METHODOLOGICAL AND STRATEGIC REQUIREMENTS FOR RESEARCH IN WATER AND SUSTAINABILITY – THE EXAMPLE OF AKIZ, A VIETNAM - GERMAN FLAGSHIP PROJECT FOR INDUSTRIAL ZONE WASTEWATER MANAGEMENT

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Abstract:

Whenever research wants to contribute to the development and implementation of technology based solution in complex fields like water management, there are certain methodological and strategic requirements to be fulfilled. Basic research will remain the fundament. However, applied research is to follow, on output-oriented research objectives. Furthermore, there is need for "multi-bridging" between academia and industries, between research and education as well as between different disciplines (like technologies/engineering and management/economics). The exchange of know-how and collaboration between different countries, complementary to each others (like Germany and Vietnam) can be very fruitful. Finally, water research will have to be embedded in the overall context of sustainability.

The article describes details and give the example of one project AKIZ - wastewater concepts for industrial zones, Tra Noc) to show, how these methodological and strategic requirements can be fulfilled.

1. Introduction

This article will line out, what methodologies and strategies are required or helpful for research in water and sustainability, taking the example of AKIZ, a flagship project to develop integrated wastewater concepts for industrial zone wastewaters in emerging countries, verified for the industrial zone of Tra Noc in the Mekong city Can Tho, Vietnam.

The group of authors shall demonstrate their efforts for intensive collaboration between scientists, engineers and economists, and for the inevitable collaboration between different countries like Vietnam and Germany, strengthened through fruitful collaboration between academia and industries. Even though the methodologies and strategies lined out in this article may look extremely ambitious and demanding, the authors would always recommend trying their best, although it will never be possible to achieve all objectives by a hundred per cent.

2. Methodological and strategic requirements

2.1. Basic research versus applied research

The clear objective of pure science and the so-called “basic research” is to find the truth - disregarding, whether it is useful or not, and whoever will be effected and how. Such kind of a fundamental approach is inspiring the progress in science. Many of extremely useful technologies have been developed, even though the researchers having created scientific basis did never know, before, for what their creation could be utilized.

However, to make science and technologies serve a specific purpose (like industrial technologies to allow for efficient production, or like water technologies for people and the environment), additional efforts are necessary. Building on the outcomes of basic research the so-called “applied research” is dedicated to use and improve the knowledge of science and technologies for a specific purpose. Applied research is to develop a solution for a defined problem of usually high complexity and priority, which could not be resolved at equal level with existing concepts. Applied research is seeking to develop novel concepts, often based on new, on enhanced, or on adapted technologies.

Water and sustainability research is driven through severe problems, for which the academic as well as the political or commercial world is seeking appropriate solutions. Of course, any solution to function properly over a long period cannot be built on false presumptions. Therefore, the applied researcher will have to look for the truth (similar like a base researcher), even though the focus of applied research is on a specific purpose. By no

doubt, there is still a lot of room for base research in water and sustainability (e. g. in the field of human- and eco-toxicity under the phenomenon of the synergetic effects after long term exposure with potential accumulation). Anyway the broad need and project activities for water management are found in applied research.

2.2. The need for an interdisciplinary approach in water research

Water and sustainability research is characterised through problems and solutions, which require the skills of more than one single field of academic science. One reason is that nearly all technological functions do not commence just after the physical instalment of technical equipment. Innovative concepts with improved of logistic and organisation continuous operations and maintenance are necessary, to make technologies work under the technical and socio-economic working conditions existing on site. Finally, a sustainable management solution is to be developed utilising technological knowledge as well as knowledge from economics and finance. Usually, a tailor-made combination of various fields respectively disciplines is the pre-condition to create research based solutions for water and sustainability.

2.3. The benefits of international collaboration

In the globalized world of our millennium, economies and knowledge are interlinked and not limited within national boundaries. Nowadays, even the strongest and largest countries, including those with the most advanced science and technology infrastructure, need collaboration with others as soon as it comes to research and implementation of complex innovations and leading-edge technologies. One reason is that such research needs more money and brains than one country could afford (such as in aeronautics or automotive). Along the global value chain of supply and infrastructure, especially in the water sector, the players from industrialised countries working at the high-tech and high-cost level are advised to enter collaboration with partners from emerging countries, working at a cost-competitive level with basic technologies.

Efforts and investments for science and technology research would not pay out, unless executed under international collaboration with the perspective to be applied in more than just one single nation. It is clear, that the pure export and import relations will be replaced in future through more complex and more collaborative forms of sharing powers and functions between the partners countries involved. There will be a new value chain of water and sanitation, dividing work-inputs as well as profit-outputs in a sustainable

manner, to provide services at a performance level, allowing the people of today and future generations to live in a healthy and clean environment.

The collaboration between Vietnam and Germany for water and sustainability research is looking back at decades of fruitful work. Both countries have found a lot of similarities and complementary interests. One of the unique similarities is history of division and reunification, in Germany between East and West, in Vietnam between South and North, and the strong will of both peoples to live in freedom, peace and happiness. Many differences in cultural, institutional and natural conditions have been inspiring the transnational research teams, leading to a number of important findings and technology based solutions.

MoST (the Vietnam Ministry of Science and Technology) and BMBF (the German Ministry of Education and Research) are holding a joint "Vietnam-German Office for Water and Sustainability Research" (VD-Office). The VD-Office shall ensure that the fruitful collaboration between the two countries and ministries is continuing for the long time period envisaged until the problems in the water and environmental sector are researched and resolved, and until the Vietnamese water and environmental infrastructure is installed and functioning according to the objectives and the standards, which the Government of Vietnam has set, and which the people and industries demand.

2.4. The unity between research and education

No visitor from Europe should miss the chance to take a walk through the "Temple of Literature" in Hanoi, where the first university in Vietnam, the National University Quoc Tu Giam was founded as early as in the year 1070.

Very much alike the wisdom behind this early foundation was the spirit of the first University of Heidelberg founded 1386: It has always been the relation between experienced teachers and ambitious young students, which was leading to better understanding and intellectual progress (sometimes with a revolutionary change of habit and paradigms). It was never (and cannot ever be) the pure professional relation between employers and employees to do research, within industrialised training lacking academic spirit and education.

So, it is always a good recommendation for Vietnamese teachers and students to read about Alexander von Humboldt, and their German counterparts to read about the great teacher of Vietnam, following Confucius. They will find exiting truth and wisdom, which is of highest value under both very different cultures in Germany as in Vietnam.

Beyond the academic world, the necessity and demand to integrate research and development has been documented in background papers under the term "Capacity Development" among others by the World Bank (WB), the Asian Development Bank (ADB) and the German GIZ

(*http://www.bmbf.wasserressourcen-management.de/_media/OECD_Challenge_of_CD.pdf*

http://www.kfw-entwicklungsbank.de/ebank/EN_Home/Topics/Capacity_development/index.jsp).

2.5. Academia to join forces with business, industry

Especially in developed countries, business and industry can only compete if working on a high level of logistical and technological know-how. The percentage of skilled staff with academic education is increasing with the level of development in all countries. Vice versa, applied research needs the know-how how to organise and succeed with implementation of improved technologies and management concepts, such as in water supply, wastewater disposal, water resources management.

The collaboration between universities and research institutes with commercial companies from business and industries of all different branches is needed, as soon as applied research comes along with the objective and effort to contribute to practical solutions for the sake of people, economy and the environment.

Therefore, many multilateral, regional and national sponsors of research activities (like UN WATER, the EU European Union and the German BMBF as well as the Vietnam MoST) encourage or even demand research consortia including academic as well as industrial business partners.

Of course, the roles and responsibilities within any concrete research programme or project should be clearly defined, with academia responsible for activities usually characterised as "scientific", and industry responsible for activities which might be characterised as "practical execution" (like the construction of machines or plants).

2.6. The link between water and sustainability

The first sewage system built underground was 1865 in London. The population of this early megacity had become so large that the effluents generated what was called the "Great Stink" 1858 along the Thames river, coming along with disastrous health problems (cholera disease) and severe damage to the water ecology and London's economy. The first sewage treatment plant on the Continent of Europe was in Frankfurt 1882 located

inland in a sensitive environment, which forced the city government to pay for modern water and sanitation infrastructure for the protection of people's health, economy and environment.

Whereas the first century and decades of research were clearly focused on the technological aspects of water and sanitation, (on the infrastructural function to transport fresh water to the consumers and take away the effluents out of town), the situation today is quite different: It is not enough just to get rid of the wastewater and discharge it some distance away from the settlements. Since there are so many people and so many industries, the discharge of one will always affect the other. Therefore the water research today is dealing with the problem how to repair and sustain the whole water cycle. This water cycle is embedded in many and complex natural cycles and processes. Overall research should contribute to a water management under which all people can be served fresh water and relieved of dirty water, without contaminating the environment where the people live in and live from (e. g. from fishery grounds or tourism in Vietnam).

These are the reasons, why, water research today is always linked to environment and sustainability. The field of sustainability research has a high degree of social relevance and that its urgent need to find solutions to existing problems relies on in-depth expertise in economics. The field of economics can draw a long tradition of adopting sustainability-relevant approaches in research (e. g. management and renewable resources or long-term accounting in public finance). This potential must be tapped more intensively than heretofore in terms of the firm establishment, further development and implementation of plans and strategies for more sustainability.

3. The AKIZ project - an integrated concept for industrial wastewaters

3.1. Objective

In Vietnam, there are many more than 200 registered industrial zones (IZ), most of them without any sustainable and functioning wastewater system. Under the framework of the BMBF ./. MoST-joint research cooperation, an integrated wastewater concept for industrial zones exemplified for the IZ Tra Noc in Can Tho (Vietnam) shall be developed and demonstrated in order to identify solutions for the current precarious situation. The name of this project is AKIZ.

German and Vietnamese universities and industrial partners are working together on various aspects for the development of the wastewater management concept. A key component of the integrated concept is the

combination of centralized and decentralized technical approaches for wastewater treatment as well as the linkage between technical and financial planning, including adapted tariff models.

3.2. Activities

Selected decentralized solutions for *near-to-source detoxification* of hazardous wastewaters, the *energy recovery* through biogas from wastewater, and the *recovery of valuable materials* with wastewater-recycling are demonstrated at technical scale for industries of Tra Noc. The application of proven and efficient high-tech solutions for industrial wastewater treatment, as they are known in Germany and other industrialized countries, requires an adaptation of technology to specific local conditions and tropical climates. Therefore, container-based pilot plants from German industrial partners are installed and operated in selected pesticide processing, sea-food production and life sciences industries as well as breweries.

For the *treatment and disposal of sewage sludge*, which will result from both the operation of centralized as well as decentralized wastewater treatment plants, adapted concepts are developed; *solid waste and contaminated site management* are taken into consideration, too.

Related to AKIZ, the German Technical Agency for Development Cooperation (GIZ) has supported to build a hazardous waste incinerator for one of the Tra Noc factories under the bi-lateral ODA (Official Development Assistance) between Germany and Vietnam.

With the development and implementation of a *monitoring system* for indirect dischargers, including a *laboratory* designed for Vietnamese industrial zones, a data bank for technological adaptations as well as for the administrative and financial management of the wastewater treatment system is created. In this context, AKIZ through GIZ is advising the MoC (Ministry of Construction) for the reform of Decree 88, dealing with industrial wastewater tariffs.

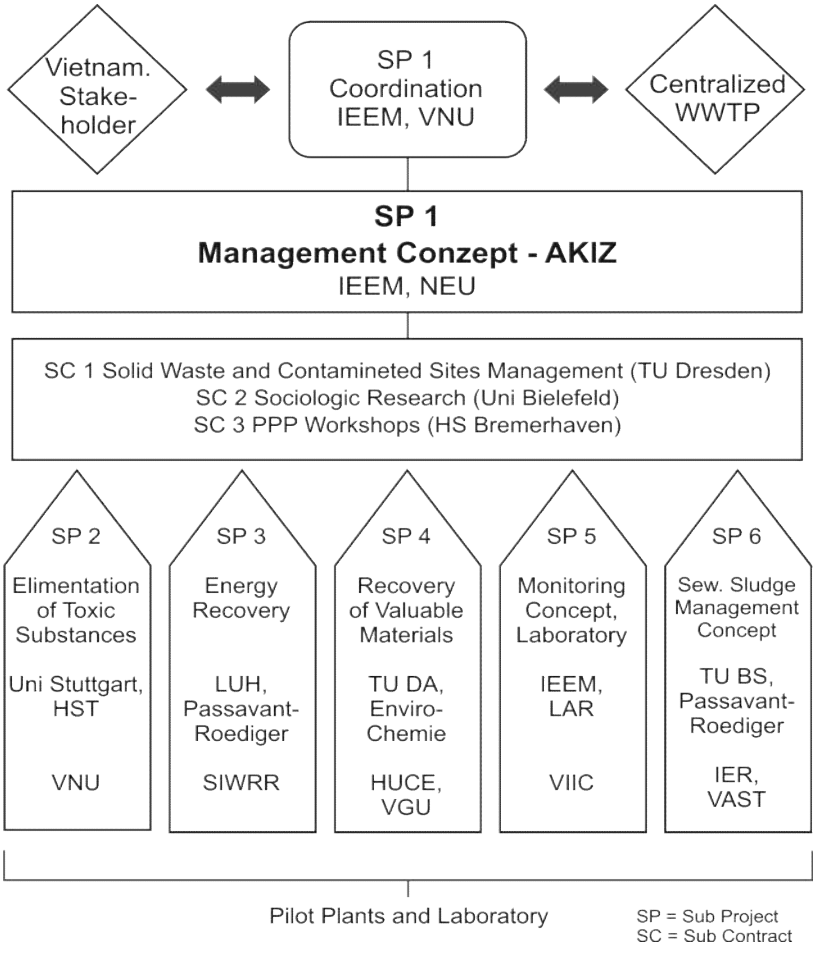
Socio-economic studies are investigating the reasons for insufficient wastewater purification and options for better law enforcement. Reasonably set and consequently applied environmental standards and quality requirements are researched and understood as a prerequisite for the use of advanced technologies in Vietnam.

All these components are fed into a comprehensive *integrated management concept* for industrial zones, which will reflect the sustainable technical and economic operations of the wastewater system in the industrial zone. This

includes decentralized wastewater treatment as well as a central wastewater treatment plant (not part of the AKIZ investments, but part of the overall AKIZ concept); furthermore the AKIZ-laboratory based control and monitoring system and a survey of ongoing operations, including cost accounting and a *business plan with financial modeling*. The AKIZ project structure is visualized in Table 1.

The findings of the project will be condensed in guidelines for integrated wastewater concepts of industrial zones *(Best Practice Guide)* for both, German and Vietnamese decision makers. Additionally, the sustainable implementation of the concept is supported by *capacity building measures*, in collaboration with GIZ for industrial-zone-facility operators as well as for *master and doctoral students* in collaboration with Vietnamese partner universities.

Table 1. AKIZ project structure



4. Strategic conclusion

Just as with the AKIZ project, it seems necessary to make sure that (at least) all larger and flagship research projects and programmes in science and technology, dealing with complex fields like water and sustainability, are "*multi-bridging*" between

- Basic research (as the fundament) and applied research (as the focus for research outputs to be delivered);
- Different disciplines, namely technologies (science, engineering) and management (economics, finance);
- Different countries, complementary to each others (like Germany and Vietnam, or EU, Europe and SEA, South East Asia);
- Research and education (with students in research laboratories and pilot plants, as well as researchers and practitioners in seminars and workshops for capacity development);
- Academia and industries (i. e. universities and research institutes, to join forces with business and industrial companies);
- Water and sustainability (water research in the overall context of socio-economic and ecologic issues).

Neither the all-integrating macro-project with poor results in details, nor the deeply specialised micro-project with poor understanding of the overall context to make things work, will bring the best in results and success, which scientists as well as their sponsors should expect from efforts in science and technology research. Therefore, wherever possible, the *macro view* (like for geo-information-systems [GIS] - based large-scale data collection and data management systems) should go together with the *micro view* (concrete verified data and technologies, ready for facility constructions and operations).

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