Research Paper

Business model analysis for faecal sludge collection and transport services in Thailand and Vietnam

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ABSTRACT

In Thailand and Vietnam, faecal sludge (FS) collection and transport services grow spontaneously without adequate business models, causing serious problems to human health and the environment. This study aimed to analyse business problems, business components with financial structure and propose a new conceptual business model. Primary, secondary business data and financial statement reports of 53 service cases were collected and analysed through field surveys, case investigations and questionnaires. The findings revealed the business problems, business components with financial structure of FS collection and transport services. The operation cost structure (7.1 to 13.5 US$/m^3) and net profit ($-65.8$ to 11.1 US$/m^3) comparison results suggested that ownership status was related to business performance. A new conceptual business model for FS collection and transport was proposed, comprising infrastructure, service, customer, finance, legislation and ownership. The proposed conceptual business model, qualitatively tested with cases in Finland, Thailand and Vietnam, proved its applicability to improve the FS collection and transport service efficiency in municipalities of low- and middle-income countries.

Key words | business component, business model, collection and transport, faecal sludge

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INTRODUCTION

Faecal sludge (FS) collection and transport belong to FS management services which are growing spontaneously in municipalities having onsite-sanitation systems. As residential areas usually stretch out, the haulage routes to disposal site tend to be long, leading to uncontrolled FS discharge, which seriously harms human health and the environment through the transmission of enteric diseases (Klingel *et al.* 2002; Strass *et al.* 2006). The causes of these serious problems are inadequate regulatory systems, loose cooperation among stakeholders and lack of FS treatment plants, while private sectors are not well recognized (Koné & Peter 2008). The profile, profitability and business model of FS collection and transport services are not yet well understood (Mbéguéré *et al.* 2010). Although several

studies have aimed to find technological solutions to improve FS collection activities and to optimize the transport routes (Chowdhry & Koné 2012), research from the managerial point-of-view to analyse FS collection and transport services should be an alternative to add more theoretical knowledge to the FS management field.

Recently, a business model approach has been applied to study FS management services (Rao *et al.* 2016); however, the mechanism of FS collection and transport business components have not been articulated. By recognizing opportunities emerging outside the traditional business models, logistics firms must constantly seek new knowledge, 'think for the customer', and anticipate and innovate services to meet customers' evolving

needs (Chapman *et al.* 2003). Business models perform two essential functions: value creation and value capture. Therefore, analysing the business model explains how value is created and delivered to customers (Zott *et al.* 2011). Consequently, this research used a business component analysis approach to describe the operational and organizational service mechanisms, then to propose a conceptual business model with innovative solutions.

There are several available business model concepts such as the business model component (Alt & Zimmermann 2001), the four-box business model (Johnson 2010), the six-component business model (Chesbrough 2007) and the nine-component business model (Osterwalder & Pigneur 2010; Otoo & Drechsel 2018). The nine-component business model was chosen for this study because it has the highest number of components among these other theoretical business models which comprehensively explain all the compartments of a services business. Basically, the nine-component business model concept has studied urban logistics services to which the FS collection and transport services belong. It has also been used to formulate FS management services by Rao *et al.* (2016). For these reasons, by adapting the nine-component business model, this paper demonstrates a comprehensive business component analysis of FS collection and transport services to explain how these services are developed and executed.

The aims of this study are: (1) to classify the FS collection and transport service problems into business problems; (2.1) to analyse business components; (2.2) to compare financial performance among the different services set-up; and (3) to propose a new conceptual business model which can systemize the FS collection and transport services and improve service performance.

METHODS

This study was designed following the ethical guidelines of the Finnish Advisory Board on Research Integrity (Tenk 2009) to study 53 cases in which all the informants understood and gave their consent for purely scientific purposes. Data on FS collection and transport services were collected from employers and employees of a total 52 service cases in Thailand and Vietnam and one case in Finland, in which interviews and questionnaire surveys were conducted separately to cross check data validity. One case in Finland was chosen as a successful FS collection and transport service with a well-defined business model. By random data sampling method to collect the total 53 cases, 6 cases were used only for qualitative analysis; 38 cases were used only for quantitative analysis; and 9 cases were used for both qualitative and quantitative analysis. Qualitative methods were applied to achieve aims 1, 2.1 and 3 and quantitative methods were used with aim 2.2.

Qualitative data were collected through semi-structured interviews with various service stakeholders including owners, operators, truck drivers and authorities from 15 service cases consisting of 4 municipality cases, 2 public companies, 8 private companies with licences and 1 private operator without a licence. The interview questions addressed mainly what the services problems were, how services were planned, deployed and how business performed. PEST analysis (Gupta 2013) was used to classify the service problems into business problems. The nine-component business model (Osterwalder & Pigneur 2010) was applied as a framework to classify business activities into business components. Each business component was described and explained with the comparison among three clusters of services scales.

Quantitative data were conducted to analyse the finance structure. Costs and income statements of 28 service cases in Thailand were collected through questionnaires and 19 service cases in Vietnam were extracted from the report *Landscape Analysis and Business Model Assessment in Faecal Sludge Management: Extraction and Transport models in Vietnam* (Nguyen *et al.* 2011). Financial performance data were compared based on the financial net profit, annual collected FS volume and operation cost structure.

A new conceptual business model was proposed by grouping and connecting the business components. Three levels, high, mid and low, were used to qualitatively assess the business model performance of service cases in Thailand and Vietnam, with reference to the Finland case. More detailed methods are explained in the Results and discussion section.

RESULTS AND DISCUSSION

Business problems of FS collection and transport services

Regarding FS collection and transport services, several environmental and technical problems have been studied (Koné & Peter 2008), but service problems were not well articulated with the business approach. To identify the business problems, this research applied PEST analysis (Gupta 2013) to classify the service problems into political, economic, socio-cultural and technological issues. The business problems are presented in the order of impact levels, from more to less crucial, on service performance as shown in Table 1.

While political and socio-cultural issues come from the external business environment, economic and technological issues are internal business problems of the services. As a part of the sanitation chain, which remains a taboo subject in most cultures (Hutton *et al.* 2014), FS collection and transport services are paid little attention by policy-makers, leading to low levels of service privatization. When public sectors in the two countries neglected to offer a service for customers, the Thailand Government set the ceiling fee tariff for FS services at about 8 US$/m^3 (2014) and based these services on the municipalities, while Vietnam did not set a fee tariff for these services and based these services on the private sector. Using Table 1, the other FS collection and transport service providers can systematically diagnose their business problems then seek the appropriate solutions outlined in the Business component analysis, as shown in the following section.

Business components of FS collection and transport services

As stated in the Methods section, the nine business components were chosen to analyse the data collected from 15 service cases of three countries, presented in Table 2. Each business component of the FS collection and transport services was explained through the service providers' perspective. Key Resource, known as trucks and operators, is the main component to execute FS collection and transport. Key Activity as transport services can be optimized by

Table 1 | Business problems of FS collection and transport services

Political issues	Economic issues
(P1) Lacking national laws, local regulations and overlapping policies lead to ineffective FS collection, transport and disposal activities	(E1) Low investments for trucks and high energy costs increase the operation cost
(P2) Some authorities allow private companies to operate these services even when their municipalities do not offer proper FS treatment plants	(E2) Revenue decreases due to limited numbers of customers, price-dumping from competitors and the increasing FS discharge fee
(P3) Without local monitoring guidelines, several unlicensed service operators disturb the market	(E3) Cost-revenue imbalances make the service unprofitable

Socio-cultural issues	Technological issues
(S1) Society perceives the services dealing with FS as dirty and 'low-level' business	(T1) Internal factors include broken equipment, poor transport vehicle condition and lack of operators' skill that lead to unhygienic practices and occupational hazards
(S2) Since FS collection and transport services are considered as unclean and hazardous jobs, the service providers tend not to commit to long-term working and do not concern the corporate social responsibility	(T2) External factors include difficult accessibility to pit or tank; poor domestic sanitation facilities; long distance to disposal plants and traffic jam
(S3) FS by-products are not widely marketized and used; therefore, FS collection and transport services are not well-developed to engage with FS treatment and reuse business	(T3) Appropriate FS collection and transport logistics technologies are not available or well-implemented

Global Positioning System installed in the trucks (Blackett & Hawkins 2017) to track trucks' location and navigate transport routes. Key Partner or network partnership among small firms was suggested in the oligopoly market where there are several small services. In these scenarios, groups of firms should together form partnerships to utilize their Key Resource, to share Customer Segment and to gain the service association power. Customer Relationship and Distribution Channel can be improved by Customer

Table 2 | Business components' evolution by scale of FS collection and transport services

Business components of FS collection and transport	Service scale, numbers of trucks, truck[a] investment cost (US$)		
	Small, 1 to 2 truck(s), less than $20,000	Medium, 3 to 5 trucks, from $20,000 to $200,000	Large, more than 5 trucks, more than $200,000
1. **Key Resource:** Inputs to operate of services, including hardware and software resources	Limited truck fleets and networks	Truck fleet increases with wider resources	High-tech trucks with various collection operation functions. Skillful staff with better working capacities
2. **Key Partner:** External resources that support the service operation	Limited partnerships and focus on internal resources	Partnerships among firms to form co-operative service provider networks	Partnerships with truck providers and treatment plants to treat FS for by-products
3. **Key Activity:** Key role to produce the proposed value	Only FS collection and transport services	Diverse services related to FS management and after sale services	Full range of FS, waste management and sanitation services for key customers
4. **Value Proposition:** Value that the services propose and deliver to the customers	Basic value is proposed for customers: collection and transport FS	Improved value with added pre-services and after sale services	High proposed values with diverse services: scheduled FS services with sanitation and hygiene services
5. **Customer Segment:** Types of customers that services serve	The main market is private households	Markets are private households and public buildings	Various markets: domestic, public areas and industrial zones
6. **Distribution Channel:** The way the service operators reach and bring service to their customers through online and offline methods	Limited communication tools without brand	Telecommunication-based with well-known brand	Information Communication Technology with internet-based and call centre. Eco-friendly and well-known brands
7. **Customer Relationship:** Interaction between the service providers and their customers	Loose relationship: Focus to serve customers who need one-time transaction service	Moderate relationship: Find and keep customers	Strong relationship: Apply customer relationship management tool
8. **Cost:** Investment costs and operation and maintenance costs	Cost-driven with optimized operational costs	Cost-driven with shared marketing and operational cost	Value-driven to take advantage of economies of scale
9. **Revenue:** Amount of income earned from customers by providing the services	Revenue fluctuates depending on daily customers	Increase revenues with the frequent customers	Stabilize revenue through key-account and repeated customers

[a]Trucks were brand new or assembled vehicles for FS collection and transport purposes.

Relationship Management (CRM) tools, which could reduce and exclude the illegal unlicensed operators. Especially in Vietnam, there were co-operative organizations supporting the small services for truck licensing and maintenance.

It can be stated from Table 2 that Key Resource, Key Partner and Key Activity were the key business components to improve the service efficiency. FS collection and transport business components have evolved tremendously by the technological innovation among large-scale services.

Since Diener *et al.* (2014) suggested Value Proposition for FS management as 'Resource recovery', this study also confirmed that Value Proposition was a prominent driver to improve FS collection and transport service quality. However, in the case of Thailand and Vietnam, Value Proposition was not well-recognized by most customers, who preferred low-cost services, so FS collection and transport services were more cost-driven than value-driven as a result. Meanwhile in Finland, there were compulsory requirements for de-sludge frequency so most of the

Customer Segments were more willing to pay for value-driven services.

The data in Table 2 also show that larger firms have more diverse Customer Segments and Distribution Channels. This study found that very small service cases with less than three trucks were less evolvable and sustainable, and similar results were found by Chowdhry & Koné (2012) and Hawkins & Muxímpua (2015). Cost was decreased by service economies of scale and Revenue was increased by economies of scope. To take advantage of the economies of scope and scale, firm mergers and acquisitions were the development trends when small firms merged together to form larger firms, or larger firms acquired the smaller ones, then become dominant service providers.

The field investigations in the three countries confirmed that, besides the nine business components, FS collection and transport services were affected by two other components, Legislation and Ownership, which varied according to country development, as shown in Table 3. While Legislation for FS collection and transport services in Thailand and Vietnam were still neglected, Finland has formulated very strong regulatory systems. Clear legal and regulatory systems enabled FS collection and transport service performance with a fair competition

environment under a market-driven economy. Monitoring activities were very important to ensure that business laws were obeyed by all service operators. Although most cases in Thailand were structured under a municipal set-up, the Vietnamese authorities fostered the private sectors to handle these services and the Finnish system promoted public and private limited companies. Table 3 demonstrates the Legislation development and Ownership types in three different contexts of high, middle and low-income countries. Ownership of the FS collection and transport services varied among the three countries with key types: common, collective or private owners according to the countrys' legislation rules. The business ownership types were defined based on the owners of stocks of business property such as joints stock or limited company. Vietnam had a special model named 'Co-operative organizations' gathering together small service providers while in Thailand FS services are still run by local administrative organizations.

Recognizing the need for legislation improvement, Vietnam's government has issued Decree 80/2014/ND-CP and the Thai Ministry of Public Health has issued guidelines on FS collection and treatment (Taweesan *et al.* 2017) to regulate the management of sludge from water drainage

Table 3 │ Extended business components of FS collection and transport services

Extended business component	Country		
	Finland	Thailand	Vietnam
10. Legislation: Legal frameworks and regulations for FS services	Ministry of the Environment clearly defines septic tank sludge as municipal waste required to be collected and transported to treatment plant. There are clear regulations concerning punishment of harming environment activities. European Commission guides the disposal and recycling routes for sewage sludge (Government decree on waste 2012)	Ministry of Public Health supervises the FS practice by providing the regulations, criteria, provision, service fee and licensing. There are standards or guidelines on FS management practices monitoring or enforcing punishment as the human excreta management regulation is not clear (Suebsoh & Charerntanyarak 2009)	Ministry of Construction is responsible for establishing and implementing policies on sanitation and wastewater infrastructure which do not mention the FS collection and transport service. There are penalties for illegal FS dropping or not maintaining hygienic conditions during transport routes (Nguyen *et al.* 2011)
11. Ownership: Capital and asset owners who keep the most significant roles in the services management	Public company: Limited and joint stock. Private sector: limited company	Local administrative organization (city, town, sub-district municipals). Private sector: Licensed and unlicensed limited company	Public company: Limited and joint stock. Licensed and unlicensed limited company. Co-operative organizations

systems, septic tanks as well as the reuse of faecal sludge. The information in Tables 2 and 3 suggest that no typical business models could be best fitted to every service, so the 11 business components of FS collection and transport services should be modified or adjusted to adapt to local situations. To sustain the business profit, Cost and Revenue needed to be optimized, hence financial analysis was applied and demonstrated the identity of which components mainly impacted on service efficiency.

Financial data of FS collection and transport services

Net profit and cost structure are two financial performance indicators of FS collection and transport services. Collected income statement data of 28 cases in Thailand and 19 cases in Vietnam were calculated by Equations (1)–(4), to compare net profits and annual collected FS amounts among cases according to ownership charted in Figure 1(a) and 1(b).

$$\text{Net Profit} = \text{Revenues} - \text{Costs} \tag{1}$$

$$\text{Revenues} = \text{FS volume} \times \text{FS collection fee rate} \tag{2}$$

$$\text{Costs} = \text{Truck cost} + \text{Operating costs} \tag{3}$$

Truck cost = approximately 20,000 US$/truck with 10% annual depreciation

$$\begin{aligned}\text{Operating Costs} = &\text{Personal cost} + \text{Fuel cost} \\ &+ \text{Maintenance Cost} \\ &+ \text{LicensingFee} + \text{Other costs} \end{aligned} \tag{4}$$

- Personal costs = No. of truck × [(No. of truck driver × wage × working day) + (No. of truck assistant × wage × working day)] + (No. of officer × Salary)
  (From the field surveys, in general, each truck was operated by one truck driver and one assistant.)
- Fuel cost = (Travelling distance × Fuel consumption) × Fuel rate
- Maintenance = 1.08 × Fuel cost (this maintenance cost is based on Thailand Development Research Institute, 2015)
- Other costs = Mobile phone, Advertising, etc.

Within each country, the net profit per cubic metre and the annual amount of collected FS were charted and arranged from negative to positive profit order to compare the financial performance among the service cases according to their ownership status. The case names were coded based on ownership status: the cases with the prefix A, B, C and P were in public ownership and the cases with the prefix D and H in private ownership. The profitability and the annual collected amount were placed together in the same chart aiming to illustrate the correlation between these two indicators.

Regarding net profit and ownership status, all negative profit cases were administrated by public sectors while all positive profit cases were in private ownership. The normalized net profit per collected FS cubic metre ranged from US$ −35.3 to 9.4 and from US$ −65.8 to 11.1 in Thailand and Vietnam, respectively. This large profit differential was due to the service operation efficiency according to the ownership status. While public sectors operate their services as their compulsory utility duty for their municipalities, the private cases run their businesses to serve customers for profitability. The negative net profits occurred significantly in the public cases in both Thailand (municipal services) and Vietnam (public firms) due to business components 5 and 6 (Table 2) in which the Distribution channels and Customer relationships were less developed. On the contrary, the private cases received positive net profits because they were more efficient in business component 3 (Key Activities) with higher amounts of collected FS. None of the private cases have negative profits even without subsidization budgets from the governments.

In terms of net profit and annual collected FS amount relationship, Figure 1(a) and 1(b) show that the cases with higher FS collected amounts tended to have higher positive profits, such as D1, D2 HCM05 and PHCM01. Only case D4 with an extremely high annual collected FS amount (70,200 m^3) has a moderate net profit (US$ 0.8/m^3). The highest negative profit cases in both Thailand and Vietnam (B13 and PHN01) had collected the lowest annual collected FS amount. It can be confirmed that a sufficient collected FS amount can lead to a positive net profit and an insufficient amount is the cause of profit loss.
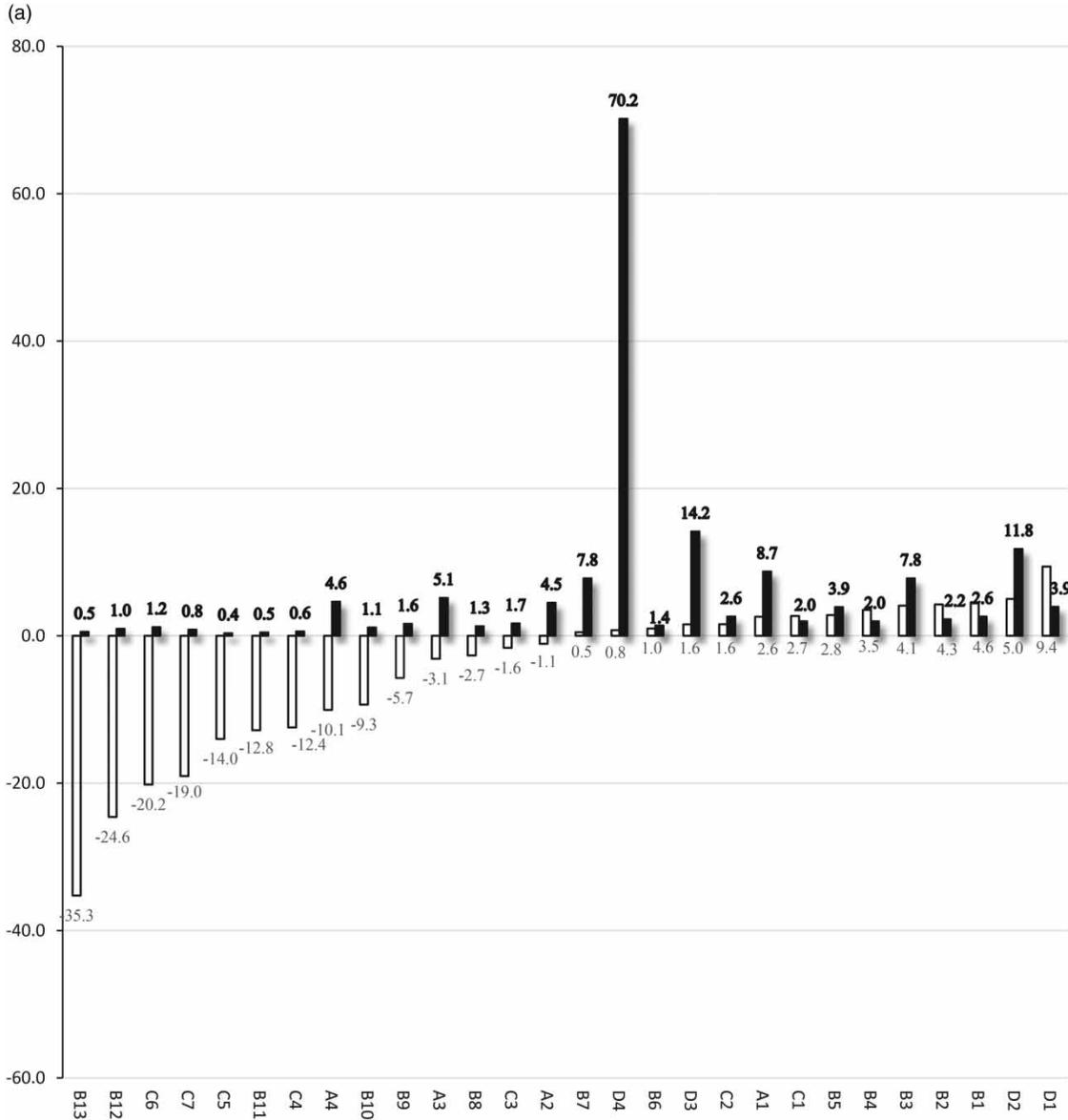
Figure 1 │ Net profit per 1 m³ collected FS (US$/m³), annual amount of collected FS (1,000 m³) and ownership for (a) Thailand cases and (b) Vietnam cases. In (b) the primary data were extracted from the Landscape Analysis and Business Model Assessment in Faecal Sludge Management: Extraction and Transport models in Vietnam (Nguyen *et al.* 2011). A: city municipals, B: town municipals, C: sub-district municipals, D: private companies. Prefix cases starting with P are public firms, the others case are private firms; HN: Hanoi city, HP: Hai Phong city, HCM: Ho Chi Minh City. ☐ Net profit per 1 m³ FS collected (US$) ■ Annual collected FS volume (1,000 m³). (*Continued*.)

There was no clear relation between annual collected FS amount and ownership status. The annual collected FS amount could fluctuate due to service operation, customer rate and vehicle numbers and sizes. The optimum collected FS amount depended on the operating cost. Detailed breakdowns of operating costs of FS collection and transport per 1 m³ for public and private firms were analysed to identify the main costs, as shown in Figure 2.

It is interesting to note the similarity of the operating costs in the two countries for Vietnam's public firms – 13.4 US$/m³, private firms – 7.3 US$/m³ and Thailand's municipalities – 13.5 US$/m³, private firms – 7.1 US$/m³. Personnel cost absorbed the biggest proportion with fuel cost the second proportion, while maintenance, licensing and others were less. To deliver the services, public firms and municipalities incurred more costs
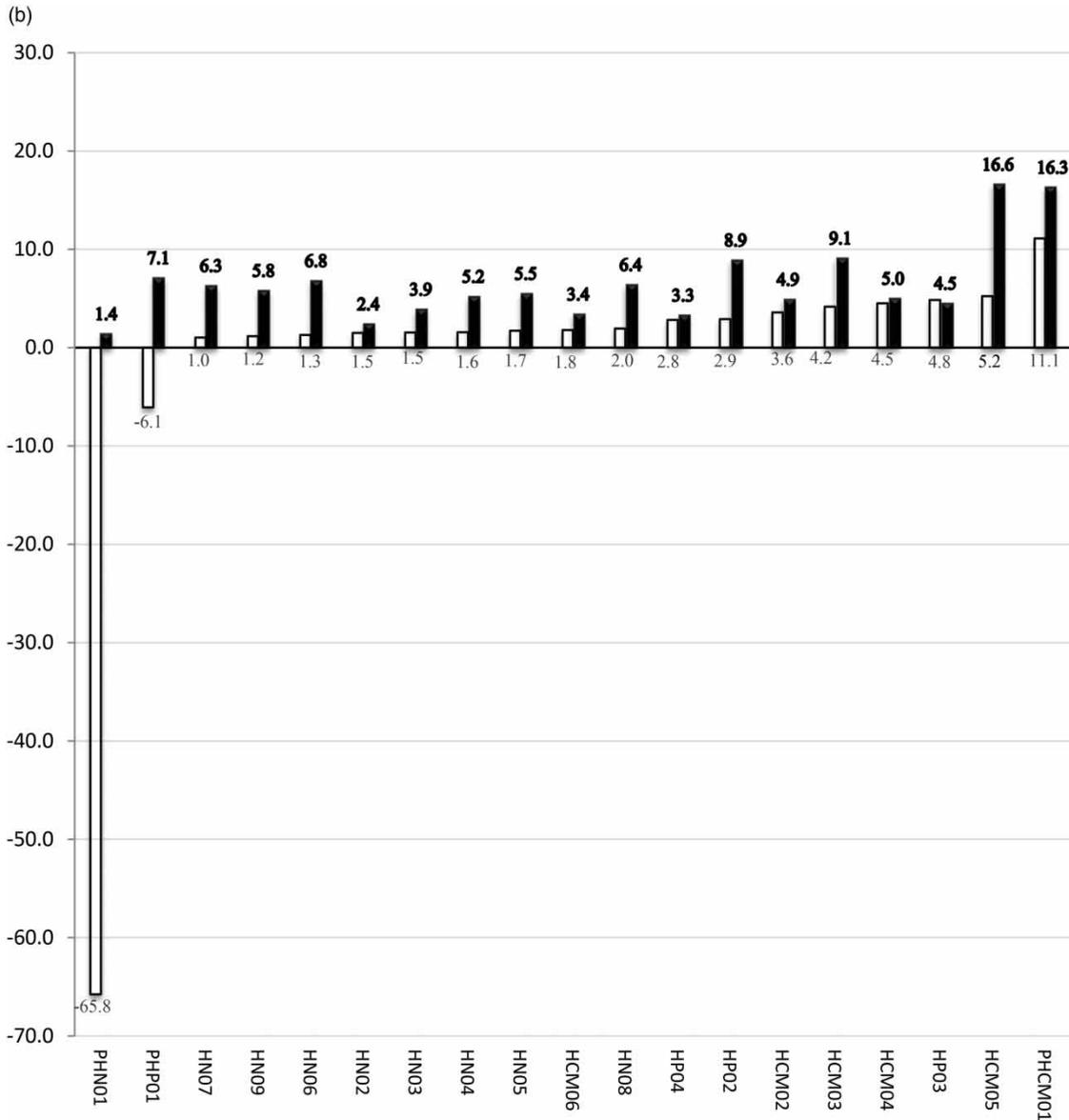
(b)

Figure 1 | Continued.

than private firms due to higher personnel costs. This result confirmed the ownership status (business component 11, Table 3) of service organization affecting the service cost. Due to lower numbers of administrative staff, lower personnel costs and fuel usage efficiency, private firms could incur less costs than public firms. These findings about operation cost structure are similar to the annual operation and maintenance costs for FS emptying businesses in South-east Asia (Rao *et al.* 2016).

New conceptual business model of FS collection and transport services

The business model is a managerial tool for FS collection and transport service providers to organize operational activities based on clearly defined ownership under the laws, regulations and monitoring guidelines. Figure 3 proposes the new conceptual business model of FS collection and transport services which was adapted from the nine-component business model (Table 2) and the two extended
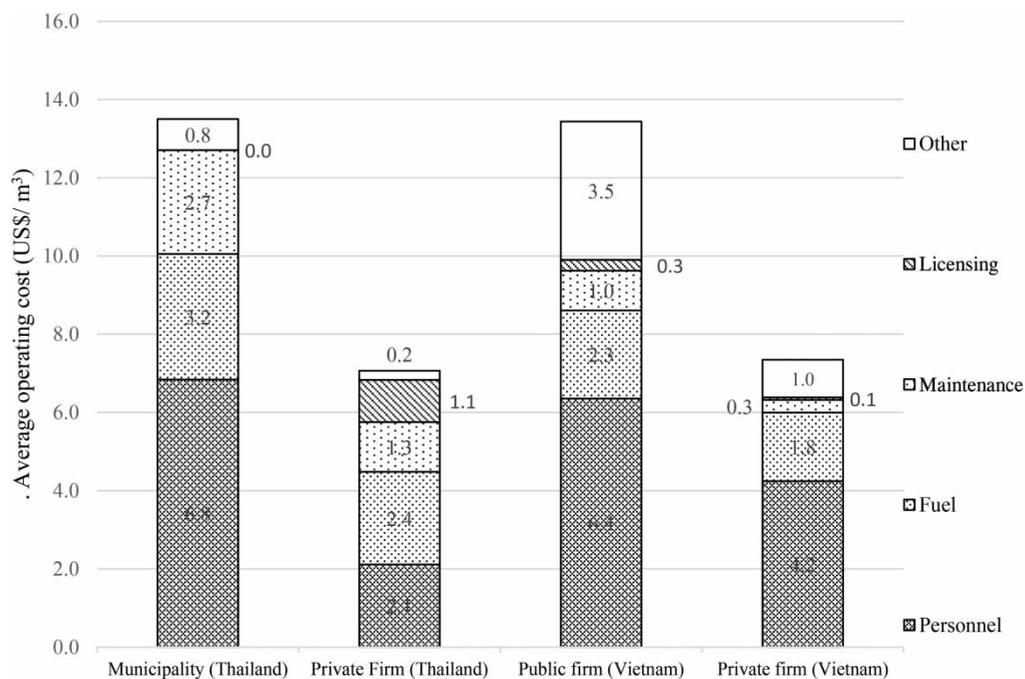
Figure 2 | Average operating cost for 1 m³ FS collection and transport (US$/m³).

components (Table 3). The nine business components are arranged into four key business component groups: Infrastructure, Service, Customer and Finance with two external components: Legislation and Ownership.

The arrows in Figure 3 show the relationship pathways that link the business components among groups. Within the Infrastructure group, Key Resource combines with Key Partner to produce the Key Activity. Key Activity is transformed into the Service, which is then proposed to the Customer based on Customer Segment. Service is delivered to the customers through the Distribution Channel and Customer Relationship. The Finance group consists of Cost and Revenue components. The mutual relationship of Cost and Revenue produces profit or loss for the service providers. The Infrastructure creates Cost while the Customer rewards the Revenue and Value Proposition is the key component to produce the loss or profit. Legislation and Ownership affect whole business operations as Legislation creates the law and regulation platforms for business owners to follow while Ownership defines the right of possessing the services. This new conceptual business model was formulized and dedicated for FS collection and transport services. The same as every service business, these

service business models undergo three stages of evolution: self-optimization, development and innovation. Business model and FS management innovation (Blackett & Hawkins 2017) are the key forces for every operator to leverage their services to thrive and compete in competitive markets.

Business model performance indicators for FS collection and transport services

The new conceptual business model was used to assess the FS service performance of the representative cases by ownership types in three countries. Developed and adapted from the effective faecal sludge management measures (Taweesan *et al.* 2015) and City Service Delivery Assessment scorecards (Blackett *et al.* 2016), five performance indicators were: Environmental Code-of-conduct (Infrastructure), Service Efficiency (Service), Customer Satisfaction (Customer), Financial Success (Finance) and Corporate Social Responsibility (Legislation and Ownership). The data utilized in assessing the FS service performance were based on the analysis results from field investigations, surveys, questionnaires and literature reviews. The levels of indicator were
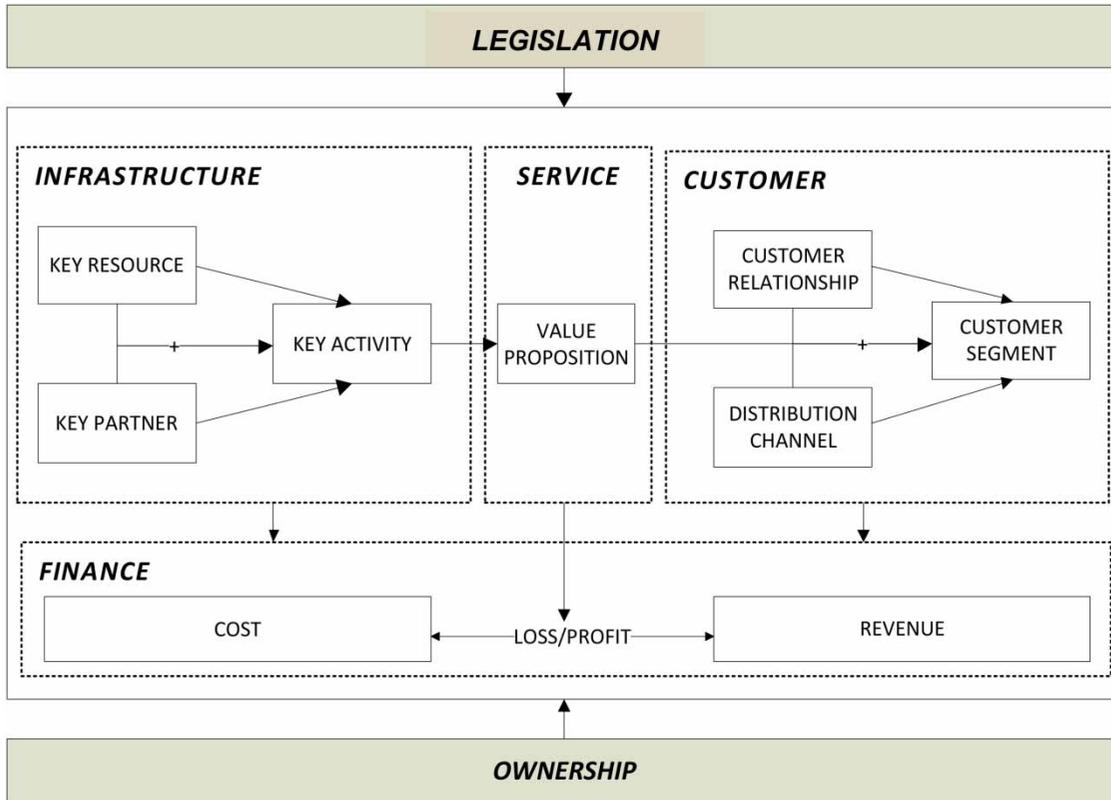
Figure 3 │ New conceptual business model of FS collection and transport services.

qualitatively ranked as high, mid and low, which generally indicated the service performance. The quantitative assessment Likert scales will be developed and conducted in the coming research.

The results shown in Table 4 are qualitative testing of the proposed conceptual business model (Figure 3) which

indicate its applicability for improving the FS collection and transport service performance. Due to the well-structured business model, all five business performance indicators of service cases in Finland were evaluated to be high. In general, due to the Infrastructure set-up, Thailand's municipal services and Vietnam's public firms had mid-level

Table 4 │ Performance indicators for FS collection and transport services

Business model performance indicator (Key business group)	Finland Public joint stock company	Thailand		Vietnam	
		Municipality firms	Private firms	Public firms	Private firms
1. Environmental Code-of-conduct (Infrastructure)	High[a]	Mid[b]	Low[c]	Mid	Low
2. Service Efficiency (Service)	High	Mid	High	Mid	High
3. Customer Satisfaction (Customer)	High	Mid	Mid	Mid	Mid
4. Financial Success (Finance)	High	Mid	High	Mid	High
5. Corporate Social Responsibility (Legislation and Ownership)	High	Low	Low	Low	Low

[a]High: Fulfilling rules and regulations of the country or municipality, customer expectation, efficiency and financially profitable.
[b]Mid: Fulfilling few rules and regulations of the country or municipality, customer expectation, efficiency and cost and revenue balance.
[c]Low: Not fulfilling rules and regulations of the country or municipality, customer expectation, efficiency and financial loss.

Environmental Code-of-conduct and Service Efficiency, higher than the private firms. The private firms could perform better than the public firms because they optimized the business components and followed the pathway list in the conceptual business model. The Customer Satisfaction indicator was mid for Thailand and Vietnam cases, while the Cooperate Social Responsibility was low.

As the core aim of the business model revolves around revenue maximization and cost minimization through an optimal value-proposition mechanism, financial success is the service sum-up positive profit amount when balancing cost and revenue. Customer satisfaction ensures revenue flow with service efficiency and the service providers must perform social responsibility and commitment to the environmental and business legislation. The evolutionary trend for FS collection and transport services should follow the business model by minimizing operation cost and increasing revenues with full ranges of services. While public sectors have better capital investment flow and the private sectors have dynamic innovations, the public–private partnership (Nguyen *et al.* 2011) is a potential model for both sectors to utilize each sector's advantages.

CONCLUSIONS

Based on the results obtained from this study, the following conclusions are made according to the research aims:

- The FS collection and transport service problems were classified into four issues, political, economic, social and technological, in which the FS service providers could identify their own business problems and seek appropriate solutions.
- From the analysis of service cases in Finland, Thailand and Vietnam, FS collection and transport services were found to consist of nine business components and two extended business components.
- From the financial analysis, Ownership appeared to be the main factor impacting on the net profit of FS business services in which private firms could incur more positive profits than public firms.
- A new conceptual business model of FS collection and transport services was developed which encompassed

11 business components and comprised the pathway for operation. Qualitative testing of the new conceptual business model with cases from three countries showed its applicability in improving FS collection and transport performance services.

This research recommends further studies should be undertaken on FS collection and transport services regarding the relationship between the optimum service scale (numbers of trucks), the most significant business components and the service profitability. Moreover, quantitative testing on the conceptual business model should be studied in other countries.

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