Geoinformation as a planning instrument for location analysis for semicentralized supply and disposal units in Hanoi

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Key words: geographical information system (GIS), Hanoi, semicentral, transport concept

SUMMARY

Many rapidly growing cities face the issue that infrastructures and public services (energy, water supply and disposal) are unable to keep pace with the rapid urbanization, often caused by immigration. This frequently results in provision shortages of energy as well as water. Vietnam is currently experiencing an economic boom accompanied by growing social and economic inequalities and rapid urbanization. In Hanoi, as in other urban and rural areas of Vietnam, the situation is characterized by a high demand for waste water treatment plants, serving only a small fraction of the accumulating wastewater. The existing structures of waste- and sanitary management should be included in the planning aspects.

The main objective of the co-operative project is the development of a semicentralized solution, combining both the upgrading of existing supply and disposal structures, as well as the construction of adapted and integrated supply and disposal systems in new settlement areas in Hanoi. This means specifically to equip new settlement areas with an integrated system of treatment capacities for different wastewater fractions as well as for organic waste.

For location analysis of Semicentral supply and Disposal Center is a geographical information system (GIS) a suitable instrument. The challenges are the collection and integration of heterogeneous information and data into a consistent system. Primary and secondary data has been combined to get the foundation for further analyses. E.g. it's possible to analyze different alternative planning situations and diverse scenarios. Furthermore the geographical information system is a planning foundation to develop a transport concept for the wastewater and organic waste treated in the semi central center.

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1. INTRODUCTION

1.1 Situation in Hanoi

Hanoi, the capital city of Vietnam, is a rapidly growing city. Infrastructures and public services (energy, water supply and disposal) have to adapt to the rapid urbanization, often caused by immigration. Hanoi with its circa seven million habitants needs an adaptive infrastructure system, which assures the supply and disposal for them. In rural as well as in urban areas there are no proper disposal. Actual there are only so called septic tanks. The concept of septic tanks is to collect the wastewater from the toilet and other housing sewages. The sludge in the septic tanks will sink down and the remaining water runs into the channels and finally untreated into the river. Normally if the septic tank is full, it will be evacuated and the sludge will transported to the central treatment plant.
But the problem is the marginal control of clearance the septic tanks. So the main problem in Hanoi is the water supply and treatment of wastewater. The untreated waste water contaminates the ground water and as a consequence is the odour nuisance and damages caused to habitants' health.
In addition the waste accumulation generates another problem. Usually the waste will be collected every day and carried to the dump side. Unfortunately the waste separation and reuse of waste is still at the initial phase. The lack in the system causes uncontrolled places with waste in the city. The waste from the restaurants mainly organic waste is collected by individuals and used for feeding their animals.

Illustration 1: Suction vehicle.

1.2 Concept Semicentral

Caused by the above-named problems the main objective of this project is the development of a semicentralized solution, combining both the upgrading of existing supply and disposal structures, as well as the construction of adapted and integrated supply and disposal systems in new settlement areas in Hanoi. This means specifically to equip new settlement areas with an integrated system of treatment capacities for different wastewater fractions as well as for organic waste.

The location of the *Semicentralized supply and Disposal Centre* (SDC) next to the district reduces the quantity of transport capacities (cf. Illustration 2). The new solution of a combined treatment of organic waste, wastewater and sludge maximise the energy efficiency through an optimized biogas production and the SDC could run in a self sufficient status. The modularized semicentral system is large enough to support a quarter or district and can be extended in a flexible way as the demand by the district is growing.

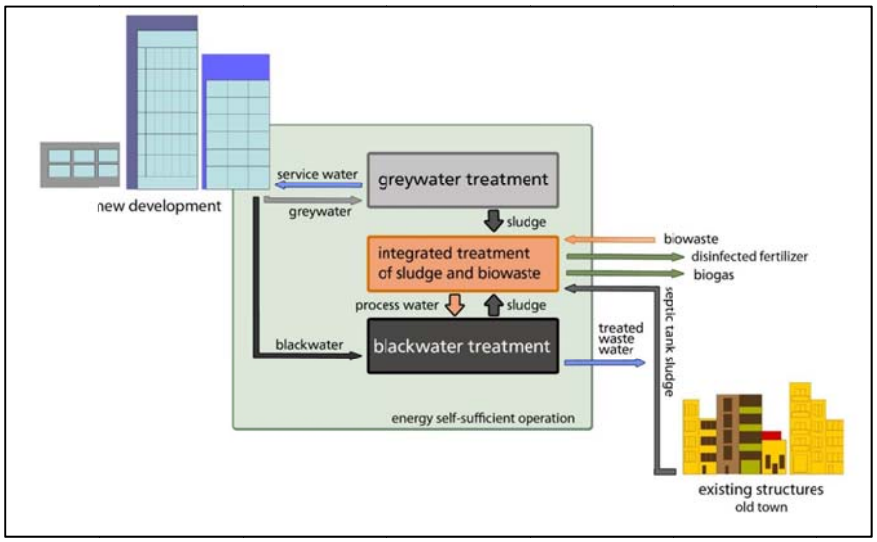

Illustration 2: Semicentraliced supply and Treatment Centre (SDC) (Schramm).

2. DATE ARQUISITION AND DATABASE

For the definition of the place of location near the district a status analysis is necessary. The results of data collection will combined in a geographical information system (GIS). The challenge is the integration of heterogeneous information. Primary and secondary data has been combined to get the foundation for further analyses. E.g. it's possible to analyze different alternative planning situations and diverse scenarios. Furthermore the geographical information system is a planning foundation to develop a transport concept for the wastewater and organic waste treated in the semi central center.

First of all it was necessary to define an investigation area (cf. Illustration 3). Therefore a site survey was arranged. The requirements of the investigation area are the following ones: typical urbanistic area, near a recipient, combination of an existing area and development area and a location of the SDC next the district. The main campaign for the project was the data collection in space the investtigation area in March/ April 2009.

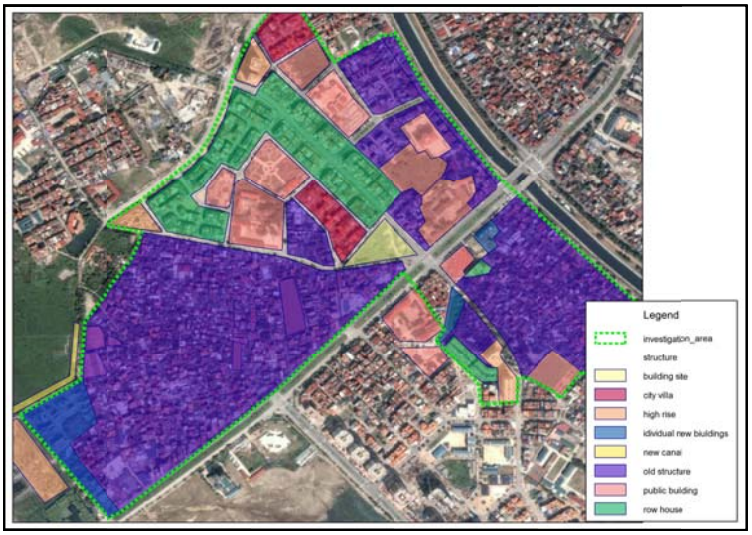

Illustration 3: Investigation area.

2.1 Secondary Data

The Database particularly consists of aerial photograph and cadastral map of Hanoi. These data are used to generate the origin for the data collection in the investigation area. Furthermore information of literature is also secondary data.

2.2 Primary Data

The inventory takes place in the investigation area. This area is a conglomerate of different buildings and combines old and new constructions. The area contains public and private buildings, from standard houses up to high-rises. It reflects the main building types in Hanoi. This data collection area will representative used for the concept of the project. The objective is to detect the plenty of septic tank sludge, organic waste of restaurants, markets and households. Detailed information could generate from interviews with individual house owners. Furthermore the number of living individual per property also notices.
The project includes the use of modern methods and equipments for the data acquisition. By using the mobile GIS most of the data could be capture directly with the spatial reference. With the skills of mobile device it's easy to collect informations in a short period of time. Particularly the location of restaurants and septic tanks including the information about size and dimension could be integrated.
But the structure (small streets) of Hanoi does not allow the use of GPS in all places. In this case the spatial relation had to capture manually based on the detailed aerial photo in the mobile GIS.

Primary data as well as secondary data are integrated in GIS. The results of the inventory and collected data with spatial reference could present in form of digital maps (cf. Illustration 4). The data are the foundation of further analyzes. E.g. it's possible to analyze different alternative planning situations and diverse scenarios. So it's possible to make location analyzes for the SDC. Furthermore GIS is a planning foundation to develop a transport concept for the wastewater and organic waste treated in the semi central center.

Illustration 4: Localization of septic tanks.

3. LOCATION ANALYZE

3.1 Semicentral supply and Treatment center

For the SDC it's necessary to make an location analyze. Due to the inventory and database in GIS it's possible to accomplish the analyze. The SDC is defined thereby, that it must be possible to treat waste water and septic tank sludge. Furthermore organic waste of marktes, houldings and restaurants are to consider. Moreover the treated waste water should re-use. Caused by this, following parameters are to consider concerning the location analyze:

- dimension of the SDC,
- patch,
- plenty of septic tank sludge and organic waste,
- short distance to recipient,
- spacing to next constructions,
- combining of new and old structures and
- existing infrastructure.

These parameters depends on each other. By combining these aspects it's possible to analyze possible locations of the SDC by GIS. Finally if the constrians changed, e.g. the plenty of septic tank sludge decline or the patch is amplify, the analyze of a possible location of the

SDC could rerun. The selected locations are rewiev by defined criteria. For it the different variants are analyzd and presendet with the GIS.

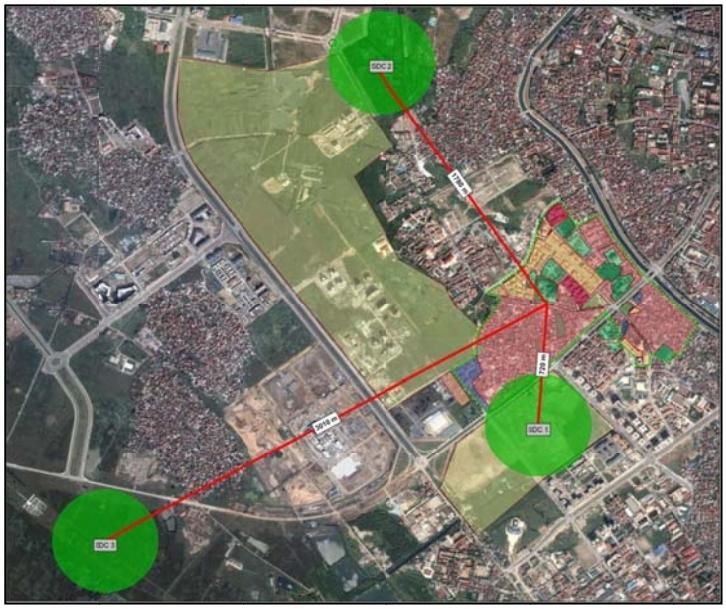

Illustration 5: Possible locations of SDC.

3.2 Transport concept

After defining a location of the SDC the transport concept could develop. Finally different transport concepts could compare with each other using the GIS. Therewith the best variant could identify. For development the transport concept especial the following aspects have to been consider:

- How far is the distance between existing constructions and SDC?
- How many septic tank sludge, waste water and organic waste have to collect within which period?
- How many buildings have to approach?
- What are the road widths?
- Which suction vehicles are needed?
- What are the tube lengths?
- What is the dimension of septic tanks?
- How many times the septic tanks have to discharge?
- …

Illustration 6 shows the first analysis of accessibility of buildings depending on distance to the next larger road which drivable with a big suction vehicle. The blue colored buildings are not achievable with the suction vehicles with 80m tube lengths. So for these buildings small suction vehicles are needed. Caused by this the septic tanks have to discharge more frequently.
Using the GIS, based on integrated data, it's feasible to consider specifications and to analyze the best transport concept.

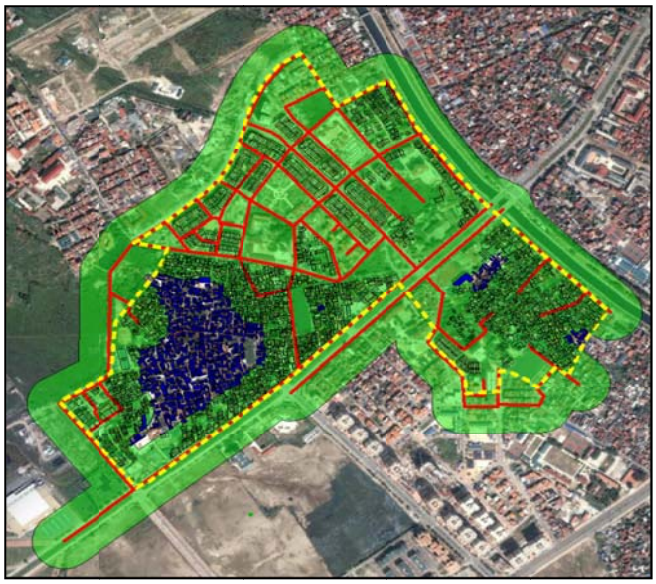

Illustration 6: Analysis of accessibility of buildings.

4. CONCLUDING REMARKS

The explanation point out that GIS is a suitable instrument for combining spatial data and based on them to accomplish analyzes for urban planning. In this case the GIS was using to integrate heterogonous data in one system for a location analyze for a Semicentral supply and Disposal center and for the transport concept. The different constraints could consider by update the results. Also the results could present in form of digital maps.
All in all GIS is an instrument to improve the situation in Hanoi concerning the water supply and treatment of wastewater. The development of a semicentralized solution, combining both the upgrading of existing supply and disposal structures, as well as the construction of adapted and integrated supply and disposal systems in new settlement areas in Hanoi. Additionally to the Semicentral Concept as a possible solution for urban areas also probably reforms in the administration might be necessary.

The joint research project of the Technische Universität (TU) Darmstadt and Hanoi University of Civil Engineering (HUCE) develops tools and methods for the calculation of a semi central disposal center. The international cooperation facilitates the efficient exchange of experience and findings.

SEMIZENTRAL
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www.semizentral.de

BIOGRAPHICAL NOTES

Verm.-Ass. Dipl.-Ing. Silja Lockemann graduated in Surveying at the Rheinische Friedrich-Wilhelms-Universität Bonn (Germany). After that she made her assessor in geodesy at the administrative district Düsseldorf in North Rhine-Westphalia. Since April 2009 she has been working as a scientific assistant with Professor Dr.-Ing. H. J. Linke at the Institute of Geodesy, Department for Landmanagement, TU-Darmstadt.

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