



<http://across-lab.org>

ACROSS INTERNATIONAL JOINT LABORATORY

MID-TERM REVIEW

Dr. Alexis Drogoul (IRD / UMMISCO), Dr. Patrick Taillandier (IRD / UMMISCO)
with the help of Prof. Nguyen Ngoc Doanh (VinUni)



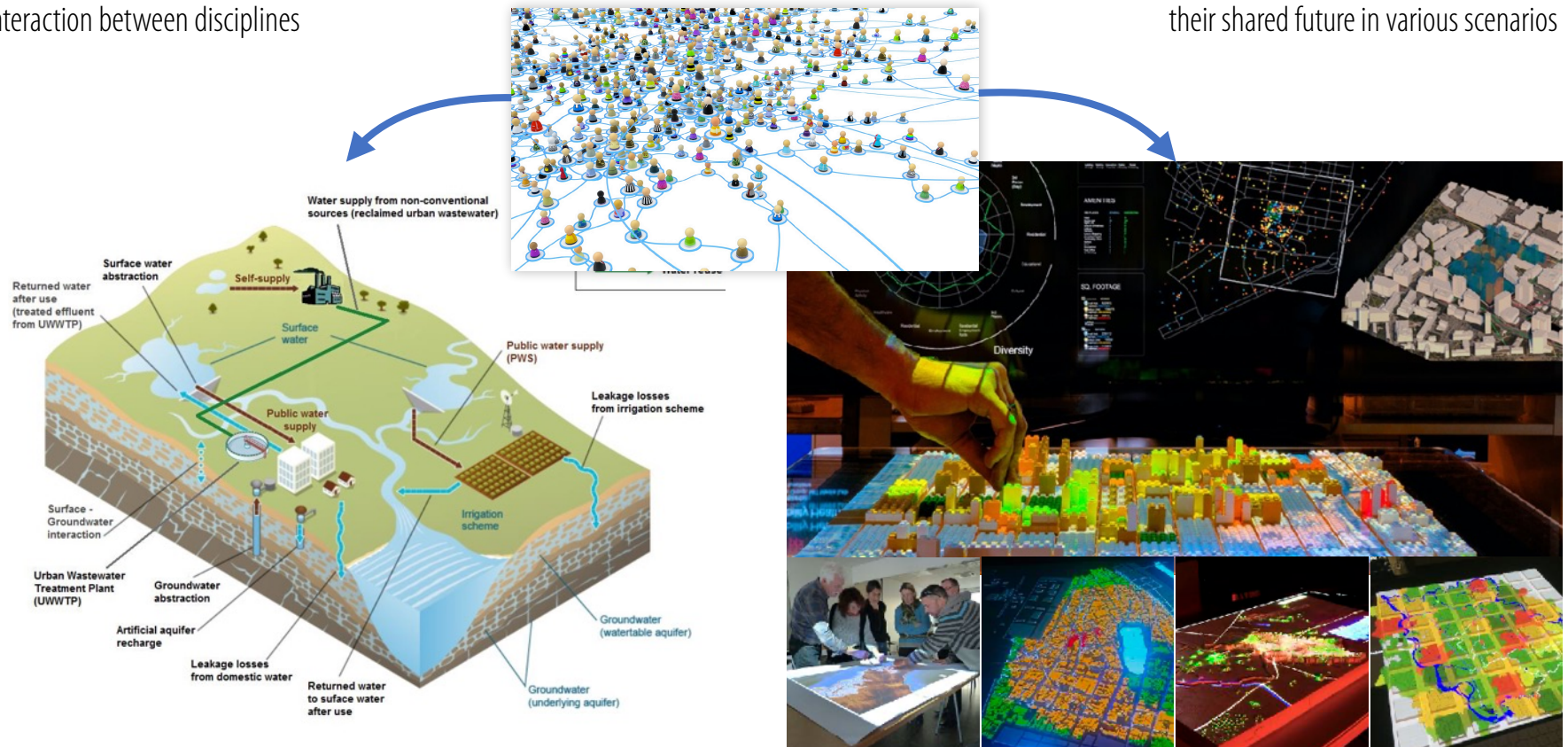
2020

ORIGINAL PROPOSAL

DEVELOP COMPUTER MODELLING TOOLS AND METHODS TO SUPPORT TWO PILLARS OF SUSTAINABILITY SCIENCE

INTERDISCIPLINARITY : models as **shared representations** and media of interaction between disciplines

TRANSDISCIPLINARITY: **participatory simulations** to engage stakeholders in negotiating their shared future in various scenarios



2020

ORIGINAL PROPOSAL

APPLICATION TO THE SUSTAINABLE MANAGEMENT OF IRRIGATION SYSTEMS IN VIETNAM, WITH 4 CASE STUDIES



CS1 - **Red River Delta:** Bac Hung Hai Irrigation System
water pollution and salinity



CS2 - **The center:** Bac Nghe An Irrigation System
salinity and management. It was changed to Ta Trach Irrigation System in Thua Thien Hue province focusing on flooding and management based on recommendation of TLU colleagues



CS3 - **The highlands:** Dak Lak Irrigation system
management and operations



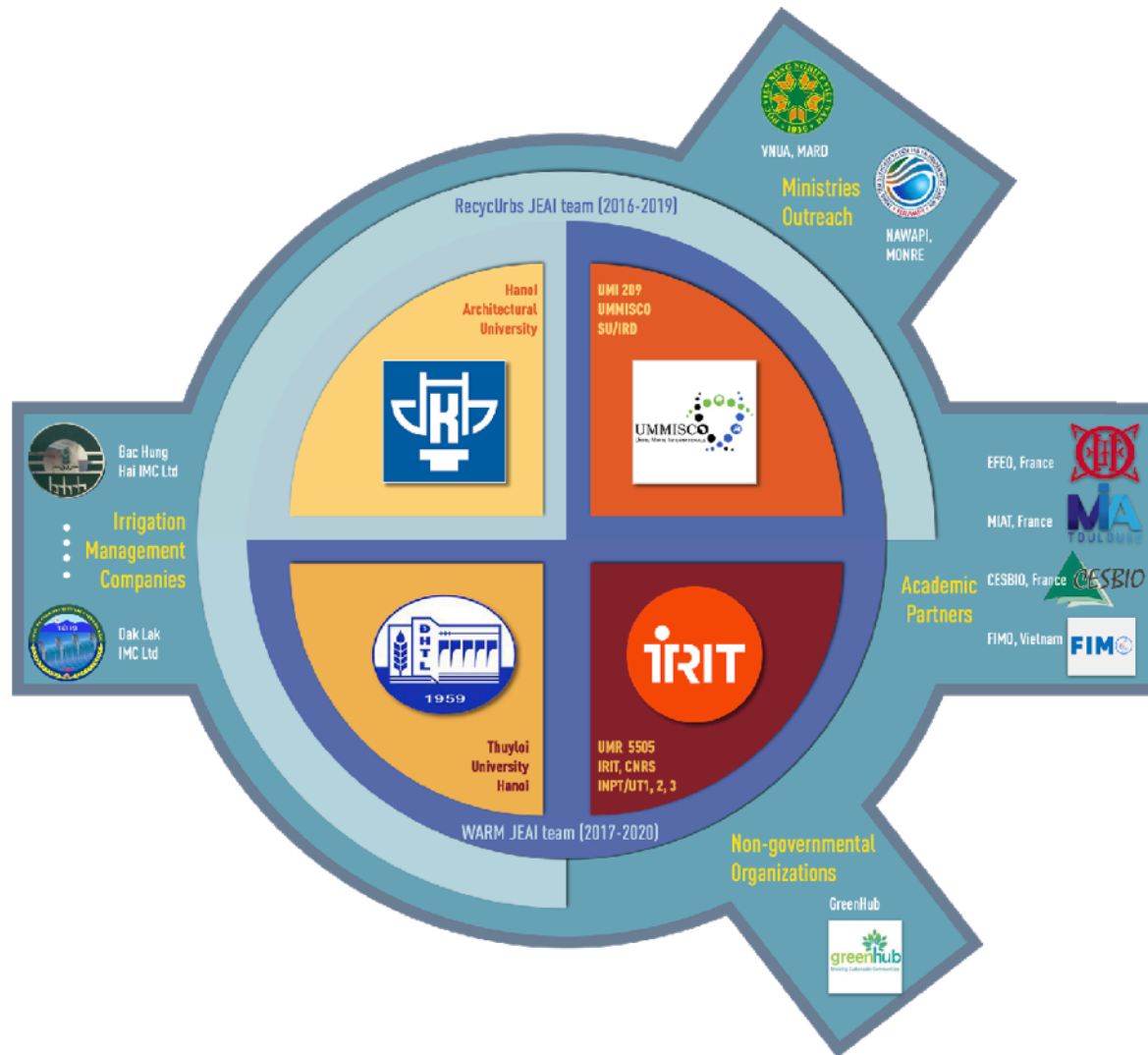
CS4 - **The Mekong Delta:** Duc Hoa Irrigation system
balanced access to water and salinity



2020

ORIGINAL PROPOSAL

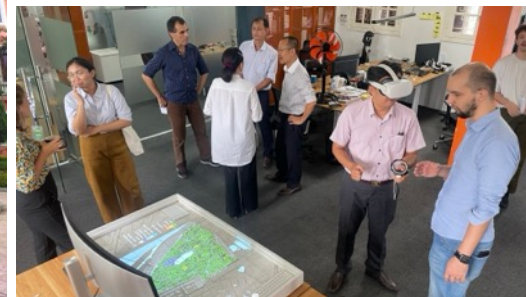
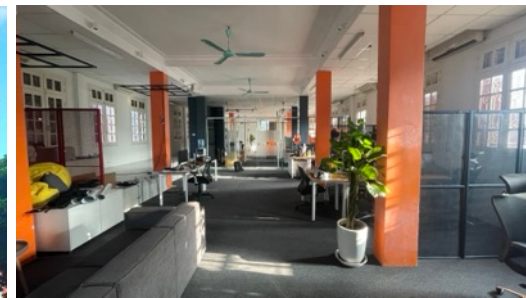
INITIAL PARTNERSHIP BALANCED BETWEEN FRANCE AND VIETNAM



2021-2023

LABORATORY

HOSTED IN THUYLOI UNIVERSITY IN A SPACIOUS AND COMFORTABLE ROOM



2021-2023

ACHIEVEMENTS



CASE STUDIES

2021-2023

BAC HUNG HAI (1)



- Several survey campaigns in 2021 and 2022, led by TLU/IRD researchers and French and Vietnamese students among authorities and stakeholders, unveiled that waste management is a major problem in BHH, particularly along irrigation canals, raising the challenge of designing collective solutions.



METHODS & TOOLS

2020-2023

GAMA PLATFORM

- ACROSS has become the de-facto "place" where GAMA is developed now
 - 5 active developers
 - New applications and extensions
- Funded by PEGASE / SLAM-B
- Open-Source Award
- Versions 1.9.1, 1.9.2 (1.9.3 to come)




<https://gama-platform.org>



APPLICATIONS

2021

ESCAPE (PHUC XA, FINISHED IN 2022)

- An ANR project led by the University of Rouen and dedicated to exploring the best evacuation strategies in different scenarios of flooding
- Case study in Phuc Xa, a district in Hanoi that borders the Red River, with scenarios of a large dam break in Hoa Binh



Case studies in irrigation systems

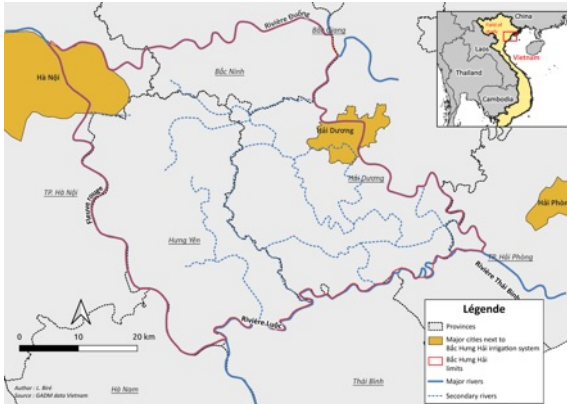
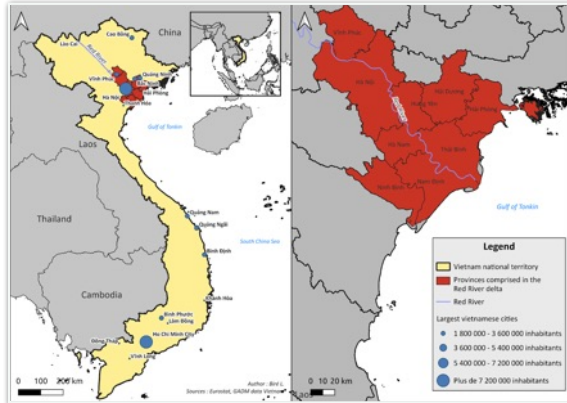
Methods/tools for designing, visualising and interacting with models and simulations

Generalisation to other applications

2021-2023

CASE STUDIES

BAC HUNG HAI (1)



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NGUYEN NGOC DOANH
PATRICK TAILLANDIER
LEO BIRE
PHAM VAN CHIEN
TRAN THI CAM GIANG
PHAM TAT THANG
ALEXIS DROGOUL
+ 6 INTERNS (2021-2023)

TLU, IRD, USSH, BHH CO.

2021-2023

CASE STUDIES

BAC HUNG HAI (2)

- The study led to the design of a serious game (RÁC) supported by agent-based simulations to provide stakeholders with mediation and awareness raising tools for tackling waste management issues. The game places actors in the role of a village chief, who must ensure a sufficient level of agricultural production while minimising pollution, which also implies cooperating with the other villages



Game sessions in **Phạm Trấn commune (Bắc Hưng Hải)** people's committee



A game session at the **French LFAY highschool in Hanoi**, during the sustainable development days



<https://github.com/ACROSS-Lab/BacHungHai-Waste>

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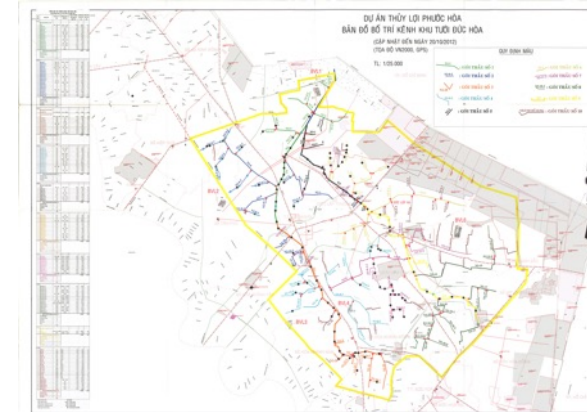
TLU, IRD, USSH, BHH CO.

2022-2023

CASE STUDIES

DUC HOA

- ▶ The Duc Hoa case study has been initiated in 2022, with field trips by TLU/USSH/IRD researchers to interview stakeholders (deciders, chiefs of hamlet and farmers) and identify socio-environmental issues that could be the target of participatory simulations.
- ▶ Main issue is how quickly the system is shifting in terms of land use, with a growing space given to industries and urban areas, and how this threatens the future of the zone.
- ▶ Surveys will continue throughout spring 2024, with the first models being tested in summer.



LEO BIRE
NGUYEN NGOC DOANH
PATRICK TAILLANDIER
HUYNH THI PHUONG LINH
PHUNG DIEP ANH
+ 2 INTERNS (2022-2023)

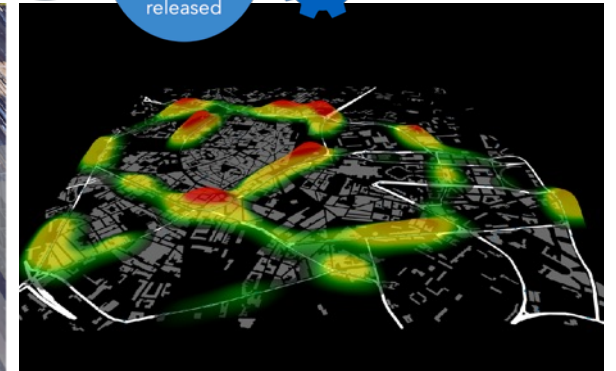
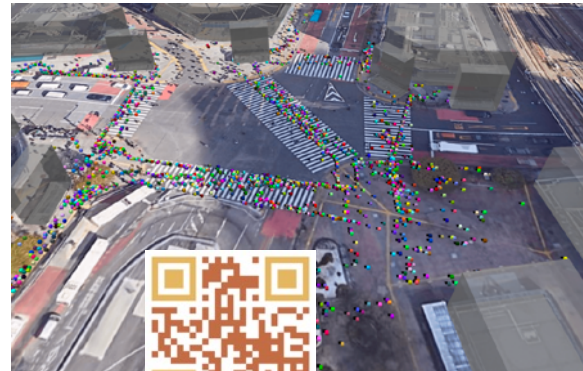
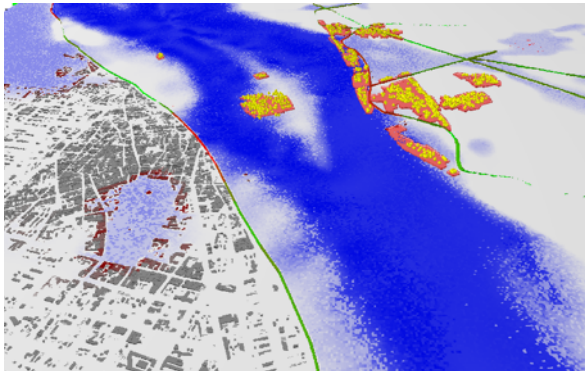
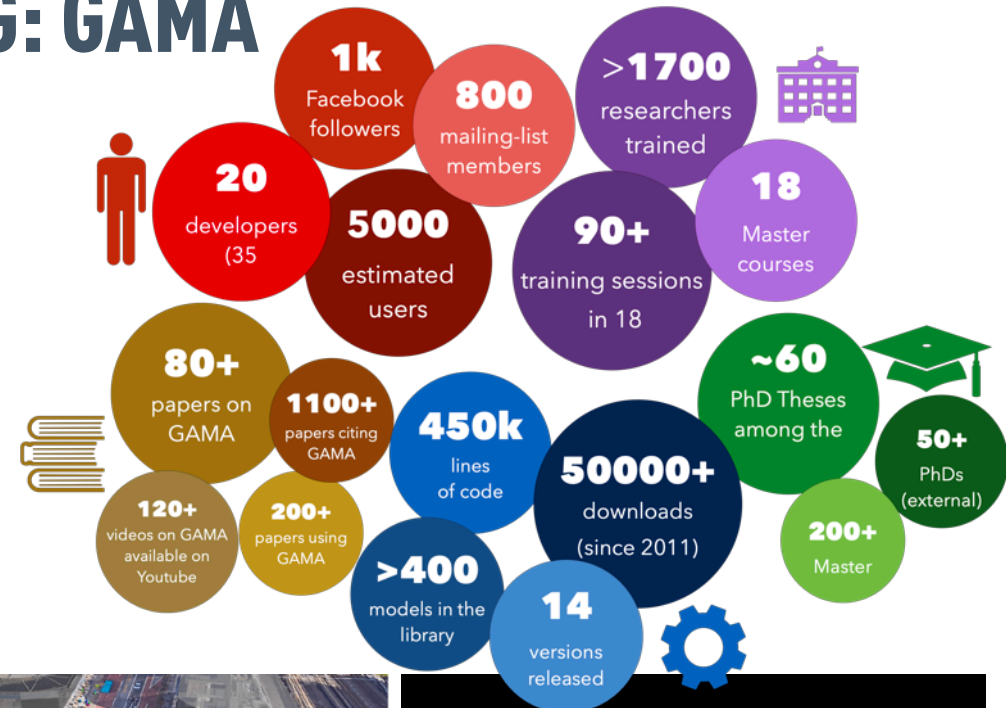
TLU, IRD, USSH

2021-2023

METHODS & TOOLS

AGENT-BASED MODELING: GAMA

- ▶ ACROSS has become the de-facto "place" where GAMA is developed now
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<https://gama-platform.org>

ALEXIS DROGOUL
PATRICK TAILLANDIER
BENOIT GAUDOU
NGUYEN HUU TRI
HUYNG QUANG NGHI
TRUONG CHI QUANG
NGUYEN NGOC DOANH
BAPTISTE LESQUOY
ARTHUR BRUGIERE
+ 10 INTERNS (2021-2023)

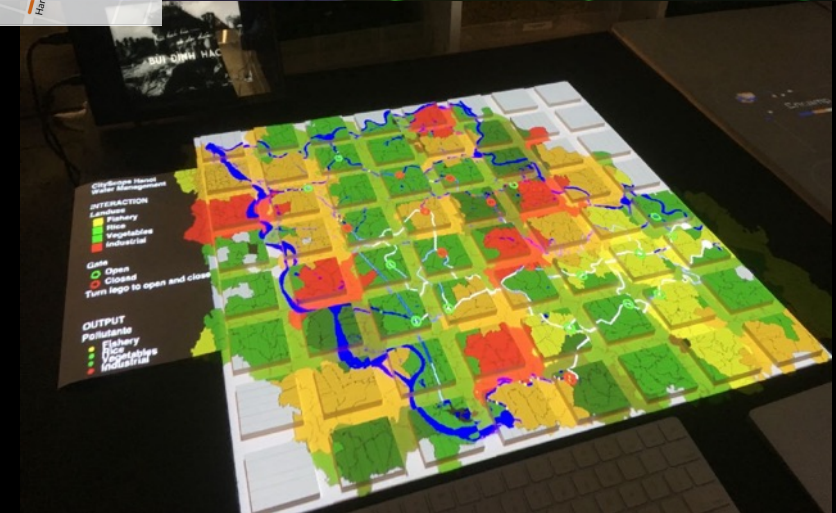
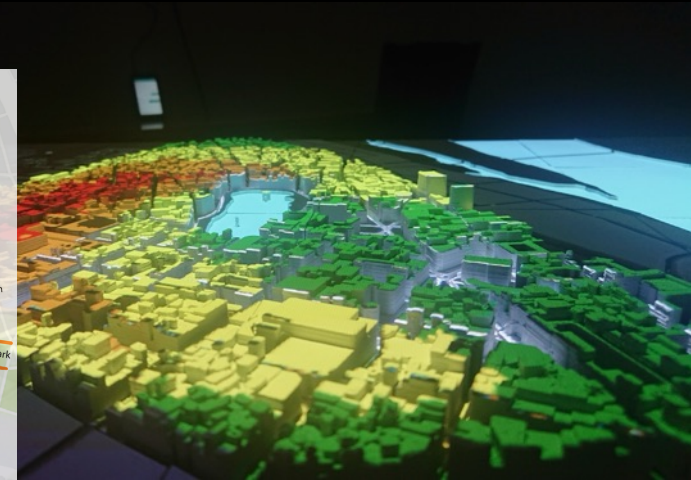
IRD, TLU, CTU, IRIT

2020-2023

METHODS & TOOLS

TANGIBLE INTERFACES

- ▶ **HoanKiemAir**
 - ▶ A physical model of a district of Hanoi to understand and visualise the link between traffic and pollution
 - ▶ Supported by Hoan Kiem People's Committee, PRX, AirParif
- ▶ **BHH table**
 - ▶ An interactive table to explore the impact of land use on water quality in Bac Hung Hai
 - ▶ Supported by TLU, BHH Company



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NGUYEN NGOC DOANH
NGUYEN HUU TRI
ARNAUD GRIGNARD
BENOIT GAUDOU
ARTHUR BRUGIERE
+ 6 INTERNS (2021-2023)



IRD, TLU, IRIT

2023-2026

METHODS & TOOLS

ALEXIS DROGOUL
JEANNE COTTENCEAU
PHUNG DIEP ANH
PATRICK TAILLANDIER
PHAM DUC DAI
ARTHUR BRUGIERE
HUYNH QUANG NGHI
+ 8 INTERNS (2021-2023)

IRD, TLU, CTU, NSTDA

VIRTUAL REALITY

- ▶ Explore and understand how immersion into virtual worlds can influence the behaviours of participants and their capacity to better learn and interact.
- ▶ The SIMPLE project, funded by EU, investigates the potential of VR to raise awareness on environmental issues (climate change, loss of biodiversity, pollution, etc.) among 12-18 year-olds, in classrooms, in 4 ASEAN countries (Vietnam, Thailand, Lao PDR and Cambodia).
- ▶ Development of prototypes (like RÁC VR) and software infrastructure in ACROSS, partnership with CTU and NSTDA

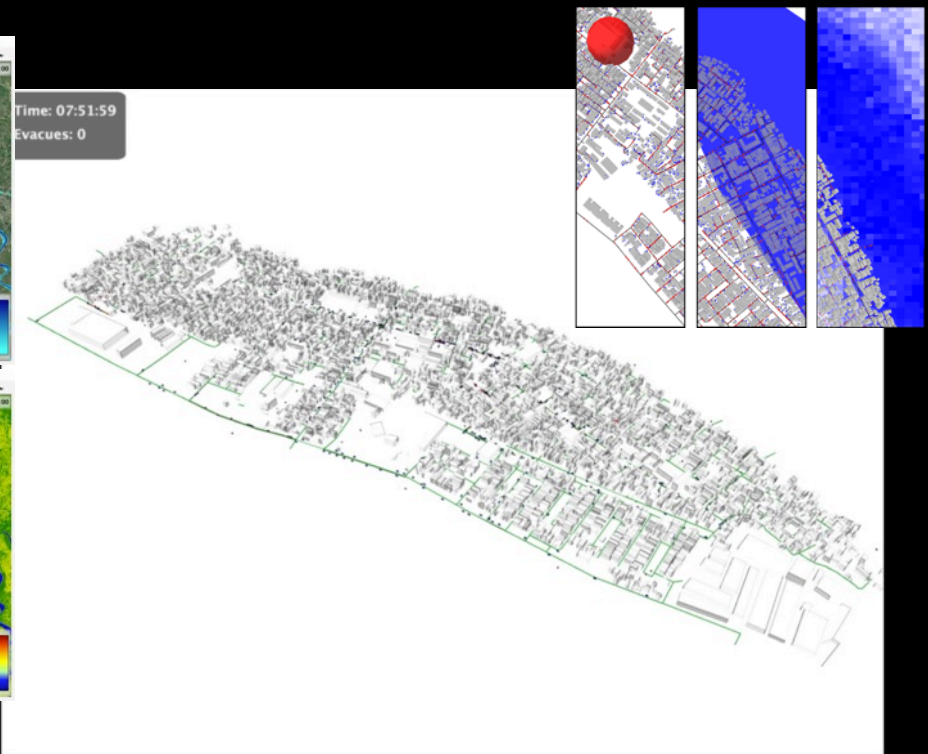
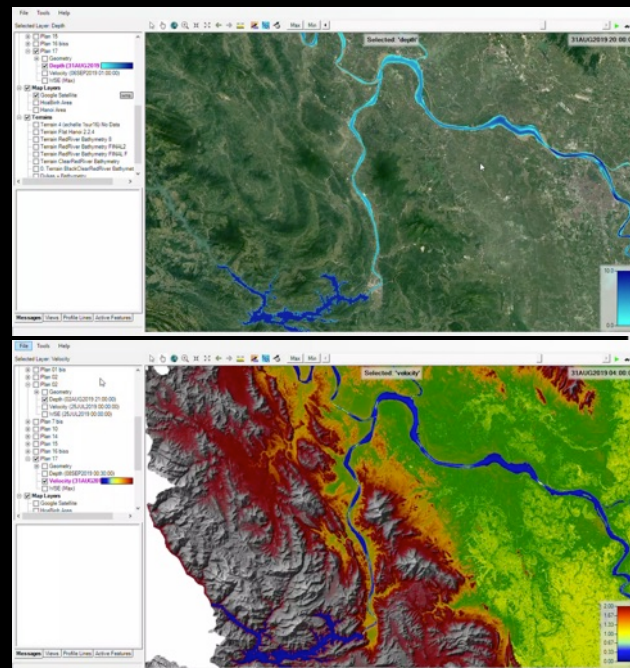


2021

APPLICATIONS

ESCAPE (PHUC XA, FINISHED IN 2022)

- ▶ An ANR project led by the University of Rouen and dedicated to exploring the best evacuation strategies in different scenarios of flooding
- ▶ Case study in Phuc Xa, a district in Hanoi that borders the Red River, with scenarios of a large dam break in Hoa Binh



PATRICK TAILLANDIER
PHAM VAN CHIEN
ARTHUR BRUGIERE
+ 2 INTERNS (2021)

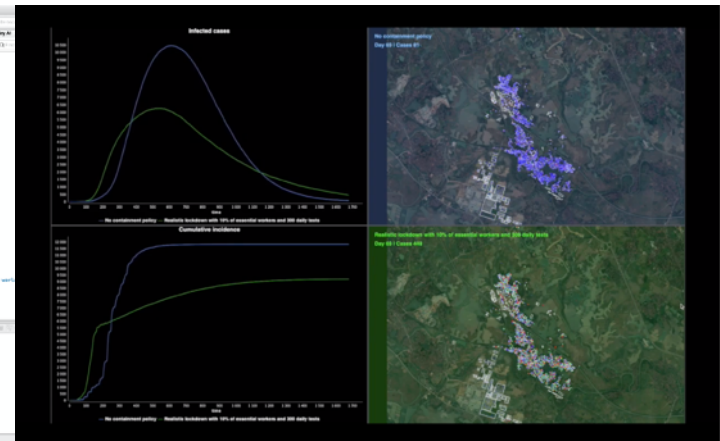
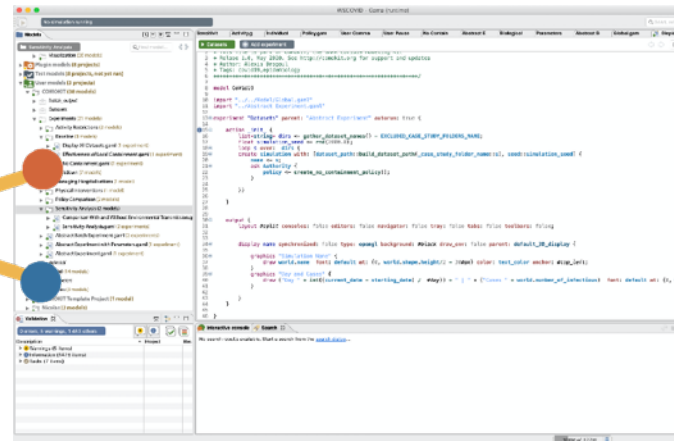
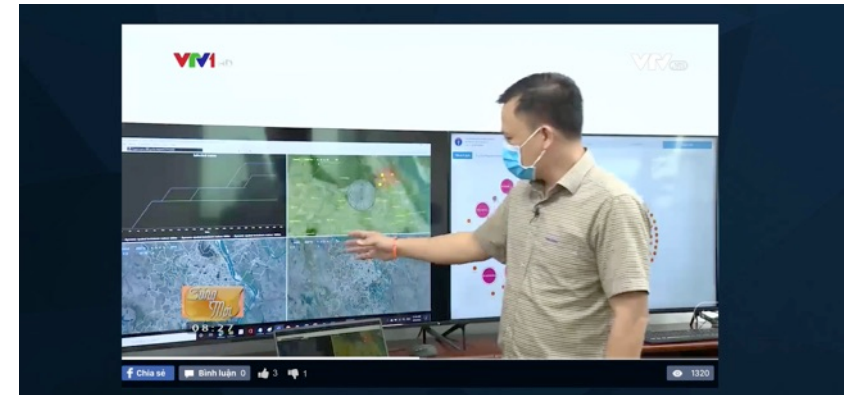
IRD, TLU, CTU, NSTDA

2021-2023

APPLICATIONS

COMOKIT (VIETNAM, FINISHED IN 2023)

- ▶ Development and provision of a modelling platform to the rapid response team of the national steering committee against Covid 19
- ▶ Developed in ACROSS by IRD, Thuyloi University, Can Tho University, NIHE (Pasteur Institute), Hong Kong University, Oxford University (OUCRU), Toulouse 1 University, INRAE
- ▶ Funded by ANRS-MIE



NGUYEN NGOC DOANH
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+ 4 INTERNS (2021-2023)

IRD, TLU, CTU, IRIT, NIHE,
OUCRU

2021

APPLICATIONS

MODIO (BIEN HOA, FINISHED IN 2022)

- ▶ **MO**deling and Tangible Simulation for **DIO**xin diffusion in Bien Hoa Airbase, Dong Nai Province, Vietnam
- ▶ Co-developed by International Centre for Research and Postgraduate Training in Mathematics Under the auspices of UNESCO/Institute of Mathematics/VAST; Vingroup Innovation Foundation (VinIF); The Chemical Force/ Ministry of Vietnamese National Defense; and IJL ACROSS
- ▶ Funded by VinIF



Representing dioxin contamination on surface at Bien Hoa Airbase/Dong Nai Province/Vietnam on the Geography Informatics System (GIS) after the report entitled *Environmental assessment - dioxin pollution at Bien Hoa airbase in 2016* of Ministry of National Defense, Vietnam and USAID



Simulation result about dioxin diffusion in 2045 based on **scenarios 1**- it reports number of seriously polluted zones (in red), and diffuses from the polluted zones to neighbor with the radius of 100m, 300m, and 500m on average and under normal environmental conditions after 10, 10 and 30 years, respectively



Simulation result about dioxin diffusion in 2045 based on **scenarios 2**- it does not report neither the seriously polluted zones nor the diffusion from the polluted points after 30 years

NGUYEN NGOC DOANH
HUYNH QUANG NGHI
PHAM TAT THANG
PHUNG KHAC HUY CHU
NGUYEN HOANG THACH
+ 2 INTERNS

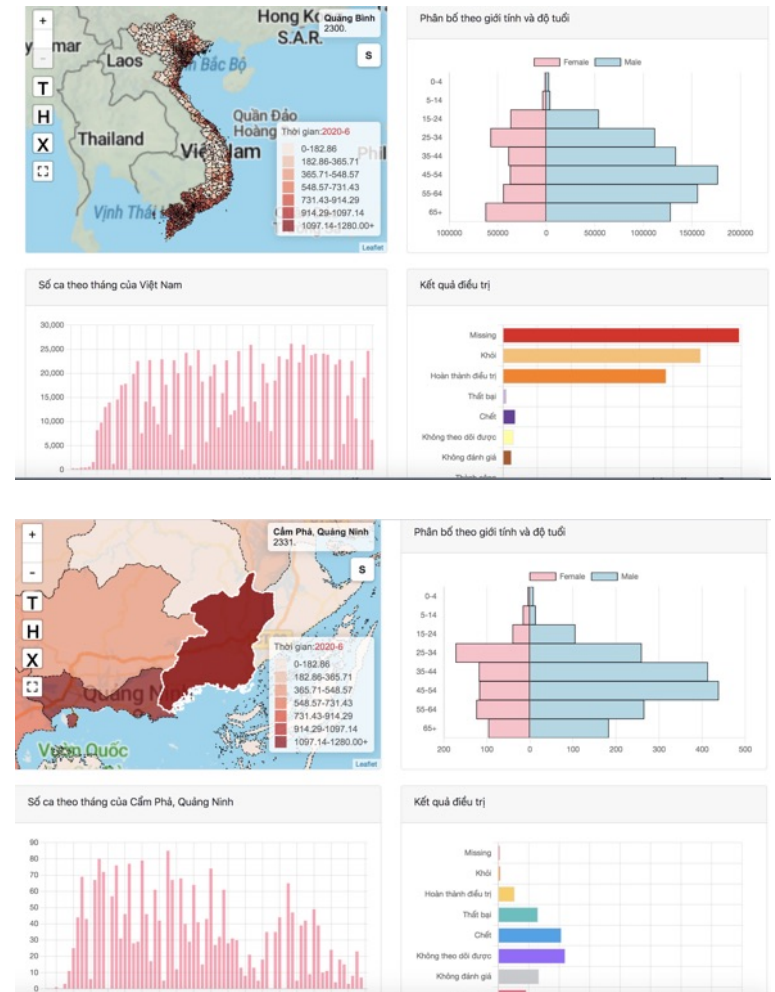
TLU, CTU, VAST, MND

2022

APPLICATIONS

GEO-TB (VIETNAM, TUBERCULOSIS, FINISHED IN 2023)

- ▶ **Geo-Spatial Platform to Support Visualization, Analysis and Prediction for Tuberculosis Notification by Space and Time**
- ▶ Co-developed by Hanoi Medical University, Can Tho University, National Lung hospital, and IJL ACROSS
- ▶ Funded by MOST



NGUYEN NGOC DOANH
HUYNH QUANG NGHI
PHAM TAT THANG
BUI MY HANH
NGUYEN VAN NHUNG
+ 2 INTERNS

TLU, CTU, HMU, NLH

2022

APPLICATIONS

MOSIFAC (FINISHED IN 2022)

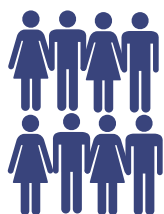
- ▶ Simulation Model for Use of Force in Response to Environmental Incidents
- ▶ Developed from 2021 to 2022 by The Chemical Force/Ministry of Vietnamese National Defence; IJL ACROSS
- ▶ Funded by The Chemical Force/Ministry of Vietnamese National Defence



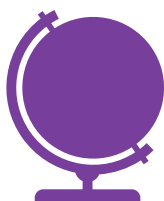
NGUYEN NGOC DOANH
HUYNH QUANG NGHI
PHAM TAT THANG
PHUNG KHAC HUY CHU
NGUYEN VAN TAI +
2 INTERNS

TLU, CTU, MND

FIGURES FROM 2021 TO 2023



18 STAFF - 8 FR / 10 VN
13 PERMANENT, 5 CONTRACT



25 SHORT SCIENTIFIC VISITS
7 LONG STAYS > 2 MONTHS



RESEARCH ACTIVITIES



176 HOURS OF LECTURES / YEAR
ON AVERAGE
11 PHD STUDENTS
17 BACHELOR INTERNS
20 MASTER INTERNS
9 VN, 9 FR, 1 SN, 1CM



15 ARTICLES IN 2021
17 ARTICLES IN 2022
>20 ARTICLES IN 2023



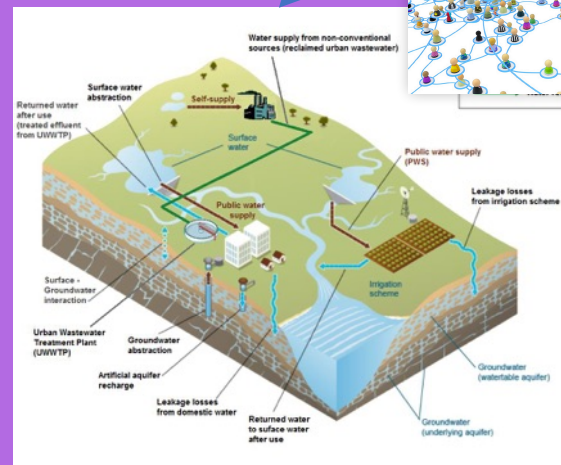
3 CONFERENCES/OUTREACH EVENTS IN 2021
13 CONFERENCES/OUTREACH EVENTS IN 2022
>10 CONFERENCES/OUTREACH EVENTS IN 2023

2021-2023

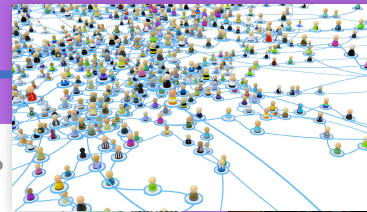
ADDED VALUE

ACROSS HAS ENABLED US TO MAKE PROGRESS ON THE TWO PRINCIPLES OF SUSTAINABILITY SCIENCE TARGETED IN THE INITIAL PROPOSAL

INTERDISCIPLINARITY : models as shared representations and media of interaction between disciplines

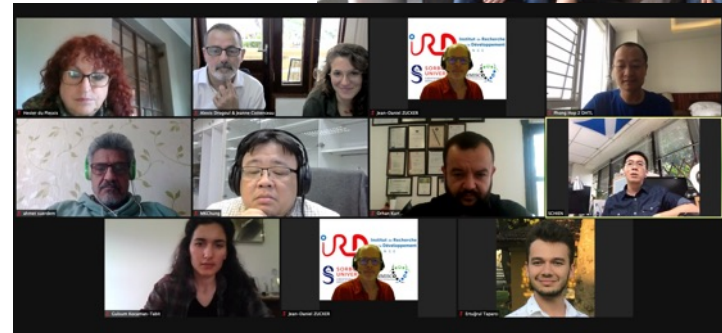
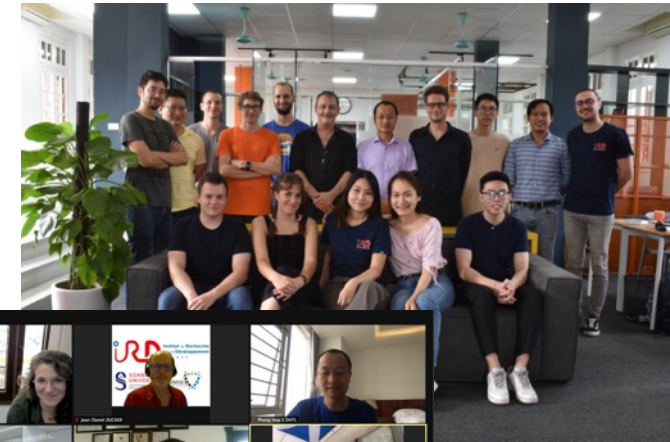


TRANSDISCIPLINARITY: participatory simulations to engage stakeholders in negotiating their shared future in various scenarios



INTERDISCIPLINARITY

- ▶ ACROSS was conceived as a hub for researchers from different backgrounds, who would probably not have worked together otherwise: TLU hydrologists with VIASM mathematicians, or IRD computer scientists with USSH sociologists; NIHE researchers and VNMAC environmental scientists; Game designers and anthropologists...
- ▶ It therefore provided opportunities to design and propose innovative projects: COMOKIT, SIMPLE, STAR FARM were born out of exchanges around knowledge produced in ACROSS, in terms of modelling, visualisation, mediation, educational tools.



TRANSDISCIPLINARITY AND PARTICIPATION

- ▶ Thanks to a strong institutional support from TLU, USSH and other partners, ACROSS has allowed us to build fruitful links with a number of stakeholders: executives from the ministries of health (COMOKIT) or agriculture (STAR FARM), technical teams managing irrigation infrastructures, farmers and local decision-makers (RÁC), people's committees (HOAN KIEM AIR), the educational community and high-school students (SIMPLE), or hospital doctors (GEO-TB)...
- ▶ Several participatory experiments (w. or w/o simulations) allowed us to better understand how to involve stakeholders at the early stage of model design.



INTEGRATION WITH TLU (1)

- ▶ Support for TLU professors
 - ▶ 10 projects funded and awarded to TLU professors in 2022 and 2023
 - ▶ 2 projects funded and awarded to TLU professors in 2024
- ▶ Support for TLU students
 - ▶ Internships (8 in 2024)
 - ▶ Research assistant contracts
- ▶ Participation to a common call for Erasmus+ project (SUCCESS)



IoT for Sustainable Water and Management System –
Case study in Bac Hung Hai Irrigation and Drainage System

Presented by: Nguyen Thu Hang

Design of an IoT system toward sustainable management of irrigation water quality in Cau Bay river – a tributary of Bac Hung Hai river

Pham Duc Dai, Dang Minh Hai

Prediction of water level in irrigation systems using the data-driven models: an application in the Bac Hung Hai

Pham Van Chien, Pham Van Han, Duong Ngoc Anh

December 16, 2021, Hanoi, Vietnam

Phuong Thanh Le
Ph.D, Vice Dean, Faculty of Economics and Management, Thuyloi University

Education:
Bachelor of Economics, 2003, NEU
Master of Banking and Finance, 2008, NEU
Ph.D of Finance, 2016, University of Wollongong, Australia

Career:
Vice Head of Finance – Banking Division, Vietnam Maritime University, 2020
Vice Dean, Faculty of Economics and Management, Thuyloi University, 2021

Expertise / domains of the presence:
In charge of developing curriculums
Conduct research relating to Vietnamese banks with partners from University of Wollongong and Australian Ministry of Finance.
20 articles and conference papers
02 research awards

HITE
CLASSIFY RURAL HOUSING TYPOLOGIES AND SETTLEMENT MORPHOLOGIES TO FLOODING ENVIRONMENT IN THE CUU DELTA ARCHITECTURAL

UNIVERSITY

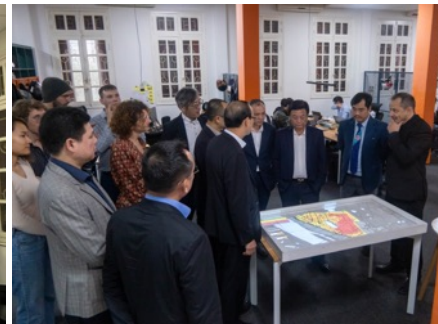
KICK OFF MEETING
NUMERICAL INVESTIGATION OF HYDRAULIC CHARACTERISTICS OF FREE SURFACE FLOW OVER TA TRACH WEIR COUPLING WITH INLINE CULVERT

Investigators: Le Thi Thu Hien
Nguyen Van Chien

Ha Noi – 12/2021

INTEGRATION WITH TLU (2)

- ▶ Scientific papers
 - ▶ 32 scientific papers sporting Thuyloi University in the signature.
- ▶ Seminars at annual scientific conferences of TLU in 2020 and 2022
- ▶ Participation to international seminars and conferences on behalf of Thuyloi / IRD
- ▶ Participation to several events (rice festival, fair, etc.)



MAIN DIFFICULTIES HAVE BEEN RELATED TO ADMINISTRATIVE MATTERS

- ▶ Launch happened during Covid19 in a closed country.
- ▶ Issuing visas for French/international researchers and students remains complex, even in the context of an IRD/TLU ODA project of the Ministry of Agriculture.
- ▶ PhD registration is still difficult in Vietnam for foreign students (and "co-tutelle" even more)
- ▶ Proposing to establish a research laboratory (as opposed to a project) is still somehow difficult in Vietnamese academic institutions
 - ▶ Difficulties to mobilise individual Vietnamese researchers for different reasons (time, resources, institutional support)
- ▶ Agreement signing
 - ▶ Difficulties in signing the document (confusion with ODA, project...); lots of versions exchanged
 - ▶ Difficulties in explaining the purpose and the contents of the agreement
- ▶ Difficulties in signing internship agreements with TLU

REMEDIATIONS

- ▶ **Agreement:** a new round of discussions will be launched to converge on the signature (see after for the possible evolution of the partnership)
- ▶ **Visas:** Thanks to the network provided by UMMISCO, we could issue visas for individual researchers with the support of USSH+VIASM, and for intern students with VNU-IFI
- ▶ **PhDs:** we are discussing with TLU and VinUni to make them accept the principle of double registration and "co-tutelle"
- ▶ **HR:** Number of initiatives have been (and will be) conducted to better involve TLU lecturers (call for projects, co-supervision of interns)
- ▶ **HR:** Close cooperation with Can Tho University (CTU) and the Hanoi University of Social Sciences (USSH) has enabled us to benefit from new skills (anthropology, game design, virtual reality) not anticipated in the initial proposal.

OUTLOOKS

- Keeping the coherence
- Expanding to new subjects
- Enlarging the partnership
- Seeking to have more impact



IRRIGATION SYSTEMS WILL REMAIN THE CORE THEME OF ACROSS

- ▶ We will be continuing developing new digital methodologies (ABM, Tangible Interfaces, VR) for supporting the sustainable management of irrigation systems and, more generally, socio-environmental systems built around them. The Bac Hung Hai, RÁC, PREMISS, or Duc Hoa projects are proof that we are moving forward with the will to continue exploring the impact of innovative tools.
- ▶ The Bac Hung Hai irrigation system will remain the main case study of the IJL (notably with a PhD shared with G-EAU and several Bachelor/Master students of TLU and USSH beginning their research).
- ▶ The Duc Hoa case study will, in parallel, be reaching the stage of building participatory workshops and first models, with the main research works being undertaken by USSH and IRD.
- ▶ An extension to the issues of dyke break and flooding early warning in the systems of Ha Tinh / Quang Binh provinces is being explored with 3 TLU students.

INCREASING CAPACITY BUILDING ACTIVITIES

- ▶ Capacity building will remain at the heart of the laboratory, with a prevision of 18 bachelor and master students being enrolled for internships in 2024 (8 from TLU, 3 from IFI, 1 from VNU, 2 from Telecom Paris, 2 from INSA Toulouse, 2 from Ecole E. Kohl).
- ▶ We also plan to increase the number of PhD candidates, from 4 in 2022 to 8 in 2025.
- ▶ This will require to increase the number of Vietnamese researchers actively involved in the daily activities of the laboratory (3 professors at TLU, 1 professor at VinUni, 2 professors at CTU for the moment, plus 9 others involved in a less regular manner), **hopefully with the support of the projects launched in 2024, notably STAR FARM (with the MARD).**
- ▶ We also need to ensure that Patrick Taillandier's departure in August 2024 is balanced by a new assignment in 2025 (either Tri Nguyen Huu or Arnaud Grignard).

2024-2026

OUTLOOKS

EXPANSION TO NEW APPLICATION DOMAINS: AGRICULTURE AND AQUACULTURE

- These last 3 years have seen an expansion of the scope of the research beyond the application to irrigation systems: COMOKIT, ESCAPE, SIMPLE, and GEO-TB are projects that explore new modeling approaches in other domains. This is a way to test the genericity of the methods we are producing and to show their usefulness in other domains.
- A subject recently emerged on the sustainable management of **fisheries** in southern Vietnam, in partnership with **Can Tho University** and **VinUniversity**, as securing future fish stocks is a major stake for the Vietnamese food industry.



- The **STAR FARM DeSIRA project**, led by FAO, and funded by the EU, plans to address the possibility of developing sustainable agri-food systems in the Mekong Delta, based on the adoption, at small and large scales, of agro-ecological practices and an in-depth study of their impacts on soil health, value chains and carbon emissions (partnership with VAAS, IPSARD, CTU, CIRAD from 2024 to 2027).

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ARTHUR BRUGIERE
NICOLAS BOTINNELLI
LE TOAN THUY

2024-2026

OUTLOOKS

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ARNAUD GRIGNARD
NGUYEN NGOC DOANH
ALEXIS DROGOUL
ARTHUR BRUGIERE
BAPTISTE LESQUOY

EXPANSION TO NEW APPLICATION DOMAINS : CITY AND MOBILITY

- ▶ ESCAPE and HoanKiem Air have provided an insight at how powerful modeling approaches are to address "urban sustainability" issues. Thanks, among other factors, to an increased partnership with VinUniversity (part of the VinGroup, actively investing in mobility and smart cities), we will see 3 new projects launching in 2024:
 - ▶ The expansion of **HoanKiemAir** into a larger model on daily mobility in the **Moov'Hanoi project** in partnership with **PRX, Région Ile-de-France, Expertise France**, with a possible extension to air quality/health models (partnership with VinUniversity)
 - ▶ The application of behavioural modelling and simulation to the design of charging strategies for electric vehicles (partnership with EDF/France, VinFast, GSM and VinUniversity)
 - ▶ The adaptation of **Escape** into a larger model for providing flooding early warning platform in Quang Binh Province (TLU, Can Tho University and VinUniversity), funded by the UK Cooperation Agency.

2024-2026

OUTLOOKS

EXPANSION TO NEW APPLICATION DOMAINS : EDUCATION TO SUSTAINABLE DEVELOPMENT

2024 🇹🇭 🇻🇳



Design of 2 virtual universes deployed and tested in 4 schools in Vietnam and Thailand

2025 🇹🇭 🇻🇳



Design of 2 more virtual universes deployed and tested in 4 more schools in Vietnam and Thailand

2026 🇰🇲 🇰🇭



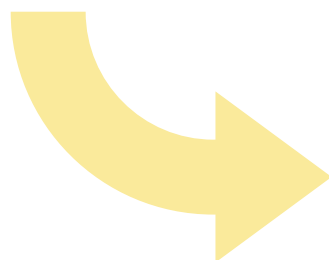
Design of 2 virtual universes deployed and tested in 4 schools in Lao PDR and Cambodia

2026 🇸🇪



Organisation of an ASEAN-wide VR contest for school and university students

SIMPLE



adapt and remediate to subsidence and climate change in the Mekong Delta



protect and restore biodiversity and the balance of species in forests

ALEXIS DROGOUL
JEANNE COTTENCEAU
PHUNG DIEP ANH
HUYNH QUANG NGHI
PHAM DUC DAI
NGUYEN THI KIM NGAN
LAURENCE LOMBARD
ARNAUD GRIGNARD
ARTHUR BRUGIERE

EVOLUTION OF THE PARTNERSHIP

- ▶ The last two years have been mainly structured by the relationship between TLU and IRD. In 2023, both IRIT and HAU, after very little contributions, have expressed their wish to leave the existing partnership.
- ▶ Indeed, there has been a progressive shift from the initial core constituted by TLU-HAU-IRIT-IRD to a new one composed today of TLU-VinUni-CTU-USSH-IRD.
- ▶ One urgent task in 2024 is to finalise the agreement and get it signed by the various institutions.
- ▶ VinUni would be interested to be part of the new agreement.

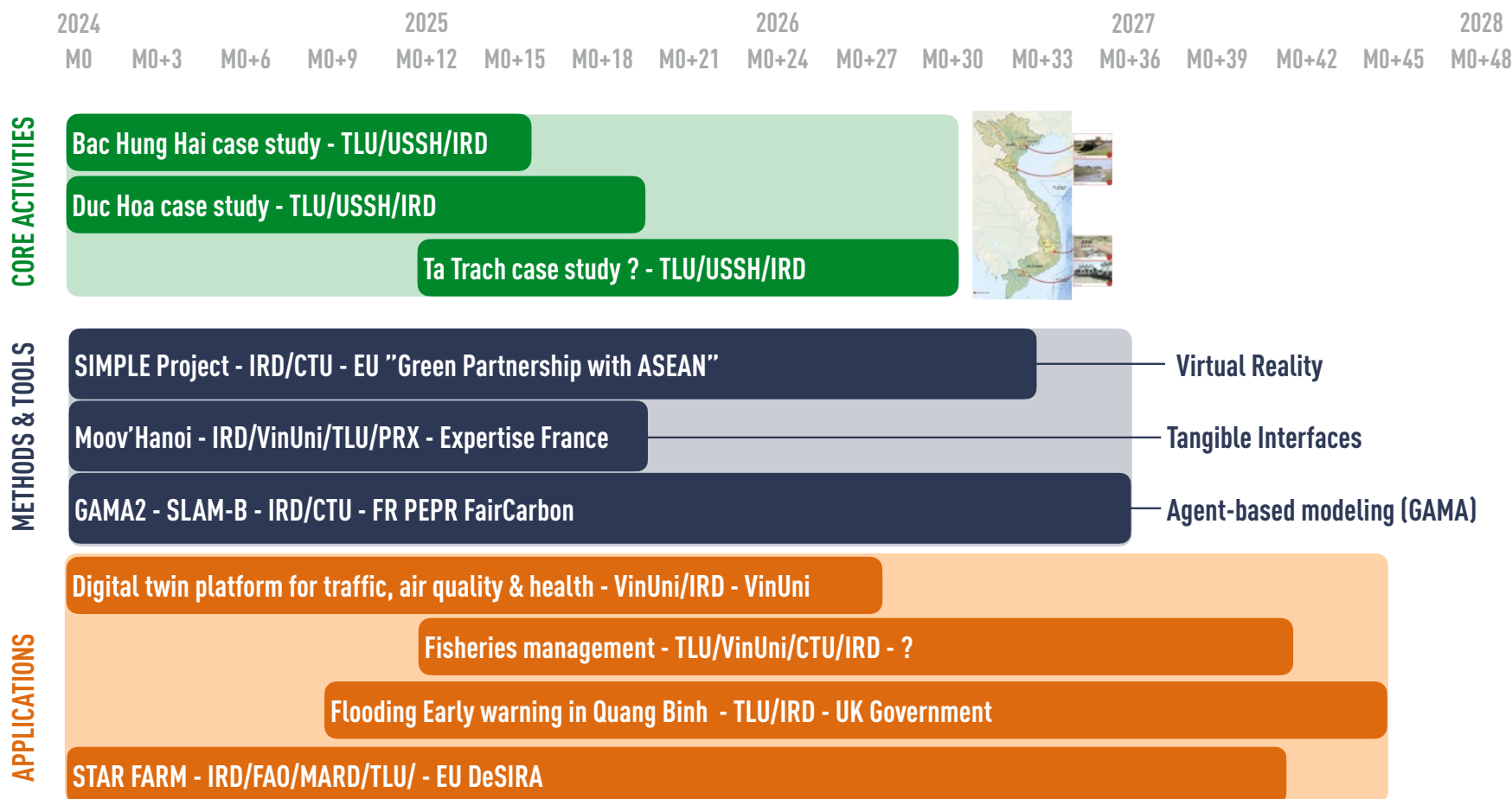
IMPACT ON SOCIETY

- ▶ The possible evolution of the partnership also reflects our will to have **more impact** (USSH regarding social sciences, VinUni the industry, and CTU the Mekong Delta)
- ▶ As a matter of fact, we are more and more focused on the question of the **impact of digital tools on sustainability and how they can "make a difference"**. For example, from **COMOKIT**, used by the Vietnamese government against COVID-19, to **HoanKiem Air**, designed with the Hoan Kiem People's Committee, **RÁC**, which supports local mediation in Bac Hung Hai, **GEO-TB**, dedicated to support the National Lung Hospital, or **SIMPLE**, where education to sustainable development is central
- ▶ In a reflexive way, the collaboration with USSH will strengthen our capacity to conduct more systematic surveys on the influence of these methods on the decision-making processes of stakeholders and better understand the role of what we produce in ACROSS in transdisciplinary approaches.

2024-2026

OUTLOOKS

ACTIVITIES AND PROJECTS



THANK YOU



<http://across-lab.org>

