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IN AN UNCERTAIN ENVIRONMENT****Business model assessment in faecal sludge management  
in selected Vietnamese cities***Nguyen Viet Anh and Nguyen Hong Sam, Vietnam***REFEREED PAPER 1829**

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*An assessment of business models in faecal sludge management (FSM) in 3 largest Vietnamese cities of Hanoi, Hai Phong, and Ho Chi Minh has been conducted through interview of 1,000 households and survey at 20 FS emptying operators. The public enterprises keep a significant market share for FSM. However, these enterprises run FSM business as a “must do” activity, which is subsidized by the city’s budget. In order to reduce operation costs and to make benefit, most of private enterprises are practicing illegal FS dumping. Financial status of private enterprises looks less optimistic in scenarios where FS is required to be brought to landfill or composting plant. A number of enterprises would not find capital recovery within 5 years, and some others would face loss. For sustainable FSM business, costs for adequate FSM should be recovered, while regulatory support and coordination role of local authorities are needed.*

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**Introduction**

Septic tank and other on-site sanitation means play very important role in urban sanitation especially in developing countries where centralized sewerage systems are still not yet developed. However, service provision arrangement for the collection/emptying, haulage, safe disposal, reuse or treatment of faecal sludge produced by on-site sanitation infrastructures is often inadequate. Number of cities is paying great efforts in setting up of faecal sludge management policies and projects. However, without understanding real situation of the faecal sludge management business which is often provided by public or private enterprises, those policies and project activities can’t be realized.

For efficient arrangement of faecal sludge management (FSM) service, information of existing FS emptying and transportation service delivery is very important. This paper presents country study results where three cities of Hanoi, Hai Phong, and Ho Chi Minh have been selected based on diversity of FSM business approaches and management models. In Hanoi, FS emptying and transportation service is provided by both city Urban Environment Company (URENCO) and private enterprises. A public utility Hanoi URENCO operates Composting plant where part of collected FS is co-composted with organic waste. FSM in Hai Phong is operated by the city’s Sewerage and Drainage Company (SADCO). Budget for FSM business of this public utility comes from collected wastewater fees, where household septic tank emptying is scheduled, and from individual FS emptying deals with other customers. The Company also has a composting plant. The Ho Chi Minh City Environment Company (CITENCO) provides market-based septic tank emptying service as do private enterprises. Composting of FS in Ho Chi Minh City is made by a private enterprise. Most of private enterprises in all 3 surveyed cities are practicing illegal dumping of FS. The study is exploring whether FSM business is profitable for the involved public utilities, and whether private enterprises are making profit if FS is disposed at right places. Current and potential FSM market shares are also discussed under different FS management models. Associated FS emptying tariff and break-even point in different scenarios are calculated. That information is needed for selection of appropriate FSM model(s) and development of associated legal framework in the cities.

## Materials and methods

For financial analysis of FSM business, in total 20 FS emptying operators including public utility and private enterprises have been surveyed. Information of overall company's Income statement, and FS-related revenue/expenditure details over last 3 business years, procedures of FS emptying, transportation, treatment and disposal, evaluation of company's leader and staff on FSM practice in the city were gathered through 6 different Questionnaires, Interviews and Site Observation forms.

Besides public utility dealing with FSM (one in each city), private FS emptying operators have been selected based on their size: 5 medium size (with 2 to 5 vacuum trucks), 4 small (with 1 truck) in Hanoi; 2 medium size and 1 small size in Hai Phong; 3 medium size and 2 small size in Ho Chi Minh City.

Financial analysis in 3 scenarios was calculated for each studied enterprise. Enterprise's Income statement includes the following parameters: Expenses (Labor costs; Operation and maintenance costs for desludging, transportation, dumping or composting; Trucks, equipment and fixed assets costs); Revenue; Profit (or Loss). All values are given in USD.

In Scenario 1, the financial projection with current FSM model is being made for the next 5 years, where the following assumptions have been made during calculations: Inflation rate 11.75% (as average inflation rate over last 3 years in Vietnam) (GSO, 2011); Exchange rate USD 1 = VND 20,600. The values of depreciation rate applied in the study were: 5 years for second hand trucks; 10 years for new trucks; 20 years for fixed assets (office, workshop, etc). FS emptying tariff will increase for 10%/yr. An exception has been made for Hai Phong city concerning wastewater fee which will be increased from current 15% surcharge to water bill, up to 20% surcharge in 2012, and 25% surcharge in 2015 as the city's commitment to the World Bank from its 1B infrastructure improvement project. Scenario 2 has been evaluated whereas FS dumping is being more strictly controlled, and all sludge emptied from the city should be brought into designated landfills or treatment plants. Values of additional fee to be paid to the private enterprises have been calculated so that private enterprises could stay profitable with their business. Scenario 3 has been also analyzed whereas sludge is being brought into designated dumping or treatment sites, but, instead of additional payment, private enterprises utilize maximum capacity of available trucks. Availability of the market has been checked in order to compare with supply capacity of the enterprises. Scenarios of 1a, 2a and 3a have been also worked out from the above mentioned Scenarios of 1 and 2, 3. All private enterprises have access to the bank loans for investment and for run of the business. Bank provides 70% of value of the trucks purchased under the Interest rates of 18%/year. The rest 30% is paid from the own capital of the enterprises. No bank loans were considered for the state-own enterprises.

In order to better describe and understand the FSM at micro level in a given city, a household survey has been conducted. In Hanoi, 1,000 urban and peri-urban households (HHs) have been surveyed. In Hai Phong and Ho Chi Minh City, 300 HHs were surveyed in each location. Questionnaires and in-depth interviews were used for gathering of information of HH socio-economic conditions, features of on-site sanitation facilities, FS emptying frequency, volume of generated FS, willingness-to-pay and users' view at FSM service. Only the households which have used the sludge emptying service at least once were selected for the survey.

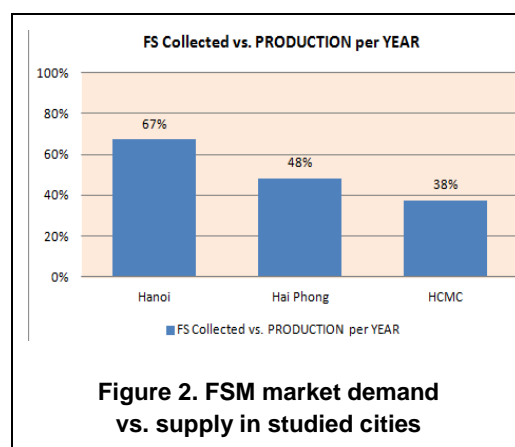
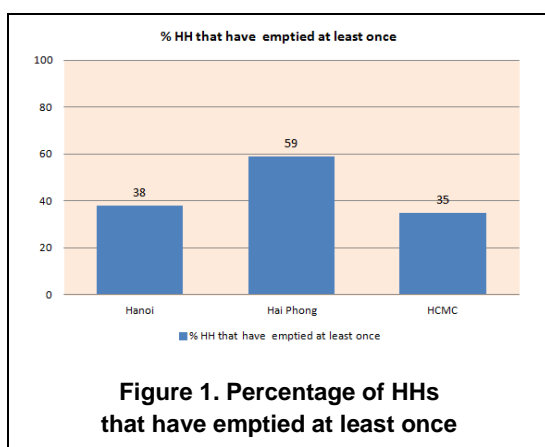
## Results and discussions

### Household survey

Figure 1 shows importance of the city authorities' role in FSM. In Hai Phong, thanks to World Bank project, providing support in HH sanitation improvement, sewer connection and scheduled desludging for free (Nguyen V. A. et al, 2012), percentage of households that have emptied septic tanks is significantly increased compared to Hanoi and Ho Chi Minh Cities (59% vs. 38% and 35%, respectively). However, since the WB project just has completed, and Hai Phong has not completed the first round of the scheduled desludging, there is still a high percentage (41%) of HHs that has never emptied their tanks. In terms of current capacity of the FSM enterprises, Hanoi has a highest percentage of sludge volume collected versus actual sludge volume production in the city (Figure 2).

Key market parameters from HHs and enterprises survey in 3 cities are presented in Table 1. Highest demand is still available in Ho Chi Minh City whereas current volume of sludge collected is only 38% of the available market. Frequency of desludging interval in Hai Phong is also shorter than in Hanoi. Average desludging interval in Hai Phong is 4.4 years vs. 6.2 years in Hanoi. For Ho Chi Minh City, average

desludging interval is also 4.4 years, what relates to the sewer connection rate, and to the size of septic tanks built in surveyed households (Nguyen V. A. et al, 2007).



No	Items	Hanoi	Hai Phong*	Ho Chi Minh City
1	Population in city, households (HHs)	489,362	232,760	1,540,938
2	Number of users per HH, persons	4.7	4.1	4.8
3	Number of HHs having septic tanks in the city	430,638	218,795	1,017,019
4	Typical septic tank volume, m <sup>3</sup>	2.6	1.9	1.6
5	Average desludging interval, years	6.2	4.4	4.4
6	Total volume of FS to be emptied, m <sup>3</sup> /year	280,376	166,466	894,087
7	FS collected, m <sup>3</sup> /year	189,000	80,569	335,756

\*Hai Phong city: Scheduled desludging by HP.01 is included.

### Financial analysis across surveyed private and public enterprises

5 year financial analysis for all surveyed enterprises has been made as *Scenario 1* based on the current Income Statements. Key results are presented in Table 2. All private enterprises are making profits. Average annual profit made by Hanoi private enterprises is USD 2,835/truck, by Hai Phong enterprises: USD 3,187/truck, by Ho Chi Minh enterprises: USD 10,727/truck.

Of the public utilities in the three surveyed cities, there is only Ho Chi Minh Urban Environment Company CITENCO (HCM.01) is making profit. The main source of revenue and profit for HCM.01 is, however, not coming from desludging service, but from leasing public toilet cabins (57% vs. 43% of revenue). Hanoi URENCO 7 (HN.01) income statement shows the company has a loss of USD 93,045 per year. This amount is being compensated by the mother company, Hanoi URENCO. The reasons of loss of URENCO 7 business are high capital costs, limited desludging order from the households in the city, the Cau Dzien composting plant is operating not at full capacity and the output compost product has not high quality. Having scheduled FS emptying paid by the wastewater fee, HP SADCO income statement shows the company still has a loss of USD 43,232 per year in the FSM “business”. In practice, the scheduled FS emptying service is ordered and paid by the Hai Phong city’s budget.

Parameters	Hanoi		Hai Phong		Ho Chi Minh City	
	Public utility	Private	Public utility	Private	Public utility	Private
No. of HHs served per truck per day		2.7		1.4		2.0
Average desludging fee, USD/trip		34.3		31.3		55.1
Net profit (after tax), USD/truck/year	Loss	2,835	Loss	3,187	26,014	10,727
Number of trips made in 2010	2,016	1,890	13,104	2,142	2,970	1,692
Break-even point (trip/truck/year)	1,965	570	1,422	264	246	248
Percentage of revenue from break-even point, %	20	125	71	166	172	201
Capital return period, years	N/A	3 to 4	N/A	3		1 to 4

Money fluxes in a public enterprise HN.01, and average values of money fluxes in Hanoi private enterprises (HN.02 ... HN.09) are illustrated in Figures 4 and 5).

In scenario 2, in order to bring all sludge to the designated city's landfill or composting plant, additional payment on each emptied m<sup>3</sup> of sludge should be required for Hanoi private enterprises, so that the firm still can have a benefit in the business while going further (for 20 km per trip in average). In average, the amount of VND 107,500 (USD 5.22) per m<sup>3</sup> of sludge delivered to the composting plant should be charged additionally to the households, or, subsidized by the city's budget. With that minimum additional payment, however, there only 3 firms can find capital recovery within 5 years: HN.03 (after 4 years), HN.06 (after 3 years) and HN.08 (after 3 years).

In Scenario 3, all sludge is to be delivered to the right sites, but city or households will not pay additional fee to the sludge emptier. While FSM market is still available (see Table 1), private enterprises will have chance to maximize capacity of their available trucks. With selected number 4 as maximum number of trips per day per truck for calculation, the results show there will be more enterprises in Hanoi can find capital recovery within 5 years. In this Scenario, marketing efforts and support from public sector for enterprises are needed to increase their revenue in FSM market.

3 Scenarios 1a, 2a and 3a have been analyzed for the private enterprises in studied cities where they borrow loans from the bank to run business, keeping the same FSM model as in scenarios 1, 2, and 3 respectively. In Scenario 1a, payment for the bank loan interest (18%/year) becomes a significant payment in the firm's expenditures. Even though the model of FSM is assumed to be kept as presence, i.e. sludge is still not brought to the right landfill, most of enterprises will face the risk of financial loss in their business (HN.02, HN.05, HN.07, HN.09). There only HN.06 and HN.08 will find their capital recovery within 5 years. In Scenario 2a, VND 107,500/m<sup>3</sup> (USD 5.22/m<sup>3</sup>) is average acceptable additional rate where enterprises can keep the same level of profits, bringing sludge to the city's treatment site. There are only 3 private enterprises which can find their capital recovery within 5 years period: HN.04, HN.08 (after 3 years) and HN.09 (after 5 years). In Scenario 3a, while sludge is brought into designated site and private enterprises utilize their maximum truck capacity instead of desludging fee increase. There private enterprises HN.03, HN.04, HN.05 and HN.08 still can find capital recovery within 5 years, where HN.02, HN.06 will face the financial losses.

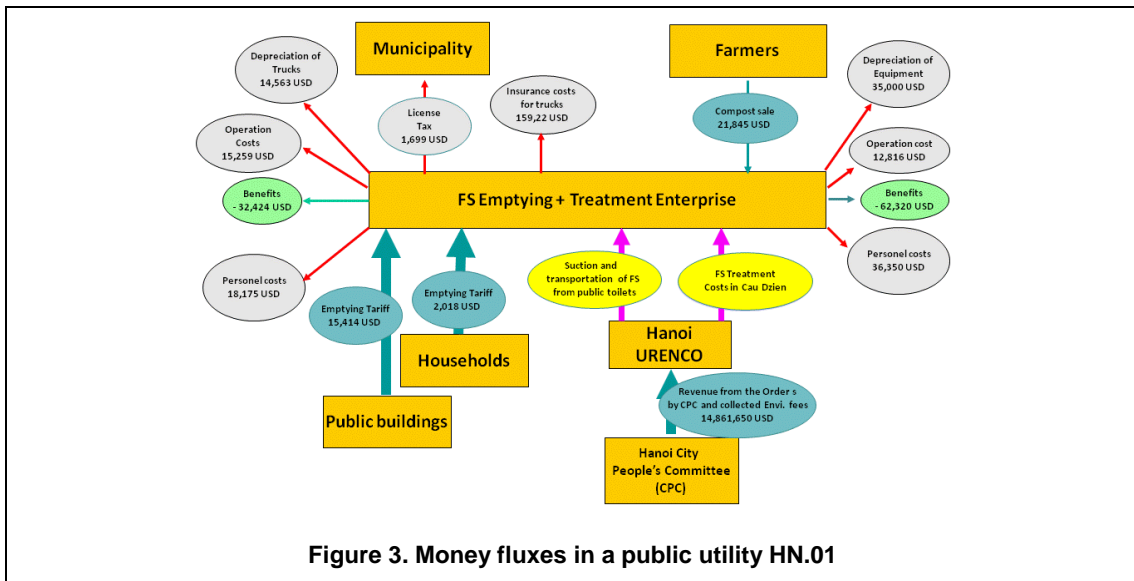


Figure 3. Money fluxes in a public utility HN.01

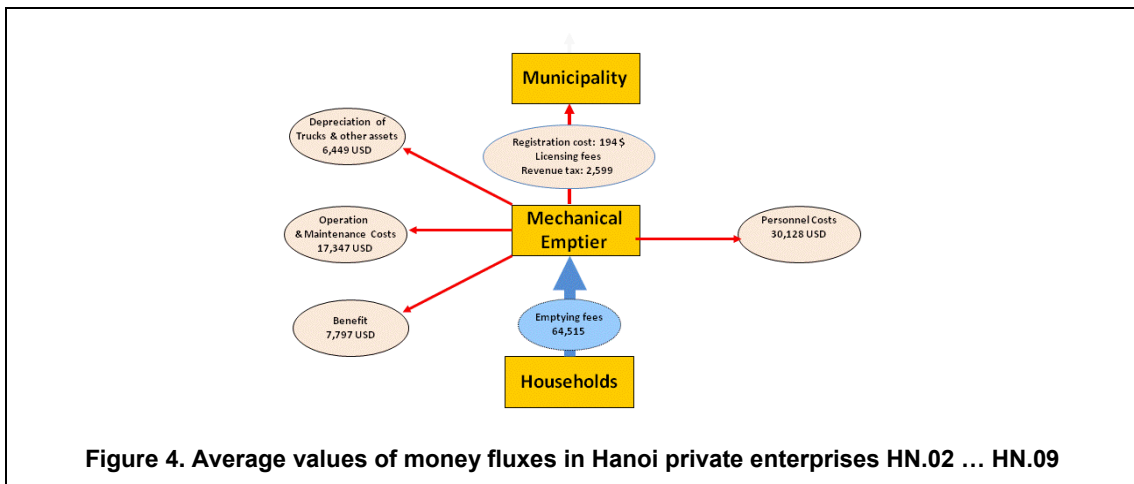


Figure 4. Average values of money fluxes in Hanoi private enterprises HN.02 ... HN.09

For Hai Phong City, Scenario 2 analysis shows in order to bring sludge for a longer distance to Trang Cat landfill and composting plant, the amount of additional fee required for each m<sup>3</sup> of sludge delivered will be ranging from 0 to VND 40,000 (USD 1.94). Private enterprises will find their capital recovery in the period from 3 to 5 years. In Scenario 3, whereas the enterprises maximize number of trips per truck per year, increased revenue will enable them to find capital recovery in the year 1 or 2.

In Scenario 2, except for HCM.02, all private enterprises in Ho Chi Minh City are still making profit without additional charges. In Scenario 3, all private operators will make more profits thanks to revenues are increased. Capital recovery will be found in all enterprises right in the year 1.

### Conclusions and recommendations

In many urban areas in developing countries, septic tank sludge management is still a hot, untouched issue. In large cities, where public enterprises have been, to some extents, well established for maintaining urban infrastructure works, those enterprises keep an significant market share for the FSM activities. However, in most of cases, for those enterprises, FSM business is not making profit. The FSM activities are often cross-subsidized by other activities of the enterprise, or subsidized by the city's budget.

Besides, private enterprises are also active in FSM business in many cities. All surveyed private FSM enterprises are making profits. However, in order to reduce running costs, most of them are practicing illegal FS dumping, which is contributing to pollution of the city environment and public health. The enterprises may face economic loss and non-recovery problem if they have to get loans to invest and to run the business, and, if the sludge is forced to be dumped in remote landfills at the same fees.

For emptying and delivery service, desludging expenditures, including running and depreciation ones, can be recovered by the competitive fees. However, FS treatment expenditures may not be recovered. Affecting factors here are selected technology for FS collection, treatment and reuse, and accepted market values of the compost product.

There are some opportunities for the private FSM enterprises to increase benefit, keeping proper FS dumping. Those are: (a) to improve business management and marketing activities for increase of revenue from available market; (b) to change the enterprise business model, expanding scope of activities and incomes; (c) to increase desludging fee. Payment for the FSM service can be paid directly by the users upon desludging, or indirectly through water bills as part of wastewater service. Applying second option, scheduled septic tank desludging can be organized, either by public or private enterprises, controlled by the city authority. Beyond scheduled emptying service can be paid applying direct payment option. Recommended actions to be taken by local authorities are: (a) to develop a septage management strategy which should be incorporated into urban infrastructure planning; (b) to enforce household connection to the city sewers, and regular desludging of septic tanks; (c) to consider financial support of FSM business, especially in the beginning stages of change, such as payment for each m<sup>3</sup> of properly delivered and/or treated sludge, provision of access to favor funding sources for investment in FSM business. In return, wastewater or solid waste management fees should be set up so that those subsidies should be recovered; (d) to apply strict control for FS collection, disposal, treatment and reuse market; (e) to provide systematic and efficient awareness raising for the public and FSM enterprises.

In future, an integrated waste management concept is to be considered. Using the same infrastructure for solid waste or wastewater management in the city for the FSM is a most feasible and sustainable solution in fast developing cities. The integrated waste management system may include at-source separation of wastes, co-treatment of sludge, organic waste and sewage treatment plant sludge for resources recovery through biogas recovery, wastewater reclamation, digested sludge utilization, etc. Further, a public – private partnership (PPP) model is a potential option to overcome a big investment capital challenge.

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