

Faecal sludge emptying services in Trinidad

FAECAL SLUDGE EMPTYING SERVICES IN TRINIDAD

by

Shervon Ifill

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Supervisor: Sam Kayaga BSc Eng (Mak), MSc, PhD (Loughborough), MSC DevMgmt
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Water, Engineering and Development Centre

School of Civil and Building Engineering

Abstract

Onsite sanitation facilities meet the sanitation needs of 2.7 billion people worldwide and the number is expected to increase to 5 billion by the year 2030. In Trinidad and Tobago (T&T) 70% of the population needs are met by on-site sanitation facilities which are predominantly toilets draining to septic tanks. Despite a high percentage of households in T&T have 'improved' sanitation facilities, the management of faecal waste downstream of households is severely neglected. Therefore, this research study focused on the first two stages of the Faecal Sludge Management (FSM) service chain (storage and emptying) by exploring the challenges encountered by faecal sludge emptying service providers in Trinidad as well as determined factors of households' satisfaction with emptying providers' services. The study used an exploratory qualitative case study research approach, and applied qualitative and quantitative data collection sources. Both public and private emptying providers' had an equal chance of being hired in Trinidad. The lack of safe and adequate faecal sludge disposal facilities and frequent truck downtime were the main challenge for public FS emptying providers in Trinidad. From the household survey respondents satisfaction scores were highest for: the time taken to clean their septic tank; a clean service; the ease of accessing the septic tank; and the equipment used, while the price charge for emptying and the time taken for the provider to respond after an appointment was made, were the lowest scored satisfaction factors. In T&T, FS is not managed, budgetary investments towards onsite sanitation are almost invisible, and the population is unaware of the implications and importance of safe faecal sludge management. A vital recommendation aimed at addressing Trinidad's FSM problems involves the participation of a committed local organisation that is willing to champion sanitation through appropriate budget allocations and establishing an enabling environment that supports all the stakeholders involved.

Keywords: faecal sludge, emptying, service providers, household, household surveys and urban

Executive Summary

In 2012, the number of people living in urban areas that have gained improved sanitation facilities since 1990 was 2.1 billion, thus onsite sanitation facilities meet the sanitation needs of 2.7 billion people worldwide and the number is expected to increase to 5 billion by the year 2030 (WHO/UNICEF, Joint Monitoring Partnership for Sanitation (JMP), 2015 and Dietvorst, 2012).

In Latin America and the Caribbean (LAC), 106 million people are without improved sanitation. Arroyo, (2010) UN-HABITAT report for LAC indicated that sanitation access in Bolivia, Nicaragua and Haiti were extremely low, adding that water bodies were highly contaminated due to “wastewater treatment being nearly invisible” for the entire region (Arroyo, 2010 p10)

Trinidad and Tobago’s (T&T) sanitation needs are met by 30% separate sewer network systems and 70% onsite (non-networked) systems. In 2011, due to the economic growth of T&T, the Organisation for Economic Cooperation and Development (OECD) removed T&T from the list of developing countries (CCTV.com, 2013), yet they are struggling to manage sanitation since there is a biased towards wastewater management rather than Faecal Sludge Management (FSM), among planners.

The two most common on-site technologies used in T&T are septic tanks and pit latrines, with septic tanks being the predominant technology as they vary in size, construction design, maintenance and location. Faecal sludge emptying services are performed by Local Government Regional Corporations (RCs) and private operators, both of whom are unregulated. The Corporations that have a Cesspool Department provide strictly emptying services to communities for a fee significantly less than what the private operators charge.

After the Beetham Wastewater Treatment Plant (WWTP) (largest in the Caribbean) was constructed (2001-2004), The Water and Sewerage Authority (WASA) in T&T has ever since functionally removed itself as being the primary state-owned agency responsible for faecal sludge (FS) management, especially along the East-West Corridor areas where on-site sanitation facilities are prevalent and the water table is highest. The Solid Waste Management Company Limited (SWMCOL) provides the facilities for public and private operators to dispose of septage, but the enabling environment by SWMCOL’s towards septage treatment and disposal is significantly inadequate.

A national policy for Faecal Sludge Management (FSM) is absent in T&T and no government or state owned entity has neither taken full ownership nor responsibility for the management, monitoring, setting of guidelines and regulation for any part of or the entire service chain; it appears to be managing itself (McCarty, 2016).

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The study aimed at understanding FSM from the household and emptying providers' perspective. It is important to understand all the components of the service chain prior to recommending any development initiatives, because the key to effective FSM is to ensure all the links are strongly connected and there are institutional arrangements to support those services. Hence the research revolved around the following proposition, scope and research direction.

The study proposition: the case study of this research would show that householders are generally satisfied with FS emptying providers operations in T&T, even though the emptying providers are unregulated and the FS disposal site significantly contributes to environmental degradation and public health implications.

Study Scope

- The larger island Trinidad was considered.
- The St Joseph Constituency (SJC) Households.
- The containment and emptying stages of the FSM chain. Due to the fact that Trinidad Cesspit Cleaners (CCs) uses vacuum tankers, aspects of transport and disposal were incorporated.
- HH perceptions of emptying services relating to their level of satisfaction.
- The above surface external characteristics of HHs containment.
- Both private and public CC's perceptions about the challenges of providing emptying services.
- Only septic tanks and pit latrines FS containment were studied.

Main Research Question

How do faecal sludge emptying providers in Trinidad operate and what factors of their services householders' are satisfied with?

Research Objectives

1. To identify what challenges faecal sludge emptying providers' in Trinidad encounter and understand how those challenges influence their services.
2. To identify what factors determine Trinidad householders' satisfaction with faecal sludge emptying service providers'.
3. To propose recommendations that could help bridge current gaps in faecal sludge containment and emptying services in Trinidad.

According to Peal et al., (2014) many 'poor' cities across Africa, Asia and LAC sanitation improvements rely predominantly on FSM, however "few cities have the management structures, institutional arrangements, infrastructure, skills or financial systems to deliver

services and it consequently remains a significant but largely neglected and ignored challenge” (Peal, et al, 2014, p 372).

Data collection methods

The Constructivists (qualitative) applied research was concluded to be the most appropriate approach for examining faecal sludge emptying services, householders’ satisfaction with the services, and the gaps in this stage of the FSM service chain in Trinidad. The study focused on the exploratory qualitative case study research method and used a combination of qualitative and quantitative sources of evidence to collect data as detailed by the experts (Yin, 2009;Denscombe, 2007). Ethical clearance was obtained on the 8th July, 2016 from the Loughborough University, Ethics Approval (Human Participants) Sub-Committee. In order to achieve the objectives, semi-structured interviews, observations, surveys and documentation were the sources of evidence used.

Results

HHs surveys and interviewees responses revealed that septic tanks were the prevalent onsite sanitation facility used in Trinidad. Also majority of septic tanks were built (81%), Rotoplastics (in-situ) septic tanks were infrequent and most standard size septic tanks design complied with the TTBS measurements (4ft x6ft x 6ft).

Among the participants who emptied their septic tanks, 34% hired either public or private operators; one provider was not selected over the other, thus emptying providers were highly visible in Trinidad

The highest scored HHs satisfaction factors were: equipment used (the provider did not use any tools or materials of the client), no mess/leaks or spills (confirming the provider when they said they provide a clean service), time taken to empty the tank (once no clogs 15 to 20 minutes), ease of accessing the tank and the truck capacity to remove all the waste. The price charged (53%) and response time after appointments were made (39%) were scored lowest among the satisfaction factors.

There was a low percentage of emptying among the HHs with 36% of respondents admitting that they emptied their tanks once in the last 10 years (self built tanks had maximum storage, reducing emptying frequency).

Majority of the HHs (34%) did not know where the collected FS was disposed of, while 23% and 27% indicated that SWMCOL and WASA, respectively, were responsible

From the HH surveys 51% of HHs had moderate confidence that the FS was safely and properly treated, 30% had no confidence and 5% had complete confidence. The

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Interviewees major challenge and the aspect of FS emptying services they would like improve were the disposal site and its ability to treat FS.

The faecal sludge treatment facility at Beetham in Trinidad is supposedly three (3) large holes that are poorly maintained and in desperate need of contemporary technologically appropriate upgrades. The state of the facility indicates that FS is inadequately, or not treated at all.

Discussion

Trinidad FS emptying services are plagued with similar shortcoming as developing countries; however, the economic potential of T&T provides an opportunity for them to develop and sustain the FSM service chain. The problems at the containment level involve compliance to building safe technology design, builder's preference, socio-economic individual considerations, rather than a lack of quantity. Although emptying providers are highly visible, they are unregulated and in the absence of a national onsite sanitation policy, their operations are also not monitored. Overall what is lacking in Trinidad is the commitment by an organisation that is willing to champion sanitation by establishing an institution for sanitation where 'the rules of the game can be set' and the enabling environment supports all the stakeholders involved. Finally, the study proposition was accepted since the results findings supported its claim that despite of FS providers being unregulated in Trinidad, HHs were satisfied with their services even at the expense of severe environmental degradation and public health risks.

Conclusion and recommendations

Recommendations

Trinidad and Tobago need to refocus their sanitation efforts towards incorporating budgetary allocation to developing FSM. The establishment of a National Sanitation Committee through which FSM policy, guidelines, regulation and monitoring can be set in place to support FS emptying providers.

Implement a sector-wide education campaign to sensitise the public and the National Planning Committees about FSM. In the absence of an effective onsite sanitation management system, environmental degradation and human health implications would overshadow the country's economic potential, thereby all stakeholders participation towards safe excreta management approaches is vital.

Conclusion

In reiteration, if safe onsite sanitation management is to become a reality in Trinidad, an enabling environment that supports every component of the service chain and their

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stakeholders must be established and the bias toward wastewater investments has to be removed allowing for adequate and appropriate budget allocations to be directed towards developing, enabling and sustaining the fragmented, almost invisible, FSM service chain in Trinidad.

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Certificate of Authorship

I certify that:

- I. I am responsible for the work submitted in this dissertation, and the original work is my own.
- II. I have not submitted this work to any other institution for an award or degree.
- III. Household surveys were carried out by Enumerators residing in Trinidad and Tobago, but interviews by the author.
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List of Abbreviations

CAPEX	Capital Expenditure
CAPMANEX	Capital Maintenance Expenditure
CARICOM	Caribbean Community and Common Market
CARSEA	Caribbean Sea Ecosystem Assessment
CEC	Certificate of Environmental Clearance
CEHI	Caribbean Environmental Health Institute
CEP	Caribbean Environment Programme
CLGF	Commonwealth Local Government Forum
CMOH	County Medical Office of Health
CS	Cesspool Supervisor
CCs	Cesspit Cleaners
EAWAG	The SWISS Federal Institute of Aquatic Science and Technology
EMA	Environment Management Authority
FAO	Food and Agriculture Organisation
FFOS	Fishermen and Friends of the Sea
FGD	Focus Group Discussion
FSM	Faecal Sludge Management
FS	Faecal Sludge
FSTF	Faecal Sludge Treatment Facility
GEF	Global Environment Facility
GDP	Gross Domestic Product
GoRTT	Government of the Republic of Trinidad and Tobago
HH	Household

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HHs	Households/Householders
HDC	Housing Development Corporation
IADB/IDB	Inter-American Development Bank
JMP	Joint Monitoring Partnership for Sanitation
KII	Key Informant Interviews
LG	Local Government
MDGs	Millennium Development Goals
MIN. Env	Ministry of the Environment
MOF	Ministry of Finance
MOH	Ministry of Health
MOLA	Ministry of Legal Affairs
MPU	Ministry of Public Utilities
MPD	Ministry of Planning and Development
MRDLG	Ministry of Rural Development and Local Government
OECD	Organisation for Economic Cooperation and Development
OPEX	Operation Expenditure
PBR	Priority Bus Route
PCC	Private Cesspit Cleaners
PHI	Public Health Inspector
PL	Pit Latrine
PPE	Personal Protective Equipment
PPP	Public Private Partnership
PSIP	Public Sector Investment Programme
RC	Regional Corporation
RCs	Regional Corporations

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SANDEC	The Department of Water and Sanitation in Developing Countries at the SWISS Federal Institute of Aquatic Science and Technology
SDA	Service Delivery Assessment
SDGs	Sustainable Development Goals
SJLRC	San Juan/Laventille Regional Corporation
SJC	St Joseph Constituency
ST	Septic Tank
SWMCOL	Solid Waste Management Company Limited
TCP	Town Country and Planning
T&T	Trinidad and Tobago
THA	Tobago House of Assembly
TTALGA	Trinidad and Tobago Association of Local Government Authorities
TTD	Trinidad and Tobago Dollars
TPRC	Tunapuna/ Piarco Regional Corporation
UN	United Nations
UNEP	United Nations Environmental Programme
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development
US	United States
USD	United States Dollars
WASH	Water, Sanitation and Hygiene
WASA	Water and Sewerage Authority
WCR	Wider Caribbean Region
WWTP	Wastewater Treatment Plant

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WRA	Water Resources Agency
WSP	Water and Sanitation Programme
WSUP	Water and Sanitation for the Urban Poor
WHO	World Health Organisation

Glossary of Terms

Cesspit

An enclosed container used for storing sewage (EAWAG/SANDEC, 2008)

Faecal sludge

The general term given to undigested or partly digested slurry of solids resulting from storage or treatment of black water or excreta (Peal et al, 2014)

Household

A single (one or two storey) house occupied by the homeowner, landlord, or caregiver of the property and their family residing in any of the districts within the SJC and use a septic tank or pit latrine to contain their faecal waste.

Sanitation

The means of collecting and disposing of human excreta and community domestic waste utilizing hygienic methods so as not to endanger the lives of individuals and communities at large (WHO 1987).

Septage

According to Bellagio, (2005) as cited in EAWAG/SANDEC, (2008), septage is the liquid and solid material pumped from a septic tank, cesspool or other primary treatment source (EAWAG/SANDEC, 2008)

Septic Tank

A one-storey chamber or chambers through which sewage flows slowly, allowing the settled matter to be retained and partly digested by anaerobic respiration

Soakaway

A pit through which effluent from a septic tank, (cesspool/ cesspit) or any other primary storage source is allowed to leach into the surrounding soil

Sewer

An open channel or closed pipe that convey sewage (EAWAG/SANDEC, 2008)

Sewerage

The components of a networked system used to collect, transport and treat sewage (EAWAG/SANDEC, 2008)

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Sewage

The mixture of urine and faeces, technically should be called black water (EAWAG/SANDEC, 2008)

1 Introduction

In 2012, the number of people living in urban areas that have gained improved sanitation facilities since 1990 was 2.1 billion. However, in 2015 it was recorded that 2.4 billion people were still without improved sanitation facilities (WHO/UNICEF, Joint Monitoring Partnership for Sanitation (JMP), 2015; Dietvorst, 2012).

In Latin America and the Caribbean (LAC) it was estimated that 106 million individuals are without improved sanitation. Keeping within that region, improved sanitation as well as shared facilities percentages for the period 1990 to 2015 increased from 67% to 83% and 5% to 7% respectively, while unimproved facilities decreased from 11% to 7% and open defecation drastically decreased from 17% to 3% during the same period (WHO/UNICEF JMP, 2015). Overall the WHO/UNICEF, JMP 2015 updated report concluded that LAC met their water target with 35% of the population gaining access to water from 1990 to 2015, but the region failed to meet their sanitation target since 36% of the population gained access to sanitation from 1990 to 2015 (ibid). Arroyo, (2010) UN-HABITAT report for LAC indicated that sanitation access in Bolivia, Nicaragua and Haiti were extremely low, adding that water bodies were highly contaminated due to “wastewater treatment being nearly invisible” for the entire region (Arroyo, 2010 p10).

The WHO/UNICEF, JMP, (2015) reported that improved sanitation facilities include flush/pour flush to: piped sewer system, septic tanks or pit latrines, pit latrine with slab, composting toilet and Ventilated Improved Pit (VIP) latrine, but the extent to which those systems ensure safe management of faecal waste was not factored in. Reports only focused on “containment at the user facility level through ‘improved’ classification”, whereas safe management encompasses just the containment and includes several stages from containment to disposal/end use (WHO/UNICEF JMP, 2015, p52-58). As established by experts, the interlinked relationship between these five (5) key stages: capture, containment, emptying & transport, treatment, and finally safe reuse or disposal constitutes the Faecal Sludge Management (FSM) service chain (Strande, Ronteltap and Brdjanovic, 2014; EAWAG/SANDEC, 2008; WHO/UNICEF JMP, 2015).

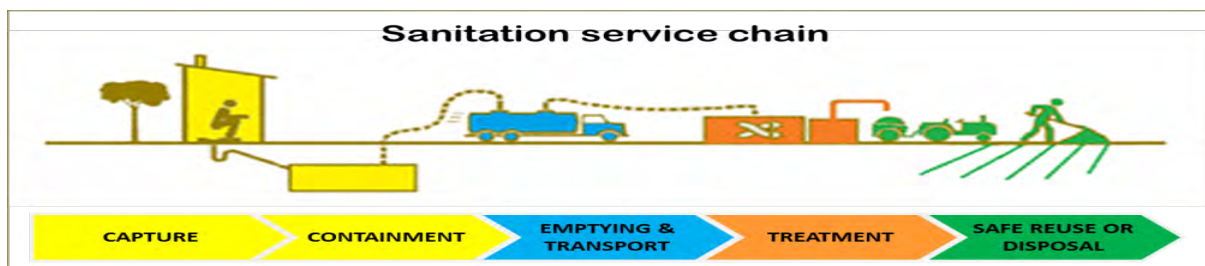


Figure 1 FSM service chain adopted from (Sanford 2015: 1)

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In reports covering LAC, the Caribbean region context is usually masked by glaring statistics of mainly Latin American countries and Haiti, whose populations are extremely larger than other islands. Thereby, the true extent of sanitation challenges, particularly onsite sanitation within low, middle and high income Caribbean islands with smaller populations as low as 10,000 and as high as 3 million, remain undetected. According to the Global Environment Facility (GEF) et al., (2001) as cited in the United Nations Environmental Programme (UNEP)/Caribbean Environment Programme (CEP), (2014-2015) website, 13% of St Lucia's population were connected to a sewer; Antigua and Barbuda was plagued by unregulated human waste disposal and insufficient drainage which caused contaminated cesspools (disease outbreaks risk increased during the rainy season and floods) and 15.6% of the Bahamian population was sewered (UNEP/CEP, 2014-2015).

Furthermore, Forrest, a presenter at the Caribbean Water and Sewerage Association (CAWASA) Inc 3rd Water Conference 2012, indicated that in the Wider Caribbean Region (WCR), "85% of wastewater enters into water sources untreated, 51.5% of households were not connected to centralised wastewater treatment plants and < 2% of urban sewage were treated before disposal" (Forrest, 2012, pp8-9). As a result, such poor practices have been adversely affecting the WCR fisheries industry, coral reefs and the tourism sector. Contrary to poor wastewater management no substantial advancements have been towards developing FSM in the Caribbean.

The Caribbean Sea Ecosystem Assessment (CARSEA) 2007 stated that each year 25 million tourist holiday in the Caribbean. The tourism sector provided 2.4 million jobs in 2004 and contributed US\$28.4 billion to the GDP and US\$19 billion of export services and merchandise. Moreover, the Fishing industry creates an estimated 200,000 full time or part-time Fishers, approximately US\$1.2 billion in yearly export earnings, mainly to the United States (US) and seven percent (7%) of Caribbean people proteins comes from eating fish (CARSEA, 2007 p 16).

Nevertheless, in light of the Caribbean potential economic gains and losses, Caribbean planners and investors continue to neglect the significance of developing, investing and managing onsite-sanitation. They place all their efforts on wastewater management (sewerage systems), which according to Blackett, et al., (2014) research brief, the latter situation is as a result of "a bias towards sewerage over FSM in most policies and projects" among city planners (Blackett, et al, 2014 p1).

In a 1997 Caribbean Environmental Health institute (CEHI) pilot project among thirteen (13) Caribbean Community and Common Market (CARICOM) countries within the WCR, "insufficient time and budget allocation for operation and maintenance, insufficient

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operational support, limited understanding of treatment processes and insufficient process monitoring and use of technologies not adaptive to the Caribbean”, were the main contributing factors (CEHI, 1997 p9) to the Caribbean wastewater dilemmas.

In 2007 a presentation given by CEHI/CARICOM, stated that: the lack of capital investment, lack of ownership, lack of regulations and monitoring regimes, inappropriate wastewater technologies and the use of bucket latrines and traditional pit latrines by some communities, to mention a few, were the prevalent sanitation challenges still plaguing the Caribbean region (CEHI/CARICOM, 2007). Interesting to note, 10 years elapsed between those reports (CEHI 1997 and 2007), issues changed only slightly, investments were made, yet no major progress was realized. What is the root cause of this problem and where does the Caribbean keep going wrong? If the WCR is still grappling to manage an invisible wastewater management system, when will developments into FSM begin?

Peal et al., (2014) said that in developing countries, despite a high percentage of households (HHs) having what the JMP defines as ‘improved’ toilets, “faecal waste downstream of HHs is severely neglected” (Peal, et al, 2014 p 372). In addition to faecal sludge collection and transport activities presenting a unique challenge for urban residents, these services are mostly provided by unregulated, uncontrolled private operators who carry out the duties of the failed public sector providers (Dietvorst, 2012).

The latter dilemmas results in extensive environmental degradation such as the evidence gathered by Burke and Maidens (2004) as cited in CARSEA (2007), which revealed that “the annual value of services provided by Caribbean coral reefs has been estimated between US\$ 3.1 billion and US\$ 4.6 billion, but degradation by 2015 would potentially cost the region between US\$350 million and US\$870 million per year” (CARSEA, 2007 p14).

Thus, by observing what occurs at the containment and emptying stages of the FSM chain in T&T, the findings could ignite the desired FSM development discussions needed to improve water quality (surface, ground and sea), environmental health and reduce public health risks in both T&T and by extension, the Caribbean region.

1.1 Sanitation systems used in Trinidad and Tobago

T&T’s sanitation needs are met by 30% separate sewer network systems and 70% onsite (non-networked) systems. Sewerage (blackwater) is collected, transported, treated and disposed of by Water and Sewerage Authority (WASA) wastewater treatment plants while storm water and drainage are not combined into WASA’s sewer system. In 2011, due to the economic growth of T&T, the Organisation for Economic Cooperation and Development (OECD) removed T&T from the list of developing countries (CCTV.com, 2013) hence one might think that T&T above all Caribbean islands better manages sanitation. Conversely, in

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one of the country's daily news print, a letter submitted to the Editor whereby, the Fishermen and Friends of the Sea (FFOS) group were advocating for the Ministry of Health (MOH) to close Maracas Bay in Trinidad due to raw faecal waste being discharged into the recreational swimming beach. The authors indicated that domestic waste management "is a nationwide and regional crisis as sewage treatment is among the most embarrassing and shameful realities of our public life and a notable shortcoming in our infrastructural planning and priorities from The Bahamas all the way down to T&T" (Beddoe, McLean and Aboud, 2016, p1).

The two most common on-site technologies used in T&T are septic tanks and pit latrines, with septic tanks being the predominant technology and they vary in size, construction design, maintenance and location in relation to the property. The type of emptying performed in T&T is mechanical emptying since vehicles used by both public and private emptying service providers are vacuum tankers. Based on the author's knowledge, manual emptying and open defecation has been disband in T&T so in light of that, it was assumed that neither activity was still practiced.

1.2 Who manages onsite sanitation in T&T?

The WASA Act came into effect on September 1st 1965. The Act consolidated 7 entities into one known as WASA, and was since given the legal mandate to manage water and sewerage in T&T. After the Beetham Wastewater Treatment Plant (WWTP) (largest in the Caribbean) was constructed (2001-2004), WASA has ever since functionally removed itself as being the primary state-owned agency responsible for septage management (see section 2.3.2 for further details), especially along the East-West Corridor areas where on-site sanitation facilities are prevalent.

Households are responsible for securing their own FS containment system usually with little to no oversight by relevant authorities and non adherence to National Standards.

Faecal sludge emptying services are performed by Local Government Regional Corporations (RCs) and private operators. The Corporations that have a Cesspool Department (some are without a cesspool department) provide strictly emptying services to communities for a fee significantly less than what the private operators charge. All revenue generated by the RCs is collected by a system set under the Ministry of Finance rather than the municipality itself.

The Solid Waste Management Company Limited (SWMCOL) provides the facilities for public and private operators to dispose of septage. The extent to which SWMCOL provide an enabling environment for FS emptying services and more so FSM is not well understood.

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Therefore as accurately stated by Peal et al, (2014) many 'poor' cities across Africa, Asia and LAC sanitation improvements relies predominantly on FSM, however "few cities have the management structures, institutional arrangements, infrastructure, skills or financial systems to deliver services and it consequently remains a significant but largely neglected and ignored challenge" (Peal, et al, 2014, p 372).

Therefore, in an attempt to divert T&T planners attention away from solely wastewater management investments and towards developing FSM, the author has embarked upon exploring the topic titled **Faecal sludge emptying services in Trinidad**, using the St Joseph Constituency (SJC) households as a case study.

1.2.1 Study Scope

What is the Problem? Apart from the public and private providers' unregulated FS emptying services being highly visible in T&T, the continual neglect by the relevant entities to provide safe and improved disposal facilities is increasing the adverse risks to human health and contributing to extensive degradation of fragile environments and water pollution across T&T.

Due to the extent of the dilemma, this study was unable to cover all aspects of the FS emptying services throughout the twin island state. As such the following boundaries were the lines in which this study was conducted.

1.2.2 Within Study Scope

- Only the larger island Trinidad was considered.
- The St Joseph Constituency (SJC) Households.
- The containment and emptying stages of the FSM chain. Due to the fact that Trinidad Cesspit Cleaners (CCs) uses vacuum tankers, aspects of transport and disposal were incorporated.
- HH perceptions of emptying services relating to their factors of satisfaction.
- The above surface external characteristics of HHs containment.
- Both private and public CC's perceptions about the challenges of providing emptying services.
- Only septic tanks and pit latrines FS containment were studied.

1.2.3 Outside Study Scope

- The island of Tobago and their on-site sanitation management arrangements
- Buildings that fell outside the researcher's definition of HH
- Financial analyses or the business models used by public and private CCs

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- Other primary containment sources (e.g. privy, compost toilets, open defecation, bucket latrines, pan latrines etc).
- Soakaway systems design, emptying and operation and maintenance.
- Faecal sludge characteristics testing
- Service Delivery Assessment (SDA) of faecal sludge in T&T nor generation of faecal flow diagrams in cities, rural areas and slums.
- In-depth socio-economic status of HHs (salary, items in home, materials used to construct house etc) not assessed in surveys
- Wastewater and sewerage systems (treatment plants, sewers, pipes, planning etc)
- Plumbers, Masons and Contractors knowledge, attitudes and perceptions of containment construction
- In-depth technical assessments of containment design (lined/unlined, baffle wall, single or double compartments, etc).
- Assessment of FSTFs performance (effluent quality testing), cost recovery of the facility in relation to CAPEX, OPEX, and CAPMANEX.
- Value for money assessments and end use/resource recovery of faecal sludge
- Marine sanitation arrangements (e.g. Yacht, ships and other marine transportation vessels) docked on T&T ports or operate within their aquatic borders

1.3 Research Direction

1.3.1 Main Research Question

How do faecal sludge emptying providers in Trinidad operate and what factors of their services householders' are satisfied with?

1.3.2 Research Aim

To explore how faecal sludge emptying services are conducted in Trinidad, together with determining householders' factors of satisfaction with the services and identify current gaps in those stages of the FSM service chain.

1.3.3 Research Objectives

4. To identify what challenges faecal sludge emptying providers' in Trinidad encounter and understand how those challenges influence their services.
5. To identify what factors determine Trinidad householders' satisfaction with faecal sludge emptying service providers'.
6. To propose recommendations that could help bridge current gaps in faecal sludge containment and emptying services in Trinidad.

1.3.4 Specific Research Questions

1. What challenges do faecal sludge emptying service providers' encounter in Trinidad?
2. What factors determines householders' satisfaction with faecal sludge emptying services?
3. What are some gaps in faecal sludge containment and emptying services in Trinidad?

1.3.5 Research Methodology Used

This investigation being the first of its kind in T&T, led to the Constructivists (qualitative) applied research being considered the most appropriate approach for examining faecal sludge emptying services, householders' satisfaction with the services, and the gaps in those stages of the FSM service chain in Trinidad. Sanitation data in T&T is very limited; hence the study adapted an exploratory qualitative case study research method to assess HH perceptions and a combination of qualitative and quantitative data collection approaches were employed.

1.4 Assumptions

The main assumptions the author applied to this study included the following:

- The information presented by WASA, mainly the estimated sanitation coverage (30% sewerred versus 70% non-sewerred) has been based on their most up-to-date records/sampling. Throughout all of WASA's publications no mention was made as to when or how that data was collected or when last it was updated. With ongoing nationwide housing development both regulated and unregulated those percentages might have moved up or down for either onsite sanitation technology used.
- The HHs within the SJC has a fairly good mixture of socio-economic/ socio-cultural areas so that no one group of people or area would be selected.
- The areas to which WASA stated were sewerred, does not cover the entire community but rather a small number of HHs within a defined section of the area were sewerred. For example, WASA indicated that the East/West Corridor is sewerred between Careenage to Mt Hope (see Table 2.3), yet upper San Juan, Aranguez, Petit Bourg to name a few are non-sewerred areas along the East/West Corridor and within WASA's stated sewer bracket.
- Most of the Heads (decision makers) within HHs work between 8:00am to 5:00pm daily hour jobs and they are just as available on weekend evenings. Persons who work shift jobs fell within the Enumerators sampling time.

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- The author assumed that the RC used (e.g. SJLRC or TPRC) did not affect HH satisfaction with the service received.
- Manual emptying does not exist in T&T and all providers used vacuum tankers
- While HHs willingness to pay for emptying services was not assessed, it was assumed that the poor were not isolated from meeting emptying needs (all were included).
- Most HHs within the SJC had their containment emptied at least once.
- The Participants' (mainly HHs) were not too sensitive about the topic under study and as such would not be offended, disgusted or embarrassed to participate by completing the survey, providing honest responses.

1.5 Dissertation Overview

Chapter one: Presents an introduction into the topic under investigation at the global, regional (LAC) and local (T&T) levels, briefly introduces the sanitation characteristics of the T&T and outlines the research direction.

Chapter two: provides a holistic background information on T&T as it relates to its location, climate, local governance, and sanitation to name a few. The institutions with some part to play in onsite sanitation and the major threats poorly managed faecal sludge can have on tourism and fisheries industries were also presented. This chapter aimed to shift the readers mind to the local context of T&T (middle income country) so as to understand part of the numerous on-site sanitation dilemmas this country is faced with and appreciate that T&T should not be painted with same sanitation brush used to paint other developing countries.

Chapter three: Presents the straightforward literature search strategy used by the author, and a review of sanitation from the SDGs all the way through to FS emptying services.

Chapter four: Encompass a detailed presentation about the methodology used to achieve the main research question, aim and objectives. Within this chapter the reader would also have the opportunity to examine the author's justification for adopting aspects of the case study method, rationale for selecting the cases and units of analyses, the data collection sources and actual approaches used, the logistics of the research, the researcher's experience, a brief data collection schedule and the limitations of the data collection process, among other topics.

Chapter five: The reader can find the results of the various data collection sources used beginning with observations (photography), HH survey results and interviewees

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contributions. A brief analysis of the results would also be presented in this chapter by comparing the results between the units of analysis (HH and CC interviews).

Chapter six: The discussion would discuss the research finding on FS emptying services in Trinidad using pre-coded themes as outline in chapter four.

Chapter seven: Will present the conclusion and recommendations of the study. The gaps identified would be the foundation to which the recommendations would be developed.

Beyond chapter seven the reader would have access to view the Referenced sources and examine documents that helped support the author's research in the Appendices section.

2 Country Background

2.1 Introduction

The background of T&T was compiled to illustrate the need for policy makers and planners to address the key areas relevant to on-site sanitation. The reader, upon viewing this section would gain an insight into T&T's location, climate, hydrogeology, politics and local governance, water supply, hazards and sanitation to mention a few. The background information presented would also help the author to justify their reasons, why an investigation into faecal sludge emptying is significantly needed in Trinidad and Tobago.

2.1.1 Location

Trinidad and Tobago is an archipelagic twin island state located at the south-eastern end of the Caribbean chain of islands. T&T, an English speaking republic lies 10⁰ N latitude and 60⁰ W longitude (see Figures 2.1 for islands position identified by the red arrow bottom right hand corner) covering an area of 5,130 sq km with a population density (as of July 2016) of 265.8 people per square kilometre (Water Resources Agency (WRA) and The Ministry of the Environment (MIN. Env.), 2001). The cosmopolitan population to date is 1.3 million with a 0.4% growth rate (Food and Agriculture Organisation (FAO) of the United Nations (UN), 2016).



Figure 2.1 Map of the Caribbean highlighting T&T's southern location. Adopted from (Mappery n.d.)

Trinidad being the larger island has an area of 4,826 km² and Tobago (smaller island), an area of 300 km². Due to Trinidad's south-eastern location, the island as seen in Figure 2.2, is bounded on the north by the Caribbean Sea, the west by the Gulf of Paria, the east by the Atlantic Ocean and the south by the Columbus Channel. However, Tobago, which is about 32 km north-east of Trinidad is separated from Trinidad by a nearly 12 km wide channel called the Tobago Sound (WRA/MIN.Env, 2001).



Figure 2.2 Map of Trinidad and Tobago. Adapted by the Author from (Destination 360, 2016)

2.1.2 Climate

As noted from the WRA/MIN.Env National report, (2001), Trinidad and Tobago has a tropical humid climate characterised by two main seasons, dry and rainy. The dry season extends from January to May, while the rainy season extends from June to December. The islands experience a 'Petit Careme' (short dry spell) for two to three weeks usually in the middle of September to October. The islands predominant North East trade winds bring the heaviest rains to the highland of north-east Trinidad and in Tobago along a south west to north-east axis. The average annual rainfall of Trinidad is 2,000mm and in Tobago it ranges from 3800mm in the Main Ridge to less than 1,250mm in the south-western lowlands of the island. Average minimal temperatures at night are between 22° C and 25° C and maximum temperatures during day are between 29° C and 31° C (WRA/MIN.Env, 2001, p15-16).

2.1.3 Hydrogeology

The WRA national report (2001) said Trinidad, which formed the eastern extension of the South American mainland of Venezuela, is made up of 99% sedimentary and metamorphic rocks, with the freshwater occurring in the sedimentary rocks. Furthermore, Trinidad exploitable freshwater occurs in three main aquifer types: "Alluvial and piedmont gravel fans, sheet or blanket sands and multiple sands" (WRA, 2001, p 21). Tobago's geology is very different from Trinidad, as it is largely composed of metamorphic and igneous rocks (WRA, 2001). There are six major soil types in Trinidad, nine in Tobago and thirteen major land patterns in T&T (Ministry of Agriculture, Land and Marine Resources, 1995).

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2.1.4 Economics

In 2010, the Inter- American Development Bank (IADB) described Trinidad and Tobago as “one of the more prosperous countries in the Caribbean region” (IADB, 2011-2015, p5). The decision made by the OECD to removed T&T from the list of developing countries came as a result of the country’s 2010 US\$20 billion Gross Domestic Product (GDP). However, in 2015 the World Bank listed T&T GDP at US\$27.806 billion (World Bank Group, 2016) and the Central Bank of Trinidad and Tobago, as cited by investTT Trinidad and Tobago (2012) recorded T&T’s 2015 GDP per captia at roughly US\$19,000 (investTT Trinidad and Tobago, 2012). In addition T&T’s non energy specific growth rates include:

- Distribution 3%
- Finance, Insurance and real estate 3.25%
- Construction 4%
- Manufacturing 5% and
- Agriculture 8.5%

Based on the Central Bank of Trinidad and Tobago Annual Economic Survey, (2014), T&T resources range from energy to manufacturing, services and eco-tourism. The major exports include crude oil, liquefied natural gas, and asphalt, petrochemical: methanol, urea and ammonia, while manufactured goods include food and beverages, tobacco, cement and iron and steel to name a few (ibid).

2.1.5 Tourism and Fisheries

Radix, (2013) noted that tourism is a major contributor to the twin island T&T, particularly Tobago’s economy; therefore, the economics behind the industry and the environment are very much connected (Radix 2013). For example the World Resource Institute as cited in IADB (2008) report and Radix (2013) indicated that tourism and the fishing industry contribute approximately half of Tobago’s GDP: tourism and fisheries benefits tally US\$ 100 million/year and US\$1 million respectively (Radix, 2013).

Therefore, T&T’s failure to prevent the untreated and uncontrolled effluent discharged into water sources (WRA, 2001) has the potential to adversely impact their fisheries (increased socioeconomic problems); tourism industry (unsafe beaches along with biodiversity depletion); public health (re-emerging/emerging infectious diseases) and the substantial increased cost of treating potable water.

2.1.6 Politics

Trinidad and Tobago has a parliamentary democracy and is an independent republic state with the highest office being held by the President. Executive power lies with the Prime Minister and his/her cabinet. Elections are held every five years. According to the

Commonwealth Local Government Forum (CLGF), 2016; Trinidad and Tobago country profile document describes the state as a unitary republic country that has a bicameral parliament: a central and local government. The central government makes significant contributions to public sector investments while local government has little own-revenue generating capacity (CLGF, 2016). The current status of local government is under revision and with the forthcoming local elections scheduled to be held in 2016, local government reform attest to give more powers and revenue generation to the local municipalities, ultimately improving their ability to provide a more efficient service to the communities they serve (ibid). How the reform will influence local municipalities in FSM has not been mentioned in any of the government public consultations held throughout T&T in 2016.

2.1.7 Local Governance

In reference to the CLFG Local Government Trinidad and Tobago report (2016), The Tobago House of Assembly (THA) functions using the local government THA Act 1996 legislation as that arrangement has been enshrined within the constitution of T&T. Local Government in Trinidad currently has no specific constitutional provisions, but as stated earlier, with local government reform the situation is said to change.

The Ministry of Rural Development and Local Government (MRDLG), formerly (the Ministry of Local Government) oversees the fourteen (14) municipalities in Trinidad (2 cities, 3 Boroughs and 9 corporations), while the THA reports directly to the Office of the Prime Minister. The Boroughs are mainly self govern administrative entities that even after colonialism, remained visible in T&T, while the Regional Corporations are local government bodies with limited autonomy as their administration are govern by the MRDLG. It should be noted that local government reform is forthcoming in the October/November 2016 local government elections, resulting in a change in local government governing autonomy.

The MRDLG main functions in relation to the corporations include: monitoring, evaluation and adjudication, drafting legislation relevant to local government, developing policy frameworks and overseeing central government financial transfers, to mention a few, but no clear role in overseeing public or private FSM services (CLGF, 2016; Government of the Republic of Trinidad and Tobago (GoRTT, 2008-2013). In T&T sanitation does not have a defined 'home' but rather its administration unfortunately shifts from state-owned entities to ministries, without any clear-cut management especially after general elections. Although one might think the MRDLG should be at the forefront of overseeing on-site sanitation services, no true management of sanitation occurs.

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T&T's municipalities, electoral wards and population densities

Municipality Corporation	Local areas (Electoral wards)		Population (2011 census)
Arima (Borough)	7		33,606
Chaguanas (Borough)	8		83,516
Couva/Tabaquite/Talparo	13		178,410
Diego Martin	10		102,957
Penal/Debe	9		87,392
Point Fortin (Borough)	6		20,235
Port of Spain city	12		37,074
Princess Town	9		102,375
Mayaro/Rio Claro	6		35,650
San Fernando city	9		48,838
San Juan Laventille	13		157,258
Sangre Grande	8		75,766
Siparia	9		86,949
Tunapuna/ Piarco	15		215,119
Total Trinidad	14	134	1,267,145
THA	1	12	60,874
TOTAL	15	146	1,344,000

Table 2.1 Adopted from (CLGF 2016: 2)

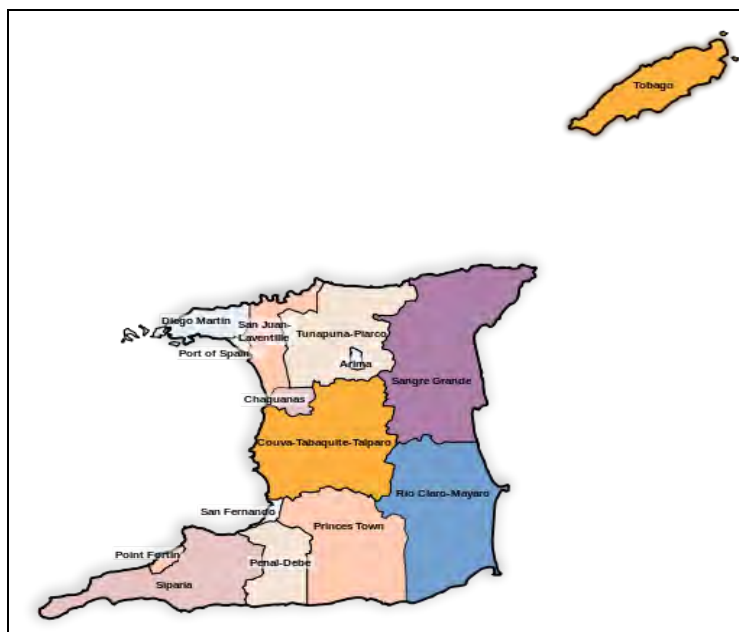


Figure 2.3 Map of municipalities boundaries in T&T

Adopted from (Caribbean Local Economic Development Project (CARILED) 2015)

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2.1.8 Roles and responsibilities of local municipalities

Proceeding out of the Municipal Corporation Act 1990, all corporations have the same powers and responsibilities and were empowered to make policies and by-laws relating to their functions in their local areas. The RCs receives government transfers upon submitting a yearly budget. Resources (equipment, trucks etc) used by the RCs (excluding the Cities and Boroughs) for FS emptying services are acquired strictly by a tendering process. Faecal sludge management falls outside the responsibility of the RCs so they too are void of budgetary allocations and FS development strategic plans within their Corporation's annual investment plans.

The THA, since it is an executive council is responsible for managing Tobago affairs. Tobago is therefore divided into seven (7) parishes: St Andrew, St Mary, St John, St David, St George, St Paul and St Patrick (NALIS, 2016). The THA has "33 areas of responsibility, with the most relevant municipal sanitation services in the areas of the environment, infrastructure (including public utilities), land and marine and tourism" (Louis, Magpili and Singleton, 2005, p4).

The following are some municipal roles and services as outlined by the Tunapuna/Piarco Regional Corporation (TPRC) webpage; the same applies to the other corporations in Trinidad.

Roles include, among others:

- Distribution of truck-borne water
- Maintenance of recreation parks, grounds, beaches, and public spaces
- Provision, maintenance and control of all the corporation's buildings
- Garbage disposal from public and private property, the development and maintenance of sanitary landfills, chemicals treatment for insect and vector control, abatement of public nuisances and dissemination of information for primary health care
- Management of retail produce market and the operation of markets and abattoirs

Services include among others:

- Processing food badges
- Emptying of septic tanks and cesspits
- Construction and maintenance of Pavilions
- Resurfacing of roadways
- Cleaning/clearing of drains (TPRC, n.d)

As communicated to the CLGF by the Trinidad and Tobago Association of Local Government Authorities (TTALGA), municipalities are responsible for collecting revenues; however, the majority of funding comes from central government transfers (CLGF, 2016). According to the Ministry of Local Government communication with CLGF as cited in the T&T CLGF (2016) report, the 2010/2011 fiscal period Trinidad municipalities “received \$1,147.8 TTD million in central-local transfers”. The THA receives a large part of its income from central government (4-7%) national budget (CLGF, 2016, p3).

2.1.9 Hazards

Collymore (2011) as cited by the Office of Disaster Preparedness and Management (ODPM) (2012), described T&T as having a ‘multi-hazardous’ environment owed to its geographical location, topography and geology, of which are said to encourage and promote flooding, tropical storms and landslides throughout the country (ODPM, 2012). Additionally, anthropogenic factors like rapid improperly planned urbanisation, squatting (unregulated housing), and growing industries (petrochemical) increase the hazardous occurrences in T&T. Further, the ODPM (2010) said Earthquakes, oil spills and Volcanoes (Mud) are also hazardous to the country, as case in point being the major eruptions of the Piparo Mud Volcano in 1997, which caused severe damage to surrounding communities (ODPM, 2012). Earthquakes occur frequently in T&T (some 5.0 and above on the magnitude scale) but no catastrophic damage has been realized.

According to the ODPM (2010), Trinidad experiences continual perennial flooding in both urban and rural areas, particularly flash-flooding along the East-West corridor (see figure 2.2, red arrow for an illustration of the boundaries of the east/west corridor which spans from Chaguaramas (not seen on map but after Port of Spain) in the west to Matelot in the east). They added that major contributors of flooding are “intense rainfall, illegal dumping of garbage into surface water ways, deforestation, and poor drainage” and infiltration zones (ODPM, 2012, p16). Flooding being a frequent occurrence causes substantial loss of property, health problems, crop damage and inconvenience of entire communities (WRA, 2001), yet this area is only partially sewered in spite of the growing number of uncontrolled squatting development homes being constructed by T&T nationals.

2.2 Water Supply

The consolidated state-owned entity WASA, was established by an Act of parliament in 1965 where seven (7) agencies: The Water and The Sanitation divisions in the Ministry of Public Utilities (MPU), County Councils, Arima Borough Council, Port of Spain City Council, The San Fernando Borough Council and The Water Distribution Authority were merged to form WASA (WASA, n.d).

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The main sources of water managed by WASA include:

- Surface; rural intakes, springs and impoundment reservoirs (60%)
- Groundwater; aquifers (28%)
- Desalinated water (12%) (WASA, n.d)

According to WASA and other national reports, the primary surface water sources in T&T are Caroni, North Oropouche, Navet, Ortorie and Hillsborough rivers, while major aquifers that supply groundwater are Northern Valley alluvial deposits at Chaguaramas, Tucker Valley, Diego Martin, alluvial fan deposits at El Socorro, Valsayn, Tacarigua and Arima, the artesian aquifer in the Sum Sum at Durham sands, reef limestone of the Central Range and sands the Erin and Mayaro formation of Southern Trinidad (WASA, n.d; FAO/UN, 2015 and WRA, 2001).

With reference to Genvar, (2011) as cited in a WASA/WRA (n.d) presentation, approximately, 94.7% of Trinidad population and 84.8% of the Tobago population is provided with piped water supply (See table 2.2), but only 16.6% of Trinidad and 39.6% of Tobago has 24 hour water supply (WASA/WRA, n.d).

In 2011, the FAO/UN (2015) report stated that, the water withdrawal in Trinidad was estimated at 383.3 million m³ of which 62% was municipal use, 34% industrial use and 4% agricultural. Of that total withdrawal, 60% was from surface water, 28% from groundwater and 12% desalinated water. Additionally, in 2006 Tobago's total water withdrawal was estimated at 10 million m³ (surface water) and 7.6 million m³ (groundwater) (FAO/UN, 2015).

Drinking water estimated coverage for T&T

Trinidad and Tobago	Total (%)	
	1990	2015
Piped onto premises	72	84
Other improved source	19	12
Other unimproved	7	5
Surface water	2	0

Table 2.2 Adopted from (WHO/UNICEF JMP, 2015).

2.3 Sanitation

2.3.1 Off-site sanitation (wastewater systems)

Sanitation in Trinidad and Tobago involves both network (approximately 428km of sewer) and non-network systems. Central municipal wastewater collection and treatment in T&T was introduced in 1962, in the City of Port of Spain and the Boroughs of Arima and San Fernando; other systems that came on stream later were in Point Fortin and Scarborough, Tobago (WASA, n.d).

Sammy in his 2011 Environmental Assessment report reiterated that 30% of Trinidad and Tobago is serviced by centralized networked wastewater treatment systems, while 70% are serviced by septic tank, soakaways and pit latrines. He further added that the WASA owns and operates twelve Wastewater Treatment Plants (WWTPs) systems (see Table 2.3 for more details) while there are approximately **243** non-WASA small packaged WWTPs owned by private and other government authorities (e.g. Housing Development Corporation (HDC), etc.) that are still not closed (decommissioned safely) or integrated into centralized wastewater systems, due to malfunctioning issues (mundane infrastructure), abandonment or technocratic issues. WASA's 1965 government mandate to "assume control" over wastewater management has become a burdensome task as WASA severely lack the capital and human resources to prevent or reduce the extensive discharge of raw sewerage into T&T waterways, that is presently occurring (Sammy, 2011; WASA, n.d).

List of WWTPs owned and operated by WASA, Areas serviced and Daily flows

No.	Name of WWTP	Areas WWTP service	Design Flow (M ³ /D)
1	Beetham	East/West Corridor between Carenage and Mt Hope-excluding Santa Cruz & Upper Maraval	80,000
2	San Fernando	City of San Fernando	17,032
3	Arima	Borough of Arima, Dundee Village	5,450
4	Scarborough	City of Scarborough	2,906
5	Trincity	Orange Grove/Samaan Gardens Trincity Industrial Estate & Mocoya	400
6	Santa Rosa	Santa Rosa Housing Development (HD)	1,590
7	Lange Park	Lange Park HD	681
8	Techier	Techier HD	454
9	Penco Lands	Penco HD	143

10	WASA Head Office	WASA Head Office Complex	130
11	Piarco	Old Piarco International Terminal building & Caroni Water Treatment Plant	176
12	Chaguaramas	Convention Centre area & Upper Macqueripe	350

Table 2.3 Adapted by the Author from (WASA, n.d:25)

To mitigate the environmental and public health problems associated with poorly functioning WWTPs, the largest IADB loan known to the Caribbean region was awarded to Trinidad and Tobago in the sum of US\$579M with US\$246.5M of that total being disbursed in 2015 to address Phase 1 of a Wastewater Infrastructure Project (Francis, 2015). The first facility, the Malabar WWTP and Collection System is currently under construction, while the second facility, the San Fernando WWTP and Collection System construction was soon to commence. This multi-phase Wastewater Infrastructure Project intention would be to increase the population sewerage connection from 30% to 45% upon completion and improve wastewater treatment (WASA, 2014).

According to the Government of T&T Public Sector Investment Programme (PSIP) (2016) document, T&T has since made significant investments (\$93.8 million TTD/ \$14, million USD spent) towards increasing HH sewer connections from 30% to 45%. As well intended as that initiative was the Ministry of Planning and Development still neglected onsite sanitation as no budgetary allocations were extended towards improving the 'operational' parts of the FSM service chain in T&T, confirming Blackett et al., (2014) research findings.

Tariffs for wastewater are exceedingly low (half the rate of water) and does not reflect the true cost of collecting, treating and disposing of wastewater. Initiatives have been taken by WASA and other stakeholders (Ministry of Public Utilities) to review the tariffs, but that process is ongoing (Williams, n.d).

2.3.2 On-site sanitation (septage systems)

Onsite sanitation management has been neglected for decades and little investments have been attributed towards its development. A personal communication with Nigel McCarty (2016) revealed that a national policy for Faecal Sludge Management (FSM) is absent in T&T and no government or state owned entity has neither taken full ownership nor responsibility for the management, monitoring, setting of guidelines and regulation of part of or the entire service chain; it appears to be managing itself (McCarty, 2016).

Williams indicated that an onsite facility, mainly septic tanks design, was tailored in accordance to the Trinidad and Tobago Bureau of Standards (TTBS) National Standards,

“TTS 1680 400: 1991 Code of Practice for the Design and Construction of Septic Tank and Associated Secondary Treatment and Disposal Systems”. He said that the National Standards of this code of practice were reviewed in 2004, (12 years ago), and the revision led to more effective systems such that drain fields replaced soakaways which would potentially minimize groundwater pollution (Williams, n.d, p6). However, the extents to which the T&T population adhere to the proposed code of practice is questionable, because from the author’s knowledge of the onsite systems used in T&T, households that own and operate a septic tank system still use soakaway pits rather than drain fields (Ifill, 2016). No guidelines were ever set for pit latrines construction by the TTBS, maybe because they shared the similar experience of most developing countries whereby pit latrines were designed to hygienically separate human waste without considering the need for emptying but rather abandonment (Thye, Templeton and Ali, 2011).

2.3.3 Onsite sanitation Institutions in T&T

WASA supposedly grants private operators a permit which allows them to provide emptying services in T&T. The cost for the permit and the formal guidelines of that procedure are not well understood. However, the permit apparently does not assess the suitability of vehicles nor grants the operator access to discharge into their (WASA) wastewater system (manhole). In fact, Nigel McCarty (2016) confirmed that such practices were illegal and that the perpetrators could be fined if caught (McCarty, 2016). The permit gives the private operator permission to operate as a cesspit cleaning truck in Trinidad and empty HHs cesspits, but through government Public Private Partnership (PPP) contracts, emptying providers could provide emptying services to government buildings and include emptying of WASA’s treatment plants during decommission projects or other private projects. Thereby, the PPPs provide a rich viable business for some private operators (mainly large companies who have fleets of trucks) and unfortunately give birth to unconstitutional practices.

The other state-owned agency, SWMCOL claim to be responsible for managing faecal waste disposal in T&T, but what has been written and what is actually been done does not coincide. SWMCOL manages three (3) solid waste landfills (usually referred to as ‘the dump’) (See Appendices for the location of landfills in T&T) in Trinidad (Beetham, Guanapo and Forrest Park) and one (1) in Tobago (Studley Park). Located on the Beetham dump is a faecal sludge treatment facility (FSTF) in which private and public providers as far as Chaguanas (central Trinidad) empty at this facility. SWMCOL Beetham FSTF was constructed in 1985 and it is uncertain as to what facilities are available on the other treatment sites or across the country.

The Town Country and Planning (TCP) Act of 1969 is the principle legal instrument for regulating land-use in T&T. This act provides orderly and progressive development of land

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and gives power of control over land-use and its acquisition (WRA, 2001). With increasing urbanisation and unregulated housing development (squatting), it is difficult to tell whether this Act is functional. Efforts have been made to better understand the role of this Act in on-site sanitation, but as outlined in section 4.14, efforts were unsuccessful.

The MOH Public Health Ordinance of 1917 Chapter 12; No 4 does inspection of containments but only as it pertains to nuisances (smells, leaks, flies etc). The system in place is that complaints are made to the district County Medical Office of Health (CMOH) Public Health Inspectorate (PHI), who after receiving the complaint visit the premise and either give verbal warnings, issue corrective notices and in very rare cases, after numerous visits and no corrective actions taken by the HH, issue a court order. The effectiveness of this system is questionable and while district complaint records were inaccessible, Public Health Inspectors were unable to provide substantial information (needed MOH approval).

Environmental Management (EMA) Act No. 34 (1995) is T&T's legislative framework for comprehensive control and protection of the country's natural resources. The Act did not include HHs as a potential source of water pollution and to date no amendments to the legislation has been made to include them. The water table is highest along the East-West corridor and Chaguanas in Trinidad. What this means is that both areas being sparingly sewered (mainly the East-West corridor), having very dense communities and home to an increasing population of unregulated housing development whereby pit latrines, septic tanks and soakaways are constructed, increases groundwater pollution at the HH level and nothing and no one can be held accountable. Inspection of HHs containment construction in those unplanned areas are not performed nor regulated, not by the TCP, the EMA or WASA. A Certificate of Environmental Clearance (CEC) only came into effect in 2001, and it was issued to developers before they preceded with certain types of activities, hence development projects before 2001 were not monitored and HHs were also exempted from that process.

According to the 2015, World Health Organisation (WHO/ United Nations International Children's Emergency Fund (UNICEF) updated report, (See Table 2.4) Trinidad and Tobago's coverage of improved sanitation facilities increased from 90% in 1990 to 92% in 2015 (WHO/UNICEF, 2015, p 80). Although the JMP reported that T&T has made 'moderate progress' (WHO/UNICEF, 2015, p 80), authorities should not view the data as a means that FSM is progressing moderately, but rather they need to examine the links within the FSM service chain so as to detect the country's true progress and current challenges in onsite sanitation.

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Onsite Sanitation estimated coverage for T&T

Trinidad and Tobago	Total (%)	
	1990	2015
	Improved facilities	90
Shared facilities	7	7
Other unimproved	3	1
Open defecation	0	0

Table 2.4 Adopted from (WHO/UNICEF JMP, 2015)

Finally, Nigel McCarty (2016), again revealed that there is currently a “pit latrine eradication” vote project, hosted by a group called the East Laventille Development Committee who help with development projects in the Laventille, East Port of Spain Constituency. He indicated that there is a \$2 million TTD/ \$298,953 USD allocation being distributed to Laventille to help residents improve their sanitation systems; upgrading from pit latrines to septic tanks with soakaway systems. He added that the Laventille area especially communities like St Barbs, Snake Valley, Eastern Quarry Africa, Egypt and Dan Kelly, to name a few, are increasingly populated, very dense, unplanned housing developments. With a project of that nature, McCarty said, it would be very difficult, almost impossible for persons to build septic tanks with soakaway pits and not risk digging into their neighbour’s yard, displacing a home entirely, preventing leaching effluent from soaking underneath homes and inevitably, persons resorting to connecting septic tanks outflow pipes into nearby drains (septage discharge). However, McCarty suggested, that a better approach could have been to purchase more trucks for the RCs so that they would be able to provide a more efficient service to those communities (McCarty, 2016).

2.4 Conclusion

In conclusion, this chapter was presented so as to sensitize the reader of a few key characteristics directly related to the onsite sanitation in T&T, the need for the Government to pay attention to this sector and to appreciate the author’s attempt to surface this shadowed issue as they explored faecal sludge emptying services in Trinidad. The reader might agree that in light of the economic benefits and increasing environment and public health risks, it is imperative that at some point in the future, onsite sanitation management be incorporated into T&T’s government and state owned entities investment plans, policy frameworks and strategic plans. The next chapter looks at the available literature surrounding this phenomenon and what research has revealed.

3 Literature review

3.1 Introduction

The literature review was conducted to comment on the status of the broad topic of sanitation, and later streamlined to identify what existing evidence on FS emptying services was investigated. The literature for the latter part of the review was organised by grouping the literature on FS emptying into three main questions. They are as follows:

- What technical considerations to emptying services were investigated?
- What social considerations to emptying services were investigated?
- What economic considerations to emptying services were investigated?

Likewise, every story has an introduction, middle and end, so the purpose of this review was to comment on the status of sanitation in relation to the Sustainable Development Goals (SDGs); followed by sanitation in relation to the post-2015 WASH targets and indicators for water and sanitation; the widely used concept of FS management and finally what investigations were made in relation to FS emptying services. Furthermore, the author concluded this section by introducing their research proposition and mentioning how it would be tested using the methodological approach detailed in chapter four.

3.1.1 Literature search strategy

The literature review was broken into two parts. The first part of the literature review pertained to the prior research direction adopted by the author which attempted to view the institutional arrangements for FSM in Trinidad and Tobago. That research direction led to the use of key words: faecal sludge management, institutions, sanitation, low-income countries, Trinidad and Tobago and urban. The databases used were Library Catalogue, Google Scholar, Google search and Aqualine of which only peer reviewed journal articles, were collected and reviewed.

Secondly, a literature research pertaining to the alternative direction taken (FS emptying services in Trinidad) used the keywords: faecal sludge, emptying, service providers, households, household surveys, urban. The general search engines, Library Catalogue, Google Scholar and Google were searched but peer reviewed documents were low in these search engines. Aqualine databases within WEDC was searched, resulting in a fair retrieval of peer reviewed research as it relates to FS emptying.

Publications such as the Water and Sanitation Programme (WSP), the Water and Sanitation for the Urban Poor (WSUP), FSM country reports funded by USAID, World Bank and WSP, and UN-HABITAT, relevant websites (SPLASH, UNDP etc), journal articles reference lists, were also searched to retrieve up-to-date information on sanitation. Notably,

those sources provided great insights into countries experiences with FSM and outcomes of city-wide case studies in FSM, whereby emptying services and HH surveys were investigated, providing important methodological guidelines which the author could use to develop their research method and data collection tools. No date or location filters were applied in the databases allowing for the maximum amount of literature on the topic to be captured. Only peer reviewed journal articles (provide current research in the field) published in English were selected for the FS emptying services review process.

According to Strande, Ronteltap and Brdjanovic, (2014) FSM is a relatively new research discipline that is rapidly gaining interests by developing countries as they are currently acknowledging its place in sanitation management (Strande, Ronteltap and Brdjanovic, 2014). Hence, while developing countries have been addressing FSM challenges holistically, literature on specifically FS emptying was limited. From country reports and other international donor reports it was observed that the narrow focus on containment options or design (quantity rather than quality approaches) has shifted to incorporate aspects of the enabling environment downstream of households collection technologies and emptying services, since aspects further down the chain were said to be a significant contributor to extensive environmental degradation and increasing health related implications (Peal, et al, 2014).

Noteworthy, the purpose of this research study, being the first of its kind in T&T, if not the WCR, was based on the first two stages of the FSM service chain (storage and emptying) to explore the challenges encountered by FS emptying service providers in Trinidad as well as determine key factors of HHs satisfaction with emptying providers services using the SJC as a case study, and recommend for improvement, ways in which containment and emptying gaps could be bridged in T&T. This approach was taken with an emphasis on understanding the institutional arrangements for FSM in T&T.

3.2 Literature review

3.2.1 Sustainable Development Goals (SDGs)

The Millennium Development Goals (MDGs) expired in 2015 and was soon replaced by seventeen (17) Sustainable Development Goals (SDGs): a universal set of goals, targets, and indicators UN members are expected to align their political policies to in achieving sustainability by the year 2030 (Ford, 2015). The SDG goals were introduced to combat global challenges, for example, Goal 6 which deals with water and sanitation. Based on the latest record, 2.4 billion people lack access to sanitation services such as pit latrines and toilets and over 80% of wastewater from human activities enter the waterways untreated (UN Sustainable Development Goals, n.d). Furthermore, Arroyo, (2010) UN-HABITAT report for the LAC region indicated that sanitation access in Bolivia, Nicaragua and Haiti

were extremely low, adding that water bodies were highly contaminated due to “wastewater treatment being nearly invisible” for the entire region (Arroyo, 2010 p10).

Moreover, the SDG 6 endeavours to ‘ensure availability and safe management of water and sanitation for all’ (Ford, 2015). One of the specific targets of Goal 6 states that by 2030, they hope to achieve access through adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situation (UN Sustainable Development Goals, n.d). It was discovered that sanitation was not being adequately addressed because the need to provide safe drinking water continuously outweighed the need to provide adequate sanitation, after all ‘water is life’. However, according to a statement on the SDGs made by Mr Heller, (n.d) as cited in the UN News Centre (2016), the initiative taken to make sanitation its own as a human right allowed policies to directly address the many challenges associated with sanitation (UN News Centre, 2016).

Additionally, Medland, Cotton and Scott, (2015), from their research findings, stated that the recent development of a rights based approach to sanitation influenced by recognising sanitation as a human right, has already created some confusion for developing countries (Mozambique, Rwanda, Kenya and Uganda) because guidelines on human right based sanitation approaches were lacking and countries were unclear as to what the human right to sanitation is and how they can progressively implement it (Medland, Cotton and Scott, 2015).

According to Albuquerque, (2009) as cited in Medland, Cotton and Scott, (2015), sanitation as a human right signifies that everyone rights to water and sanitation should include services that are: physically accessible or close to household; sufficient, and culturally acceptable quality in secure location (address women having to go far unsafe places to defecate at night) and affordably priced so that everyone have the ability to acquire basic goods and services (Medland, Cotton and Scott, 2015). What that means is developing countries legislations and policy direction documents would have to be amended to incorporate the human right to sanitation approach, which really brings into question whether the SDGs can realistically achieve sustainable sanitation in developing countries. Webster (2007) stated that Sub-Saharan Africa sanitation targets were not expected to be met until 2076 (Webster, 2007), yet the SDGs and targets were set to be achieved by 2030/2040.

Furthermore, based on the post-2015 WASH targets and indicators consultations, the concept of sustainability must encapsulate key parameters such as affordability, accountability, financial and environmental sustainability (World Bank and WSP, 2014). In the author’s opinion, the sustainability concept was very similar to what the JMP had

recommended during the MDGs except that previous broad definitions led to varying interpretations and little to moderate progress in some developing countries. Nonetheless, as ambitious as the SDG targets are, the involvement of the JMP, World Bank and UNICEF in focusing sanitation parameters and streamlining definitions such as 'improved sanitation facilities' and 'safe excreta management'; with the specific country central and local government support, sustainable sanitation could become a reality in some developing countries (Ifill, 2016).

3.2.2 Sanitation

According to the WHO sanitation is the means of collecting and disposing of human excreta and community domestic waste utilizing hygienic methods so as not to endanger the lives of individuals and communities at large (WHO, 1987). Sanitation involves on-site sanitation (FS captured and stored on-site) and off-site sanitation (wastewater collected and transported to treatment facilities via a sewerage network). Sewerage systems used by developing countries were accepted as the solution to domestic waste management, but onsite technologies, introduced as a temporary solution, is becoming the most sustainable solution to meeting their SDGs sanitation targets.

Regardless of the type of sanitation system (on-site or off-site), the UN News Centre, (2016) and Medland and others, (2015) both explained that the lack of sanitation has a domino effect on developing countries national progress as it obstructs the right to health and life, disrupts the right to education, exacerbates the transmission of infectious diseases such as cholera, typhoid and hepatitis and broadens gender inequality gaps among men, women and children (UN News Centre, 2016; Medland, Cotton and Scott, 2015). The UN-HABITAT said that over the past 25 years significant progress in water and sanitation was observed. In 2010 the sanitation coverage in developing countries increased from 36% of the population in 1990 to 56%, but to-date, 2.6 billion people are still without access to toilets and other adequate sanitation facilities (UH-HABITAT, 2012).

The WHO/UNICEF, JMP, (2015) updated report identified 'improved sanitation facilities' as flush/pour flush to: piped sewer system, septic tanks or pit latrines, pit latrine with slab, composting toilet and Ventilated Improved Pit (VIP) latrine, but the extent to which those systems ensured safe management of faecal waste was not considered. However, in the JMP and WHO/UNICEF post-2015 WASH targets and indicators consultation report, the 'improved sanitation facilities' as a marker for progress was replaced by the notion of "adequate sanitation at home" (World Bank and WSP, 2014). This approach aimed at strengthening the criteria used to assess sanitation (improve reported sanitation statistics accuracy) thereby presenting a true picture of how country's sanitation systems has been progressing and where the gaps might be.

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According to the JMP and WHO/UNICEF WASH target number 3, “by 2040 everyone uses adequate sanitation when at home, health centres, and households with adequate sanitation are safely managed and inequalities in access to each services have been progressively reduced” (World Bank and WSP, 2014, p3). They defined adequate sanitation facilities at home to include: a pit latrine with a superstructure and a platform or squatting slab constructed of durable material (could include pour-flush latrines, composting toilets and VIP latrines), and a toilet connected to either a septic tank or a sewer (small bore or conventional) (ibid).

Furthermore, one of the indicators for measuring the WASH target number 3 would be “the percentage of households with adequate sanitation whose excreta was safely managed and the share of human excreta that reaches the designated disposal sites” (ibid, p4). The definitions were more refined in that a pit latrine should be made with durable materials and the percentage of safe FS management should include safe emptying of FS, which is the percentage that reach designated disposal sites, not what had been collected. The consultations are really working on altering planners’ mindset away from haphazard development initiatives (the mentality of quantity rather than quality) towards sustainable development that is affordable.

In an attempt to link the situation to the context under study, the author’s opinion is that, in T&T, SWMCOL claim to be the state-owned agency responsible for managing waste disposal, but the percentage of collected FS reaching those disposal sites is not monitored and the extent to which the waste is treated is not measured. The WHO/UNICEF and JMP 2015 report recoded that sanitation ‘improved facilities’ for T&T was over 90% of the population in 2015. That record presents an unfortunate situation for T&T planners because it seems as though they are ascertaining those reported percentages to mean T&T does not have a sanitation problem, when in fact they do. How then do T&T planners become aware of the need to incorporate the SDGs on water and sanitation as well as the JMP post-2015 WASH targets and indicators into their sanitation management schemes if research identifying the gaps is not available? (Ifill, 2016)

Form the JMP post -2015 revisions; onsite- sanitation systems improvements could increase since the concepts were more focused, leaving little room for misconceptions and ambiguity in how developing and middle income countries treat excreta management. In reference to the indicator, and by the JMP’s inclusive definitions, measuring the safe management of household excreta has shifted from solely the containment design and now includes “the containment, emptying and transportation of the excreta to the designated disposal or treatment sites, or the safe re-use of the waste at the household or community level, as deemed fit to the local context” (World Bank and WSP, 2014, p8).

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Additionally, the JMP's criteria for ascertaining the share of households excreta that reach the designated disposal site, included: "sewer networks, hygienic collection from septic tanks or latrines by suction trucks (or similar equipment limiting human contact) and transported to the designated location (treatment facility or solid waste collection site) or stored onsite" (decommissioned until waste was safe to handle or re-use) (ibid). With those wrinkles ironed out; tackling onsite sanitation by firstly mapping excreta flow along the FSM service chain would produce country specific recommendations that would address sanitation institutional inadequacies and areas where the enabling environment for sanitation needs strengthening.

3.2.3 Faecal Sludge Management (FSM)

Faecal sludge management (FSM) is the management of septage contained within on-site sanitation technologies such as septic tank or pit latrine (EAWAG/SANDEC, 2008). Onsite sanitation facilities meet the sanitation needs of 2.7 billion people worldwide, but that number is expected to increase to 5 billion by the year 2030. For example, Strauss et al, (2000) as cited in Strande, et al., (2014) found that in Sub-Sahara Africa 65-100% of the urban areas sanitation needs are served by onsite technologies (Strande et al, 2014), while in T&T, WASA estimated that 70% of the population (urban and rural) depend on on-site sanitation facilities to meet their sanitation needs (WASA, n.d).

As illustrated in Figure 1, the interlinked relationship between five (5) key components: containment/storage, emptying/collection, transportation, treatment, and finally disposal/end-use constitutes the Faecal Sludge Management (FSM) service chain (Strande, Ronteltap and Brdjanovic, 2014; EAWAG/SANDEC, 2008; WHO/UNICEF JMP, 2015). Conversely, Medland, Cotton and Scott, (2015) described the inter-relationship and range of components needed to support service delivery for urban sanitation as 'the enabling environment' concept. They added that the enabling environment concept (see Figure 3.1 below) holistically addresses urban sanitation inadequacies because the reality that technical innovation being insufficient in addressing urban sanitation deficits had long been established (Medland, Cotton and Scott, 2015).



Figure 3.1 The enabling environment for urban sanitation (Medland, Cotton and Scott, 2015: 2)

Policies and strategic direction documents play an important part in building the institution for urban sanitation as they are said to set ‘the rules of the game’ for activities carried out by a specific actor and they are closely linked to financial planning and budgetary allocations (Medland, Cotton and Scott, 2015). In many countries like T&T, Rwanda, Cameroon, to name a few, FSM sanitation components are absent thereby confirming Scott and Cotton, (2005) as cited in Medland, Cotton and Scott, (2015) findings where policies or strategies that focus on sanitation or FSM, were unavailable in many of their study cases (Medland, Cotton and Scott, 2015).

FSM roles and responsibilities are attached to the policy and strategic direction guiding documents as they outline the organisations ‘modus operandi’ and if those are absent then the FSM system would malfunction. Sanitation is hardly ever the responsibility of, or managed by one organisation, thereby resulting in overlapping roles and in some cases no management. Financial allocations are usually poorly organised for the sanitation sector, but even more challenging is coordinating sanitation budgets among the numerous organisation or departments (ibid). In a WSUP practice note written by Bisaga, Norman and Drabble, (2015) it was revealed that most African cities municipal sanitation budgets are less than one percent. They added that apart from central government transfers and municipal own generated revenue schemes (e.g. sanitation taxes), municipal governments should focus their expenditure on smaller infrastructure and recurrent costs initiatives, which could stem from sanitation advocacy strategies like “media campaigns, lobbying electoral officials and targeting pro-poor ‘champions’ within local institutions”, as a plausible measure to improve sanitation and increase municipal sanitation budgets. Outcomes and lessons of that strategy, being in the trial stages in Mozambique, Kenya and Ghana, were unavailable (Bisaga, Norman and Drabble, 2015, p1&2).

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The International Water Management Institute, (2007) as cited in Medland, Cotton and Scott, (2015) indicated that faecal waste, either raw or treated (digested sludge) has potential economic and financial value particularly in agriculture (organic fertilizer and soil conditioner). In addition, FaME (a lead organisation under SANDEC) as cited in Medland and others, said that the breakdown of the sanitation service chain is attributed to both poor investments and the inability to make appropriate budget allocations (Medland, Cotton and Scott, 2015). Notably, a WSUP (2015) project note on the introduction of FSM in Lusaka, argued that “if FSM services are given the best possible chance of success when embedded within a mandated local service provider that is willing to innovate and continuously adapt”, effective FSM system could become a reality in developing countries (WSUP, 2015). Furthermore, the human resource capacity of both private and public providers with respect to managing the sanitation service chain was said to be caused by: insufficient staff to carry out the roles and responsibilities assigned to them and the low knowledge and skill of staff preventing them from functioning effectively (Medland, Cotton and Scott, 2015). For the enabling environment to function there needs to be commitment from both central and local entities, followed by effective public education and advocacy campaigns so as to alter households behaviour towards ‘proper’ sanitation practices (very complex in nature) and the planners/ investors attitude towards financing sanitation realising the potential economic contributions and not just the high initial investment costs.

Peal et al., (2014) study stated that their rationale for modifying the Service Delivery Assessment (SDA) tool to generate FS Flow Diagrams that map cities FS flow from containment to disposal or re-use, were as a result of researchers heavy reliance on providing on-site sanitation facilities (containment), rather than understanding the flow of the excreta through the system, how effective the enabling environment was in managing and monitoring FS flow in very dense urban areas and the ways in which the service providers could support the selected sanitation facility designs, specific to that country (Peal, et al, 2014).

The modified SDA tool examines the enabling environment, institutional arrangements and technical abilities of cities in their ability to manage FS. Once different cities data were collected they were sectioned into three categories: enabling, developing and sustaining services. In order to make a fair judgement country specific data (secondary data and Key Informant Interviews (KIIs)) such as policy, budget and planning documentation to assess the extent of FSM enabling services; expenditure inputs and outputs in assessing developing services and finally maintenance and used approaches to assess sustaining services were collected and analysed (ibid). Following individual city assessments, city-wide comparisons between geographically grouped countries were made so as to identify

gaps in FS management and recommend approaches that could be institutionalized across that city or the whole region.

Some major conclusions of Peal, et al., (2014) 12 city FSM study were that illegal dumping into waterways and landfills were prevalent among both manual and mechanical pit emptiers, emptying was dominated by the private sectors rather than the municipalities and utilities, in LAC and East Asia mechanical emptying was the norm, FS treatment facilities were lacking and those available were performing poorly and two out of the twelve cities (Dumaguette and Manila in the Philippines), even though they were not well developed, they had formal mechanisms for treated sludge reuse (Peal, et al, 2014). However, the authors indicated that their review covered cities in Sub-Saharan Africa, Asia and Latin America and the Caribbean, but unfortunately, the LAC countries investigated have not included Caribbean islands only Latin America countries, again treating the WCR as an appendage to Latin America by only making reference to the name but research pertaining to Caribbean islands have not been done.

The SDA tool even though it was based on secondary data, the ability of the tool in mapping FS management from household containment to disposal or the reuse stage; the visual representation (score card) really highlights the need for cities to strengthen their FSM programmes pointing out the weak areas. Peal et al., (2014) concluded that many 'poor' cities across Africa, Asia and LAC sanitation improvements relies predominantly on FSM, however "few cities have the management structures, institutional arrangements, infrastructure, skills or financial systems to deliver services and it consequently remains a significant but largely neglected and ignored challenge" (Peal, et al, 2014, p 372).

An EAWAG/SANDEC report also concluded that the current state of faecal sludge management involved poor containment, unhygienic manual emptying or costly hygienic mechanical emptying, long haulage sites resulting in illegal dumping and inadequate disposal and treatment facilities; usually as a result of poor institutional capacity, low budgetary allocations, absent FSM policies and low political will or FSM prioritization, to name a few (EAWAG/SANDEC, n.d).

In conclusion

In T&T where the national human resource capacity for FSM is limited, poor FSM municipal financing is rampant and the one public sector actively involved in FS collection and transportation (Regional Corporations) being disjointed; mapping the FS flow could be a step in the right direction, thereby opening round table discussions among the planners, households and other stakeholders in T&T so as to improve FSM.

3.2.4 FS emptying services

The volume of FS generated vary depending on the geographic location, population densities, and FS characteristics and include onsite facilities such as pit latrines, septic tank, public ablution blocks, aqua privies, VIP latrines and compost toilets. Strande, et al., (2014) found that the prevalence of storage technologies used by different countries vary, from septic tanks being the dominant onsite technology used in Argentina, Thailand, and Vietnam, to pit latrines with varying degrees of improved status dominating in Kampala, Uganda, Tanzania and Dar Es Salaam, to name a few (Strande, Ronteltap and Brdjanovic, 2014). Now that the post-2015 WASH targets have revamped the notion of improved facilities, planners have to balance providing sufficient 'adequate sanitation facilities at home' and all aspects of safe excreta management from containment designs to their parallel supporting services (e.g. emptying, treatment, budgeting, capacity building etc.).

As pointed out by Boot and Scott (2008), FSM is most effective when all the links in the service chain are adequately addressed. Based on their experience in the field, they concluded that urban onsite sanitation systems and services problems were associated with emptying & transport and disposal of FS within the FSM service chain (Boot and Scott, 2008); but generally excreta disposal has both social and technical considerations (Chaggu et al, 2002).

3.2.5 What technical considerations to FS emptying were investigated?

As previously mention onsite sanitation technologies include an array of options but current evidence focused on pit latrine emptying since they were found to be the prevalent storage technology used in developing countries. Hence, the use of pit latrines among rapidly growing densely populated city dwellers complicates excreta management, mainly because pit latrines were designed to be abandoned and not emptied. City planners in developing countries now forced to empty pit latrines, were doing so with obstacles such as limited pit access (cities too dense), households inability to construct proper latrines, poor solid waste practices which results in wood, stones, plastics, glass and other materials being disposed of in pit latrines; thus finding the most appropriate emptying technology posed a challenge (Thye, Temlpton and Ali, 2011).

A study done by Brouckaert et al., (2013), in their attempt to model the filling of pit latrines in South Africa (sample size 18 pits) concluded that the design of a pit latrine sanitation service would mostly likely be influenced by the costs, logistics, human resources and treatment options, rather than pit filling rate models (sporadic data samples failed to produce substantial evidence from their research). They also said that the use of non-biodegradable material in the pit increased the filling rate and when proper waste disposal

practices were observed pits were found to last 15 to 20 years before filling; reducing emptying frequencies (Brouckaert et al, 2013).

A critical review of pit latrine emptying technologies conducted by Thye et al., (2011) stated that the two main types of pit (both pit latrine and septic tanks) emptying services were manual (digging out pit or the use of buckets) and mechanical (mainly vacuum tankers). They added that based on their critical review of the literature, the Conventional Vacuum Tankers, the Vacutug, the Manual Pit Emptying Technology (MAPET) and the Gulper were the major types of manual and mechanical pit emptying technologies used in developing countries. From their review of the literature they proposed a pit emptying decision-making framework for developing countries to use when selecting the most appropriate emptying technology. While the decision-making framework relied on technical factors (some of which may not be applicable to middle income countries), caution was given to not undermine the need to include the social and economic factors (Thye, Temlpton and Ali, 2011). Pit emptying technologies has to be appropriate to the context in which they will function in order to maximise the benefits to the user and provider (ibid), so it is not a matter of one technology being ideal but what works best for that country. Finally, technical considerations for FS emptying services such as modelling the containment filling rate, or selecting the best emptying technology do contribute to safe excreta management, but according to Halcrow and others (2014), research that focus on understanding the social practices of on-site sanitation users would better target the desired capacity building for FS management among developing countries (Halcrow et al, 2014).

3.2.6 What social considerations to FS emptying were investigated?

Repeatedly, experts mentioned the importance of considering the social aspect of any development project, because the designs are not geared towards robots, but humans. Frenou and Tsitsikalis, (2015) stated that FSM having gained recent attention by developing countries, majority of developers and investors efforts remain focused on the technological quality of sanitation ('how to increase the rate of access' of built sanitation facilities) rather than the institutional quality of sanitation ('how to improve' the management systems for urban sanitation) (Frenoux and Tsitsikalis , 2015).

However, Faechem and Craincross (1978) as cited in Chaggu, et al., (2002) said that "it is extremely difficult to achieve changes in excreta disposal practices as they are part of the basic behavioural pattern of a community and are not readily modified" (Chaggu et al, 2002, p 609). Social considerations for FS emptying services relates to understanding the culture of both the providers and the users of sanitation facilities since local customs and cultural practices determine the appropriateness of the technology used (Webster, 2007).

Chaggu et al., (2002) excreta management research conducted in Dar Es Salaam stated that culture, poor sanitation record keeping and fragmented sanitation activities among various subsectors, contributed to the poor state of their excreta management. Based on household surveys (filled out on the spot), literature reviews (based on Dar Es Salaam), personal visits (among the urban community) and KIIs, the authors concluded that by addressing the cultural changes (women as breadwinners of the home, the new norm) and socioeconomic status of the pit users (increase users knowledge on the uptake of faecal sludge reuse products), appropriate emptying services such as ecological sanitation (dry latrines) and anaerobic digesters have the potential to improve Dar Es Salaam excreta management; they could be a solution. From their assessment, educated, rich people opted for the more expensive storage technologies, while poor people with the habit of digging deep pits and generally unknowledgeable of water pollution, built raised pit latrines. The general attitude of the providers where disposal was concerned was “out of sight, out of mind” and as long as socio-economic challenges are present pit latrines were said to be around for a long time with no easy solution to fix the problems (Chaggu et al, 2002).

Jenkins et al., (2015) systematic assessment of residential sanitation facilities in unplanned settlements of Dar Es Salaam, was aimed at understanding pit emptying behaviour and demand for supply for pit emptying services. They found that about 97% of the HHs used pit latrines but hygienic sanitation services were low. Also they concluded that HHs extended emptying as long as possible (48% never emptied their latrine over 10 years old), resorted to unsafe practices such as ‘flooding out’, used pits until they were filled to capacity and faced high cost for emptying services (Jenkins, et al, 2015). Such behavioural practices were as a result of poverty, dense areas making emptying the only option and interestingly, unhygienic manual emptiers being favoured over mechanical emptiers because they removed all the sludge without damage to the latrine. In the absence of hygienic sanitation service ‘flooding out’ was prevalent and residence demand for a hygienic service was found to be one that involved a quick, clean, affordable, odour free, all the sludge remove away from the property service. The Gulper was the most feasible technology proposed based on Dar Es Salaam’s social variances (ibid).

Halcrow et al., (2014), in their formative research study used the Sanitation- Focus - Opportunity-Ability-Motivation (SaniFOAM) behaviour change framework to help build capacity for sustainable FS management services. They too, in many ways agreed that by understanding the tenants’ and building owners in Buthan city, knowledge of containment, willingness to pay for services and the effects of enforcement for non compliance; appropriate targeted consumer awareness, educational behavioural change communication campaigns and accompanying consumer support services, when implemented contributed significantly to the ownership of a sustainable sanitation system (Halcrow et al, 2014).

Faecal sludge emptying services in Trinidad

From the literature, the new trend has been directed towards understanding the social considerations rather than technical because technical aspects are dynamic as seen in the post-2015 SDGs, targets and indicators, and could take less effort (this phrase should not be taken as concrete, but figuratively) to solved as oppose to changing communities culture and HHs behaviours. What would be interesting to see is how the SDGs concept of rights based sanitation would be applied by municipalities and what influence would it have on improving sanitation services? Also, a taken point was that without a firm sanitation institution or an enabling environment for sanitation whereby 'the rules of the game' were set, no matter how well intended the initiative, FS management was not effective.

3.2.7 What economic considerations to FS emptying were investigated?

Faecal sludge emptying service providers vary but they were generally classed into two groups: public operators and private operators. As mentioned earlier private providers dominated the sanitation market in developing countries since public municipalities and utilities fail to carry out emptying activities. For example, in three Cambodian cities and Daka Senegal, unregulated, formal or informal private emptying operators were found to dominate the FS emptying market resulting in hygienic and unhygienic emptying practices polluting the environment as disposal facilities were inadequate (e.g. long distance, absent facilities and illegal dumping practices) (Frenoux and Tsitsikalis , 2015; Mbéguéré et al, 2010).

Furthermore Kone and Chowdhry, (2004) survey which assessed the profitability of private faecal sludge emptying businesses in Africa and Asia found that 50% of the private operators had one truck (small business), 44% owned 2-4 trucks (medium sized businesses) and 6% owned 5 or more trucks (larger businesses). Hence larger businesses were less susceptible to downtime allowing them to make huge profits while the one truck operators made little profits as downtime meant a complete shutdown of their daily operations (Kone and Chowdhry, 2010).

Similarly, Mbéguéré et al, (2010) embarked on a study that profiled the private operating companies and explored their profitability margins in providing FS emptying services in Daka, Senegal. From their findings it was found that the prevalent private operators in Dhaka usually owned one truck that was hardly ever less than 10 years old. Additionally, of the 52 directory listed FS Operators in Dhaka, only 12 companies (termed Limited Liability Companies (LLC) and Economic Interest Groups (GIE)) were incorporated in an association, while 40 were informal individual operators. It was said that the LLC and GIE incorporated companies role included "acknowledging the emptiers work, formalising the sector (issuing licenses) regulating and limiting the number of trucks and importantly ensuring transparency in public tenders" (Mbéguéré et al, 2010, p 1290). That approach might have improved sanitation services but really the possibility of monopolisation could

undermine the perceived benefits because the Operators with one truck being inexperienced, with high frequency of breakdowns (offsets the demand-supply ratio), exposed to the high cost of second hand trucks (US\$ 25000 to US\$45000), their inability to compete with larger truck fleet (LLC and GIE companies), being confined to only domestic emptying services as oppose to securing other non-domestic ventures, resulted in those 'small businesses' going out of business. In fact the study concluded that emptying services among the informal domestic operators needed to diversify (include non-domestic operations e.g. sewerage maintenance) in order to ensure their survival (Mbéguéré et al, 2010).

Overall what is needed is the national and local authorities' is their commitment to create the enabling environment that would help build and sustain FS emptying providers' ability to provide their services, especially when the financing sanitation service provisions continue to not be a priority in developing countries (Mbéguéré et al, 2010; Kone and Chowdry, 2004).

Conversely to understanding the providers profile and profitability aspects, the relationship between the providers and the HHs are critical in ensuring sanitation emptying services are effective. Therefore, whether manual or mechanical methods for FS emptying were to be used, should the service being offered fail to incorporate the amount HHs are willingness to pay for the services, an affordable cost of emptying services and understand the current demand-supply ratios (competition), no matter the FSM framework set in place, poor performance would be the undesired outcome. For instance a HH survey conducted by Jenkins et al., (2015) found that in Dar Es Salaam, of the 97% of HHs that use pit latrines, 57% were willing to pay (WTP) \geq US\$17 to remove \geq 200L of sludge for an efficient service (Jenkins et al, 2015) but in Cambodia, even though the poor was not isolated from sanitation services (emptying fees were reasonable), manual emptiers and mainly small business operators, despite the stiff competition and operators making a profit, the HHs demand for emptying was low as $> 2\%$ (Frenoux and Tsitsikalis , 2015). Again behaviour and culture would undermine a feasible sustainable solution.

Varying emptying fees depended on different factors for different providers. Frenoux and Tsitsikalis (2015) interviews with emptying operators in Phnom Penh indicated that emptying service tariffs varied as the operators explained that fees depended on the number of trips made to the size of work (size of the containment, accessibility, effort to empty etc) and the distance to travel rather than the volume of waste, hence average fee per trip determined the fee and not the volume (ibid).

Another key aspect in FS emptying services is that the providers ought to understand their clients and strive to suffice HHs level of satisfaction with emptying services, their demand

and emptying habits. In three Cambodian cities that were surveyed, Frenoux and Tsitsikalidis (2015), HH service satisfaction was found to be high (96% in Phnom Penh and 98% in Siem Reap) with mechanical services satisfaction factors being: clean service, operator was quick to come and fast to operate, and manual services satisfaction factors were: clean and cheap service. Interestingly, the Authors found that despite HH satisfaction, the HHs indicated that they would not hire the same provider for the next emptying, thereby representing the low emptying demand rate in Cambodia and the extent of the demand-supply ration and competition (ibid). However, in Dar Es Salaam, urban HHs were dissatisfied with mechanical emptying services because they lacked transparency in their prices charged, their prices were very costly, damaged was done to their pits and they were usually unable to completely empty the pits. Meanwhile, manual operators' services were more satisfactory as 30% poor HHs in Dar Es Salaam opted for that method because manual operators were said to completely empty their pits and their prices were affordable, regardless of their unhygienic practices (Jenkins et al, 2015).

To sum up, FS emptying services require an understanding of three main factors: the type of containment used along with the compatible emptying technology, the socio-cultural nature of the users and their behavioural practices and finally the emptying providers' and their economic viability among those providers in providing FS emptying services. The Authors of the reviewed literature were highly credible professionals with years of experience in the field; hence their contributions were very valid as they all had been cited in other FSM publications and in Multi-lateral agencies consultation reports (UN, World Bank, WSP, JMP, Bill and Melinda Gates Foundation, EAWAG/SANDEC etc). Thus, while the sample size of articles specifically on FS emptying services were low, this review was very instrumental in building the foundation for the methodology the author could use to achieve their research objectives and add to FSM challenges in their study context. The data collection tools used across the various studies (Interviews, observations, documentation and HH surveys), provided vital evidence to assist the researcher in planning their data collection tools.

3.2.8 Gaps in the literature

Throughout all the social FS emptying literature reviewed, there is a huge gap in the involvement of women as managers in sanitation. The importance of improving sanitation so as to educate women were established in the literature and the SDGs, but what no research focused on, was women as the drivers in on-site sanitation management. The author is aware of the gender inequality struggles within developing countries, but why are women not given lead roles in sanitation management and how could they impact FSM management?

Research focusing on the media (cell phones, billboards etc) influence on altering behavioural changes towards safer sanitation emptying habits was lacking. Credit has been awarded to Halcrow et al., (2014) and the WSUP, (2015) ongoing practical lessons, but the Authors focused on advocacy in relation to municipal financing and not on public behavioural change.

Overall the city-wide initiatives focused on understanding the enabling environment for FSM in Africa, Asia and Latin America, with no analysis on the status of FS flow in the Caribbean region and or providing an understanding of how FSM challenges vary from island to island. As long as onsite sanitation systems are a part of a country's sanitation management framework, issues of containment technologies, emptying services, disposal and treatment and end use will arise, but no knowledge is known about the Caribbean region and literature on that region was unavailable. Some challenges (manual emptying) in developing countries were not representative of T&T context (middle income country), so it would have been beneficial to have observed the different issues plaguing those countries where FS management is concerned (e.g. technocratic issues, policy frameworks etc).

Based on the background information presented in chapter 2, T&T is the most economically sound island among the rest of islands and as such investors in T&T need to redirect investments towards understanding the status of FS management so as to develop the institutions under which sector wide sanitation services can operate effectively. Of the 70% of HHs in Trinidad that use on-site technologies, estimates of 40% septic tanks use and 30% pit latrines use have been recorded (Louis, Magpili and Singleton, 2005), but the exact estimates for specific Constituencies are lacking in spite of the rapid increase in nation-wide unplanned (squatting) housing developments.

3.2.9 Conclusion

The next chapter presents the methodology which detailed how the author proceeded to investigate FS emptying services in Trinidad. The study proposition is that: the case study of this research would show that householders are generally satisfied with FS emptying providers operations in T&T, even though the emptying providers are unregulated and the FS disposal site significantly contributes to environmental degradation and public health implications. The methods used were aligned with what had been observed in the literature, but adapted to suit Trinidad's context. In this region sanitation research is confined to wastewater, so it is hoped that this study would give way for future on-site sanitation (FSM) investigations in the WCR.

4 Methodology

4.1 Introduction

This chapter presents the researcher's justification for the study methods, research design, data collection techniques used and field work context that were adopted in order to complete the study. In addition, the rationale for selecting the various data collection sources, the case and unit of analysis were presented.

4.1.1 Main Research Question

How do faecal sludge emptying providers in Trinidad operate and what factors of their services householders' are satisfied with?

4.1.2 Research Objectives

1. To identify what challenges faecal sludge emptying providers' in Trinidad encounter and understand how those factors influence their services.
2. To identify what factors determine Trinidad householders' satisfaction with faecal sludge emptying service providers'.
3. To propose recommendations that could help bridge current gaps in faecal sludge containment and emptying services in Trinidad.

4.1.3 Specific Research Questions

1. What challenges do faecal sludge emptying service providers' encounter in Trinidad?
2. How satisfied are householders' with the faecal sludge emptying services they receive in Trinidad?
3. What are some gaps in faecal sludge containment and emptying services in Trinidad?

4.1.4 Sources of Data

In order to achieve the research objectives, information was gathered from published literature, interviews, household surveys, observations and relevant country documents. A review of research methodologies was conducted so as to understand why certain methods are used, how could they be best used and determine the most appropriate approaches to use in order to achieve this study objectives.

4.2 Methodological Approach

The two types of research paradigms commonly used in research are the Positivist and Constructivist; but the Constructivists paradigm is mainly used in social sciences to answer questions about real-life events; "the truth being relative is based on one's worldview"

(Baxter and Jack, 2008 p1). Both approaches are further separated into pure/basic and applied research. Basic (theory-based) research involves examining variables in order to build or test a theory (using a theoretical approach to solve a scientific question in search of knowledge), while applied (problem-based) research is about “addressing an existing problem or issue” (Hancock and Algozzine, 2006, p 20). It involves gaining practical understanding of the problem in a natural, contemporary way. The idea is to use key God given elements, knowledge, understanding and wisdom to provide solutions to humanity problems.

The Positivist (top-down) approach attempts to solve a problem using experiments: moving from a preset theory to some conclusion/s. The process is as follows:

(Top) Theory ---Hypothesis --- Investigation ---- Conclusion (Bottom)

This approach commonly uses quantitative data (numerical measurements) to acquire precise results especially when a firm conclusion about a theory is needed and when both the population (numbers) and the scope of information needed are vast.

Alternatively, the Constructivist (bottom-up) approach (used mostly in social science research), moves from an investigation (data collection or observations) to either generate a theory or test a theory. The process is as follows:

(Bottom) Investigation ---- Patterns ---- Hypothesis ---- Theory (Top)

The Constructivist (bottom-up) approach commonly uses qualitative data (words) to ‘make sense’ of the problem. This is achieved by studying interactions between participant and researcher in a humanistic, natural and contemporary way (Baxter and Jack, 2008). The words are ‘coded’ to develop patterns which when analysed can develop potential propositions and later theories, which when observed collectively, they all give a clearer view of what the true problem is and how it can be best solved.

Based on the above overview on methodological approaches in research, the Constructivists (qualitative) applied research was concluded to be the most appropriate approach for examining faecal sludge emptying services, householders’ satisfaction with the services, and the gaps in this stage of the FSM service chain in Trinidad. Hence, the study focused on the exploratory qualitative case study research method and the combination of qualitative and quantitative sources of evidence to collect data was used to explore the issue.

4.2.1 Case study research design

The research design should not be confused with the work plan, whereby the later serves as a subsidiary to the research design. Therefore, in reference to Yin, (2009), the research

design “is a logical plan for getting from ‘here’ to ‘there’ where ‘here’ may be defined as the initial research questions and ‘there’ is some conclusion (answer) about those questions” (Yin, 2009, p 26). The research design is like a builder’s blue print, and deals with a logical problem not a logistical problem (Yin, 2009). Before, the research method was selected, it was imperative that the research questions were clear. Selecting the most appropriate research method is not always clear-cut because some research topics require the use of more than one method (nested methods) (Yin, 2009). Hence, there are five components to consider when doing a case study research that Yin, (2009) used and they are as outlined below (Yin components are in bold and the study research application is in plain text):

A study’s questions: The main research question of this study is ‘How do faecal sludge emptying providers in Trinidad operate and what factors of their services householders’ are satisfied with?’

Yin, (2009) indicated that ‘how’ and ‘why’ questions are best addressed by the case study method, as its focus explores or describes both phenomenon and context in a realistic way using various sources of evidence (Yin, 2009; Baxter and Jack, 2008).

Its propositions, if any: Depending on the context and phenomenon being investigated, case study research could be used to either build a theory or test a theory, or according to Baxter and Jack (2008), case studies allow the researcher to support ‘reconstruction’ or ‘deconstruction’ of various phenomena (Baxter and Jack, 2008, p1). Potential propositions can come from literature, observations based on generalizations, tested theories and professional/personal experience; they are important elements in case study research because they help develop the conceptual framework that guides the research (Baxter and Jack, 2008). Hence from the researcher’s literature review on FSM and personal experience living in Trinidad for the past 30 years, the following potential proposition was proposed.

Potential study proposition: The case study of this research will show that Householders are generally satisfied with FS emptying providers operations in T&T, even though the emptying providers are unregulated and the FS disposal site significantly contributes to environmental degradation and public health implications.

Its unit (s) of analysis: Before the researcher could determine and define the unit/s of analysis, the types of case study design needs to be selected, of which could be either of the options shown in the Figure 4.1 below. Thus, for this study a single case with embedded units of analysis was chosen. The country context was Trinidad, the case setting was the St Joseph Constituency (SJC) and the embedded units were two (2), (i) households within the SJC and (ii) faecal sludge (cesspit cleaning) emptying providers who operate in Trinidad. Based on expert advice multiple-case study design (with or without

embedded cases), increases the robustness of using the case study research method (Yin, 2009). However, time and resources worked against the researcher, resulting in a single-case design with embedded units being the suitable approach to explore the contemporary, yet neglected phenomenon.

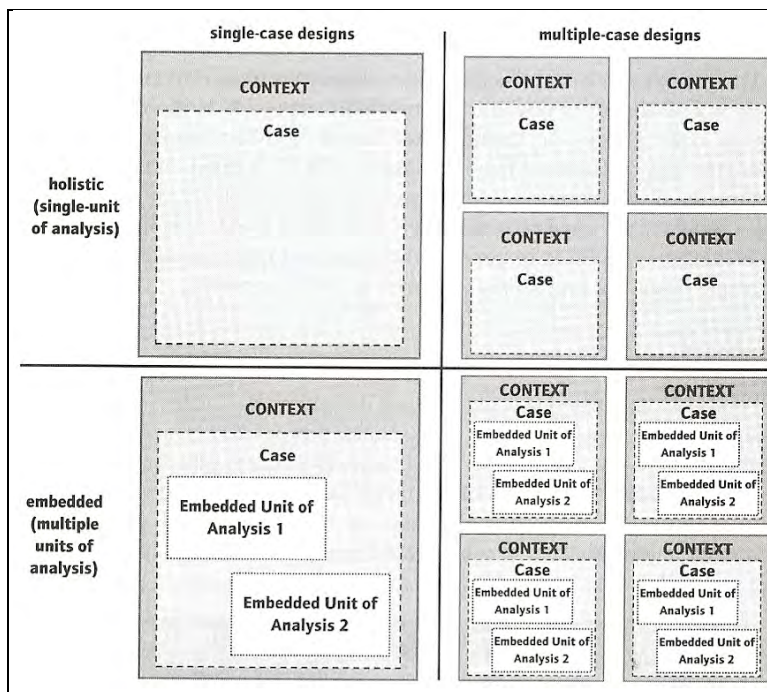


Figure 4.1 Basic case study designs. Adopted from (Fearon 2009),

The logic linking the data to the propositions: The combination of both qualitative and quantitative sources of evidence utilized in the study was relevant in covering all of the research objectives and exploring faecal sludge emptying services, householders’ level of satisfaction and some gaps in this stage of the FSM service chain in Trinidad. Qualitative primary data included interviews and observations, while quantitative primary data involved a household survey/questionnaire. Secondary qualitative evidence was sorted from available documentation. Both sources of evidence when braided together, add credibility to the case as well as would help the researcher understand the issue better in its local and global context.

The criteria for interpreting the findings: As stated by Yin (2009), five data analysis techniques include “pattern matching, time series analysis, explanation building, linking data to propositions, and cross-case synthesis” (Yin, 2009, p 34). Baxter and Jack, (2008), stated that using a single case with embedded units of analysis data can be analysed by (a) “separately (within case analysis)”, (b) “between different units (between case analysis)” or (c) “across all units (cross-case analysis)”; but a common disadvantage is that novice researchers’ fail to link individual analyses back to the global phenomenon initially

proposed, thereby shifting the focus of the research scope resulting in irrelevant study findings (Baxter and Jack, 2008, p7). Ultimately, no matter the case study, the focus should be to keep referring back to the proposition/s, because it keeps the analysis within study boundaries, explore rival propositions, derive alternate explanations of an issue and increases confidence in the findings as other propositions and rival propositions can either be accepted or fail to accept (Yin, 2009; Baxter and Jack, 2008). Furthermore, Yin, (2009) said generalizations to theoretical propositions and not populations should be the approach taken because a case does not represent a sample. In research when samples are taken, the frequencies of that sample is counted (statistical generalization), but in case study research cases are used to test or build a theory, resulting in analytic generalization (Yin, 2009).

4.3 Research Methods

In social science, Yin, (2009) outlined the five research methods that can be used to answer research questions: experiments, surveys, case study, history, and archival analysis methods (Yin, 2009). In an attempt to achieve the research objectives the research methods listed were briefly examined in order to select the most appropriate research method that would link the research objectives to the research design and the research design to the research method.

4.3.1 Experiments

An experiment is an empirical investigation conducted under controlled conditions for the purpose of examining the properties of, and relationships between specific factors (Denscombe, 2007). With reference to Yin, (2009) experiments deliberately separate phenomenon from its context by focusing on only a few variables (the environment is controlled in a laboratory) (Yin, 2009). However, its relevance in social science is held in high esteem by some social scientists as it is seen as a 'model of good practice' (Denscombe, 2007, p 48). An experiment focuses on ascertaining cause and effect relationships by isolating different factors, as well as testing existing theories. However, Denscombe, (2007) indicated that laboratory experiments differ from field experiments based on location, (on site; in the field), control (close control of variable; use available possibilities), measurements (precise or accurate; observations) and time (short duration; long duration) (Denscombe, 2007, p 58). Due to the context and phenomenon of this study the control nature of the Experiment method was deemed inappropriate and as such was not selected.

4.3.2 Surveys

A survey according to Denscombe, (2007) is a means of 'mapping' or 'to view comprehensively and in detail' (ibid, p 7). He adds that surveys provide a wide and

inclusive coverage when viewing a research problem; they provide details at a specific point in time and are a form of empirical research (Denscombe, 2007). Denscombe holds adamant that the survey approach is a research strategy and not a research method, while Yin, (2009) says surveys just like case studies are research methods, each with its own strengths and weaknesses (Denscombe, 2007; Yin, 2009). A survey has the potential to deal with phenomenon and context, but they are extremely limited by their ability to specifically examine context. The research has to constantly balance the number of variables to be analysed, the number of questions that can be asked, while achieving a desirable sample size from which valuable conclusions could be made (Yin, 2009). Nonetheless, the survey method was selected to address the quantitative data collection requirement of this study (Household surveys).

4.3.3 History

History is a type of research method used mainly in examining past events, however, contemporary events could be examined using history. According to Yin, (2009), history addresses the entangled relationship between phenomenon and context, but not in contemporary events (Yin, 2009). The nature of this study looks at a contemporary event (faecal sludge emptying services in present time, therefore History was not selected as the appropriate research method for this study.

4.3.4 Archival analysis

This method involves analysing archival records in search of identifying trends or evaluating performance for example organisational or student performance (Yin, 2009). This method was not selected because even though on-site sanitation has been used as a form of sanitation for decades, the formality of the service chain (FSM), has recently been given some attention by developing countries, because can be instrumental in addressing their sanitation shortcomings. As such the absence of artefacts/archival records on FSM from past years in developing countries, limits the use of this method for this study.

4.3.5 Case Study

According to Yin, (2009), a case study is an empirical investigation that looks at a contemporary phenomenon in its natural, realistic context, and should be used when the boundaries between phenomenon and context are not clear, behaviour cannot be controlled and to provide answers to 'how' and 'why' questions (Yin, 2009; Baxter and Jack, 2008). Formerly, case studies were viewed by researchers as being relevant only as a preliminary research method and could not be used to describe or test a hypothesis, but Yin disagrees. He argued that the hierarchical approach of evaluating research methods, where case studies are only appropriate at the exploratory stage of an investigation, exploratory and causal inquires can only be done using experiments and descriptive

phases are best addressed by surveys and history, are all stereotypical (Yin, 2009). In fact, distinguishing between the various research methods and determining their relevance, Yin, (2009) encourages researchers' to elude the hierarchical stereotypical approach in favour of a holistic and pluralistic approach. Hence, the three purposive approaches according to Yin, (2009) were: descriptive, exploratory, or explanatory, meaning that case studies, like any other research method, could be descriptive, explanatory, or explanatory (Yin, 2009).

Thus, when making a decision of which method is most appropriate to use in research, Yin indicated that the three criteria that should be used are: "the research question, control of behavioural events and focus on contemporary events", as shown in the table 3.0 below (Yin, 2009, p8).

Criteria to use when selecting a research method

	(1)	(2)	(3)
Method	Form of research Question	Requires Control of Behavioural Events?	Focuses on Contemporary Events
Experiment	How, why?	Yes	Yes
Survey	Who, what, where, how many, how much?	No	Yes
Archival Analysis	Who, what, where, how many, how much?	No	Yes/no
History	How, why?	No	No
Case Study	How, why?	No	Yes

Table 4.1 Adopted from (Yin 2009:8).

Denscombe, (2007) also added that case studies research that are discovery led are either descriptive, exploratory or comparative, while case studies that are theory led are either explanatory, illustrative or experiment. They are explained in table 4.2 below.

Types of research approaches when using the case study method

Discovery led	
Description	Describes what is happening in a case study setting (e.g. events, processes and relationships)
Exploration	Explores the key issues affecting those in a case study setting (e.g. problems or opportunities)
Comparison	Compares settings to learn from the similarities and differences between them

Theory led

Explanation	Explains the causes of events, processes or relationships within a setting
Illustration	Uses a case study as an illustration of how a particular theory applies in a real life setting
Experiment	Uses a case study as a test-bed for experimenting with changes to specific factors (for variables).

Table 4.2 Adopted from (Denscombe 2007: 38)

Therefore, based on Yin's criteria for selecting a research method, Denscombe's definitions of research approaches and Yin's case study design component guide, an exploration single-case study with embedded units of analysis was the research method used to achieve the research objectives and answer the research questions of this study. The findings of this study would serve as a pilot study for future research involving faecal sludge emptying in other constituencies' and the remaining components of the FSM service chain in Trinidad and Tobago.

4.4 Research Methodology

Introduction

The Constructivists approach requires respondent-researcher interactions which can be best achieved from one of the various primary sources of data collection tools: interviews, questionnaires/surveys, focus group discussions and observations (participant or direct). Conversely, documentation and archival records are secondary sources of data used (Denscombe, 2007; Yin, 2009). The various sources of data, when braided together, produce a clear picture of both the phenomenon and the context under investigation.

4.5 Questionnaire

Questionnaires, is a common data collection tool used when large quantities of data on a range of topics are needed from a large number of respondents (Denscombe, 2007; Wilkinson and Birmingham, 2003). Questionnaires, being a written list of questions can be most effective in that the questions when analysed produces substantial information, which is indicative of a well designed questionnaire. The aim must not be to change respondents' attitude but rather extract their views, opinions or experience about the research issue (Denscombe, 2007).

4.5.1 When is it appropriate to use Questionnaires?

According to Denscombe, (2007), questionnaires can be used when:

- The study involves a large number of delocalised respondents'

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- The information to be collected needs to be straightforward, short and uncontroversial
- The data needs to be standardized, and
- The respondents' literacy (ability to read and write) are able

4.5.2 Types of Questionnaires

Wilkinson and Birmingham, (2003), identified three types of questionnaires: "mailed survey, group-administered questionnaires and household drop-off survey" (Wilkinson and Birmingham, 2003, p10). While the mailed survey is the most common type of questionnaire used, among other factors, it generally suffers a low response rate; thereby it was not selected for this study.

Group-administered questionnaires tend to have a higher response rate than mailed surveys, because the groups when approached, they feel obligated to respond at that time. Households, while they appear in a cluster (group), the head of the HHs would not all be available at any one given time to answer the survey, so this survey type was not selected.

Household drop-off surveys, being a hybrid of mailed and group administered questionnaires, requires the researcher to hand deliver the questionnaire to the participant household, to be collected at a later date. This approach although time consuming, allow the participant to have any questions addressed during the drop-off or collection period, increasing the response rate and number of completed questionnaires (Wilkinson and Birmingham, 2003).

The hybrid (household drop-off) questionnaire was the questionnaire type used by the researcher to collect quantitative data from households in the case site (St Joseph constituency). The Enumerators would approach the HH and request their participation, either by verbal or written consent. They (Enumerators) would wait until the participant complete the survey, allowing the participant to have any question/s they may have clarified. Additionally, should some respondents' have a slight disability (e.g. poor sight when reading etc) but wish to contribute their experiences; the Enumerator can provide some assistance by scribing their responses or reading the question to them. Finally, in an attempt to achieve a reasonable amount of completed surveys and a timely and sufficient response rate, the Enumerators waited for the participants completed survey rather than returning for it at a later time.

4.5.3 Considerations needed when designing questionnaires

In referring to the guidance given by Denscombe, (2007), the following were some considerations used when designing the HH drop-off questionnaire tool:

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- Simple language used with all technical terms substituted with 'lay man' terms
- The national and local culture was considered when posing questions
- Sensitive questions or offensive phrases were avoided e.g. salary range, ethnicity, 'shit' etc.
- Only questions relevant to the research objectives were asked
- Unwarranted assumptions were avoided
- Significant questions were set first, while general information was placed at the end
- Short and straightforward questions were set to prevent boredom and tardiness
- Sufficient options provided along with the 'Other' option for respondents' to add their thoughts if it was not pre-coded by the researcher (Denscombe, 2007).

4.5.4 Advantages and Disadvantages of questionnaires

The questions were a mixture of open ended (expression of thoughts, opinions, experiences) and closed ended (pre-coded options to chose from) questions. However, some key advantages and disadvantages of questionnaires can be seen in the table below.

Advantages and disadvantages of Questionnaires

Advantages	Disadvantages
Easy to construct	Poor response rate
Cheap way of collecting data	Limited in verifying truthfulness
Answers can be pre-coded for simplicity	Bias by limiting and shaping answers
Can collect data from large populations	Incomplete or poorly completed surveys

Table 4.3 Adapted by author from (Denscombe 2007:171).

4.6 Interviews

Introduction

Interviews being one of the most important sources for data collection of factual straightforward information used in case studies are better exploited when applied to the exploration of complex or sensitive issues (Yin, 2009; Denscombe, 2007). They gather information on participants feeling, experiences, thought and opinions thereby making questionnaires or archival records a less appropriate method. When conducting in-depth interviews, or interchangeably (interviews), the viability and feasibility (minimal cost, travel and informants easily accessed) of the method should be carefully considered (Denscombe, 2007). There are three models of interviews; unstructured, semi-structured and structured.

4.6.1 Unstructured interview

Unstructured interviews are very flexible. The interviewee has the opportunity to 'speak their mind' on an issue that is guided by the researcher. No predetermined list of questions is set, but the guide predetermined by the researcher provides some control over the interview. When using this model, if the interviewer is unable to steer the interview, they can lose control over the interview as the interviewee discussions may stray from the topic of interest. Unstructured interviews are very time consuming (interviews can last for hours) and the data analysis can be exhaustive (transcribing and coding extensive amount of recordings) (Wilkinson and Birmingham, 2003).

4.6.2 Semi-structured Interview

When using semi-structured interviews, the researcher has a list of clear questions on a topic or issue to which the interviewee would be asked to answer. It is less flexible than unstructured interviews because the interviewer has more control and steers the discussion by posing the questions. Moreover, this model allows the interviewee to direct the flow of information as they were allowed to express their thoughts, opinions and experiences openly (Wilkinson and Birmingham, 2003).

4.6.3 Structured Interviews

A structured interview involves a rigid control and an orderly list of structured questions and answers. This model, because of its rigid nature can be associated with quantitative data collection, since it resembles a questionnaire being asked face-to-face (Denscombe, 2007). The main advantage to using this model is the standardized approach which provides uniform information for comparison of data, thus simplifying data analysis (ibid).

4.6.4 Focus Group Discussion (FGD)

FGDs are similar to interviews, but for the extraction of information from small groups. It consists of the group (small is better) and the Moderator (most likely The Researcher). The Moderator facilitates the discussion by providing a stimulus and observing the group's response to that stimulus. This process allows the researcher to gather a wealth of rich information from the group as well as learn from the group interactions, their perceptions, experiences and opinions about the topic or issue in focus (Denscombe, 2007).

Advantages and disadvantages of interviews are as outlined in the table below.

Advantages	Disadvantages
Provides a vast wealth of information	Costly in terms of time
High validity	Subject to interviewer- effect/biases
High response rate	Data analysis can be exhaustive

Table 4.4 Adapted by author from (Denscombe 2007)

Interviews being a good data collection tool would be used in this research, because the topic, while it is not a palatable topic of discussion for the average countryman, the process of how operators view their job, society's opinions of them and what the topic involves may be sensitive to some informants. Interviews would allow the researcher to explore the context in which FS emptying is performed in Trinidad in more detail than had previously known.

4.7 Observation

Observation is a primary source of data collection and can be developed as part of a case study protocol during which time the fieldworker collects data in the form of field notes so as to understand the norms, attitudes and processes of the investigated groups (Yin, 2003; Denscombe, 2007; Wilkinson and Birmingham, 2003). Denscombe (2007) noted that Systematic and Participant are the two main kind observation used in social science research. Systematic observation favours quantitative data along with statistical analysis, while Participant observation favours qualitative data, thereby allowing the researcher to penetrate the situation so as to unravel, understand and explore cases perceptions (Denscombe, 2007). Participant observation involves a variety of skills such as listening, participating, interacting, recording, timing, and contributing to name a few (Wilkinson and Birmingham, 2003).

Yin, (2009) said that Observation evidence can be so valuable that photograph taking at the case site, can significantly help the researcher to convey vital case characteristics to outside observers. Additionally, reliability of observational evidence can be increased when multiple observers, simultaneously make observations at the same case site (Yin, 2009).

Observation evidence would provide great insight into the actual process of FS emptying services in Trinidad because it would give the researcher an opportunity to see what really happens compared to what is said, gain hands on evidence of what factors satisfy HHs and identify the challenges the both providers' encounter. The researcher was unable to directly or participatory observe FS emptying in Trinidad, because this research strategy was adopted upon the researcher return from Trinidad and Tobago (see section 4.15). Nonetheless, the author managed to obtain photographs of containments, aspects of emptying services and the primary faecal sludge treatment facility (disposal site).

4.8 Documents

Documents are a secondary source of data collection and can be used throughout the research design. Types of documents include government administration documents,

reports, newspaper articles, journals, websites, diaries, formal research and grey literature. According to Yin, (2009), documentation strengths were listed as being “stable, unobtrusive, exact and broad in coverage”, and the weaknesses to be, “access, selection and reporting bias and difficult to find” (Yin, 2009 p102). In case studies, documentation is used to substantiate and compare evidence from other sources. Yin, (2009), said that over reliance on documentation was a common mistake among researchers pursuing case studies, because documents were written with a specific purpose and to a specific audience, to which their findings were taken as the ‘gospel’ truth (Yin, 2009).

The documentation sources of information deemed necessary to this study were country specific technical specifications on septic tank construction, FSM policy documents, Guidelines for FS emptying and FSM sector wide planning documents for T&T. Documents (once accessible) could be used to help the researcher achieve the research objectives, suffice reliability and validity concerns of other data sources and triangulate verbal records with written records and written records to actions taken.

4.9 Conclusion

In conclusion, the sources of data collection that could be utilized were questionnaires, interviews, observation and documentation. All the above data collection sources would help the researcher explore FS emptying in Trinidad in a case setting, minimise bias by their use of different sources and identify key points of improvement for scaling up the research in the future.

4.10 Triangulation

Triangulation involves the practice of viewing an issue from multiple perspectives. It can include the use of different methods, different data or sources of evidence and different researchers participating in the same study to increase the validity of the study. The four kinds of triangulation include: data, theoretical, researcher and methodological with the fourth being the most common type of triangulation used in social science research (Denscombe, 2007).

For the case study aspect, methodological triangulation (within methods) and data triangulation were used to enhance the validity and reliability of the findings. Notably, using the two types of triangulation does not exempt a study from bias; it simply reduces the bias, so caution should be taken when citing the study conclusions.

4.11 Ethical Consideration

Ethical clearance was obtained from Loughborough University Ethics Approval (Human Participant) Sub Committee, on the 8th July, 2016. The completed ethics form can be viewed at the end of the Appendices section. The FS emptying providers and HHs were

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briefed on the purpose of the study, why they were selected and the benefit of the study through a Participant Information Sheet and a Consent form, which were emailed to the FS emptying providers prior to the interview date and the HHs had the option of providing verbal consent after receiving and reading a written consent administered by the Enumerators before the start of the survey.

4.11.1 Country Approvals

No approvals forms for approaching HHs in Trinidad were obtained. The author being a national of T&T was not required to complete any research approval forms, mainly because they were not applicable as the author was operating within their own community. Approval might be applicable to non-citizens conducting specific research in T&T. However, approval had to be obtained by the government and private Technocrats (CEOs and Managers) before engaging their staff members. In the case of interviewing the SJLRC, approval was obtained by the RC CEO prior to interviews and upon completed interviews, the Cesspool Supervisor transcribed notes were vetted by them and a copy was made available to their CEO. The private companies Managers/business owners had to give their approval for either them or their staff to participate in the interview, which was granted for one of the private companies, although they later declined to participate in the study.

Participants were informed of:

- Their decision to withdraw from the study at anytime without giving an explanation to the researcher.
- Their participation being voluntary and they will not be given any incentives or reward for their participation
- Their contributions will be treated with confidentiality and anonymity. The FS cleaners were also given the opportunity to vet their transcribed notes prior to the final publication. They were free to request omission of any statements recorded in the notes.
- Their freeness to ask any questions and to know that they were under no obligation to participate in the study was encouraged.

Finally, mainly verbal consent was obtained from both case groups. The Householders were administered a survey and FS cesspit cleaners were invited to participate in a semi-structured online (Skype) or telephone interview. A copy of the consent form used can be viewed in the Appendices Section.

4.12 Case location and context

The St Joseph Constituency is one of the 41 constituencies that make up the government of Trinidad and Tobago. It is situated along the East/West Corridor of Trinidad and falls

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under the jurisdiction of the TPRC, the local municipality responsible for administering local services to those communities. As can be seen in Figures 4.2 and 4.3, the TPRC is one of the country's largest municipalities and consists of about 70 communities. The 2000 Housing Population census indicated that the TPRC population consists of 203,975 persons (55,206 HHs), and estimates that by 2020 the population projections would increase between 330,000 and 380,000. The topography of the region is dominated by the Northern Range (average elevation between 457 and 610m) and is home to sixteen (16) watersheds and one of the four major aquifers in Trinidad, The Northern Gravels (TPRC, 2012).

The WRA indicated that the highest water table in Trinidad resides along the East-West Corridor and Chaguanas. Nonetheless, the TPRC (2012) investment plan outlined key problems to be lack of centralised sewerage treatment, incidence of squatting and unauthorised development and the vulnerability of some areas to landslides and flooding, yet no mention was made in their strategic direction to address faecal sludge (on-site sanitation) issues (TPRC, 2012). Thus it is evident that not only little attention is given to on-site sanitation, but very little is known about the actual consequences of neglecting to address it at the local governing level.

The TPRC has highly dense communities some as seen in Figure 4.3 below. Noticeably, the SJC was flagged as a densely populated community, with an estimated population of about 2,593 plus HHs (Hernandez, 2016). Based on the author's knowledge of the area and their personal communication with Hernandez (2016), the SJC boundary (rough sketch Figure 4.4), belongs to the St George district and consists of, San Juan, Aranguez, Mt Hope, Mt Lambert, St Joseph, Champ Fleur, Petit Bourg, Curepe, Valsayn and St Joseph. Also, areas such as, Bamboo settlement (outside red outline) and Mt Dor are included in the SJC (Ifill, 2016 and Hernandez, 2016). The topography of the SJC has a mixture of hilly and plain (flat) areas. The areas with a mixture of plain and hilly zones are Petit Bourg, Mt Dor, Champ Fleur, Mt hope, upper San Juan and St Joseph, while Aranguez, Valsayn, Mt Lambert, lower San Juan, Curepe and Bamboo settlement are predominately plain areas, all prone to flooding during the rainy season. Such characteristics are not indigenous to the SJC only, but could be observed in other constituencies; hence the SJC can be seen as a small but representative case for most of the northern parts of the larger twin island, Trinidad (Ifill, 2016).

Figure 4.3 Population densities of communities within the TPRC. Adopted from (Tunapuna/Piarco Municipal Investment 2012: 7)



Figure 4.4 Rough sketch of the SJC boundary (red outline) not drawn to scale. Adopted from (Ragoonath 2015)

4.13 Rational for selecting the case and units of analysis

In this study, Trinidad was viewed as the context in which the case would be studied, even though the island could be viewed as the case should the boundaries extend to include the WCR.

4.13.1 St Joseph Constituency (case)

The SJC was selected because it is a small, dense community with similar characteristics (topography, population density, sanitation systems etc) to other constituencies in the north of Trinidad. Additionally, from both WASA's records and the author's knowledge most HHS in this constituency were not connected to WASA's sewerage network system (non-sewered); meaning HHS in the SJC add to the 70% of the population that rely on on-site sanitation facilities and services. There are WWTP lifting stations in two areas (St Joseph and Mt Hope) that collect sewerage from planned private and public housing development communities (WASA, n.d), but they (communities) are few. Also, as outlined in section 4.15, time and resources limited the researcher's efforts to approach multiple non-networked constituencies located in central and south Trinidad. The author, being a national of Trinidad and Tobago and a constituent of the SJC for the past 30 years,

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concluded that the SJC having a high percentage of non-networked areas, the Enumerators familiarity with the community, and HHs being readily accessible, to be the reasons for purposively selecting the SJC as the case area to investigate faecal sludge emptying services and HH satisfaction with FS emptying providers' services in Trinidad.

Moreover, the researcher did not have specific evidence on current HH income values, but based on participatory observations (living in the area), the author assumed that the SJC has a relatively fair mixture of high, middle and low economic HHs spread throughout the constituency, therefore, no group or area would have been isolated, targeted or favoured (Ifill, 2016). It would also allow the researcher to capture HHs that use either type of containment (septic tanks or pit latrines), rather than just one. The house-hold drop-off questionnaire type was selected as the survey tool which required Enumerators to walk through the districts, drop-off the survey and wait for them to be completed by the respondent. This process would have occur on weekdays and or weekend on evenings when homeowners (the Parent or Guardian making the decisions in the home) would most likely have returned from work or be at home, and the Enumerators had finished their work shift or had more time on weekends.

4.13.2 Embedded case one

Households (HH)

Households were selected at random by the Enumerators from each of the areas that fell within the SJC. For the purpose of this study, Households were represented by *a single (one or two storey) house occupied by the homeowner, landlord, or caregiver of the property and their family, residing in any of the districts within the SJC and use a septic tank or pit latrine to contain their faecal waste* (Ifill, 2016). Therefore, HDC apartment complexes/planning, houses with a business on the property (e.g. living quarters on the first floor and restaurant business on the ground floor), school buildings, hotels, guesthouses, mini –marts, shops, privately owned apartment complexes, commercial buildings, industries, factories, groceries, public shared buildings (e.g. community centres, churches etc), public sanitation facilities (public square toilets etc) and government buildings were all excluded from this case unit.

4.13.3 Embedded case two

Cesspit Cleaners

The aim of this study placed this group at the heart of the research; hence it was imperative that they were included once they provided faecal sludge emptying (cesspit cleaning) services to HHs. They were purposively selected based on accessibility and type of provider (private or public). Private companies contact information was obtained from

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mainly the Trinidad and Tobago yellow pages, and from areas where they advertised (electrical poles and walls). The public providers (municipalities) contact information was listed in the directory, but their Cesspool Department was visited. The private providers were not unionised, hence they were not all based in one place nor do they work in only one geographical area. While their business might be located in one area (e.g. Chaguanas), they provided cesspit cleaning services to any area or constituency throughout Trinidad, without any legal restrictions. However, the public providers were more confined by their regional boundaries and as such mainly provided emptying services to communities that fell under their jurisdiction.

Nonetheless, Nigel McCarty, (2016) in a personal communication, indicated that the latter arrangement was not always upheld by RCs that were close to each other, for example the SJLRC and the TPRC jurisdiction lines are so close; either RC could provide emptying services to the SJC. See also Figure 4.2 to view the proximity of the TPRC to the SJLRC and three other RCs. Furthermore, McCarty said that the RCs were also disjointed and the Cesspool Supervisors of the various RCs that have Cesspool Departments do not collaborate, share documentation, nor engage in inter-organisational communication, or planning activities with each other (McCarty, 2016).

4.13.4 Enumerators

The researcher was unable to travel to Trinidad a second time to conduct the HH surveys, because of limited resources and again a change in the study direction, such a visit was not factored in (See section 4.15 for further information). However, thanks to a few instrumental Enumerators, the surveys were administered. The Enumerators were family and friends of whom all had some experience, from past tenures in conducting national surveys, they are involved in scientific or market research and lives within and around the SJC. The names, position in relation to the research and Constituency of the Enumerators were outlined in the Table 4.5 below.

Enumerators of the study

Enumerators Name	Position in relation to research	Constituency
Ms. Avion Kim Ifill	Manager (Survey Administration)	St Joseph
Ms. Lovon Ifill	Enumerator	St Joseph
Mrs. Camille McEwen-Small	Manager (Data Entry)	Tunapuna/Piarco
Mr. Nazim Nimblet	Enumerator	St Augustine

Table 4.5 compiled by the author (Ifill, 2016)

Each Enumerator, based on distance, assigned themselves to two or three areas within the SJC boundary. Some Enumerators had vehicles (3 out of the 4) and as such they surveyed the districts that required the most walking. For example, taking the Petit Bourg area which is partly hilly, HHs in lower, middle and upper Petit Bourg were approached to participate in the survey, so the Enumerator on foot would have to do a lot more walking to reach the furthest HHs. That strategy (sampling lower, middle and upper HHs) was used by all the Enumerators throughout each area so as to achieve a representative sample of HHs perspective on satisfaction factors of FS emptying service in the community. Enumerators' experiences during analysis were considered so as to caution the researcher's theoretical generalizations on the issue. Ms Avion Ifill was responsible for leading the survey team (distribution of surveys, Enumerators resources etc), while Mrs McEwen-Small printed the electronic surveys, collected the participants completed surveys and entered the data using a readable computer software. The compiled data was sent to the author for their analysis.

4.14 Actual data collection strategy used

The appropriate type of data collection and sources of evidence used in answering the specific research questions are outlined in Table 4.6 below.

Strategy used to answer the specific research questions

Research Questions	Type of Data Collection	Source of Evidence
What challenges do faecal sludge emptying service providers' encounter in Trinidad?	Quantitative & Qualitative	Interviews, questionnaire, observations
What factors determines householders' satisfaction with faecal sludge emptying services?	Qualitative	Questionnaire, interviews
What are some gaps in faecal containment emptying services in Trinidad?	Qualitative	Interviews, documents, observations, questionnaires

Table 4.6 Adapted by author from (Nkansah 2009:121)

4.14.1 Questionnaire

One Hundred household drop-off questionnaires was the quantitative data collection tool used to gather information on HHs perceptions of satisfaction factors with FS emptying services. The questionnaires were designed by the author with the Social and Hygiene,

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Economic, Financial, Technical, Institutional and Environmental (SHEFTIE) framework so as to guide the analysis and discussion of the findings. The survey questions were then emailed to Mrs Camille McEwen –Small in Trinidad, who formatted the questionnaire into a computer readable format, allowing for quick data entry. Once the desired design was achieved, 100 surveys were printed. Thirty percent (30%) participation was determined to be representative of the case area since that percentage would reflect normalcy. That 30% is what statisticians use as an estimate of normal distribution among a sample population and would be representative of what the rest of the constituencies HHS responses would be should the survey extend to other constituencies. A quota sample of 100 surveys was applied with the intent to achieve a minimum of 30% to a maximum of 60% response rate of HH perceptions on FS emptying services. The questions were coded into the six (6) broad themes: Technical, Economic, Satisfaction, Social, Institutional and Environmental, adapted from the SHEFTIE framework. The main factors reflecting HHs satisfaction factors of faecal sludge emptying services was determined using this approach.

Ten surveys were piloted on male and female locals within the community. Based on the persons responses and the Enumerators comments, some questions were either re-constructed (made easy to understand), omitted (reduce survey length and time spent for completion) or written using simpler phases. From the pilot it was found that questions which asked Participants' to rank their responses were a bit troublesome for the Respondent and as such the questions were simplified by removing the ranking aspect. The questionnaires were distributed to randomly selected HHs by the Enumerators. The number of actual completed HH surveys and other findings were detailed in chapter five. A copy of the questionnaire and respondents' main thoughts related to each coded theme, have been attached in the Appendices section.

4.14.2 Interviews

The key informants for the interviews were conveniently selected. The semi-structured interview tool was used to identify the challenges encountered by FS emptying service providers and determine how those challenges influenced FSM. Both telephone and online (Skype) interviews were used. Prior to the actual interview, some interviewees when contacted indicated that their time was limited and that the telephone option would work best for them, while others who had access to a computer with the Skype software installed, opted for the online option. A list of questions was prepared to guide the interview with participants. Five Cesspit Cleaners (public and private) were identified, of which 1 public manager and two operators (both public) participated.

The names of the private CCs, as listed in the Trinidad yellow pages were: AJR Septic Cleaning, Cousin's Septic Cleaning, AAR (Ragbar) Cesspit Tank Cleaning and Emergency Septic Tanks and Systems Cleaning Services, while the public emptying provider was the

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San Juan/Laventille Regional Corporation (SLJRC). Of the 4 private companies listed, all 4 were contacted. One company contact number seemed to be out of service since numerous calls to that number was unsuccessful. Three of the remaining four companies responded. Of the three who responded, one company Manager was out of the country at the time of the interviews and the Secretary was unable to give any approvals without the Manager's authorization. Another company did not give their approval and opted not to participate in study. The fourth company gave their approval and opted to participate by telephone interview on a set date, but when time came to conduct the interview the Manager was not answering the numerous calls made by the author. An explanation for non-participation was the Participants' right (stated in the Participants' information sheet located in the Appendices) and the author respected their rights at all cost.

The final sample size for the private CCs was zero.

The SLJRC is situated in the Champ Fleur area within the SJC and even though its jurisdiction serves San Juan/Laventille communities, they provide cesspit emptying services to parts of the SJC. The SJLRC is situated north of Trinidad therefore; the views shared by their Cesspool Team might or might not represent the views of other northern and southern RCs Cesspool Teams. However, in referring to section 4.15, the author attempted to seek the participation of a RC in the south of the island, but it was unsuccessful. The SJLRC Cesspool Department Supervisor and Operators volunteered their participation; hence they were conveniently selected to provide some insight into the public providers' (RCs) perspective on FS emptying services in Trinidad.

The TPRC (responsible for the SJC) was approached (a letter to the CEO was delivered) but the author was informed by a staff member that records of their Cesspool Department were held under the City of Port of Spain Public Health Department. It should be noted that the letter was written in line with the researcher's initial research objectives which changed upon the researcher's return to their support University.

The interview questions were also coded using the six (6) broad themes as the HH survey so as to explore what challenges CCs face, triangulate the different data collection methods used (survey versus interview) and be able to discuss the findings. The interview questions were piloted with an Operator and the Enumerators in Trinidad. This strategy helped the researcher to ensure that the language or phrases used was appropriate (culturally sensitive); the questions were worded properly (easy to understand), and to eliminate any misleading questions.

The telephone interviews all lasted between 30- 45 minutes, while the Skype interview lasted 40 minutes. The recordings were transcribed and emailed to the participants for vetting purposes. Any statements made, to which the Participant did not wish to have

published were not included in the study and were removed from the transcript. While the provider's names were stated, interviewees' who were exposed to employment risks requested that their names were not mentioned in the study; they were all coded as (Public Interviewee). However, some interviewees, upon approval, their names were mentioned in the study. The findings were outlined in chapter five. A template of the interview questions for Operators and Managers, the interviewees' thoughts relating to the six themes and full transcripts of one of the Interviewees, were attached in the Appendices section.

4.14.3 Direct observation

Due to the alternative research direction (occurred after the researcher returned from T&T), the researcher was unable to directly observe a septic tank or pit latrine being cleaned/emptied, but did managed to obtained photographs of containments (self constructed and ready-made) and latrines, FS emptying equipment and service and the Beetham disposal site.

4.14.4 Documentation

Upon purchase, the author was able to view the TTBS document titled: Trinidad and Tobago: Code of Practice for the Design and Construction of Septic Tanks and Associated Secondary Treatment and Disposal Systems (TTS16 80 400: 1991). It was from that document the author was able to define the areas for the containment photographic evidence, which has been presented in chapter 5. Other documents viewed included Rotoplastics catalogue on their septic tanks specification and deign and the SJLRC internal guidelines on HH preparation for cesspit cleaning services. The low documentation sample size meant that the study discussion and conclusions were cautiously drawn from the HH surveys and key informant interviews (KII). In addition without documents the author was limited in triangulating the other two sources of evidence investigated (e.g. disposal site photos to documented design drawings, maintenance, and emptying guideline to national guidelines, FSM policy documents etc).

4.15 Researcher's experience

Prior to pursuing the present research direction, the researcher initially set out to investigate the "Institutional arrangements for FSM service chain in Trinidad and Tobago". Therefore, the author visited Trinidad from May 23rd 2016 to June 9th 2016 (18 days) with the primary aim being to make contact with Technocrats in the relevant government ministries and request the opportunity to view public and or ministerial documents surrounding FSM.

At a later date, they (Technocrats) would be invited to participate in an online Skype interview so as to explore their knowledge, attitudes and perceptions on how the FSM service chain can be improved.

The researcher wrote letters to the heads of the various ministries informing them of their intentions and request for information. To the researcher surprise, resistance was the main response received. None of the twelve (12) Government Ministries to whom letters were delivered to, responded to the Author.

One WASA employee, who will not be named, even told the Researcher to *“be careful what you write in your paper because you don’t want when certain people read it, they victimise you. After all Trinidad and Tobago runs on inefficiency and sanitation being neglected is big business for some people”* (WASA, 2016).

Was the latter quote a scare tactic, a threat or a word of caution?

However, the author managed to speak with some staff (Specialised Officers) in two ministries (EMA and SWMCOL), but they were unable to provide substantial evidence without their Heads of Department approval, which was never granted. No feedback was given despite the researcher’s calls and emails to the various Ministries.

Interestingly, the researcher contacted the Cesspool Supervisor (CS) of a RC in south Trinidad (not named), to request a meeting.

That meeting would have allowed the researcher to deliver the letter to the CEO of that RC and seek the CS participation in the online interview at a later date.

The call was made and the CS agreed to meet the author. While in transit to the RC the following day, the author received a call from the CS informing them (the author) that they (CS) could not meet because they (CS) was called into a meeting with their CEO the morning of the visit and was commanded not to disclose any information to the author. No further explanation was given, so the author aborted the visit and planned their next course of action.

The Researcher visit ended and upon returning to their supported University, they briefed their Dissertation Supervisor about their experience. Their Supervisor then advised the author to re-focus their approach and rather than attempting to explore the issue from the top (Technocrats), explore it from the bottom (Citizenry), mainly on the first two stages of the FSM service chain. Hence, the alternative approach taken served to explore “faecal sludge emptying services in Trinidad” using the case study research method.

This pose a challenge for the researcher because the case study method, being a difficult method, was not initially considered by the researcher, therefore time had to be spent first understanding the case study concept before any research design could have been done.

Additional literature review focusing on FS emptying had to be carried out and the logistics of conducting a HH survey/questionnaire while in the UK, had to be determined, all in a short space of time. As flustered and discouraged as the researcher felt at the time, they approached the task as best as possible.

This experience has left the researcher both baffled and Interested at the same time.

Baffled because of the resistance given and interested to know why there was resistance, especially towards exploring FSM in their home country. Is sanitation in Trinidad and Tobago deliberately neglected for monetary gains of a few? Who are those beneficiaries? Why does it seem like the government of Trinidad and Tobago has turned a 'blind eye' or 'buried their heads in the sand' regarding on-site sanitation? (Ifill, 2016)

4.16 Logistics of data collection

In order to complete the new study focus within the allotted time, firstly, a quick interpersonal feasibility assessment was done to determine if the author had sufficient money, time, and assistance back home to conduct the HH surveys. Secondly, before, either HH surveys or interviews could have been advanced, Loughborough University/WEDC Risk Assessment forms were completed and submitted for clearance.

4.16.1 Travel arrangements

The author was unable to make a second visit to their home country to conduct interviews and administer HH surveys. Instead the researcher had to rely on family and friends to administer the HH surveys and enter the data collected. Refer to section 4.12.4 for Enumerators details.

4.16.2 Data Collection tools

The questionnaire was designed to suit the culture of Trinidad and was formatted to allow for quick completion by the participants. The semi-structured interview questions were kept short and only relevant questions were asked. Since the interviews were telephone and Skype online interviews the researcher concluded that it was cheaper to use the Skype pay as you go credit system to conduct the telephone interviews (mobile calls from the UK to T&T were too costly), while they relied on the internet for the Skype online interview. In order to record the telephone interviews for transcribing, an online recording software (Eaver) was purchased. Enumerators were not paid for their services, but printing and all other costs were absorbed by the researcher.

4.17 Data collection schedule

Questionnaires were piloted from 25th to 27th July, 2016 and administered from 1st to 8th August, 2016. The data was entered on the 9th August, 2016 and returned to the author on the 10th August, 2016. Interviews were conducted on the 26th (two participants) and the 29th of July, 2016. Transcriptions were done during the 30th to 1st August, 2016.

4.18 Limitations of data collection

The data collection was approached with high expectations, but due a vast number of unforeseen occurrences, the research suffered many limitations. They were as follows:-

- The absence of the researcher during the HH survey limited the extent of what could have been investigated. While the Enumerators were aware of the topic being investigated, they mainly focused on conducting surveys rather than verifying participants' responses. In addition, their time was volunteered and the surveys were conducted after both them and the home-owner working hours. Without verification of truthfulness (direct observations of containment), the participants' responses were taken at face value; reporting bias could be present.
- Enumerators lacked the technical expertise to adequately assess containment design so this aspect was excluded from their task. Also, Enumerators had some experience conducting surveys but they were not trained in the topic investigated which could have affected the data collection process using the survey tool.
- Interviewer bias from both the Interviewer and the Enumerators may have occurred of which cautioned the Author's ability to make theoretical generalisations. Some Enumerators indicated that the Indo-Trinidadian participants all declined their invitation to participate (aspects of ethnic discrepancies), resulting in no input from that ethnic group.
- Data tool used- The researcher having to remove ranking questions on the survey may have missed HHs major concerns and reduce the potential of those questions on zooming in on a particular issue. The ranking aspect took the respondents too long (40 minutes) to complete the survey and time was a critical factor for both the respondents and Enumerators.
- Time and resources were major limiting factors for the author, which resulted in a single case study with embedded units of analysis being the approach taken. Multiple case studies would have been more robust in exploring this issue.
- Interviewees' indicated that their job did not afford them much spare time so online interviews rather than FGDs were most feasible. Therefore, the author was limited by what could be asked due to time limits and the cost of purchasing Skype credit. The wealth of information was limited in the absence of FGDs.

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- Selection bias- The interviewees were purposively selected based on accessibility, and willingness to participate resulting in a small sample size. Other key players, at different geographic locations were missed. Hence, the views of the public FS emptying providers interviewed might or might not represent other geographically located public and private CC providers.
- National documents being inaccessible limited the author's ability to triangulate the various sources of evidence used, providers operations and gaps in FS management at the institutional level.
- Response bias-While interviewees said that a national policy on the issue and guidelines for FS management were absent, the non-participation of Government Agencies and Ministries could mean that some framework or plan for FSM development might have been available. Caution was taken when discussing the findings.
- The last minute change in the research direction together with the date at which the author received the confirmation email of Ethical Clearance posed a challenge, because no data collection could have been taken outside of the University Ethical Approval Guidelines (Ethical forms were submitted July 5th 2016, the approval confirmation email was sent July 8th 2016 but the author did not receive the email (technological error). However a forwarded confirmation email was received by the author on July, 25th 2016. The time lost limited the number of interviewees that could have been interviewed (small sample size), the time for Enumerators to conduct HH surveys, data entry and retrieval.
- The data entry personnel in Trinidad fell ill (diagnosed with an auto-immune diseases) which delayed the data entry process and time the author received the data.
- In addition, the author had to wait for the public and private interviewees to vet their responses and communicate their opinions back to the author. The public interviewees contributions could not have been analysed until their CEO gave approval of which took longer than expected.
- The weather (sporadic heavy rainfall as T&T rainy season began) posed a challenge for the Enumerators to complete the survey within the schedule time, thus the intended quota of HHs surveys were not met.

4.19 Conclusion

From reviewing this chapter, the author was able link the objectives with the research method selected and the data collection tools utilized. Given the numerous limitations, the

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data collection tools used was found to be adequate in answering the main and specific research questions; the findings were displayed in chapter five.

5 Results

5.1.1 Introduction

This Chapter presents the findings of the data collection sources. The first presentation would be observations, followed by household surveys, and interviews. Documents as stated in chapter 4 were too small a sample size to make major contributions, but containment and emptying guidelines were retrieved and have both been used as a framework for observations to be examined. Observations would be presented firstly on containments, followed by FS emptying services and finally the disposal site. The main results from interviewees' contributions have been presented using pre-coded themes. Additionally, a brief analysis between the embedded units has been done so as to provide insights into this issue and possibly link the findings to the study propositions.

5.2 **Observations and Documentation**

The direct containment observations were made using the basic boundaries for investigating above-surface external containment characteristics: containment type, containment size and adherence to National Standards, access to inside the containment, accessibility in relation to Cesspit Cleaners getting to the tank itself and containment exterior maintenance/evidence of nuisances (flies, smells, leaking).

5.2.1 Containment type

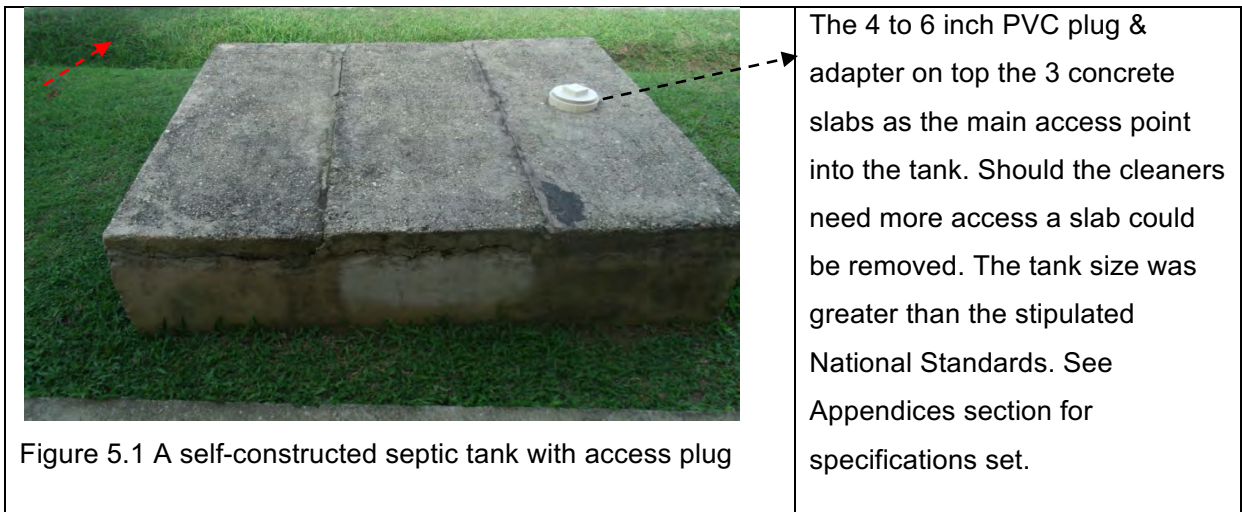
The following photographs were observations made by the author regarding containments: self-constructed septic tanks, Rotoplastic 'Fatboy' septic tanks and pit latrines. For the purpose of this study "*self constructed septic tank meant the owner fitted the cost of purchasing the materials, paying the labour fees and building the system either by doing all the work themselves, hiring a tradesman to do the work or partnering with a tradesman to build the tank*" (Ifill, 2016). Tradesmen hired for constructing septic tanks in T&T were usually licensed plumbers, masons or small scale home contractors.

5.2.2 Containment size and adherence to National Standards

As explained in section 2.3.2 HHs septic tanks are to be built within specific specifications, so that a regular sized septic tank would be 4 feet wide, 6 feet long, and 6 feet deep. It also stated that the 2004 reviews advised that HHs use drains fields as oppose to soakaway pits to reduce groundwater pollution. Based on Figure 5.1 and 5.3 the self constructed septic tanks were outside the design specifications, as the owners designed it for maximum storage (approximately 4x6x10), and a soakaway pit was used instead of a drain field.

5.2.3 Access to inside the containment

As seen in Figure 5.1 the pit had a 4 to 6 inch PVC plug and adapter as the main access point for CCs to use when cleaning the tank, while Figure 5.4 had a three concrete slab cover. According to the TTBS National Standards, septic tank covers should be “*of reinforced concrete, cast iron or any material approved by the responsible authority. A cover shall incorporate a suitable lifting device, shall be in one piece, and shall fit neatly and be sealed to prevent the ingress of water*” (TTS 16 80 400: 1991, 1998 p 8). Neither of the two containments fully observed the Standards, which HHs adapted over time. One complete slab cover was discontinued over the years by HHs because they said it became a problem when emptying and as such was replaced by Plumbers recommendations to fit the PVC plug in the slab. One slab could be removed during cleaning rather than having to rebuild the entire slab cover.



However, the SJLRC preparation guidelines for HH to adhere to before septic tank cleaning, states that the access plug hinders their ability to properly clean the tank because they (Operators) are unable to see inside the tank, resulting in mainly the removal of water. Eventually, for proper cleaning to be done the HH may have to remove a slab and replace it at their cost, not the Corporation.



Figure 5.2 A septic tank and soakaway system

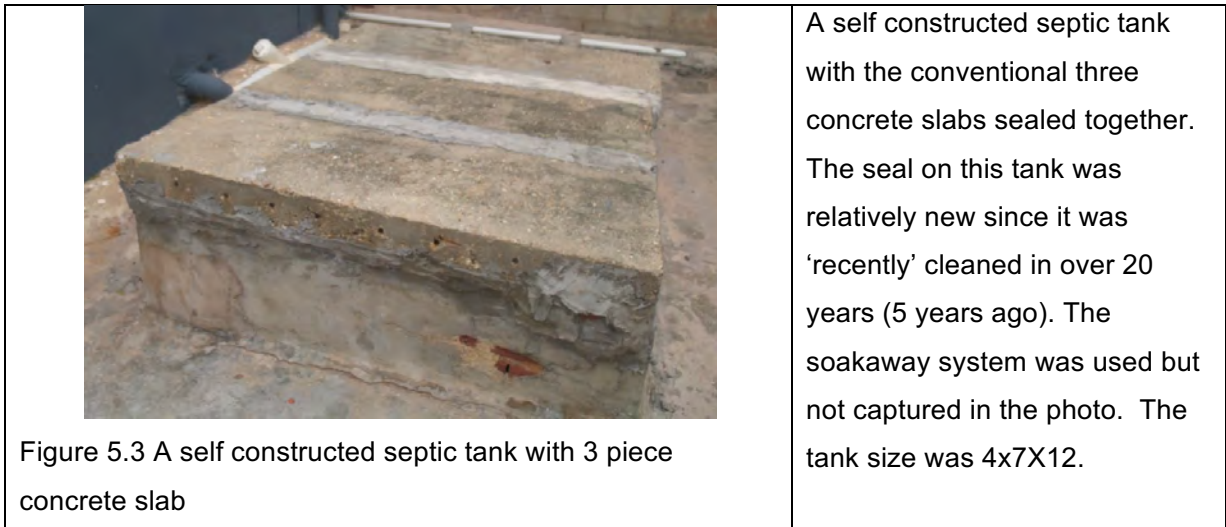
A soakaway pit a few meters from septic tank. It should be noted that both systems while they were constructed for easy access for CCs, they were a mere 1 ½ meters from the public drain. See figure 5.1 for the view of the proximity of the public drain to the septic tank (red arrow).

Nonetheless, some containment was self constructed without the PVC plug, but used three concrete slab as the cover as seen in Figure 5.3. Also while the soakaway pit for Figure 5.3 was not captured in the photo, one was present further away from the tank.

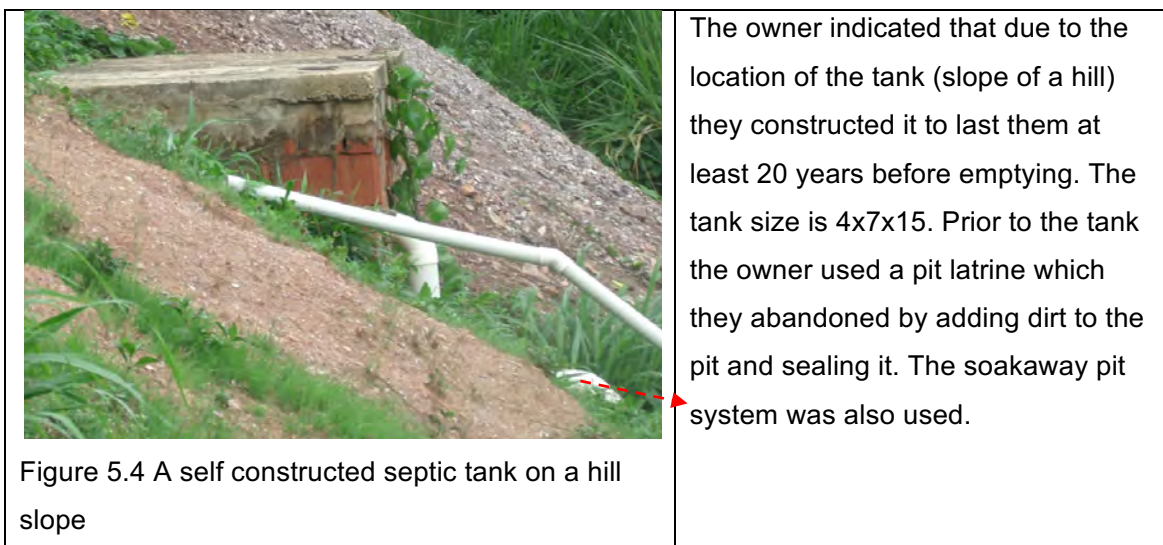
This confirms the author's view that the adherence of the T&T's population to the National Standards varied.

5.2.4 Accessibility in relation to Cesspit Cleaners getting to the tank itself

The national standards stipulated that septic tanks should not be located within 1.5 m or 5 feet of a building or property boundary. Figure 5.1 provides a slight view of the tank location with relation to the drain and road (red dotted arrow). This tank is very accessible by the CCs, but should there be internal technical defects, the risk of septage leaking into the nearby drain is very high and raises some concerns during the rainy season, especially if a flash flood occurs. On the other hand, Figure 5.3 is located at the back of a two story house a great distance away from the road. The householder indicated that when they had their tank cleaned, the provider had to use 5 lengths of 10feet long hoses in order to access the tank (see figure 5.11 of an actual hose set up).



Furthermore, Figure 5. 4 septic tank location meant it could only be accessed by passing the cleaning hose through a neighbour's property since that Household was situated on a hill slope sandwiched by three Houses. The house was accessed by passing through their neighbour's property. However, there are extreme cases of lack of compliance as seen in Figure 5.8. The slab cover was not safely sealed as evident by the smell. Also the soakaway pit was poorly constructed resulting in the soil caving into the hole; narrowing the passage way used by residents further on from that house. The National Standards stated that the tank and pit construction should be carefully inspected at all stages of construction to ensure that is in keeping with adherence to the code. While, the HHs survey did not test whether authorities inspected septic tank construction, it is evident that had the authorities done an inspection, that system would not have been in that condition. The neighbours indicated that a hired mason built the system for the resident, thereby bringing into question the Tradesmen knowledge, understanding and compliance of the National Codes.



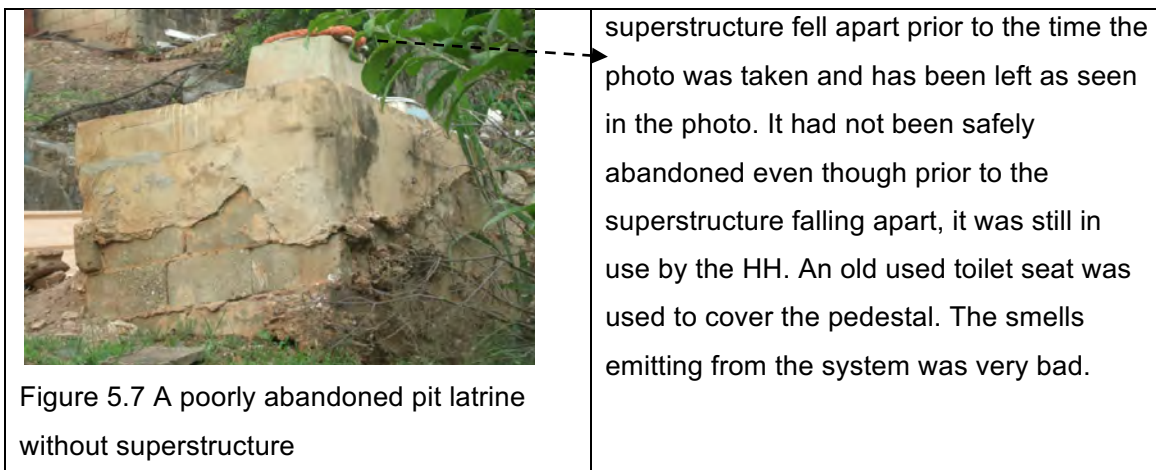
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Rotoplastics tanks varying sizes provide adequate storage as they are available to HHs in 600 or 800 gallons. In the Appendices section the specifications and internal illustrations of these tanks operation have can be viewed and personal conclusions drawn later on.



There were no specifications by the TTBS for traditional pit latrine construction, hence HHs that use pit latrines built them base on their individual socio-economic factors as seen in Figure 5.6. In Figure 5.7 the superstructure of the pit latrine fell apart prior to when the photo was taken. A resident indicated to the author that it fell apart due to strong winds as this community was a hilly area. The homeowner seems to have abandoned the pit by placing an old toilet seat over the pedestal rather than sealing it off. It is not known whether the HH would have the pit emptied, construct a new one or it was still in use.

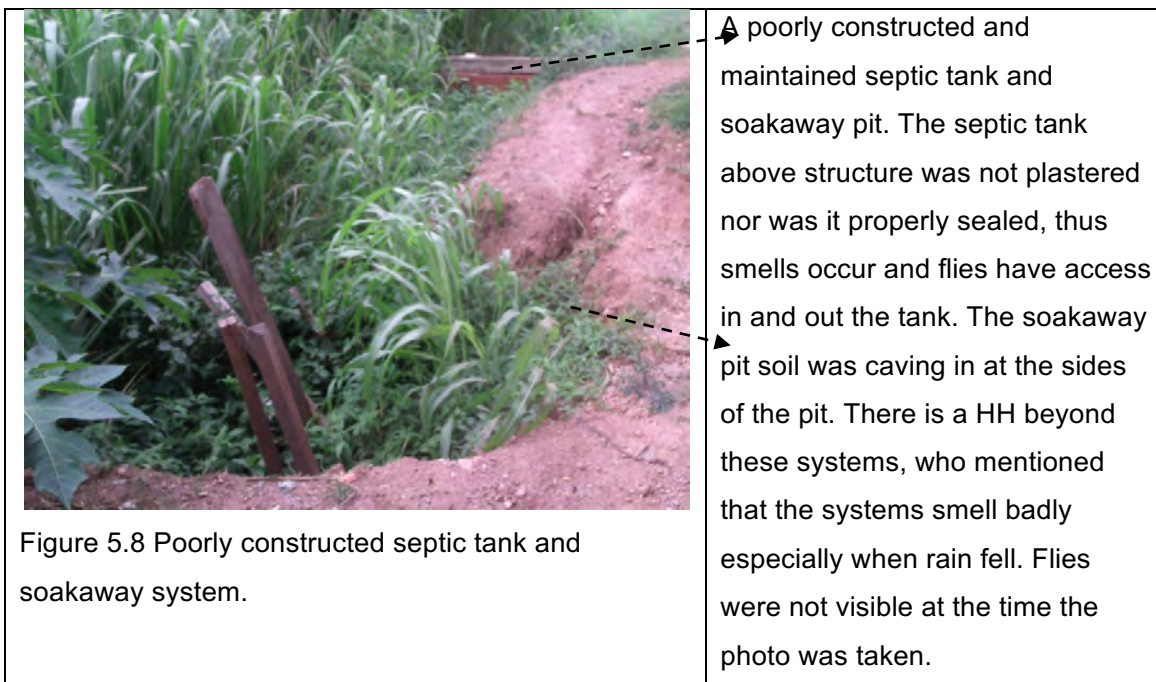




5.2.5 Containment exterior Maintenance/evidence of nuisances

From the photos, Figures 5.1 and 5.3 storage exterior were well maintained. However, Figures 5.6, 5.7 and 5.8 were not well maintained. The least concern was the bush because that could have been addressed by the HHs cutting the grass around the tank and no governing authority has the task of checking whether the bush around HHs homes are well kept, but the latrine slab in 5.6 needed repair since it was unable to prevent water and flies from entering. Figure 5.8 was newly constructed (less than two years ago) therefore it was not expected to be emptied soon. Figure 5.7 poor pit latrine decommissioning resulted in smells so bad that the neighbour indicated that they complained on numerous occasions to the Public Health Department and pleaded with the owner to address the problem but nothing was done by either party. They said they had been having that problem for years and no one seems to consider that they have neighbours around.

Recommended desludging of the National Standards septic tanks were to be done approximately every two (2) years with inspection of the system every 12 to 18 months. The Rotoplastics tanks were recommended to de-sludge every 3-5 years based on the maximum number of users in the HH, and the effluent filter leading to soakaway pit should be cleaned every 6 months or as required. They also recommend that inspection of the system occur every 12 to 18 months (See Appendices section).



5.2.6 Containment Documentation

The Trinidad and Tobago National Standards: TTS 1680 400: 1991 Code of Practice for the Design and Construction of Septic Tank and Associated Secondary Treatment and Disposal Systems provided specifications for HH septic tank systems in receipt of only black water. The standards document provided a drawing of a proposed simple septic tank, and might be a bit technical for the average home owner and or unskilled tradesman to follow resulting in what had been observed in Figure 5.8; also the internal specifications were not observed and could vary drastically. Other factors for non compliance, while they would be many, were not tested in the surveys. Additionally, the private company called Rotoplastics provided readymade septic tanks; an option few HH in the survey have taken (the situation might be the same across the country). Rotoplastics product specifications, septic tank prices, sample of their system design/drawing and the TTBS National Standards specifications and their drawings have been attached in the Appendices section for viewing.

5.3 Emptying and Transportation

Observations of actual emptying were not captured but the vacuum tanker used by the public emptying providers has been presented in Figure 5.9. Mechanical vacuum tankers were the method and emptying vehicle used by the provider interviewed; other mechanical type trucks might be utilised by other RCs and private operators. Photos were provided by the emptying providers.



Figures 5.9 Vacuum tanker used for emptying onsite sanitation containments.



The photos are of the same truck at different angles. The tanker was built onto the chassis.

The trucks were clean did not smell and was well equipped. Visible was a bucket which was used by the operators' for what they call 'washing out' the hose after cleaning (the bucket is filled with water and the hose is placed in the bucket to clean the hose before replacing on the truck). The hose used were green 4 inch hoses. Extra hose was included as the hose shaft had hose on either side of the truck. The truck had a driver and two operating assistants.



Figure 5.10 A truck emptying FS at disposal site

Photo courtesy Public Interviewee, (2016).

A view of a truck emptying FS at the disposal site. The pump was released, spouting the contents at the side of the 'pond'. This was one problem the Interviewees complained about; the lack of a valve to which the truck contents could be released into, preventing the air blowing the contents around and into the city during early mornings. To the side is a concrete box with a metal screen sheet that suppose to screen out large materials, but it serves little purpose as providers dump FS anywhere around the receiving 'pond'.

To concur with the providers statements that the topography of the island results in accessibility challenges, in the photo five lengths of hose (see the joints) can be seen leading from the truck to the HH containment. It is uncertain as to the total amount of hose used, but accessibility influence the price private sector charge for emptying. There was no evidence of leaking hoses, confirming the provider's account that they generally provide a clean service with no mess.

Photo courtesy Public Interviewee, (2016).

Bottom right: Figure 5.11 An example of septic tank accessibility challenges.



5.3.1 Disposal

The following photographs were taken from the Port of Spain disposal site, the Beetham dump. Based on SWMCOL's account, they manage the FSTF which they call a waste stabilisation pond (WSP). There were no company records of the pond design, construction or maintenance so the author displayed only what they observed and related their observations to Interviewees contributions.



Figure 5.12 The Beetham FSTF

Photo courtesy Public Interviewee, (2016).

A view of what SWMCOL describes as a WSP to which they treat FS collected. As can be seen there is no treatment apparatus present. The road leading to and from the facility is dirt (no asphalt) and the effluent discharge point leads directly to the Caroni Swamp seen in the distant end of the photo (see red star).



Figure 5.13 The 1st receiving pond at the Beetham FSTF filled with dried FS



Figure 5.14 Poor maintenance of the disposal facility

Photos courtesy Public Interviewee, (2016).

A view of first receiving FS 'pond'. There is hardly any water in the pond leaving the raw FS open to air. The parameter of the pond is not lined with any durable material. The presence of the scavengers walking on the dried FS is indicative that not only was the pond filled to capacity but it shows that maintenance works like desludging of the pond has not been done for quite some time. The Interviewees stated that at some stage SWMCOL would have a Backhoe dig out some of the sludge and bank it at the side somewhere.

The presence of old tires and garbage stacked up in and around the pond invites a host of health problems. Without any laboratory test, just by observing this site, FS is not adequately treated in Trinidad.

5.4 Household surveys

Of the 100 surveys printed and distributed, 44 HHs voluntarily participated giving a total 44 completely filled out and returned surveys. Hence the intended 30% response target was achieved and the main findings were presented below, while the Respondents' thoughts/responses as coded within the six themes can be found in the Appendices section.

From the Household surveys 71% of the HHs had septic tanks, 14% had pit latrine, 14% had sewer connections and 2 % had both a septic tank and a pit latrine. Additionally, 80%

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of the respondents owned their home, 7% were landlords living on the property and 9% were Care givers or House sitters. Based on the containment size 59% of the HHs septic tanks that were self built were of the standard size, and of that percentage, 34% indicated that they spent \$5,600TTD/ US\$800 to construct their own septic tanks. Among the participants who emptied their septic tanks, 34% hired either public or private operators; one provider was not selected over the other based on the survey results. Hence, emptying providers were highly visible in Trinidad. Only 5% of the respondents indicated that they emptied their pit latrines while 16% said they abandoned the old pit by filling it with dirt and building a new one. Emptying rates were low among the respondents with a mere 36% of respondents had emptied their tanks in the last 10 years. Some Respondents said they have not emptied their tanks in last 20 to 25 years, giving an indication of the depth septic tanks are built in Trinidad. Also, other reasons for such practices could be attributed to: chemical additives were added to septic tanks to digest sludge which delayed emptying, tanks were built for maximum storage (extensive depths), tanks may have punctured a groundwater well resulting in low sludge accumulation thus not requiring emptying, or the system soakaway pit was well designed and the soil has excellent percolating properties resulting in a high performance onsite system.

Based on the results Respondents were charged emptying prices as low as US\$37 (\$250TTD) and as high as US\$372 (2500TTD). The five highly scored factors for satisfaction among HHs were no mess/ leaks/spills (62%), the equipment used (69%), the truck capacity to remove all the waste (62%), ease of access to the tank (62%) and the technical knowledge of the staff (62%). The second highly scored satisfaction factors were the way the tank was opened (60%), time taken to empty the tank (60%), the price (53%) (Regional Corporations price was far cheaper than the private), and having to clean up (55%). The time taken between appointment and response (39%) was the least satisfied factor among HHs.

Household main reasons for emptying their septic tanks were smells (43%), difficulty to flush (18%), flooding during the rainy season (12%), and overflowing contents/leaks/spills into drain (21%) and based on manufacturer's recommendations (5%). Seven (7%) percent said they did not use any signs to tell them the tank was full, 2% said they checked their system every couple months to indicate when emptying was due and 5% said they emptied when they realized that the tank was full to capacity.

The major problem HHs were faced with when emptying their septic tanks was taken time off from work to allow CCs access to empty their tanks, and the most important criteria for HHs when selecting an emptying provider were the price charged (61%), the tank completely emptied (64%), the time taken to empty the tank (48%) and the quick response time after making the appointment (55%).

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Based on the HHs responses, 23% said that WASA was responsible for treating FS, 27% claim that SWMCOL was responsible and 34% indicated that they do not know which entity was responsible for treating FS in Trinidad. Finally, the level of confidence HHs perceive to have in Trinidad's ability to safely and properly treat FS was mixed whereby 30% had no confidence, 51% had moderate confidence and 5% had complete confidence.

5.5 Interviews

The author was unable to secure the participation of the private sector, hence the results of the interview comes from the public provider Cesspool Department team. Due to employment risks participants' names were not stated. However, their contributions were outlined using the six themes as presented below. An analysis comparing both HHs surveys and Emptying providers' responses were also presented. The head of the Cesspool Department full transcription, and thoughts/responses to the six pre coded broad themes can be viewed in the Appendices section.

Technical Containment

The main type of HHs containment emptied by public providers was self constructed septic tanks. In fact an interviewee said:

“Basically what had happened is that most of the people who had pit latrines are now converting to septic tanks, so out of 100 requests we may do one pit latrine”. (See also section 2.3.3).

On average, 8 out of the 10 emptying jobs done, the providers sated that HHs had the regular 4x6x8 size septic tanks while few HHs (3 out of 10) used the Rotoplastics FatBoy septic tanks. Additionally, pit latrine emptying was not prevalent (1 out of 100).

Containments were not always accessible as some septic tanks were said to be under HHs bedroom and bathroom floor, some on hills 500ft -600ft from the road, tanks in bushes, narrow passages, near drains and could only be accessed from the PVC plug placed on top tanks while majority of tank rests underground. However, most HHs tanks were in front their yard making the job easy.

Materials found in septic tanks included towels, rags, clothing such as a pair of jeans, sanitary napkins, children toys, stone, cloth, women and men underwear and piled up toilet paper called a 'cake'.

Technical Truck

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Trucks used for predominantly mechanically emptying were vacuum tankers. The provider owned 4 trucks but on any given day only 2 were functional. Three (3) of the truck capacities were 1000 gallons/ 4546 litres and one (1) truck capacity was 1500 gallons/ 6819 litres. Due to truck capacities, on average approximately 3000 gallons or 13, 638 litres of faecal waste was emptied per day or three trips were made to the disposal site per day.

Emptying Challenges

Due to material found in tanks clogging or what is called 'chokes' increased truck downtime as chokes were estimated to have occurred 3 out of every 20 jobs. Truck downtime reduces emptying efficiency which was enhanced during the rainy season and national festivals (Divali and Christmas) when requests were more frequent and the operators were operating at full capacity. Aranguez and San Juan were the areas needing the most frequent emptying services from the SJC, especially during the rainy season where flooding is high in those areas.

The RCs operate within flexible working days from Monday to Friday, beginning the day at 7am and may end at 11:00am due to the nature of the job and the health risks they were exposed to daily. Furthermore, the disposal site working schedule is Monday to Saturday 8am to 6pm and on Sundays 8am to 12:00noon. Emptying facilities are closed on public holidays. Those private providers, who claim to provide 24/7 emptying services would have been affected by the inaccessibility of the disposal site, while the public providers fell within the emptying schedule, may be limited in providing longer work hours and completely more daily emptying requests.

There is the need for new trucks as trucks were said to be 20 to 30 plus years old and in constant need of frequent pump repairs which reduced emptying services. Interviewees said Plumbers advised HHs to use the PVC plug on top their tanks, but that makes emptying difficult especially if the tank had not been cleaned in a while. The disposal site is home to waste pickers and other persons involved in criminal activity, resulting in Operators being robbed at gun point on many occasions of whatever the thieves consider to be valuable in their (operators) possession.

Some HHs who were unwilling to open their pits resulted in instances of threats made to operators should mess be made on their property from materials removed from chokes. The implementation of the PVC plug prevented Operators from seeing in the tank and that in turn lead to chokes. When the homeowner was asked to break their septic tank slab cover, they refused, resulting in the Operators abandoning the job (major damage could be done to the truck pump) and the Householder becoming aggravated because their tanks were not cleaned, money was paid and debris from the tank being left for them (householder) to dispose. All those events coupled with the ignorance of septage, septic

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tank proper use and cultural differences, led to verbal threats and insults hurled at the Operators. Additionally, the mentality of the public made the job difficult at times; operators were scorned and looked down upon by the public in light of them generally providing a clean, satisfactory and efficient service.

Economic

The cost for a brand new cesspit cleaning truck could cost between US\$ 127,000 to US\$ 224,000 (\$850,000TTD to \$1.5M TTD), but the actual cost of a locally assembled truck (Chassis and tank) was not given by the Interviewees. In a month, the 22 day work period in which the public provider operated, it cost US\$22 in fuel to fill one truck every 2 days (Fuel for the two functional trucks cost US\$242 per month). The cost charged to empty HHs regular 4x6x6 tank was US\$75 and for larger tanks US\$150; price based strictly on tank size. Even if the 4 trucks and 8 operators were used to empty a hard to access tank, the fee remained the same. If a pit latrine was to be emptied the price was the same and usually stood at US\$75 irrespective of the size of the pit. It was said that:

“The pit latrine takes a lot more effort because you have to throw in more water to get it to come through the vacuum and into our truck, but their size is usually less than a septic tank so effort balances off the reduced size of the pit”.

The cost to offload collected septage was US\$22 per trip, and not per volume. Both private and public providers paid the same price to offload regardless of the size of the tanker.

Satisfaction

The provider perceived that HHs satisfaction with their services were mainly the price charged (public cheaper than private), the short waiting time after making an appointment (one to two weeks), their efficient service (used their own tools such as fish hook for removing chokes, buckets for flushing the hose, clean job once no chokes, truck capacity to contain all the waste once tank was regular size), their respectful and well mannered staff and the time taken to empty the tank (15 to 20 minutes without chokes).

Health and Safety

Public operators provided with full Personal Protective Equipment (PPE) such uniforms (overalls), rubber boots, rubber gloves up to their elbows and respirators. Employee medicals were performed but they were infrequent and basic check-ups.

Institutional

SWMCOL was identified by the interviewees' as the state owned agency responsible for monitoring FS disposal arrangements. Absent at all levels (local and central) were FS

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guidelines, monitoring organisations and managers. Neither public nor private operators' were a part of a FS Emptying Association nor were the private providers found in one place. Public providers do not collaborate as one interviewee said public providers operate as "every man for themselves". WASA takes no part in septage management in fact it was illegal for emptying providers, public or private to empty septage into WASA's manholes or treatment facilities without their authorisation. It was said that:

"The charge maybe about \$40TTD to \$100TTD, but where they have increased the rates for talking on your cell phone while driving without a headset or using the Priority Bus Route (PBR) without a pass, they have not increased the charges for disposing faecal waste into the manholes".

Environmental

The Disposal site was the Beetham dump located in Port of Spain who SWMCOL said, a FSTF is present. The disposal site was said to be unsanitary, poorly managed and inadequate in treating FS. Three large holes have been dug and emptying providers empty in the holes. No one monitors the activities on the facility. The chicken depot companies were said to have been disposing in the same holes, FS was being deposited. The fumes emitted from the vacuum pump upon emptying were not controlled, resulting in the Gulf of Paria winds carrying those fumes into the city early in the morning. Overall the disposal site was not in keeping with good practices and international standards.

5.6 Embedded units analysis

In this section a brief analysis was done to compare the HHs responses, observation and documentation, and Interviewee responses so as to identify where gaps in FS emptying services were in Trinidad.

Containment

HHs surveys and interviewees account revealed that majority of septic tanks were built (81%), Rotoplastics tanks were infrequent and most standard size septic tanks design complied with the TTBS measurements (4ft x6ft x6ft). However, the access point to get inside the tank was dominated by the PVC plug (36%) placed on to the tank. The interviewees indicated that the plug restricted their emptying performance because the plug limited the operators' ability to see inside the tank. Based on that situation choked hose/clogs were said to be frequent; HHs refused to open their tank slabs, fishing out the choked line resulted in mess made, and the overall client satisfaction was reduced, impacting on the provider performance. The PVC plug hinders emptying because operators

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being unable to see inside the tank results in the suction of the liquid contents and not the sludge. This resulted in some HHs being dissatisfied with the services because their tanks would refill faster after cleaning. The Plumbers were said to be responsible for the plug design, even though the TTBS code prescribe a particular sized concrete slab to be the septic tank sealed cover. Hence an evaluation of tradesmen knowledge, attitude and perceptions of containment design could address some discrepancies and improve providers FS emptying experiences.

Satisfaction

Interviewees perceived that their cheap price, clean service, well mannered staff, short waiting time after making an appointment, efficient service and short time taken to empty the tank, to be the key factors that determined HHs satisfaction with their service. However, from the HH surveys the highest scored HH satisfaction factors were: equipment used (the provider did not use any tools or materials of the client), no mess/leaks or spills (confirming the provider when they said they provide a clean service), time taken to empty the tank (once no clogs 15 to 20 minutes), ease of accessing the tank and the truck capacity to remove all the waste. The price charged and response time scored lowest among the satisfaction percentages with (53%) and (39%) respectively. The fact that the participants were not asked to distinguish whether the price charged was from the public or private provider, meant that the public providers' cheap price got masked by the high private sector prices, reducing the price percentage factor. Additionally, the time taken after making an appointment and receiving a response was (39%), which could be directed towards either the public and small private providers', both being susceptible to frequent truck downtime. HHs said that they were forced to secure the private provider because the RC took too long to respond, but the public Interviewees said that the private sector response time was longer than theirs, such that HHs experienced a two month waiting period. The author was unable to distinguish which provider was responsible for the poor response time, but clearly price control and internal technical issues affecting operations among the providers are gaps that need to be bridged.

Emptying challenges (materials found in tanks)

The interviewees said that materials found in septic tanks included: towels, rags, clothing such as a pair of jeans, sanitary napkins, children toys, stone, cloth, women and men underwear and piled up toilet paper called a 'cake'. HHs responses to the same question resulted in similar responses, and included materials such as condoms, baby diapers, gazette/newspaper and hair. The low percentage of emptying among the HHs was evident with 36% of respondents admitting that they emptied their tanks once in the last 10 years (self built tanks had maximum storage, reducing emptying frequency). The Interviewees

cited the poor emptying habits along with materials found in that tanks as the reason why they experience chokes in the line (accumulation of a 'cake', water soaked sanitary napkins and thick sludge).

Institutional

Majority of the HHs (34%) did not know where the collected FS was disposed of, while 23% and 27% indicated that SWMCOL and WASA, respectively, were responsible for treating septage. The Interviewees themselves also thought that WASA and SWMCOL were both responsible for FS management, yet they were fully aware that neither state-owned entity managed emptying services nor do they provide the facilities to aid them in their service provision.

Environmental

From the HH surveys 51% of HHs had moderate confidence that the FS was safely and properly treated, 30% had no confidence and 5% had complete confidence. The Interviewees major challenge and the aspect of FS emptying they would like improve were the disposal site and its ability to treat FS safely. No documentation was obtain to triangulate the disposal situation, but on SWMCOL's website, they indicated that they manage 3 landfill sites across Trinidad and one in Tobago and they provide domestic waste treatment services at their sites. According to Interviewees, (2016) the facility is supposedly three (3) large holes that are poorly maintained and in desperate need of contemporary technologically appropriate upgrades (see Figures 5.12-5.14). De-sludging occurs infrequently, with no processing of the faecal waste. The road to the facility is an unpaved dirt road and the conditions are unsuitable and unhygienic for an operator to be station at the site for any given period of time during the day. The only facility SWMCOL has in place is a booth at the dump entrance with an Operator who records the truck (private and public) registration number so as to ensure disposal payments to the agency (SWMCOL) were up-to-date (Public Interviewee, 2016).

5.7 Conclusion

In conclusion that data collection tools and sources of evidence proved worthy in helping the author achieve their research objectives. The following chapter would further discuss the finding using key aspects of the SHEFTIE framework as it relates to FS emptying services and FSM in Trinidad.

6 Discussion

“What has been will be again, what has been done will be done again; there is nothing new under the sun. Is there anything of which one can say, “Look! This is something new”? It was here already, long ago; it was here before our time”. (Ecclesiastes 1:9-10)

The purpose of this section would be to discuss the findings of this study using the six pre-coded themes adapted from the SHEFTIE framework as a guide to help examine T&T's FS emptying service system. Reference would also be made to literature since this phenomenon along with other countries challenges, are not new nor are they unique to T&T. The discussion would link the findings back to the global context and what has been done before, by showing T&T own FSM shortcomings.

6.1 Technical

The two types of onsite sanitation containments used in Trinidad are septic tanks and pit latrines. The exact distribution of either facility throughout the district was not determined, but septic tanks were the predominant choice. Householders' in Trinidad usually build their on-site sanitation facilities (septic tanks and pit latrines), either on their own or they hire a tradesman, therefore septic tanks were emptied and pit latrines were mainly abandoned. The constructed septic tanks allowed HHs to gain maximum storage (outside of National Specifications and Rotoplastics in-situ tanks) thus emptying was prolonged as long as possible, if ever at all.

The Rotoplastics company 'FatBoy' septic tanks were infrequent despite their ability to reduce ground water pollution by tightly sealing in the contents and their high durability (said to last a lifetime). With the high water table resulting in recurring groundwater pollution especially along the East West Corridor, one might think, those systems would be the prevalent choice of technology. However, the FatBoy septic tanks also need a trench drain or soakaway pit to function effectively, which does not reduce the ground water pollution problem. Additionally, they cost more money to purchase and install than a self built tank and they provide 'capped' storage (500, 600 and 800 gallons) that requires de-sludging every three years (500 gallon) based on the number of users. Therefore, even though the system is technically sound, the culture and behaviour of the T&T populace undermines its potential in minimising ground water pollution from faecal waste. Moreover research considering the ground water pollution attributed to chemicals/materials used when constructing the FatBoy septic tank is unavailable. Hence which system is the most appropriate system to use and how can T&T find a balance in sufficing HHs social complexities and simultaneously protect the environment and public health?

Noteworthy, as a measure to improve sanitation in densely populated areas of the city, there is a recent initiative called the 'septic tank eradication' vote project, hosted by a group called the East Laventille Development Committee whereby HHs in that area are encouraged to replace their pit latrines with septic tanks. It is uncertain as to what factors contributed to the birth of that project, but based on T&T's sanitation record (see section 2.3), rather than the project implementation being designed to include the SDGs targets and indicators for sustainable sanitation and safe excreta management, it remained focused on the JMP's 'improved facility' definition rather than the post -2015 WASH definition whereby 'adequate sanitation facilities at home' incorporates the components downstream of the containment. With such outdated approaches, significant progress towards FSM is not anticipated from that project because the parallel services to support the forthcoming increase in septic tanks emptying services have not been factored into the project implementation and sustainability stages. According to Nigel McCarty, (2016), the money and energy used for that project could have been used to purchase new emptying trucks for the RCs (McCarty, 2016). This current situation, as highlighted in Halcrow et al., (2014) social study and WSUP, (2015) practice note, confirms the need for FSM planning to consider a multifaceted approach: that is the social norms, the economic viability of the providers to support the commitment technology, and the authorities in providing the enabling environment for effective FS emptying services. Trinidad and Tobago continues to engage in blind development projects designed in a vacuum.

Another technical aspect of interest, as pointed out by the interviewees, was the vehicle used for emptying services in Trinidad. Mechanical vacuum tankers were the main emptying type and vehicle used and manual emptying was not practiced. The age of emptying trucks was a major challenge for the public CCs as trucks were said to be over 20 years old. Also, there is and has been a disparity between the Cities Corporations and the RCs in that the purchasing of trucks by the RCs undergoes a tendering process, while the Cities Corporations purchase trucks without tendering. The usual outcome entails the RCs receiving locally assembled vehicles outside of their requested specifications (the cheapest tender considered and RC operators were not included in the decision-making processes) while the Cities acquire fully assembled vehicles shipped from external automotive companies, regardless of the price and specifications (McCarty, 2016). The inequality of vehicular financing among the corporations limits the service RCs could provide because having few functional trucks (on average 2 out of 4 functional) that were over 20 years old, increases public operators vehicle downtime and impact negatively on the service they could offer, thus offsetting the demand-supply balance between them and the private operators. The HHs being forced to secure emptying services from the private sector were then charged higher fees and without anyone to control the private providers pricing, the HHs were preyed upon.

6.2 Economic

The economic profitability of both private and public FS emptying providers were not assessed in this study, but from the information gathered, it was concluded that the RC being an active player in FS emptying services in Trinidad, their economic profitability in providing FS emptying services was low. The RC FS emptying taxes are collected by the Ministry of Finance since fees for emptying were paid directly to the Government Bank and not the municipality accounts. Additionally, the RCs provide only emptying services, they do not manage the service chain, so FSM budget allocations within their yearly budgets were absent, and government transfers received were prioritized on community infrastructural projects rather than onsite sanitation. This situation further explains the technical vehicular and equipment issues RC experience.

However, the cost charged by the public provider for emptying services were said to be based on the district Councillors assessment of their community dwellers ability to pay for emptying services. Hence, the prices of US\$75 to empty a standard size septic tank and US\$150 charged for emptying a tank size greater than the standard size were set, and the RC complied. They had no involvement in setting the prices and were not included in the national budget consultations for the RC. Hence, the potential profits that could result from resource recovery investments, the economic viability of the public providers to sustain emptying services, FSTF upgrades and maintenance, and the health of the operators and environmental protection, were all excluded from the fees charged. In fact, according to McCarty (2016) and the SJRC guidelines information sheet in the Appendix section (see initial fee was scratched off and reworded), the fees were less than what is currently charged (US\$37 and US\$75), but in 2016 they rose to the aforementioned prices (McCarty, 2016). Interestingly, the recently increased emptying fees was not influenced by HHs ability to pay for emptying services, but according to a Public Interviewee, the recent Government, in their attempt to reduce public spending and buffer the unaccounted, mismanagement of public funds by the former Administration, the fees were increased as a means to simply raise local revenue.

Nevertheless, the fees charged prohibit the public provider from making meaningful profits, as well as make investments towards improving their service. While the disposal fee (US\$22) is not exorbitant, the many institutional odds working against the public provider, undermines their economic potential and the significant contributions they make to FS emptying services in Trinidad. The private providers who may own large businesses (many large capacity trucks), make huge profits off the cheap disposal fee, hence the high fees they charge HHs could be an act of greed, the nature of the job (no one wants to do it), the sanitation market being cornered by a few influential people (sanitation Mafia) and the lack of consumer protection from the authorities who lack the resources to identify sanitation

as a problem in T&T. Across all sectors throughout T&T sanitation is not made a priority, giving way for unregulated private companies to monopolize FS emptying services, solicit high prices from HHs, contribute little to environmental protection and undoubtedly lower emptying frequencies among the population as they continue to practice building deeper tanks disregarding safe protocols. Tanks 10 years old were emptied once (36%), hence the economic potential of municipalities attempting to schedule de-sludging as a municipal financing approach, will not materialize under the current sanitation climate in Trinidad.

Interestingly, T&T's Local Government elections would be held in October or November, 2016 and have been earmarked to bring reform to the local sector, yet among the numerous country-wide consultations held, no priority, not one Minister or Councillor made mention to FSM or challenges surrounding FS emptying services. The potential of own-revenue generated by the RCs could increase once the promised LG reform is delivered, but in the absence of a national and local sanitation framework, there are doubts that the FS emptying services, as a revenue stream would become a reality even to the authorities in Trinidad.

6.3 Institutional

The main challenge for emptying providers was unanimously concerned with FS disposal. From an organisational perspective, SWMCOL and the RC are the two local organisations directly involved in FS emptying services. SWMCOL public claim that they provide FS treatment highlights two points: they are not responsible for FS management and their role is to provide treatment services only, but based on the observations, that is limited because in order to treat FS there must be a technologically appropriate FSTF opposite to what SWMCOL provides. The RC also placed FS emptying services under their list of service provisions, not direct duties, and WASA takes no part in septage management. The MRDLG presides over the operations of the RCs, yet absent from their strategic frameworks, policies and plans are approaches directed towards FS emptying services monitoring and regulation. There is no institution for onsite sanitation (FSM) in Trinidad. According to Medland, Cotton and Scott (2015), if there is no sanitation policies and strategic direction, then there is no set rules of the game, and outside of those two components, the rest of the chain suffers; overall an enabling environment for FSM becomes invisible, (Medland, Cotton and Scott, 2015).

Moreover, SWMCOL being responsible for solid waste management and by extension FS treatment, both facilities are housed on the same site. SWMCOL's operating hours are Monday to Saturday from 8am-6pm and on Sunday from 8am to 12noon. The RC FS emptying work day usually begins at 7am/7:30am Monday to Friday and end when the operators would have completed their daily emptying requests (could be as early as 11 am) (Public Interviewee, 2016). Conversely, some private providers advertise 24/7 cesspit

cleaning services. Upon closure of the disposal site, where do they dispose of the collected waste? Do they illegally dump the waste after hours or do they park trucks full of waste overnight on their compounds? Furthermore, could questions such as those be the reason why the private operators all declined from participating in the study?

Nonetheless, SWMCOL operating hours, though they were considered fair, SWMCOL's blatant disregard for the public and environmental health overrides fair operating hours, as some emptying providers expressed disgust and shame with the FSTF and the way in which Trinidad treats its environment. SWMCOL's cheap disposal fee (US\$22) increases FS emptying providers' profits and builds local entrepreneurship, but it does not address the inability of such low fees to construct proper FSTF, maintain the facility and ultimately safely treat FS in Trinidad. It should be noted that the Beetham FSTF receives FS from RCs in West, North Central and Central Trinidad and from private operators within the environs. Understanding SWMCOL's attitude, perception and knowledge of FSM could be a good place to start when addressing disposal site issues.

Emptying providers in Trinidad are unregulated and fragmented. If FSM policies are absent then regulation, collation of providers, monitoring and management, are also absent. Hence both public and private operators make up the rules as they see fit which may, or may not consider the public and the environment's interest as a priority. Both WASA and SWMCOL issue a permit to emptying operators but the scope of the permit is limited to: permission to clean cesspit tanks (WASA) and to empty at the disposal site (SWMCOL), without any consideration to the safe operations, the suitability of the vehicle used to empty cesspits or uniting the providers into an association where monitoring, regulations and other benefits could be achieved. The private operators may provide other government sanitation services, but without government documentation and private sector involvement, the author cannot discuss whether Public Private Partnership (PPP) in sanitation is present and what benefits they offer.

6.4 Environmental

Based on WASA documents, poorly decommissioned WWTPs are disposing raw FS into surface waterways across T&T but with International Development Bank (IDB) investments (IADB loans) some improvements are being made. However, the same cannot be said about SWMCOL, but there is hope that bringing the issue forward, national investments for sanitation would later incorporate FSM treatment arrangements. The use of a WSP is an appropriate treatment option based on Trinidad's climate, resources etc, but political commitment, inclusive environmental regulations, and Ministerial monitoring of FS emptying providers, are all critical commitments needed to improve the current environmental situation in Trinidad.

6.5 Social

The materials found during septic tank emptying should not be overlooked, because it speaks of social and cultural practices unknown to the planning committees. An Interviewee indicated that they found women underwear, cloth and rags in the septic tanks, and to them such occurrences were overlooked. Based on the author's personal experience and local knowledge, it should be noted that menstrual hygiene practices in Trinidad is not as straightforward as one might think. Not all women utilize manufactured menstrual materials, because some women who maintain their fore parents cultural practices, use their old underwear, cloth or rags as sanitary pads and either flush the 'cloth pads' down the toilet or burn them as a means of preventing witch craft being done on their used 'cloth pads' should they be disposed of in the garbage.

Another social concern that arose was the public's reaction towards FS emptying providers, the nature of the job and the involvement of women and the youth in sanitation. From the interviews, the interviewees all indicated that the general public scorned them; they 'talk down' to the operators, held their noses whenever the truck passed by and clients stayed indoors during emptying. Those behavioural patterns are indicative that the public is not properly educated about FS emptying services as it pertains to the procedure and relevance of its safe management. Additionally, signs of social ignorance were communicated to the author by the Enumerators experiences when conducted the survey. Some Enumerators expressed situations where a few respondents displayed racial tendencies, some were disgusted by the topic and opted to stop the survey and others simply went through the motion without giving the issue any thought. Therefore, the general attitude of Trinidadians towards FS was 'out of sight, out of mind' (Chaggu et al, 2002). Public education on onsite-sanitation (FSM) is critical for sustainability because the HHs being the primary stakeholders need to be involved in shaping a healthier environment.

Interesting to note, is that one of the Public Interviewee indicated that within the Regional Corporation Cesspool Departments, women are never hired to Head the Department; the offer is always given to men, even if they were under qualified for the position. The interviewee said that that rule existed since colonial times (British colonization in T&T) and has never changed. Hence, the result is an aging sanitation workforce and a shortage of sanitation workers. During colonial times sanitation jobs were given to the least educated men because the nature of the job, only the poor and destitute would have signed up for it. Upon reviewing the SDGs and studies that have repeatedly shown the economic benefits of placing sanitation at the head of national development, that perpetuating mentality in Trinidad must change, otherwise their reluctance, low political will and ignorance towards the importance of sanitation management could erode their many economic benefits.

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Many arguments, for and against women being appointed as Managers over sanitation would arise, however, the final decision should not be based solely on women's gender and old colonial perceptions, because society has evolved, norms have changed drastically, and men, usually unaware of cultural issues pertaining to women, if not considered during the project design some groups could be left out of sanitation planning programmes. Finally, the bias among local education programmes and WASA focus solely on wastewater management. By educating young people about the plethora of opportunities sanitation studies offer as an early investment project towards a rich sanitation workforce in the future, T&T could be known to the WCR as the island to have established a well equipped, sustainable, institutionalized sanitation management system and hence lead the WCR in FSM.

6.6 Conclusion

Trinidad FS emptying services are plagued with similar shortcoming as developing countries; however, the economic potential of T&T provides an opportunity for them to develop and sustain the FSM service chain. The problems at the containment level involve compliance to building safe technological designs, householders' preference, socio-economic individual considerations and ministerial oversight, rather than a lack of quantity. Although emptying providers are highly visible, they are unregulated and in the absence of onsite sanitation policy, their operations are also not monitored. Overall what is lacking in Trinidad is the commitment by an organisation that is willing to champion sanitation by establishing an institution for sanitation where 'the rules of the game can be set' and the enabling environment supports all the stakeholders involved. Finally, the study proposition was accepted since the study findings supported its claim.

7 Conclusion and Recommendations

7.1 Recommendations

In this chapter the recommendations would reflect gaps identified in the study in relation to key aspects of the SHEFTIE framework. The recommendations targeted the three main research objectives, which once considered, FS emptying services in Trinidad could significantly improve giving birth to an effective FS management system with defined policies, plans and development frameworks.

Objective 1: To identify what challenges faecal sludge emptying providers' in Trinidad encounter and understand how those challenges influence their services.

The main challenges for FS emptying providers, particularly the public sector, were frequent truck downtime and inadequate disposal facilities, and the lowest scored HHs satisfaction factors were the price and time taken for provider to respond after appointments were made. Therefore, the ideal place to start would be to build a solid foundation on which onsite sanitation could stand. Hence an institution can be considered as the 'parent of the home' whereby the 'rules of the game' are set and the organisations that are directly or indirectly involved with onsite sanitation sector-wide activities, considered as the 'children within the home', co-operate by complying to the set rules. The rules would be drawn from SDGs targets and indicators for safe excreta management and current lessons learnt from other developing countries practical research so as to improve on designing a sustainable onsite sanitation system. The practicality of this recommendation is as illustrated in Figure 7.1.

The author is unable to comment on the effectiveness of Local Government reform in empowering municipalities' to provide better services to communities since LG elections and the revised legislative reform has not occurred. However, should the local municipalities be given more autonomy and their own-revenue policy addressed (municipalities collect sanitation taxes rather than the Ministry of Finance), their contributions toward FS emptying services could be extended, especially where the frequent truck downtime attributed to old trucks was concerned. In order to experience the significant benefits of this recommendation, the RCs CEOs and Cesspool Departments should be align to the proposed strategy for institutionalising onsite sanitation.

Additionally, the challenge of inaccessibility of the tank in relation to the PVC plug could be addressed through sector-wide septic tanks construction education programmes aimed at the tradesmen, contractors and homeowners. As sated within the proposed onsite sanitation strategy, identifying communities' specific challenges and addressing them, in

keeping with the National Sanitation Committee (NSC) policies and guidelines, it could target aspects of septic design and emptying challenges among builder and providers.

Strategy for Institutionalising Onsite Sanitation in Trinidad

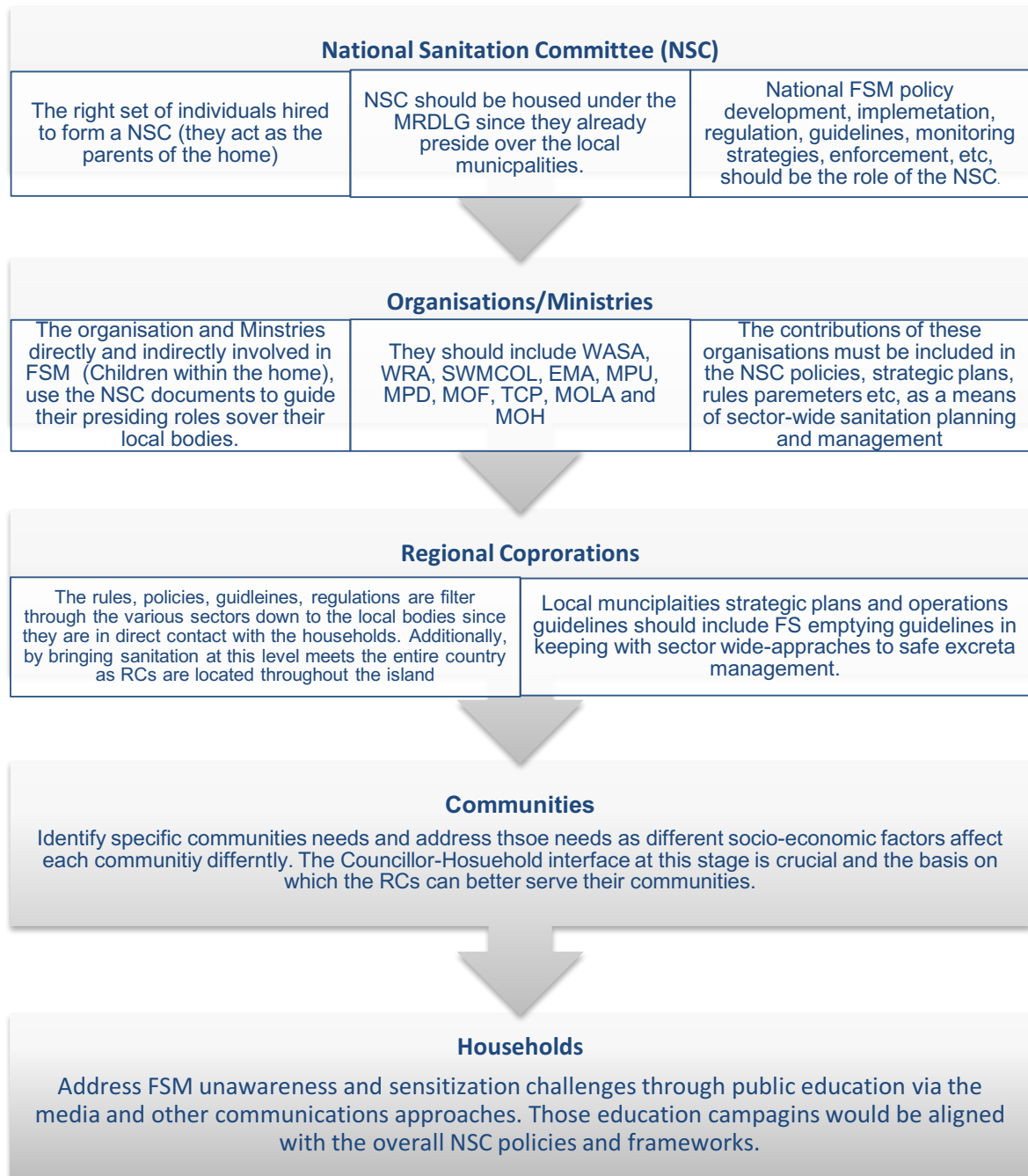


Figure 7.1 Proposed strategies for building an Institution for onsite sanitation in Trinidad.

Developed by (Ifill, 2016)

Faecal sludge emptying services in Trinidad

The FSTF technology used waste stabilisation pond (WSP) track record of being a 'simple', environmentally friendly, requires little energy input and sustainable technology makes it appropriate for Trinidad (climate, land, capital investments etc). With respect to resource recovery, the market for the treated product has to be assessed before expensive technologies are advanced. For example treated FS could be reused as a soil conditioner in built environment projects (parks etc), in road restoration schemes, reforestation programmes, farming and even in the construction industry. The two wastewater treatment plants projects undertaken by WASA mentioned the installation of bio digester, however, WASA takes no part in septage management and FS emptying providers are not allowed to empty into WASA treatment facilities. Hence, it is recommended that a sustainable means of stabilising onsite facilities de-sludge faecal waste to country specific standards, be done before expensive technology is advanced. For example, how effective are organic materials like coconut shells or activated charcoal from coconut shells in wastewater treatment and by extension what are some ways sludge could be treated and reused without the use of expensive digesters?

Objective 2: To identify what factors determine Trinidad householders' satisfaction with faecal sludge emptying service providers'.

Satisfaction, although a relative term, is crucial in ensuring the sustainability of FS emptying services and by extension the FSM service chain. The price charged and the time taken for a response after appointments were made could be addressed through sector-wide sanitation planning, public education and HHs participation as they comply with the construction standards set, get involved in advocacy campaigns and use their voice in altering the government's spending of their taxes (use people power).

The price charged to empty septic tank is determined by the tank size (mainly public provider) and accessibility (mainly private sector). Accessibility issue falls under the purview of both Town Country and Planning (TCP) and the Ministry of Planning and Development (MPD). In the absence of planned national housing development monitoring and regulation, containment will continue to be an issue and a complex factor to change in the short term. Realistically, a better approach would be to focus on the incorporation of onsite sanitation into national development strategic plans and frameworks and among the relevant departments within the Ministry of Legal Affairs where HHs price complaints could be considered; make accommodations to include price control for sanitation emptying services. The poor response time could be addressed by recommendations made for objective 1 where the public sector, having more autonomy over their revenue generation

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and expenditure, they could invest in FS emptying equipment and improve their response time (purchase new trucks or improve their mechanical repairs department).

The private sector challenges were not evaluated because of poor participation so recommendations are directed towards the public providers. Once the NSC set the rules and non-compliance actions are backed by effective enforcement laws, both emptying providers' and the public challenges could be alleviated.

Objective 3: To propose recommendations that could help bridge current gaps in faecal sludge containment and emptying services in Trinidad.

The overall gaps in FS emptying services and onsite containment are as a result of a national onsite sanitation policy being absent. Trinidad's technocratic mentality towards FS management is that the absence of a national onsite sanitation, means Trinidad does not have a sanitation problem, but the fact that they perceive they do not have a problem is because in the absence of an onsite sanitation policy in place to monitor and guide FS management, the problems go undetected. Hence, it is recommended that sector-wide education programmes aimed at sensitizing the technocrats of the country's onsite sanitation problems, the consequences of neglecting the problem and their involvement by providing ways in which feasible solutions could arrest environmental degradation and public health risks. Likewise, 'you cannot apply what you do not understand' so research has to be carried out across the various sectors so as to identify their roles, their responsibilities, attitudes, perceptions' and intentions towards FSM. Outside of this assessment step, blind planning would result and the situation would seem to be going nowhere.

Finally, either WASA or SWMCOL could commit to issuing emptying providers with licenses to operate. The license should cover all aspects of FS emptying safe practices and operation (health and safety, disposal guidelines, emptying guidelines, enforcement etc), not just emptying services. This approach could lead to a FS emptying services association being established in Trinidad, thereby providing information about the providers, their challenges, institutional needs, price control, business diversification opportunities, call centres/ common ground where HHs could hire providers etc, all of which could minimise monopolisation by the larger fleet private providers and maintain a healthy safe FS emptying market in Trinidad.

7.2 Recommendations for future research

This study focused on FS emptying services in Trinidad and on the first components of the FSM service chain, but the FSM service chain has other components that are vital for

effective FS management. Those aspects (transport and disposal) were briefly examined in the study, but the author believes that a holistic understanding of Trinidad's FSM challenges along the service chain would add value to this study and future development. This study is the first of its kind in Trinidad, if not the WCR so research on FSM in this region is desperately needed in order to safeguard against the adverse effects neglecting FSM has on the Fisheries, Tourism and socio-economic sustainability of the WCR.

Research could include but not limited to:

- Assessing the enabling environment for FSM service chain and FSM municipal financing in the WCR: a comparison among the Caribbean islands best practices
- International donors and financiers support in the WCR looking at ways in which onsite sanitation could be incorporated within their sanitation financing policy frameworks
- Service Delivery Assessment score cards and shit flow diagrams for the WCR islands
- KAP surveys among building Contractors, Masons and Plumbers in T&T about FS containment design. Do differences in perceptions impact design and how do their differences in design affect FSM performance?
- The role of media in creating desired behavioural change towards FSM facilities, service providers, disposal and protection of the environment.
- Women and their role in sanitation
- Assessing the local market for resource recovery potential among the national community use of treated FS in Trinidad and Tobago in agriculture and landscaping

7.3 Methodology Reflection

The methodology used to conduct this study helped the author accomplish the task. The data collection sources: interviews, observations and household surveys provided vital information on FS emptying services and some. The literature review set the foundation for the author's methodological approaches used and provided a holistic understanding of sanitation in the global context. Therefore, the combination of existing literature and the actual data collection sources, the author was able to achieve their main research objectives and specific research questions.

7.4 Overall study limitations

The author approached this study with high expectations but due to some personal limitations (two immediate family members battling heart disease and kidney failure) which occasionally affected the author's emotional and psychological balance. Nonetheless the

author pressed forward and was able to achieve their objective. Also, the author limited resources restricted them from making a second visit to Trinidad and Tobago and as such they had to rely on family and friends to conduct the surveys; they (Enumerators) were limited in what could have been investigated, and FGDs and face to face interviews across T&T was not feasible with the author being absent. The time difference between the UK and T&T (UK five hours ahead of T&T) affected communication with key informant interviews and time arrangements. The author initially desired to investigate FSM institutional arrangements in T&T, but at the last minute, due to technocratic resistance and poor participation, they had to switch directions, thus being confined to the first components of the FSM service chain and a bit pressed for time. Finally, a study of this nature (FSM service chain) and T&T's ignorance of global sanitation developments require more than four months to clinically assess the situation, research the problem and propose significant recommendations.

7.5 Conclusion

The main research question was: How do faecal sludge emptying providers in Trinidad operate and how satisfied are householders' with their services?

The efficiency of FS emptying services requires the participation of both the providers' and the households mutually supporting each other. The demand-supply ratio (emptying providers' in relation to their ability of emptying providers to respond to HHs emptying request for FS services) is facilitated by the highly visible unregulated FS emptying providers' (public and private) and the predominant on-site sanitation facility used; that is the septic tank. This study proposed a preliminary strategy the Trinidad authorities could considered so as to lay the foundation for building an institution for onsite sanitation that would combat FS emptying providers and households many challenges.

The solution is not an overnight three step procedure, but very complex indeed. Trinidad has neglected onsite sanitation for decades and in light of the global economic pitfalls, it will be unrealistic to think that it will become a priority even though it should. Hence the approach should be gradual and consistent. This study can potentially open up sector wide sanitation platforms for discussion, serve as a pilot for further research by inter-island ministries and give a voice to a silent problem.

If safe onsite sanitation management is to become a reality in Trinidad, an enabling environment that supports every component of the service chain and their stakeholders must be established and the bias toward wastewater investments has to be removed allowing for adequate and appropriate budget allocations to be directed towards developing, enabling and sustaining the fragmented, almost invisible, FSM service chain in Trinidad.

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Appendices Section

Appendix1: Participants responses /thoughts on FS emptying services

Survey questions	Responses/thoughts	No. of Ans
Technical (containment)	Septic tank	31
Containment type	pit latrine	6
	both St/PL	6
	sewer connection	1
Containment size	Standard size 4x6x6	26
	Non-standard size	7
	I don't know	9
	Average size	1
Containment construction	Built it myself	11
	I and a plumber built it	3
	Hired a tradesman	14
	House contractor built it when bought/built home	7
	I use Rotoplastics Fat Boy tanks	3
	I don't know/can't remember	5
Containment access	4" or 6" PVC access plug	16
	3 piece concrete slabs	8
	One whole concrete slab	5
	Two piece concrete slab	2
	Fat boy ST	3
	Other	3
Technical (Maintenance)	Smell	19
Signs that tell the tank/pit is full	Difficulty flushing	8
	Flooding during rainy season	5
	Overflowing contents/leaks/spills in drains	9
	Manufacturer recommendations	2
	Blockage	1
	Make regular checks every couple months	1
	None/it was full	5
Number of time emptied (last 10 years)	Once	16
	Twice	6
	Three times	4
	About 5 times	1

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	I can't remember	7
Have you had your pit latrine emptied	Yes	2
	No	7
	I never emptied it , just cover with dirt and built a new one	6
	Use it to throw rubbish	1
Type of materials used or end up in tank	Cloth	1
	Condoms	1
	Hair	1
	Hand towels/napkins	2
	Tissue, pads, pampers, wipes	9
	Gazette/ newspaper	1
	Almost anything	1
	No response	11
Economic (cost)	\$250TTD- \$500TTD	11
Service charge paid for emptying	\$600-800TTD	10
	\$1500TTD	3
	\$2000TTD	3
	\$2500TTD	1
Reason for price charged	It's a government/corporation service	3
	Type and nature of the job/dirt tank, overflows	7
	Government take too long so forced to go with private	1
	Distance of the tank/Access/ size/ parking availability	5
	Quick response, easy ability/pricing	1
	I am a WASA employee	1
	I don't know	5
	No response	2
Cost of containment construction	\$5,600 TTD self built standard ST	15
	\$ 5, 800 TTD 500 gallon Rotoplastics ST + installation	1
	\$6,900 TTD 600 Rotoplastics ST + installation	2
	\$2500 standard PL with concrete base	6
	\$1800 standard PL with wood base	4
	Other	14
Satisfaction	Price	23
Factors of satisfaction	Time taken to empty tank	26
	Ease of accessing the tank	27
	No leaks/mess	27
	The way the tank was opened	26
	Truck ability to remove all the waste	27
	Technical knowledge of emptying staff	27

Faecal sludge emptying services in Trinidad

	Equipment used	30
	Clean up after the job	24
	Time taken from appointment to actually responding	17
	Overall quality of the service	25
Fairness of the price charged	Very fair	6
	Fair	18
	Partly fair	7
Affordability	Very affordable	8
	Affordable	12
	I barely had the payment	5
	I did not have a choice	7
Social	Price	32
Most important factors considered when hiring a provider	Ability to completely empty the tank	33
	Time taken to empty the tank	30
	Quick response time after making appointment	31
	Company ability to access your tank extra hose)	31
Problem you have with emptying	Hiring a mason to reseal or rebuild slab cover	12
	Frequency of emptying your tank	13
	Clean up after providers complete the job	10
	Taking time off from work when time to clean tank	23
	Cleaners have trouble accessing the tank	14
	Hiring the service provider	17
Respondent house status	Home owner	35
	Land lord	3
	Care giver/House sitter	4
Number of persons living in the house	From 2 to 4 persons in one house	15
	From 5 to 7 persons in one house	19
	From 8 to 10 persons in one house	4
	11 to 13 persons in one house	2
Did the provider wear PPE/ what did they wear	Yes	22
	No	3
	Boots, gloves, overalls, goggles, face mask	20
Institutional (management)	Public (Regional corporations)	15
Emptying service provider hired	Private Operators	15
	WASA	2
	Other	2
Government organisation responsible for monitoring CCs	WASA	12
	Regional Corporation	12
	MOH	4
	SWMCOL	9

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	I don't know	4
Confidence with FS properly treated?	No confidence (0% - 30%)	13
	Moderate confidence (40%- 70%)	22
	Complete confidence (80%-100%)	2
	I cant say because of corruption	1
Environmental	It is disposed of in WASA treatment plant	10
Where FS is disposed	It is disposed of in SWMCOL treatment plant	12
	I don't know	15

Interviewees segment

Interview questions	Responses/thoughts
Operators	
Technical (containment)	Self constructed septic tanks
Main containment type & size	On average 3 out 10 septic tanks are Rotoplastics tanks Most people are changing from pits to septic tanks We empty septic tanks alone Most people have the regular 4x6x6 tanks Bigger than the regular
Containment accessibility	PVC 6 to 8 inch 'clean out cover' If not cleaned for a while a bigger hole is made. Some tanks difficult to reach and are in strange places Tanks under bedroom and bathroom floor, need to raise tiles narrow/tight passages behind a house bushy areas over drains most times in front the yard
Materials found in containment?	Rags, toys, pair of jeans, cloth, stone, women and men underwear, towels Sanitary pads Toilet paper after a while form a 'cake'
Technical (Truck)	
Truck capacity	1000 gallons trucks Approx. 3000 gallons emptied per day (3 trips)
Emptying challenges	Chokes (occurs approx. 3 times in 20 jobs) Downtime due to chokes, longer response time Materials from chokes are to be disposed by HH which is frowned upon Service request increase in rainy season

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	<p>Tanks not seal so more calls during rainy season</p> <p>little consultation with drivers when purchasing trucks</p> <p>No air condition in trucks</p>
Most frequent areas in SJC emptied	Aranguez
Economic (cost)	
Service charged for emptying?	\$500 TTD/US\$75 for a regular 4x6x6 tank/pit, \$1000TTD/US\$150 for greater tank size
Factors that would determine the cost?	<p>Size of tank only</p> <p>Councillors of each cooperation would set price in accordance to socio-economic status and cooperation agrees</p> <p>Cooperation need to make money so price recently changed</p>
Satisfaction	Price (cheaper than private sector)
Clients' satisfaction with your service?	<p>Short waiting time after appointment (1-2 weeks)</p> <p>Efficient service</p> <p>Operators respectful and well mannered</p> <p>Ensure job is well done</p> <p>15 to 20 minutes emptying time without chokes</p>
Social (perceptions)	
Health and safety aspects	<p>PPE provided</p> <p>Uniforms, rubber boots, respirators, rubber gloves up to elbows</p> <p>Medicals once a year</p> <p>No record of health problems</p>
How society view CC activities	<p>A lot of people scorn us</p> <p>Materials taken out of clogged hoses are HH responsibility, but some get angry with us when seen in their yard</p> <p>It does not matter to me it's an honest job</p> <p>Labour unions and government see us at the bottom/ they don't fight for better conditions and wages for us</p> <p>People turn their faces, block their noses when truck passes</p> <p>The workforce is aging not many young people</p>
Areas of CC improvements	<p>Disposal</p> <p>New trucks (some trucks 20 to 30 plus years old)</p>
Institutional (management)	
Government organisation in charge of monitoring CC activities?	<p>I don't know</p> <p>SWMCOL</p> <p>WASA</p>

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National guidelines for CC activities	Absent It have no guidelines Ideas made up as we go along Do the job safe and not unsanitary to the public
Are CC companies unified	No The RCs can be accessed but not unified Private can be seen if in the area but they not unified
Environmental	Beetham dump Port of Spain
Where FS is disposed	Very fare and only on extreme cases dispose in a manhole authorised by WASA
Issues with the disposal site	Unsanitary/Unhealthy, the location Three big holes to dump waste Open air and vacuum pump blows the waste when emptied Not properly managed Road to dump unpaved so gets soggy/swampy when rain falls-trucks get stuck in the mud Crime such as robbery happens at the site No water supply for washing up (was present by SWMCOL moved it) No one manages the site Holes when full a tractor take out the sludge, place it at the side

Interview questions (Public Managers)	Responses/thoughts
Technical (containment)	
Type of containment emptied	Mainly Septic tanks
Containment size	Regular 4x6x6 but some larger Few (3 out of 10) rotoplastics tanks
How many requests come from HHs	Average of 5 per day but depends on season Rainy season may get a max of 10 requests per day, but average will be 6 or 7 requests
Areas mostly emptied in SJC area	Aranguez and San Juan
Technical (Truck)	
Type of truck used for emptying	They are vacuum tankers
Truck capacities	Smallest is 1000 gallons and largest 1500 gallons
Emptying challenges	Delicate pump which breaks down often Only two operational trucks at any given time The mechanics delay repairs for too long

Faecal sludge emptying services in Trinidad

	<p>Threats to operators when at some jobs</p> <p>Plumbers are advising the public to use the 4 in PVC plugs which limits access to inside the tank</p> <p>Some people do not like to open the tanks</p> <p>houses in hilly areas could be 500-600 feet away from roads requiring 2 to 4 trucks to do one job (slows services)</p> <p>When SWMCOL have strikes and the dump is closed trucks have to be parked with waste overnight</p> <p>Limited disposal options outside of Beetham for emptying</p>
How many trucks owned	Four but only 2 works at any given time
Main type of repair work done on trucks	Mainly pump on vehicles (they give more trouble due to technical engine)
Economic (cost)	
Cost for emptying service	Regular tanks \$500TTD/US\$75 anything large is \$1000TTD/US\$150
What determine the price	Strictly size of tank determine price. No matter if it is pit or tank same amount is charged
Cost to supply fuel for trucks	Even 4 trucks and 8 operators are used to empty one tank, it's the same price
Cost for disposal	Out of 22 working days say \$150TT/2 days or US\$22US to fill the trucks
Is the business competitive	Its \$150TTD or US\$22
Cost of acquiring a truck	Fees charged per trip not by volume or the size of the truck
	Private sector make a 'killing' with the price because their trucks can contain about 3 ½ to 4 septic tanks in one trip
	There are a lot more players in the field year but competition has reduced when it should be more
	During festivals (Divali and Christmas) it is more competitive
	Could cost the \$850,000TTD to \$1.5 million TTD (US\$127,000 to US\$ 224,000) for brand new trucks
	RCs have to go through a tendering process to acquire trucks
	Trucks Chassis ordered from Massy, Toyota etc local companies T&T and tankers built to suit the chassis by Tropical Engineering
	Cities and Boroughs exempted from tendering, they purchase trucks fully assembled from external automotive companies (comes on ships ready to use)
	Cities have more autonomy than RCs (they have Mayors)
Satisfaction	Price
Clients' satisfaction with your service?	People tell us we operate like a private business
	Due to breakdowns promises are made but we do our best and fill the promise

Faecal sludge emptying services in Trinidad

	Shorter waiting time than private sector
Social (perceptions)	The operators are given full PPE
Health and Safety	Medicals done every 3 years where the crew go for basic vitals check up and an x-ray or two Government provides no compensation for the Cesspit workers, they view them at the bottom of the food chain
How society view CC	People still have the old time stupid mentality People block their noses, turn their faces when they see the trucks Crews are threatened by HH if any septage or clog materials fall in their yard or any mess is made People are scornful, some do not even inspect their tanks emptied, they stay inside their homes People speak to the operators in degrading manner
Institutional (management)	No we don't collaborate
Are CC companies unified/collaborate	We only help the other in the event of floods Each to his own
Which organisation manages the disposal arrangements	SWMCOL There is a SWMCOL office on the dump that checks the trucks in to empty. There facility opens for business Monday to Saturday 8am to 6pm and Sunday 8am to 12:00 noon. Closed on public holidays Disposing in WASA manhole is illegal and operators can be fined
National guidelines for CC activities	We have our guidelines as to what we expect from HHs No national guidelines Probably the only guideline we have is go to SWMCOL in the dump and offload
Permits for CCs	I cannot say! Well if the company empty at SWMCOL then I think they would have gotten a license
How services are advertised and how can someone hire your service	Public normally call the RC or by word of mouth and are directed to the Cesspool Department No newspaper adds Coming into the office is the only process Service fees paid to First Citizen Bank Requests are recorder in ledger and a waiting period (1to 2 wks) given
Organisation responsible for monitoring CC activities	There are no standards set therefore there is no one monitoring anything
Environmental	

Faecal sludge emptying services in Trinidad

Where FS is disposed	Beetham landfill designated area for FS disposal
Thoughts about the disposal site	<p>Not keeping with what you read as good practices internationally</p> <p>Open air resulting in Gulf of Paria winds blows fumes into Port of Spain</p> <p>Fumes entering the city between 8:30 to 9:00 am is not a healthy situation</p>
Areas for improvement	<p>All of septage disposal</p> <p>Operators at the site</p> <p>Better facilities separating chicken depot dumping from septage for they were dumping in the same site</p> <p>There is no monitoring, no nothing and the situation will one day explode in our faces.</p> <p>The forth coming Local Government Reform, not one of consultations raised FSM as an issue</p>



Faecal sludge emptying services in Trinidad: A case study

Participant Information Sheet

Main Investigator: Shervon Ifill, MSc Student

@: s.ifill-15@student.lboro.ac.uk

Supervisor: Dr Sam Kayaga, Senior Lecturer and Programme Manager at WEDC

@: S.M.Kayaga@Lboro.ac.uk

Water, Engineering and Development Centre,

Loughborough University Epinal Way, Leicestershire, UK, LE11 3TU

You are being approached to take part in a study investigating faecal sludge emptying services in Trinidad: A case study.

This Participant Information Sheet will help you decide if you'd like to take part. It sets out why I am doing the study, what your participation would involve, what the benefits and risks to you might be, and what would happen after the study ends. I will go through this information with you and answer any questions you may have.

Once you have decided to take part in this study, you will be asked to sign the Consent Form on the last page of this document. You will be given a copy of both the 'Participant Information Sheet' and the 'Participant Consent Form' to keep.

This document is 4 pages long, including the consent form. Please make sure you have read and understood all of the pages.

Part 1: Understanding the study

What is the purpose of the study?

This study aims to examine faecal sludge emptying services in Trinidad to determine what factors enable or disable the service providers', together with householders' level of satisfaction with the services they receive and propose ways to improve this stage of the Faecal Sludge Management (FSM) service chain. The FSM service chain deals with the process of how faecal sludge (human poop) is stored, collected, transported, treated and disposed.

Storage--- emptying----transport-----treatment-----disposal/end use

The storage is the containment used to 'hold' the waste until it is ready to be removed and are either septic tank, pit latrines, buckets and so on.

Faecal sludge emptying services in Trinidad

The information to achieve the research aim will be collected through a review of academic literature, interviews with private and public cesspit company's managers and operators who provide a service to householders living in the St Joseph Constituency in Trinidad, household surveys from the St Joseph Constituency and observations.

This study is NOT funded nor sponsored by any international, governmental, local nor regional authority and the fieldwork is facilitated by local research assistants living in the study area (Trinidad). The entire research is a self funded initiative of the researcher.

Who is doing this research and why?

This study is part of an MSc student research project supported by Loughborough University and particularly the Water, Engineering and Development Center (WEDC). It is the researcher for the project that will be leading the telephone or online interview.

The researcher's current qualification is in Water and Waste Engineering with a focus on Faecal Sludge Management (FSM) in the Caribbean and with a background in Public Health.

Once I take part, can I change my mind?

Of Course! After you have read this information and asked any questions you may have, I will ask you to complete an Informed Consent Form. However if at any time, before, during or after the sessions you wish to withdraw from the study please just contact the main investigator. You can withdraw at any time, for any reason and you will not be asked to explain your reasons for withdrawing.

Part 2: Understanding your role in the study

What will I be asked to do?

If you are reading this, it means that the investigator would like to receive your point of view on the "faecal sludge emptying services in Trinidad" carried out by your company, with the intent to explore how it's done and what factors enable or disable emptying service providers'. This will contribute to the study's objective to propose ways on improving any inadequacies with faecal sludge (cesspit) emptying services.

This will take the form of a telephone or Skype interview with questions on your knowledge, practices and point of view on the faecal sludge emptying services in Trinidad.

How long will it take?

The interview is expected to take 30 to 45 minutes.

Part 3: Ethical treatment and Data protection

Will my taking part in this study be kept confidential?

You should be aware that as a key informant any views that you express may be referred to or quoted as part of this research study. However, any reference made to the information you provide (e.g. your name or company name) will be treated anonymously.

The interview will be recorded using a recording software. This is for the use of the researcher to refer back to important information that you may have provided once the

Faecal sludge emptying services in Trinidad

interview has ended. The audio recording of the interview will be kept in a secure place (complying with storage of data under the 1998 Data Protection Act) and not released for use by any third parties. The recording will be destroyed within ten years of the completion of the investigation).

The study has been approved by Loughborough University Ethics Committee.

What are my rights?

The participant has the right to withdraw from the investigation at any time and to require their own data to be destroyed. There will be no financial rewards or other incentives given for your participation, it is all voluntary participation.

What will happen to the results of the study?

The results and recommendations of this study will remain with the main investigator and with examiners in WEDC, Loughborough University.

I have some more questions who should I contact?

Should you have any questions relating to the study or your interview please contact the researcher at: s.ifill-15@student.lboro.ac.uk

What if I am not happy with how the research was conducted?

If for any reason you are not happy with the way that the research was conducted, please refer to Loughborough University's policy relating to Research Misconduct and Whistle Blowing, available online at [http://www.lboro.ac.uk/admin/committees/ethical/Whistleblowing\(2\).htm](http://www.lboro.ac.uk/admin/committees/ethical/Whistleblowing(2).htm)

Appendix 3: Participant informed consent form



Faecal sludge emptying services in Trinidad: A case study

INFORMED CONSENT FORM

(to be completed after Participant Information Sheet has been read)

The purpose and details of this study have been explained to me. I understand that this study is designed to further scientific knowledge and that all procedures have been approved by the Loughborough University Ethical Approvals (Human Participants) Sub-Committee.

I have read and understood the information sheet and this consent form.

I have had an opportunity to ask questions about my participation.

I understand that I am under no obligation to take part in the study.

I understand that I have the right to withdraw from this study at any stage for any reason, and that I will not be required to explain my reasons for withdrawing.

I understand that all the information I provide will be treated in strict confidence and will be kept anonymous and confidential to the researchers unless (under the statutory obligations of the agencies which the researchers are working with), it is judged that confidentiality will have to be breached for the safety of the participant or others.

I agree to participate in this study. Write your name in the space provided as giving consent, and email the signed form to the investigator at the above stated email address.

Your Name	
Online signature (if available)	
Investigator Name	
Investigator signature	

Appendix 4: Semi-structured interview guide questions (Operators)

Can you state the name of your company and your position?

How many years have you been working in the said position?

From Aranguez to Curepe, which areas you mostly provided emptying services to? Why?

In any given day, how many of the cesspit cleaning requests done are from households?

For the time you have been doing this job, which system (septic tank/pit latrine) do most home owners' have?

Does your company empty both septic tanks and pit latrines?

Can you briefly tell me how your company clean tank/latrine?

Approximately how many gallons/litres of sewage you empty per day (trips made to offload)?

What are some challenges you face when cleaning septic tanks or pit latrines in terms of: Accessibility of the tank, materials found in tank/pit, truck downtime, and climate (rainy and dry seasons)?

Based on your most recent emptying, what were some factors you think the client was satisfied with? How could you tell?

How much does your company charge to clean a septic tank or pit latrine? What factors determine the price charge?

Where do you dispose of the sewage collected?

What are your thoughts about the disposal site? Do you have any problems with the site?

Which organisation in Trinidad and Tobago is responsible for monitoring cesspit cleaning activities?

Are there any local guidelines that cesspit cleaning companies need to follow when providing emptying services?

Are cesspits cleaning companies unified?

Does your company provide PPE for Operators when going on cesspit cleaning jobs?

What aspects of cesspit cleaning you would like to see improve in Trinidad?

How does society or your social group view your job?

Is there anything else you would like to share?

Appendix 4: Semi-structured Interview guiding questions (Managers)

Can you state your company name and your position?

How long have you been working in the cesspit cleaning business?

On a daily basis how many of cleaning requests does your company get to clean household septic tank/pit latrine?

Which type of containment (septic tank/pit latrines) do you mainly clean?

How do you advertise your services? Is there any one geographical area you provide services to?

If someone wants to have their cesspit cleaned how can they hire your company? (Procedure)

Based on your most recent emptying, what were some factors you think the client was satisfied with?

What type of trucks do you use for emptying septic tanks/pit latrines?

What mechanical repair work you mostly perform on your trucks?

How many trucks does your company operate?

How expensive is it to acquire a cesspit cleaning truck in Trinidad?

How expensive is it to supply fuel for your company trucks per day/month?

Would you say this business is a competitive business? Why?

Are cesspits cleaning companies unified or a part of an association of some sort?

How much does it cost a home owner to have their cesspit cleaned? What are some factors that would determine the price charged?

Is it expensive to offload the sewage collected? To which organisation is the payment made?

Where do you disposed of the sewage when collected?

What are your thoughts about the disposal site?

Are there any formal guidelines that cesspit cleaning companies must follow when emptying septic tanks/pit latrines?

Do cesspits cleaning companies need a permit/license to operate in Trinidad? Explain?

Which organisation in Trinidad and Tobago is responsible for monitoring cesspit cleaning activities?

What are some aspects of cesspit cleaning you would like to see improve in Trinidad?

Is there any other information you would like to share?

Appendix 5: Participant informed consent form for Households



Participant letter

I am _____ working with a master student Ms. Shervon Ifill, who is undertaking a small research project as part of her studies on a Master degree in Waste and Waste Engineering at Loughborough University in the United Kingdom.

The objectives of the research project are to gather information on cesspit cleaning services and householders' level of satisfaction with the service from the St Joseph Constituency.

To do this, a short survey has been developed, which I would be extremely grateful if you would voluntarily participate by answering the following questions with the Enumerator present.

Your informed consent is needed; therefore you can give verbal consent.

The questionnaire should take no more than 15-20 minutes to complete and all information is anonymous and confidential, so there is no need to give your name, house number or any sort of identification information to the Enumerators.

There will be no reward or incentives given for your participation. You can choose not to answer any question you are uncomfortable answering and you can choose to stop the survey at anytime you wish.

The data will be analysed using appropriate computer software and once that is done the paper with your responses will be destroyed.

If you would like to receive a summary of my findings please send me your email address details separately.

Thank you very much for your time and participation.

Shervon Ifill

Loughborough University

Postgraduate student

Contact: s.ifill-15@student.lboro.ac.uk

Appendix 6: TTBS septic tank specifications and plan design

**Table 1 — (Clause 4.1 and sub-clauses 4.1.1 and 4.1.2)
SEPTIC TANK DESIGNED FOR TOILET WASTES ONLY**

Number of users (1)	Nominal Capacity (litres) (2)	Recommended Dimensions (m)			
		Length (3)	Width (4)	Liquid Depth (5)	Total Depth (6)
Up to and including 9	1450	1.50	0.75	1.20	1.50
10	1610	1.75	0.75	1.30	1.60
11 to 15	1820	1.90	0.75	1.30	1.70
16 to 20	2420	2.20	0.75	1.40	1.70

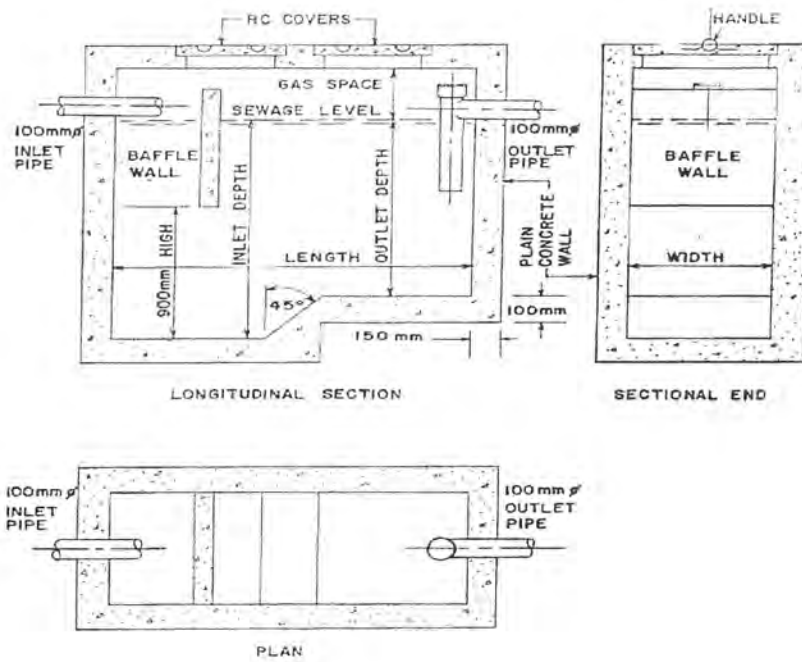
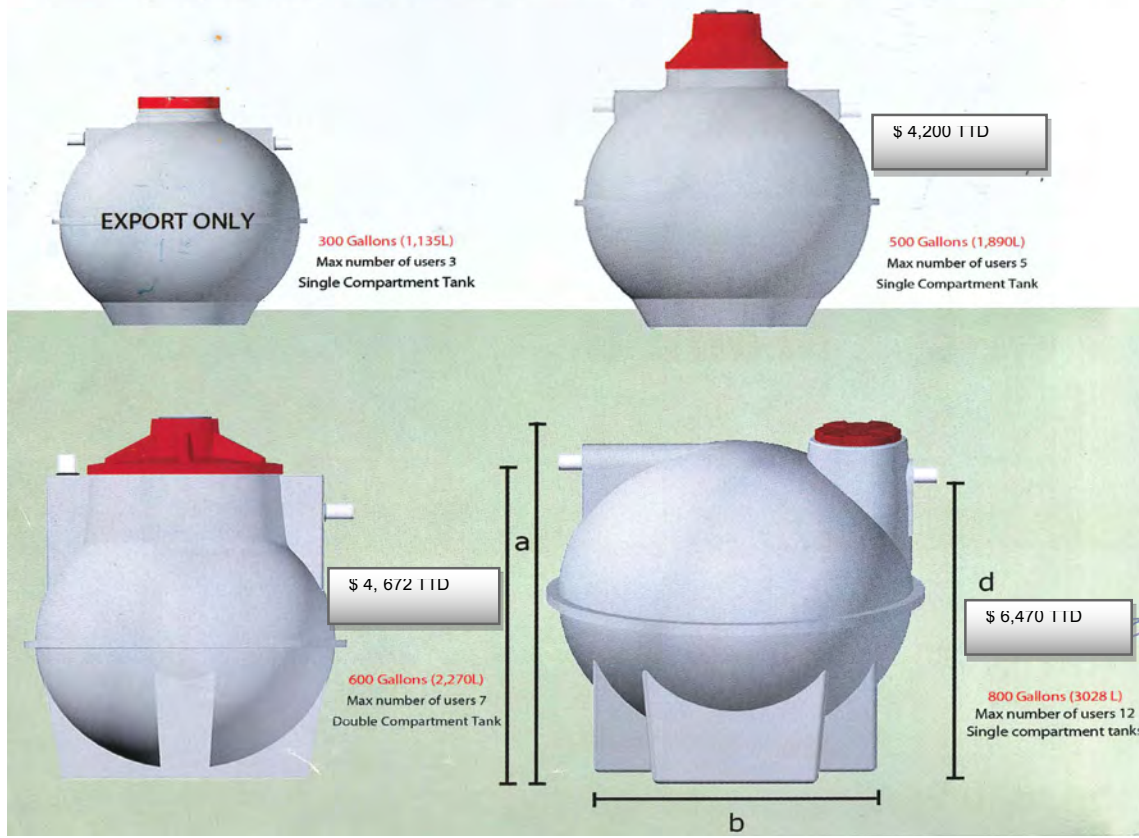


FIGURE 1
(Clause 4.4 & Sub-Clause 4.5.1)
TYPICAL SEPTIC TANK

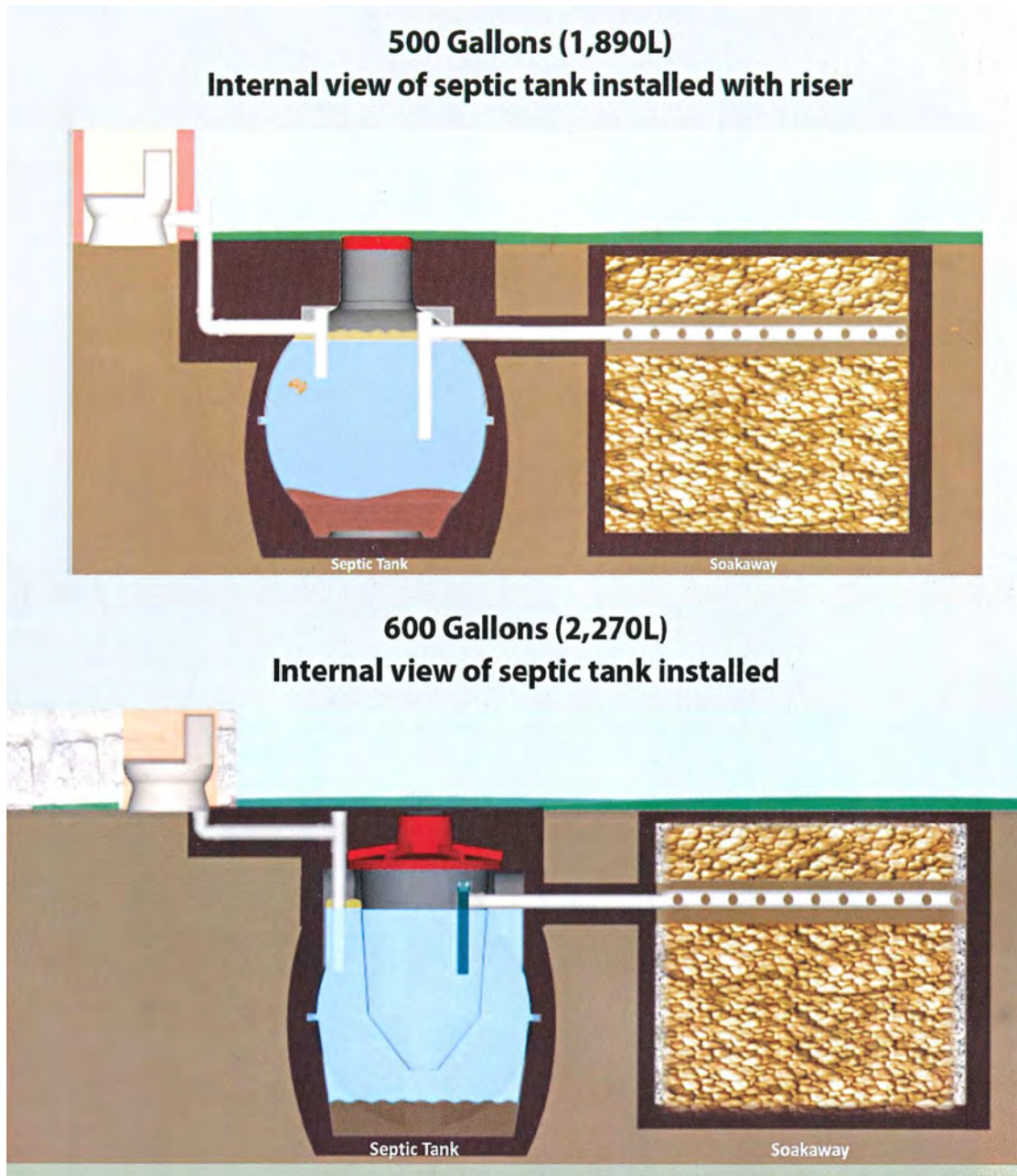
Appendix 7: Rotoplastics septic tank specifications and design

SPECIFICATIONS

SEPTIC TANK	a Total Height	b Diameter	c Height to Inlet	d Height to Outlet
300 Gal	61.25" (156 cm)	57" (145 cm)	50" (127 cm)	47.5" (121 cm)
500 Gal	81" (206 cm)	67" (170 cm)	53" (135 cm)	51.25" (130 cm)
600 Gal	85" (216 cm)	67" (170 cm)	68.5" (174 cm)	60.5" (154 cm)
800 Gal	80" (203 cm)	75" (191 cm)	67" (170 cm)	65" (165 cm)




Appendix 8: Internal design of the Rotoplastics septic tank



Appendix 9: SJLRC in house septic tank emptying guidelines

PLEASE READ



Cleansing Department
Telephone: 663-3947

- 1) Original receipt must be produced to the driver of the cesspool emptier.
- 2) Adequate access to cesspits or septic tanks must be provided by and at the cost of the owner/occupier.
- 3) Seats (cesspits) and manhole covers (septic tanks) must be removed immediately before pumping and replaced after cleaning by and at the cost of the owner/occupier.
- 4) A sufficient supply of water must be provided within 3 ft to 4 ft from the tank.
- 5) The Corporation cannot guarantee the **emptying or cash refund** to the owner in the emptying of cesspits, septic tanks into which *unsuitable* materials (i.e. bottles, rags, pieces of wood etc) have been deposited. Materials other than faeces, water and toilet paper are likely to block the suction hose and damage our pumps.
- 6) Consent must be given to the driver of the cesspool emptier to enter into the owner / occupier's yard or onto any bridge. The said Corporation will not be liable or responsible for any damages done to any owner/occupier's property.
- 7) **The job sheet should be signed *only* when the owner/occupier is satisfied that the job is satisfactorily completed. If not, please contact office immediately. The Corporation takes no responsibility to have any job redone on the basis of the failure of the customer to comply with the above instructions.**
- 8) The payment of ^{\$500.00}~~\$250.00~~ **guarantees** the cleaning of a cesspits and/or septic tanks with the size of 4'x 6'x 6'.
- 9) The Corporation **cannot guarantee** the proper pumping of septic tanks in which 4" and 6" P.V.C caps are fitted to be used as access points into septic tanks. This allows for mainly the removal of water.
- 10) **Customers will be contacted twenty four (24) hours before their date of appointment.**

Failure to keep this appointment cannot guarantee an immediate appointment.

Appendix 10: Interviewee transcribed notes

Interviewer: Can you state your company name and your position?

Interviewee: The San Juan Laventille Regional Corporation and Cesspool Supervisor.

Interviewer: How many years have you been working in the cesspit cleaning business?

Interviewee: Since the 4th of June, 1994.

Interviewer: On a daily basis how many of cleaning requests does your company get to clean household septic tank/pit latrine?

Interviewee: Average of 5 per day, but that would be dictated by the type of season. The two seasons we have is rainy season and the dry season and we usually tend to get more requests as soon as rain starts to fall.

Interviewer: How many requests can you get during the rainy season?

Interviewee: Well the maximum we might reach is about 10 a day, but it will not be a consistent 10, it will fluctuate. The max we will reach is 10 maybe a little more but in the rainy season we say about 6 or 7.

Interviewer: Which type of containment (septic tank/pit latrines) do you mainly clean?

Interviewee: Septic tanks!

Interviewer: How does the corporation advertise their cesspit cleaning services? How does the public know that you offer this service?

Interviewee: The public normally call into the RC to ask for information, there is no documents on the newspaper or otherwise, word of mouth or by calling the RC and directed to their cesspit department.

Interviewer: Being situated in the SJC which areas do you mostly provide services too within the SJC? Between Aranguez and Curepe bracket.

Interviewee: I was speaking to a Councillor recently as to the SJC itself and he was giving me the impression that parts of SJC goes over the hill into Maracas, Las Cuevas come back around, taking in part of the Santa Cruz hills was part of that. But if we are to deal with it based on how the Regional Corporations we deal with it basically be between Aranguez and Hutton Street so that will be the area itself.

Interviewer: Which districts within that Aranguez to Curepe slot then do you provide emptying mostly?

Faecal sludge emptying services in Trinidad

Interviewee: Mostly the Aranguez, El Socorro and San Juan area.

Interviewer: If someone wants to have their cesspit cleaned how can they hire the services of the corporation? (Procedure)

Interviewee: The only process is coming to the office directly and having your request processed by a member of staff who will ask various questions pertaining to the location, size of tank and how urgent the request is need will come into play. Then after getting we will write them a voucher to have the services paid for at the First Citizens bank in San Juan and after coming back to us we will enter it into a ledger and they will have a waiting period.

Interviewer: Based on your emptying services what were some factors you think the client was satisfied with in hiring the corporation?

Interviewee: Mainly the price! Most persons who deal with us are mostly quite satisfied with how we deal with them. They actually tell us we often operate like a the private company or the private sector but we have some problems that we faced from time to time like break downs and maintenance of the vehicles so the type of service we would like to offer, you are only able to perhaps make a promise to the customer and hope to stick within that promise.

Interviewer: What type of trucks do you use for emptying septic tanks/pit latrines?

Interviewee: We call them vacuum tankers.

Interviewer: What mechanical repairs you mostly perform on your trucks?

Interviewee: Mainly the pumps on the vehicles will give the more trouble because they are a little more technical the engine themselves.

Interviewer: How many trucks does the SLRC operate?

Interviewee: We have 4 vehicles right now, but usually we only have 2 working vehicles at any given time, but we will leave it at 4.

Interviewer: How expensive is it to acquire a cesspit cleaning truck in Trinidad?

Interviewee: They could range anything like \$850,000 or \$1.5Million!

Interviewer: Are these brand new trucks?

Interviewee: Yes brand new trucks .What usually happens is that most times we go to one of the truck distributors for example Massy, Toyota, the suppliers of Isuzu, and you ask them of truck of a certain size or engine size, length of vehicle and width of vehicle and

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then that truck now, after sourcing the truck you carry the truck to Tropical Engineering and they build a tank for the truck. That itself is a very costly process. They build the tank on what is called the Chassis. Now mind you the RCs, the City and Borough Corporations functions slightly differently. The Cities and the Boroughs have a board that they apply to, to buy their vehicles, but we have to go through the tendering process and go through the Ministry of Works Engineers for them to say yah or nah as to what we want where specks are concern. So POS City Corporation, whatever they ask for, it comes on a boat, they just pull off the plastic and they go with it fully assembled according to what specks they want. But we in the RCs still have to go through tenders boards and the whole long process, as to who they feel we should take the vehicles from, and normally what we ask for we don't get.

Interviewer: Why is there a discrepancy between the two if cities, boroughs and corporations all fall under local municipalities in Trinidad? What do you think is causing that disparity?

Interviewee: It has always been like that and it has never changed. The Cities always had more power or a lot more autonomy to do what they want, as what they need or requesting as opposed to the RCs. I don't know if it is so because they have a Mayor and we have a Chairman, I don't know, but I met the system like and that is what we have to deal with.

Interviewer: How expensive is it to supply fuel to those trucks per day/month?

Interviewee: We have an average of 21 working days in the month and I will say perhaps about \$150TTD and every two days they are filled up; so \$150TTD in diesel every two days.

Interviewer: Would you say this cesspit cleaning is a competitive service between yourself and the private sector? Are there a lot of players in the field in Trinidad?

Interviewee: There are a lot more players in the field every year but right now i would say they may not be the amount of competition that they should have in the sense that sometimes when persons check the private companies they give a waiting period sometimes even comparable to us or a bit longer. According to the dry season or the rainy season and according to which holiday is coming close, say for example the Divali season into Christmas, it is very competitive.

Interviewer: Are cesspits cleaning companies unified or do RCs collaborate and come together?

Interviewee: No we don't. The various Cesspit Supervisors do not come together and plan the way forward. Basically it is every man for himself! For instance, you may know of a particular Cesspool Supervisor from another RC but even if he retires and someone else

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takes his place you would not know because no meetings take place so you are not aware. Basically, you just take care of your local situation to the best of your ability and if there is something that is perhaps difficult and you feel you need assistance from a neighbouring RC then you will seek assistance through the CEOs. For example when there are floods in various areas where they need the pumper trucks urgently to deal with over flowing pit latrines and so forth, that is the time you will see the different CEOs getting together and we will send our vehicles to work in another RC.

Interviewer: It has been revealed the SJLRC charge \$500 for a standard size 4x6x6 tank and \$1000 for anything larger than that. Hence other than the size of the tank, what other factors would determine the price charged?

Interviewee: It is strictly the size of the tank. The San Juan/ Laventille area as you may realize is a very, very hilly and quite a few of the jobs themselves would need 2 crews to get to the certain septic tanks. For example in Febeau village in Laventille road in San Juan, it is only recently over the past 20 years they have really gone in there and paved the roads and carry roads up to persons houses and even then sometimes you can only go through a track or up some steps to get to a house that maybe some 500-600 feet from the road. In a case like that you will need to carry 2 crews in order to get the job done, but the price remains the same. If I carry 4 vehicles and 8 operators to do a particular work, the price remains the same for standard 4x6x6 and no extra money is charged for the extra crews.

Interviewer: Based on the request you receive how many of the households have the standard sized tanks?

Interviewee: 8 out of 10!

Interviewer: Is it expensive to offload at the designated sewage disposal site?

Interviewee: No! That is actually where the private sector makes a killing! Some of the private contractors their trucks can actually carry 3 ½ to 4 septic tanks in one trip. So when they pass the gate by solid waste to offload the one pass you make is a standard price of approximately \$150 to offload. That is the standard price per load, no matter how large the track is.

Interviewer: Therefore offloading price has nothing to with capacity?

Interviewee: Nothing to do with the capacity!

Interviewer: Which organisation is responsible or manages that whole arrangement?

Faecal sludge emptying services in Trinidad

Interviewee: The SWMCOL. Where the Beetham landfill is situated there is a SWMCOL office right as you enter the landfill on the left side and they manage every truck that pass that gate suppose to be registered so they manage the whole landfill plus the Faecal sludge aspect of it.

Interviewer: Where do you dispose of the faecal waste and what are your thoughts about the disposal site?

Interviewee: The Beetham landfill. My thoughts have always been that it is not effective and it is not in keeping with what you read as good practices internationally, because everything is exposed to the open air. The winds that come from the Gulf of Paria, normally during the morning period takes all the fumes from the dump straight down to POS, especially when they have those fires on the dump the smoke covers POS and you cannot see POS. As about 8:30 to 9:00 in the morning it clears up because the direction of the winds change as it goes out to sea. So with the winds blowing into POS, it is not the right situation at all.

Interviewer: Within your tenure in the Cesspit department, have you ever seen any formal guidelines that cesspit cleaning companies must follow when emptying septic tanks/pit latrines?

Interviewee: We have guidelines as to what we expect of the public when we clean their septic tanks but after we take the FS from them, there are no guidelines as to where it should be disposed. Should I say, the only guideline is you go to SWMCOL in the dump and you offload; otherwise no guidelines. For example the SWMCOL had an industrial strike last week for about 2 or 3 days and we were not informed of that. The strike started about 7:00 to 7:30 in the morning so when my trucks role at 7 o'clock they reach by SWMCOL gate at 7:45 to 8 o'clock ready to offload with their first load. So we found ourselves in a situation where we reach by the gate, gates locked, they said we cannot go in because nobody is working and we had to find a place to dispose of that faecal matter.

Interviewer: Did your trucks have to go to another site to offload?

Interviewee: No! If step one is not functioning, then go to step 2. There is no step 2; there is no step 3. Because we had an emergency call with WASA 3 to 4 weeks ago and we went to help them with a situation where an underground sewer line was clogged and faecal matter was flowing in the road in Barataria San Juan, we were able to help them clean that manhole and dispose of the waste in another manhole they showed us to offload. Because we had done that for them the week before we were able to use that facility. We knew that once the waste was deposited into WASA's Manhole it would go straight to the Beetham Wastewater treatment plant. However, if the RC workers were found doing that they would have been charged.

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Interviewer: It is illegal for the RC to empty into WASA's manholes?

Interviewee: Yes it is illegal! The charge maybe about \$40 to \$100 dollars but where they have increased the rates for talking on your cell phone while driving w/o a head piece or using the PBR without a pass, they have not increased the charges for disposing faecal waste into the manhole. So even if operators got caught the most they will pay is \$ 100 to \$200. But the bottom line is we did not know the situation at Beetham and we had no plan B or C. What we had to do the second day is park the truck filled with faecal waste overnight on the compound until we could have gotten to go to Beetham to offload. So persons who would have been book and who would have taken time off from work to have their tanks cleaned, everything was at a standstill because we could not empty the collected faecal waste.

Interviewer: Do cesspits cleaning companies need a permit/license to operate in Trinidad? Explain?

Interviewee: I cannot say yes or no. But once the company is registered to empty then I guess they do. I am not sure which ministry is responsible but the one responsible for small business you register with them. Once you register your business and have all your documents and you speak with SWMCOL and indicate you would like to offload faecal matter, then that is all that is needed. I don't believe they inspect trucks to determine if you meet the requirements.

Interviewer: Which organisation in Trinidad and Tobago is responsible for monitoring cesspit cleaning activities?

Interviewee: There are no standards set, so if there are no standards set then there is no monitoring.

Interviewer: What are some aspects of cesspit cleaning that you would like to see improve in Trinidad?

Interviewee: The whole aspect of sewer disposal. How to put this gently! Some years ago like in the 80s, because of the difficulty in disposing, trucks were actually going into the Caura River and disposing. They had some others who were going in the rivers in Sangre Grande and disposing. If you do not have checks and balances, or person to really monitor that situation. Solid waste would have someone in the back by the pond telling you where they would want you to offload, and sometime ago I don't know if that person got promoted or he left the job and they didn't get a replacement. So what you found happening is that tanker of chicken depots of their guts and their features and heads and necks or whatever, these tankers would come in and offloading in the faecal pond. Now when you have that situation, the faecal sludge cannot be processed properly. So the whole aspect of

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offloading in an open area, open air just offloading, it is ludicrous! A tank should have been built for that (chicken depots waste) and a process put in place to process the stuff, filter it and process it to the point of what can be added back into the environment or whatever. There is no process, no monitoring in that sense, no whatsoever!

Interviewer: With the forthcoming local government reform, has any inclination been made by anyone to some aspect of onsite-sanitation?

Interviewee: I can't say yes or no to that. What I can say is before the 2010 elections, I was in Kent house that is the Head Office for Local Government, I was stationed down there at the time and the then Minister Hazel Manning, had some consultants from Canada dealing with a waste management document for Trinidad and Tobago, but more so Trinidad and they were in the Beetham dump dealing with the garbage aspects of it so I suppose they were to have a spill over into the faecal waste management, but government had changed and the consultants were paid in accordance to what they would have done, they were paid off and for the last five years nothing has been done. I am not hearing anything recently about that, all the various cottage meetings they were having, and nobody brought it

Interviewer: That is interesting. So of the consultations that took place in all of the constituencies, no one brought up an issue with onsite sanitation?

Interviewee: I have not heard anything and everyone I had asked about it nobody brought it up. Nobody!

Interviewer: In terms of the public's attitude or perspectives towards FSM or cesspit cleaning, what is the general attitude of the public towards this type of work?

Interviewee: I feel people still have the old time stupid mentality. They see the truck coming and they hold their nose, they look at the guys on the truck in a different way. For example, a week ago one of the Drivers and his crew had a situation where when they went into a certain premises; one of the occupants of the house was very abusive, actually threatening-stating that "if anything fall on the ground here or any mess on ground, (he was more coarse than that) but what he will do and would not forget to do them. We have certain instructions that we give to the public, as to how best we can do our job. If there septic tanks are sealed in a certain way, so plumbers are advising persons to put the 4 inch PVC cap onto the septic tank as an easy access to get into the tank. But as I keep telling the public, that is only allowing us to take out water. So they that got a choke/clog and when they were in the process of pulling the hose out whatever cloth was at the end of the hose, caused a little spillage on the ground itself and more threats came. So they indicated to the Householder that if they do not uncover the tank they would unable to do the job properly. Eventually, they had to leave the premises. The person was very upset and did not want to

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sign the document stating that the truck was there. Those are some of the things we meet. When I first took over from the former Supervisor a lady came to clean her tank and she was a bit scornful about having to go inspect her tank to make it was cleaned properly. The former supervisor said "Ms Lady what is in the tank is not my own, it all yours and furthermore it is not ice-cream we are coming to clean". Another instance occurred where the same crew on the same day had to clean a septic tank that was under a house and the owner wanted to crawl through the space that was about 18 inches tall and 18 inches wide, and crawl on their belly and put the hose into hole that was about 10 feet deep under the house. The people spoke to the men in a degrading manner saying things like "go and do it".

The public look and speak to the men in a degrading way and that is about 45% of the people we deal with perception.

Interviewer: Would you say the govt compensate the men for the job they do?

Interviewee: No compensation! There is allowance which the driver being on the truck between the hours of 11:00 and 12:00 noon, instead of having to find someplace to park the truck in order to have lunch, he gets an allowed to work through his lunch period. They get a \$5.00 allowance everyday for the type of work that they do, and once every 3 years they might send them to take an x-ray or two. Not much compensation what so ever.

Interviewer: Is there anything further on this topic you would like to share? If not that brings us to the end of the interview. Thank you for your participation!

Others discussions were taken off record upon the interviewee's request as the interviewee had a casual conversation with the Interviewer.

Notes:

Interview date: July, 2016

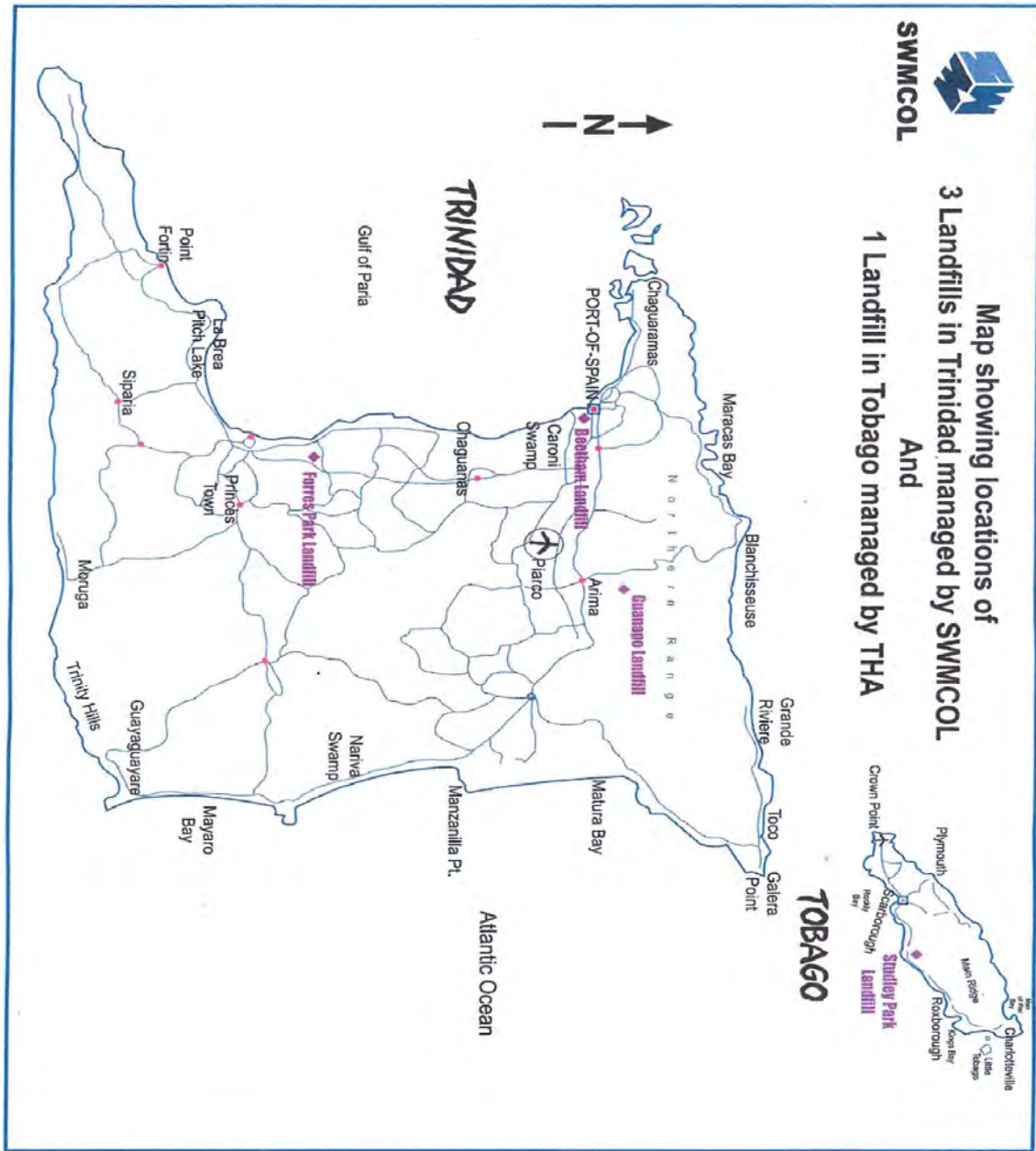
Time: 5:30pm Trinidad local time/ 10:30 pm UK time

Type of interview: Skype online interview

Duration: 40 minutes

Interviewer: Ms Shervon Ifill

Appendix 11: SWMCOL landfill sites in T&T



Appendix 12: Literature search process

Using the Aqualine (WEDC) databases, the following was applied, and only scholarly journals were selected:

The word faecal sludge management AND low income countries = 5 results (3 downloaded, two no relevant)

The words faecal sludge management AND institutions= 6 results (2 were downloaded, 3 were repeated sources, and one not accessible)

The words faecal sludge management AND sanitation =43 results (books were the filtered out leaving 39 sources). 6 sources were repeated, 3 relevant but not accessible and 30 not relevant

The words faecal sludge management AND urban= 25 results

The words faecal sludge management AND Trinidad and Tobago = 0 results

Using the Aqualine (WEDC) databases, the following was applied, and only scholarly journals were selected:

The word faecal sludge AND emptying = 160 results which was refined by scholarly journals = 100 results

The words faecal sludge AND service providers= 382 results which was refined by scholarly journals = 86 results

The words faecal sludge AND emptying AND service providers =43 results

The words faecal sludge AND emptying AND households = 87 results

The words faecal sludge AND emptying AND household surveys = 59 results

The words faecal sludge AND emptying AND services =108 results

The words faecal sludge AND emptying AND urban =45 results

The relevant journal articles abstracts were read, and once they fell within the inclusion criteria, they were collected and reviewed for the literature review. While some terms yield more results than others it should be noted that after a while the same publications were found in all the searches. Other articles, upon reading their abstracts were deemed either irrelevant to the topic or outside the scope and were not selected.

A total of 7 articles (Aqualine), 1 published thesis (Library Catalogue) and 1 book (Google scholar/Google search) collected, 2 city wide reports (USAID and World Bank Group and WSP) and five city-wide case studies (World Bank Group and WSP) were all used as the main evidence for this literature review.

