, Prefectures, Wilaya) and the Ministry for Home Affairs, and the management of specific contract files (strategy, investments, tariffs, public audits, regional accounting offices), and the first contract renewal, which lasted three years and was terminated on 11th May 2009.

As INDH-INMAE project manager, I created the department and am in charge of the project according to the provisions of the framework agreement INDH *(Initiative Nationale pour le Développement Humain)* signed on 13th September 2005, whose target is to fight against unsafe housing (relocations or staying put with connections to water, drains and electricity) for approximately 900 000 inhabitants in the region of greater Casablanca. Between 2006 and 2011 I managed a team of 70, whose task was to develop a provisional investment programme of EUR 160M. I created, managed and developed different partnerships in order to find answers to different questions regarding the governance of operations in the informal zone and to provide the financing to make them possible: partnerships with IDMAJ SAKAN (a public enterprise responsible for the eradication of shanty towns in the greater Casablanca region), with the Ministry of Housing and Urbanism within the framework of a FSH (housing solidarity fund of the Ministry for Housing and Urbanism) financing agreement, with the Ministry for Home Affairs, with the World Bank in the framework of GPOBA (Global Partnership on Output-Based Aid), with the International Association of French-

Speaking Mayors, and NGOs (Fundacion CEAR).

Thanks to the initiative of Claude de Miras, an economist at the IRD, an agreement was signed in 2010 between the IRD and LYDEC, with a view to the conducting of the capitalisation study for the INDH-INMAE project. This study has two essential objectives, on the one hand to capitalise by synthesising the original approach developed by the INDH-INMAE management in the framework of the INDH, and on the other hand, to contribute, particularly by the analysis of financing modalities and cost structures of the INDH-INMAE project, to the research project signed by the IRD and the IDDRI Foundation in May 2009 on the subject: "Financing the urban services of drainage and drinking water in developing countries: modalities for the long-term global cost sharing between players".

The international recognition of the Morocco project, because of their experience in social inclusion (UN 2010 Habitat prize) and the innovative plan (project management and multi-player governance) implemented in the Greater Casablanca region within the framework of the INDH between the IDMAJ SAKAN and the INDH-INMAE project, led to the participation of Abderrahmane Ifrassen (Director General of IDMAJ SAKAN), Christopher Cluzeau and Claude de Miras in workshops held in Hồ Chí Minh City from 6th to 10th December 2010, whose subject was: "Urban inclusion, creating a city and its networks. Governance and financing drainage and drinking water services".

The organisers of this event were the Province/Hồ Chí Minh City with the HIDS (Hồ Chí Minh City Institute for Development Studies). These workshops were the occasion to develop South-South cooperation between two countries, Việt Nam and Morocco, two emerging contexts with rapid economic and urban growth, which must conciliate urban and human development (the force of the urbanisation process and the political response and how it will it be implemented).

I am continuing my participation and work developing studies and research linked to the implementation of complex social projects that require specific approaches and methods (multi-player governance, informal sectors, commitment of stakeholders and the respect of particularities).

Claude de MIRAS

Email: cldemiras@yahoo.fr

TITLES AND DIPLOMAS

Economist, Research Director, IRD.

SUMMARY OF RESEARCH

I was posted to Morocco in September 2008 to carry out a research programme concerning the governance of basic urban services. My first work (2009-2010) was in collaboration with the General Directorate for local authorities for the Moroccan Ministry for Home Affairs (design of a multi-player diagnostic of the urban sector's public hygiene and sanitation). From 2010 to 2011, my second project involved the capitalisation of the INDH-INMAE Project (Lyonnaise des Eaux, Casablanca) for access to water and drainage in the poorer neighbourhoods of Greater Casablanca. Currently, in collaboration with the National Institute of Urban Development in Rabat, I am involved in the development of the problematic and analysis for mastering the project management of basic services in the agglomeration of Casablanca (the UCLG GOLD 111 Project). Since 2010, this research has developed within the framework of "Financing urban services for drinking water and sanitation in developing countries: modalities of global long-term cost sharing between players" supported by the IDDRI.

The general research problematic aims to analyse the implementation of urban governance in the domain of urban services of water and sanitation. Over the past two decades, the number of stakeholders (the State, devolved authorities, territorial authorities, public agencies, private operators, civil society, PPPs, financial backers) who participate in urban decision-making has multiplied. The question of the coordination and synchronisation of inter-institutional efficiency and of the search for the optimisation of this shared public project has become a central issue. Indeed, transaction costs and delays generated by a composite multi-player, multi-sector and multi-level decision-making, have increasingly affected the real cost of urbanisation and most probably have become a burden on its dynamism and tenability. The analysis of the development conditions of basic urban services of which the social, financial and land imprint is considerable, leads me to consider that, as well as the social, environmental and economic tenability, the institutional tenability today constitutes a bottleneck for the mastering of urban planning for expanding metropolises.

By comparing the implementation of urban water, sanitary, rainfall and electricity projects, it is possible to break down the process of the formation of the costs of urbanisation by going beyond the costs of equipment and the internal costs of management announced *ex ante*. An *ex post* approach allows us to bring to light the constitutive elements of the total cost of the urbanisation addressed by the networks. Mastering the hidden costs, induced by a perfectible multi-

player coordination, today appears to be a strategic component of the sustainable city. The IDDRI, the OECD, the French Alliance for Cities and Territorial Development, *Cités-Unies* and local governments testify to the importance of the questions emerging from territorial development and to which scientific research is responding in a methodological, analytical and theoretical manner.

Alexis DROGOUL

Email: alexis.drogoul@ird.fr

TITLES AND DIPLOMAS

2000: Accreditation to supervise research work, Computer Sciences, University of Paris 6.
1993: Ph.D. thesis in Computer Sciences, University of Paris 6.

PRESENT PROFESSIONAL POSTING

Research Director since December 2004 at the IRD, Associate Researcher (since 2012) at the University of Cần Thơ, Việt Nam; Professor of Computer Science (2000-2004) at the University of Paris 6, LIP6 laboratory; Computer Science Lecturer (1995-2000) at the University Paris 6, LAFORIA & LIP6 laboratories.

SUMMARY OF RESEARCH

My general research problematic concerns the conception of tools of artificial intelligence to help with the modelling and simulation of complex systems, with a great desire to facilitate interdisciplinary work and extract multi-domain cross-cutting concepts. On these grounds, I was already participating in 1991 in the defining of certain basic concepts of "agent-based modelling", and at the same time working in parallel on numerous thematic applications (in ethology, hydrology, geography, road traffic, to mention but a few). From 1998, at the crossroads of the domains of computer science, experimental economy and participative conception, I worked more specifically on participative simulation and modelling methods, which allow us to involve social players in the conception of models which showed themselves to be particularly adapted to the management of conflicts concerning the users of shared resources; they have been successfully applied in the field (in Bhutan, Việt Nam, Thailand and Mexico). In 2005, I became the designer and one of the principal architects of the modelling and simulation platform GAMA (http://gama-platform.googlecode.com), which, to recapitulate 15 years of research in the domain, aims to put at the disposition of non-computer scientists tools of conception for spatially explicit, multi-scale and multi- formalism models, as well as allow an "intelligent" exploration (by simulation and optimisation) of the space of their parameters. In parallel, the thematic projects in which I have been participating for more than five years now, first in Hà Nội then at the University of Cần Thơ, involve decision support in the policy of fighting against environmental catastrophes (the rise and salination of the Mekong waters, biological invasions, avian flu epidemiology, urban catastrophes).

Jean-Philippe FONTENELLE

Email: fontenelle@gret.org

TITLES AND DIPLOMAS

2004: Post-graduate doctorate in Agronomy under the guidance of P. Mathieu, Sociologist, and P. Defourney (director), Agronomist, Catholic University of Louvain-la-Neuve: *"Agrarian dynamics, irrigation and institutions in the Red River Delta (Việt Nam): a multi-scale analysis of the agricultural management of water".*

PRESENT PROFESSIONAL POSTING

Operations Director of the Groupe de Recherche et d'Echanges Technologiques (GRET).

SUMMARY OF RESEARCH

My research problematic concentrates on the agricultural management of water. To tackle it, I use a social management of water approach. It is a multi-disciplinary approach that combines tools from exact science with tools from human and social sciences. This approach, derived from the systemic approach, which was developed by agronomists during the 1970s, considers water management as a complex object of research, which is at the same time a historically constituted, geographically located, technical, economic and social fact whose analysis requires the use of complementary tools from rural hydraulics, agronomy, geography, history, sociology, etc.

My academic and professional career has led me to implement and manage research groups for the social management of water in many countries: France, Africa, (Ethiopia and South Africa) and Asia (Cambodia, Myanmar, Nepal, Thailand and Việt Nam).

My most in-depth work was carried out in Việt Nam within the framework of the Red River Programme, a cooperation project led in partnership with the VASS, where I was technical assistant for GRET between 1994 and 1999. My work concerned the evolution of the agricultural management of water in the Red River Delta at a pivotal period of economic transition in the Vietnamese countryside. This work resulted in a doctorate in agronomy in 2004, as well as in numerous publications.

Over the last five years, the amount of research I have been carrying out has greatly diminished owing to the responsibilities I have taken on within the management of GRET.

Clément FRENOUX

Email: clement frenoux@yahoo.fr

TITLES AND DIPLOMAS

2009: Ph.D. Candidate in Economic Sciences. *Laboratoire d'étude et de recherche sur l'économie, les politiques et les systèmes sociaux* (LEREPS), University Capitole 1. TESC doctoral school.

2006: Science of Territories Master's, Development Economy and Territorial Development, University of Pierre Mendes France (UPMF), Economy, Strategy and Enterprise (ESE), Grenoble.

PRESENT PROFESSIONAL POSTING

Doctoral student in economic sciences under a CIFRE contract (LEREPS/Gret); responsible for Water and Sanitation study/ project at GRET.

SUMMARY OF RESEARCH

I worked at GRET for eight years, three of which were spent in Paris and five in Cambodia, managing and monitoring a field project (EU, UNICEF, WB, MAE, AFD, etc.), in consultancy coordination on behalf of international financial backers (WB, Gates Foundation, WSP, AFD) in Cambodia and Laos and in Southeast Asia (Indonesia, Việt Nam, Philippines). I also worked in Mauritania, Burkina Faso, Senegal, Haiti and Peru on technical assistance and project monitoring missions. As a specialist in the public sector services for the supply of drinking water and provision of sanitation, my areas of expertise include:

- Financial and institutional design: institutional, organisational regulatory studies within the framework of the introduction and participation of the private sector; studies into financial modelling concerning access to credit and grants;
- Market analysis (socio-economic and demand): conception and analysis of socio-economic surveys, demand analysis and market analysis;
- Management and technical expertise: definition and conception of infrastructures, management and regulation methods;
- Evaluation and progress-monitoring: realisation of development programme evaluation, definition and implementation of monitoring and evaluation tools for projects;
- Training and audit: technical, commercial and financial training of local operators and institutions; technical and financial audits of drinking water services.

Since 2009, I have been preparing a doctorate in economic sciences at LEREPS, at the University of Toulouse, on the emergence of small private operators in the water sector on the basis of "institutionalist" grids (North, Williamson, Ostrom) and recently on those stemming from works into innovation and entrepreneurship (Schumpeter, Knight). This research problematic concerns:

- The study of "alternative" forms of coordination for the financing and management of drinking water and sanitation;
- The influence of the interaction between institutional environment institutions and

organisations on social and economic management performances and the regulation of local natural monopolies;

- The role and dynamic of innovation and entrepreneurship in the urban service network sector.

Benoit GAUDOU

Email: benoit.gaudou@univ-tisel.fr

TITLES AND DIPLOMAS

2008: Doctorate thesis in artificial intelligence, University of Toulouse.

PRESENT PROFESSIONAL POSTING

In 2010, after completing two post-doctorate years at the *Institut de la Francophonie pour l'Informatique* (IFI) in Hà Nội, I took up a post as lecturer in the computer science faculty at the University of Toulouse 1 Capitole.

I am carrying out my research within the *Institut de Recherche en Informatique de Toulouse* (IRIT) in the "Systèmes Multi-Agents Coopératifs" (SMAC) team.

SUMMARY OF RESEARCH

Generally speaking, my research work concerns the formal or non-formal modelling of different notions occurring in human cognition and decision-making (particularly confidence and emotions) and the integration of these models within multi-agent simulations.

This research is currently part of two research projects:

- The Maelia project (Multi-Agent for Environmental Norms Impact Assessment) supported by the RTRA STAE. The MAELIA project consists in modelling the socio-environmental impacts of the governance and management norms of renewable natural resources and the environment. It aims at developing a modelling and simulation platform of the direct/indirect and expected/unexpected impacts of norms on a territory whose resources are both subject to competitive competition, concurrent exploitation and are dependent on physic-bio-geochemical variations. The preferred domain of application is water management in the Adour-Garonne basin;
- The ANR EmoTES project (Emotions in Social Interaction: theory, experiences, logical and computerised studies). The aim of the EmoTES project is to study the so-called strategic emotions, such as guilt, remorse, envy, anger, and moral satisfaction, which may arise in a strategic interaction context (that is to say, when the utility of an agent's choice also depends on what other agents are going to decide to do) under the triple point of view of psychological theories, logical formalisation and simulation. The aim is to integrate strategic emotions into the behaviour of agents on the Soc Lab (simulation platform of organisations based on the formalisation of C. Sibertin-Blanc and P. Roggero of Sociologie de l'Action Organisee) platform.

I am also involved in several other thematic networks supported by the National Network of Complex Systems, whose networks are SimTools-Network, MAPS (Multi-agent modelling applied to spatialised phenomena) and METISSE (Methods and Theories for an Engineering of Socio-Environmental Systems). Finally, I am participating in the development of the GAMA platform for multi-agent modelling and simulation.

Christophe GIRONDE

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TITLES AND DIPLOMAS

Doctorate in Development Studies, Graduate Institute of Development Studies (IUED) / University of Geneva, 2001; thesis entitled "Rehabilitation and Transformation of Family Economy in North Việt Nam - Village Activity Systems and Relation Networks in the Red River Delta".

PRESENT PROFESSIONAL POSTING

Responsible for teaching and research at the IUED, Geneva.

SUMMARY OF RESEARCH

My research has essentially focused on the processes of transformation of rural economies and societies. It concerns the field of political economy, and is based on field research among communities and representatives of local authorities.

My work concentrates on Việt Nam, based on doctoral research conducted at the end of the 1990s. I took a particular interest in the evolution of the productive activity system of communities, in social differentiations, in the process of institutional transition toward a so-called market economy and in the role of local authorities in these transformations.

More recently, I had the opportunity to work as a consultant on the questions of community participation in the definition and implementation of anti-poverty programs in Việt Nam and in Mali.

Arnaud GRIGNARD

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TITLES AND DIPLOMAS

2008: Diploma in Electronic Engineering, Telecommunications and Computer Science, ESCPE Lyons *(Ecole Supérieure de Chimie Physique Electronique)*.

2001-2004: Preparatory classes to enter an engineering school (CPE, Lyons). Advanced and Specialised Mathematics *(Maths Sup-Maths Spé)*

PRESENT PROFESSIONAL POSTING

For two years, I worked within the Rhône-Alpins Institute of Complex Systems as a research engineer at the ENS, Lyons. I participated in the development of a modelling and simulation platform and more particularly in the visualisation and graphic edition of complex systems. This platform was used on an epidemiological model within a European FP7 Dynanets project. We studied the dynamic of multi-scale networks by concentrating on the propagation of a virus on a human scale (*i.e.* within a city) then on an urban scale (*i.e.* between different cities).

I am currently in the first year of my doctorate in an international doctorate programme organised by the University Paris 6 in the UMMISCO laboratory. This thesis is directed by Alexis Drougoul and is in co-supervision with Việt Nam. The thesis aims to study and produce new visualisation tools that will allow the representation and interpretation of a multi-agent system. These new tools are being developed thanks to real data acquired by different teams attached to the IRD.

Patrice GUILLOTREAU

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TITLES AND DIPLOMAS

2003: Accreditation to supervise research, University of Nantes.
1993: Post-doctorate studies at the University of Portsmouth (United Kingdom), CEMARE (Centre for the Economics and Management of Aquatic Resources).
1993: Doctorate thesis in Economic Sciences, University of Rennes 1.

PRESENT PROFESSIONAL POSTING

Since September 1994, university lecturer accredited to be a senior research supervisor in economics (CNU 05) at the University of Nantes.
Researcher at the Laboratory of Economy and Management, Nantes Atlantique (LEMNA EA4272).
Since 2004, assistant director of the research federation at the CNRS *Institut Universitaire Mer et Littoral* (IUML), which groups together 430 sea and coast researchers in Nantes.

SUMMARY OF RESEARCH

Since 1989 my research work has been concerned with the maritime economy and more particularly with the fish product sector. By using an approach that mixes input from the natural resource economy with those from the industrial economy, my research attempts to better understand the industrial organization based on the exploitation of renewable, natural and common resources. The biological constraints added to the stock externalities, which characterise this type of exploitation, led to some particular forms of collective organisation (development of property rights, auction markets to sell production, value and transformation chain, co-financing of activities, agreements on resource access, etc.).

Among the recent themes, which raise questions about the organisation of maritime sectors, here are a few examples I would like to present:

- Formation and transmission of prices along the value chain (measure and origin of the spatial dispersion of prices, determinants of consumption and of international trade of sea products, role of eco-labels, structural changes and asymmetry in price transmission, incidence of electronic auctions and selling at distance on the price of fish);
- Organisational changes in the world tuna market (the effect of variations, such as El Niño and the vulnerability of small insular economies to climate change, the study of fishing strategies relative to drifting Fish Aggregating Devices, history of canning factories, globalisation of markets, impact of piracy on fishing);
- Regulation of access to natural resources and maritime space (negotiation of the EU ACP Fishing agreements, individual and collective property rights, analysis of user conflicts of marine space and resources).

Nguyễn Mạnh Hùng

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TITLES AND DIPLOMAS

2008: Doctorate thesis in Political Sciences and International Relations, University of Delaware, USA.
2003: Master's in International Relations, Diplomatic Academy of Việt Nam, Ministry of Foreign Affairs.

PRESENT PROFESSIONAL POSTING

Researcher at the Institute of World Economy and Politics, VASS.

Lecturer in the Department of Economic Development, University of Economy and Foreign Affairs, National University of Việt Nam.

SUMMARY OF RESEARCH

International Relations: theoretical approaches, international politics and economy, international development, non-conventional security, governance.

Analysis of Public Policies: development policies, foreign policy, cooperation, development and non-conventional security in the Mekong region.

Yves PERRAUDEAU

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TITLES AND DIPLOMAS

1986: Doctorate under the guidance of Pr. Pierre Bauchet at the University Paris 1 – Sorbonne, Thesis: "Examining the Problematic of the Redeployment of French Industrial Deep-Sea Fishing: an example in the Kerguelen Islands", awarded the highest honours of the jury.

Awards: *Chevalier de l'ordre des Palmes Académiques,* February 2004; *Officier de l'ordre des Palmes Académiques,* February 2008.

PRESENT PROFESSIONAL POSTING

I am a senior lecturer at the University of Nantes and have been the director of the Nantes IAE Institute of Economy and Management since 2011; I am also responsible for cooperation with Southeast Asia, nominated by the President of the University of Nantes.

I have been responsible for a Master's in "Finance and International Business" specialty "International Finance and Maritime Logistics" since 2004. Before this, I was the Director of the *Centre d'observation et de recherche sur les ressources aquatiques et industries du littoral* (1995-2000); I am currently a researcher at the Economy and Management Laboratory, Nantes-Atlantique.

SUMMARY OF RESEARCH

As well as doing traditional teaching in macro-economy and economic history, I teach maritime fishing economy in the multi-disciplinary Master's "Integrated Management of Coastal Zones" at the geography faculty in Nantes and maritime geo-strategy in the "international Finance and Maritime Logistics" Master's.

As far as research is concerned, my work essentially concerns the fishing and aquaculture economy. This work began at the time of my thesis and led to my becoming, from 1997 to 2007, a member of the Scientific, Technical and Economic Committee of Fishing (CSTEP) of the European Union – the General Directorate of Maritime Affairs – from 2002 to 2007.

Since 2003, I have been responsible for the scientific part of the research contract "National pluri-annual (2002-2006) programme for the collection of socio-economic data concerning maritime fishing", which is part of the European Regulation Framework of 20th June 2000. I have also had the scientific responsibility for several programmes, particularly, "Study of risk management of the price of sea products: theoretical feasibility of a derived market" (Ministry/OFIMER, 2004-2006) and "Image and social valorisation of the maritime fishing sector" (European Commission / Europêche, 2007-2008). I have been a member of the Scientific Council of the Grand Port Maritime of Nantes, Saint-Nazaire since 2009.

Conférences & Séminaires

Mireille RAZAFINDRAKOTO

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TITLES AND DIPLOMAS

2010: Certification for Direction of Research, Paris-Dauphine University.

1996: Doctorate in Economic Sciences, *École des Hautes Études en Sciences Sociales,* Paris (EHESS). With highest honour and congratulations from the jury *(Summa cum laude)*.

1991: Statistician Economist Engineer, diploma from the ENSAE-CESD, Paris *(École Nationale de la Statistique et de l'Administration Économique, Centre européen de formation des statisticiens économistes des pays en développement)* Valedictorian.

PRESENT PROFESSIONAL POSTING

Research Director, Institute for Development Research (IRD), Research, DIAL (Development, Institutions and Long Term Analysis) Unit.

Posted in Việt Nam, at the General Statistics Office (GSO), since July 2006. Responsible for the implementation of the DIAL research program in Việt Nam.

SUMMARY OF RESEARCH

My present work particularly focuses on: the links between well-being and the living conditions of households, inequalities and governance, job satisfaction, corruption and poverty, as well as the evaluation of the impact of public policies. The research on Việt Nam concerns a program on the "issues and constraints of the economic transition since Đổi Mới". This research takes a multi-disciplinary view, combining quantitative and qualitative approaches, and uses the perspective of comparison with other developing countries. It is carried out according to three complementary axes:

1. The role of the informal sector on the labour market and its impact on the living conditions of households. Starting from the analysis of the characteristics of this sector, we try to find out in what way it contributes to the improvement of the standard of living and to the reduction of inequality. What are the specificities of the informal sector that should be taken into account in public policy?
2. Follow-up and evaluation of the impact of public policies, in particular in distributive terms. On the one hand, it involves the analysis of the influence of the commercial opening-up of Việt Nam, notably the social consequences of Việt Nam joining the WTO (*ex ante* approach by resorting to micro-macro models). On the other hand, the objective is to measure the efficiency of the political battle with poverty that is taking place in the mountain regions where ethnic minorities live (*ex post* evaluation: analysis of causalities, specific methods for evaluating impact);
3. The role and the performance of institutions in the transition process. This involves exploring the links between governance (role and functioning mode of public institutions), the value system of

the society, the economic dynamic and the living conditions of the population. The analyses are on, among others, the multiple dimensions of poverty (subjective well-being, employment conditions, social participation and exclusion, conditions for access to public services, etc.).

Francois ROUBAUD

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TITLES AND DIPLOMAS

1991: Doctorate in Economy, Paris XI University – Nanterre. With highest honours and congratulations from the jury *(Summa cum laude)*, candidate for thesis prize and publication.
1986: Diploma of Statistician-Economist, *École Nationale de la Statistique et de l'Administration Économique* (ENSAE), Paris.

PRESENT PROFESSIONAL POSTING

Research Director, Institute for Development Research (IRD), DIAL (Development, Institutions and Long-Term Analysis) Unit. Posted in Việt Nam, General Statistics Office (GSO-ISS), in September 2006 (Research Programme on the Economic and Social Transition in Việt Nam).

SUMMARY Of RESEARCH

As a development economist, my work follows two lines of research:

Statistical: survey methodology, data processing:

- Development of mixed survey methods (households/enterprises) and creator of 1-2-3 surveys for statistical measuring and analysis of the informal sector (projects in Africa, Latin America, and in Asia);
- Development of modules "Multiple Dimensions of Poverty", "Governance" and "Democracy" (projects in Africa and in Latin America);
- Support for national statistics institutes in the implementation and analysis of survey results.

Economic:

- Functioning of labour market, informal sector, urban dynamics and the impact on living conditions;
- Links between governance, democracy, new dimensions of poverty and the process of economic development;
- Analysis of public policies in developing countries: structural adjustment programmes, anti-poverty strategies, follow-up and evaluation of impact.

Patrick TAILLANDIER

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TITLES AND DIPLOMAS

2008: Doctorate thesis in Geo-Information Science, *Université Paris-Est,* carried out at the COGIT laboratory of the IGN: "Automatic revision of knowledge guiding the informed exploration of report trees, applied in the context of the generalisation of geographical data".

PRESENT PROFESSIONAL POSTING

Geography lecturer at the University of Rouen – UMR IDEES: "Identity and differentiation of Spaces, the Environment and Societies" – MTG (Modelling and graphic processing in Geography) Laboratory. Holder of a Chair of Excellence at the CNRS.

SUMMARY OF RESEARCH

My research work concerns the computerised modelling and simulation of complex systems. I am particularly interested in modelling based upon the agents of socio-environmental systems.

In this framework I am involved in three research axes:

- Integration of geographical data in agent-based models. The aim of this axis is to provide modellers with tools to integrate and manipulate data coming from geographical information systems (GIS) in simulations;
- Definition of cognitive agents in simulation. There exist today many platforms that aim to help modellers create their own models. Nevertheless, within the framework of the modelling of complex entities such as human beings, these platforms are often very limited. I am therefore interested in defining tools that will allow us to compensate for this. An important case of application for this axis concerns the modelling of farmers' behaviour;
- Analysis and calibration of agent-based models. Agent-based models are generally very complex. Understanding their dynamic and being able to calibrate them is most of the time very difficult. I am therefore working on the development of models that allow, with the help of techniques from artificial intelligence, the analysis of the automatic calibration of models.

I am also involved in the software development of two agent-modelling platforms:

- GAMA platform: a platform that incorporates a rich modelling language and a more thorough management of geographical data. This platform is being developed in part with Vietnamese partners *(Institut de la Francophonie pour l'Informatique, University of* Cần Thơ);
- MAGeo platform: a platform that is designed for geographers and modellers without any programming experience. This platform offers a graphic modelling interface based on the use of "boxes".

José TISSIER

Email: tissier@afd.fr

TITLE AND DIPLOMAS

Agro-Engineer and Agro-Economist.

PRESENT PROFESSIONAL POSTING

I have been working in agricultural development for more than 35 years.

After spending some years doing my military cooperation in Tunisia, then spending time as a shepherd in Poitou-Charentes, I spent the first part of my professional career working principally in professional organisations in France *(Chambre d'Agriculture,* Corrèze, in the department of agricultural utility – breeding and economy and management) where I was responsible for development or applied research *(Institut Technique de l'Elevage),* before going to New Caledonia to work in a public administration department responsible for land reform *(Office Foncier de Nouvelle-Calédonie)* and in local authorities where I was responsible for regional economic development (Northern region referred to as "Fabius-Pisani").

In 1993, at the age of 40, I joined the *Caisse Francaise de Développement* where I successively occupied posts where I was responsible for rural and agricultural development in offices in Yaoundé, Rabat, and Ouagadougou. At the end of 2006, I joined the headquarters of the AFD in Paris to work in the rural and agricultural department as head project engineer. At the beginning of 2010, I became Deputy Director of this same department.

Olivier TESSIER

Email: otessier2002@yahoo.fr

TITLES AND DIPLOMAS

2003: Doctor of Anthropology, University of Aix - Marseille 1, *"The Native Country is a Sweet Star Fruit". Social Roots and Spatial Mobility: Essay to Define a Local Social Space in the North of Việt Nam. Academie d'Aix-Marseille, Université de Provence* (Aix-Marseille 1), Department of Anthropology, Arts and Humanities Section, December, 2003, 658 p. + 150 p. annexes.
1993: Engineer of Agronomic Techniques in Warm Regions, specialising in: Social Management of Water, *Centre National des Etudes Agronomiques en Regions Chaudes* (CNEARC), Montpellier.

SUMMARY OF RESEARCH

After studying to become a tropical agronomic engineer and spending four years in charge of development programmes (Burkina Faso, Haiti), I began a doctorate in anthropology in 1995 (University of Aix-Marseille) for which the field work was situated in the north of Việt Nam (province of Phú Thọ). While writing my thesis, which I defended in 2003, I attempted to demonstrate the Kinh (or Viet) rural space, generally conceived and described as the aggregation of total and exclusive units represented by the village, which takes on a different aspect when envisaged through the angle of exchanges, of the dynamics of constitution and transformation of social and political spaces. The peasants' legendary ties to the "land of their ancestors" have been replaced by a more complex and burgeoning reality, that of a mobile population always ready to move to wherever opportunities present themselves.

Co-editor of "Le Village en question", the fruit of a multi-disciplinary research programme conjointly carried out from 1996 to 2000 by the centre EFEO in Hà Nội and the VASS, I also coordinated my own research at the same time: two scientific cooperation programmes (1999-2000) for the Catholic University of Louvain, in the mountainous provinces of Sơn La and Hòa Bình. During the same period, I participated in expert missions for international organisations (European Union, World Bank). Finally, from January 2005 to September 2006, I directed the FSP project "Research Support on Economic and Social Transition Issues in Việt Nam", which was financed by the Ministry for Foreign Affairs and implemented by the EFEO centre in Hà Nội.

In the framework of my posting at the EFEO as a lecturer (September 2006), I pursued my research into the key question concerning the evolution of the relationship between the "State – peasant communities" throughout the XIXth and XXth centuries by looking at them from a water management and hydraulic viewpoint, the omnipresence of which shaped the countryside and permeated human culture. In concrete terms, it is advisable to examine the economic, political and social conditions of the implementation of large-scale hydraulic infrastructure in

the Red River and Mekong River deltas, to envisage the possibilities of controlling human activity and land offered by such a laying out of space, to take an interest in the construction techniques which have progressively resulted in the remodelling of the territory, and finally to analyse the modalities of water management implemented by peasant communities on the one hand, and by the State through its specialised corporations, which are veritable technical services, on the other.

As head of the EFEO-VASS archeological cooperation programme, I coordinated different projects in order to support the Institute of Archaeology in its mission of conservation – cultural heritage development of the site. At the same time, for two years I carried out archive-based research in Viet Nam and France into the history of Hà Nội Citadelle during the XIXth century. Based on Vietnamese imperial annals and on the abundant written and iconographical sources (plans, maps, photographs) produced during the colonial period, this historical reconstitution work resulted in the organisation of several lectures and an exhibition. A written publication is currently being drafted.

Finally, over the last two years I have been coordinating the establishment project for a sub-division of the EFEO in Hồ Chí Minh City. The project's originality lies in the creation of a special partnership that organically associates an EFEO scientific centre and the local representation of the AFD. This centre is forecast to open in October 2012. The elaborated research programme involves two axes:

- Evolution Dynamics of the Mekong Delta (XVIIIth – XXIst centuries): Part 1 – From the Delta to the State: national integration, local dynamics ; Part 2 – The Mekong : from the river to the future of the Delta;
- Culture and Social History in the South of Việt Nam (XIXth-XXth centuries): research into family and village cults; Lục Vân Tiên illustrated by Nguyễn Đình Chiểu and publication in French of the "social science" writings by Son Nam concerning the Mekong Delta.

VÕ Đức Ân

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TITLES AND DIPLOMAS

2008: Master's in Computer Science, double diploma from the *Institut de la francophonie pour l'informatique* (IFI) and from the University of La Rochelle.
2004: Computer engineer, University of Sciences, (Huế, Việt Nam).

PRESENT PROFESSIONAL POSTING

Since July 2007, I have been working in the MSI-IFI team as trainee/engineer. I am participating in the development of the agent-based simulation and modelling platform GAMA (http://gama-platform.googlecode.com). This platform is used to develop several agent-based models in different application domains, such as epidemiology, aid management following natural disasters, insect invasions, etc.

Since September 2009, I have been studying for a doctorate financed by the *Agence Universitaire de la Francophonie* under Alexis Drougoul (Director of Research, IRD). I am currently working in two research laboratories: MSI-IFI in Hà Nội and at the IRD in Bondy, France. The aim of my thesis is to propose an agent-based modelling language in order to develop multi-level agent-based models. The defense of my thesis is forecast for the end of 2012.

Conférences & Séminaires

Acronyms and Abbreviations

ADB	Asian Development Bank
AFD	*Agence Française de Développement*
AIRD	*Agence Inter-Etablissements de Recherche pour le Développement*
AUF	*Agence Universitaire de la Francophonie*
AWWF	Alternative World Water Forum
BOT	Build Operate Transfer
CGPA	*Centre de Gestion de la Pêche Artisanale* (France)
CIRAD	*Centre de Coopération Internationale en Recherche Agronomique pour le Développement*
CNEARC	*Centre National des Etudes Agronomiques en Régions Chaudes*
CNRS	*Centre National de la Recherche Scientifique*
CPU	Community of Polder Users, Prey Nup (Cambodia)
DC	Developing Country
DCF	Data Collection Framework
DIEPA	International Drinking Water and Sanitation Decade
DPMA	*Direction des Pêches Maritimes* (France)
DPSIR	Driver-Pressure-State-Impact-Response (model)
DRC	Democratic Republic of Congo
EEZ	Exclusive Economic Zone
ÉFEO	*École Française d'Extrême-Orient*
EPAP	*l'Eau Potable et de l'Assainissement, du Pluvial (secteur de)*
EPHE	*École Pratique des Hautes Etudes*
FAO	Food and Agriculture Organisation of the United Nations
FSP2S	*Fonds de Solidarité Prioritaire en Sciences Sociales*
GAML	Gama Modelling Language
GDP	Gross Domestic Product
GIS	Geographic Information Systems
GMO	Genetically Modified Organism
GRET	*Groupe de recherche et d'échanges technologiques*
HIDS	Hồ Chí Minh City Institute for Development Studies
HSF	Housing Solidarity Fund
ICJ	International Court of Justice
ICPS	Industrial and Commercial Public Services
IEP	*Institut d'Etudes Politiques*
IFI	*Institut de la Francophonie pour l'Informatique (Việt Nam)*

INRA	*Institut National de la Recherche Agronomique*
IOPC	International Oil Pollution Compensation Fund
IRD	*Institut de Recherche pour le Développement*
IUED	*Institut Universitaire d'Etudes du Développement*
IWRM	Integrated Water Resources Management
JO	*Journal officiel*
JTD	*Journées de Tam Đảo*
LEREPS	*Laboratoire d'Etudes et de Recherches sur l'Economie, les Politiques et les Systèmes Sociaux*
MAELIA	Multi-agent for Environmental Norms Impact Assessment
MARD	Ministry of Agriculture and Rural Development (Việt Nam)
MBC	Montego Bay Convention
MDGs	Millennium Development Goals
MoU	Memorandum of Understanding
MSY	Maximum Sustainable Yield
MWRM	Ministry of Water Resources and Meteorology
NGO	Non-Governmental Organisation
NIDH	National Initiative for Human Development
OCDE	Organisation for Economic Cooperation and Development
ODA	Official Development Assistance
OMI	International Maritime Organisation
PPP	Public-Private Partnership
PPWSA	Phnom Penh Water Supply Authority
RICEP	*Réseau d'Informations Comptables et Economiques sur la Pêche*
RoW	Representation of World
SPOs	Small Private Operators
SRE	Water Resources Service (Việt Nam)
TAC	Total Allowable Catches
UN	United Nations
UNEP	United Nations Environment Programme
VASS	Việt Nam Academy of Social Sciences
VIAS	Việt Nam Institute of Agronomic Sciences
WHO	World Health Organisation
WWF	World Water Forum

Conférences
& Séminaires

What is AFD ?

The Agence Française de Développement (AFD) is a public development finance institution that has been working to fight poverty and foster economic growth in developing countries and the French Overseas Communities for seventy years. It executes the policy defined by the French Government.

AFD is present on four continents where it has an international network of seventy agencies and representation offices, including nine in the French Overseas Communities and one in Brussels. It finances and supports projects that improve people's living conditions, promote economic growth and protect the planet, such as schooling for children, maternal health, support for farmers and small businesses, water supply, tropical forest preservation, and the fight against climate change.

In 2012, AFD approved €7 billion to finance activities in developing countries and the French Overseas Communities. The funds will help get 10 million children into primary school and 3 million into secondary school; they will also improve drinking water supply for 1.79 million people. Energy efficiency projects financed by AFD in 2012 will save nearly 3.6 million tons of carbon dioxide emissions annually.

www.afd.fr

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Water and its Many Issues

Methods and Cross-cutting Analysis
"Tam Đảo Summer School Week" (Việt Nam)

(Nước và các vấn đề liên quan
Phương pháp và tính đa ngành trong phân tích)

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Water and its Many Issues

Methods and Cross-cutting Analysis

The Vietnam Academy of Social Sciences (VASS), the *Agence Française de Développement* (AFD), the *Institut de Recherche pour le Développement* (IRD), the University of Nantes, the *École française d'Extrême-Orient* (ÉFEO) and the *Agence Universitaire de la Francophonie* (AUF) have decided to give their support to the Regional Social Sciences Summer University, referred to as "Tam Đảo Days", in the framework of the 2010-2013 partnership agreement.

This partnership has the objectives of developing a multi-disciplinary training of excellence, creating a platform for debate, and attracting a wide academic and non-academic audience from across Southeast Asia.

This work contains a verbatim account of the presentations and debates from the plenary sessions and workshops that took place from 13th to 21th July 2012 in Hà Nội and in the Tam Đảo Hill station on the topic of "Water and its Many Issues". Four main areas of reflection are prioritised in the framework of the thematic workshops: sea, risks and governance; urban growth, social needs and water and sanitation service offers; field survey training in the framework of social and economic water management and a practical approach to agent-based modelling.

CONTACTS

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Conférences & Séminaires

ÉCOLE FRANÇAISE D'EXTRÊME-ORIENT

afd AGENCE FRANÇAISE DE DÉVELOPPEMENT