WORKING PAPER 3

PRIVATE AND SOCIAL ENTERPRISE ENGAGEMENT IN WATER AND SANITATION FOR THE POOR

SANITATION VALUE CHAINS IN LOW-DENSITY SETTINGS IN INDONESIA AND VIETNAM

JULIET WILLETTS & ANNA GERO

WITH SUPPORT FROM AKBAR SUSAMTO, RYAN SANJAYA, DON TRIEU THANH, STEVE MOHR, JANINA MURTA AND NAOMI CARRARD

ENTERPRISE IN WASH

ENTERPRISE IN WASH

'Enterprise in WASH' is a joint research project led by the Institute for Sustainable Futures (ISF) at the University of Technology Sydney, which investigates the role of private and social enterprises in the delivery of water, sanitation and hygiene (WASH) services for the poor. Partner organisations are shown below. For other Enterprise in WASH publications, see www.enterpriseinwash.info

ABOUT THE AUTHORS

The Institute for Sustainable Futures (ISF) was established by the University of Technology, Sydney in 1996 to work with industry, government and the community to develop sustainable futures through research and consultancy. Our mission is to create change toward sustainable futures that protect and enhance the environment, human well-being and social equity. We seek to adopt an inter-disciplinary approach to our work and engage our partner organisations in a collaborative process that emphasises strategic decision-making. For further information visit: www.isf.uts.edu.au

Research in Economics and Business (P2EB) at University Gadjah Mada conducts research in economics, with a particular emphasis on methodological thinking and high policy impact.

SNV Netherlands Development Organisation is an international not-for-profit development organisation who believes that no-one should have to live in poverty and that all people should have the opportunity to pursue their own sustainable development. SNV has been active in Vietnam since 1995 and now has a team of more than 80 international and national professionals across sustainable and inclusive agriculture, water, sanitation and hygiene, renewable energy and REDD+.

CITATION

Willetts, J., Gero, A., Susamto, A.A., Sanjaya, M.R., Doan Trieu Thanh, Mohr, S., Murta, J. and Carrard, N. (2015) 'Sanitation value chains in low density settings in Indonesia and Vietnam, Enterprise in WASH - Working Paper 3', Institute for Sustainable Futures, University of Technology Sydney.

ACKNOWLEDGEMENTS

In Indonesia, significant appreciation is extended to research partner Plan International Indonesia for their role in this research. The Indonesian fieldwork was supported by Dina Ocvita Daulay and by local office of Plan International Indonesia in Timor Tengah Utara and Mangarrai Timur. Wahyu Triwahyudi made contributions to the methodological design for data collection. Research participants in Timor Tengah Utara and Mangarrai Timur are also thanked for their valuable time and contributions.

The Vietnam fieldwork was supported by Thanh Doan Trieu from SNV Netherlands Development Organisation, who also contributed significantly to methodological design, data analysis and contextualisation. In Vietnam we also sincerely thank the Water and Sanitation Program (WSP) and SNV for sharing the methods and results of their "Rural Sanitation Demand Creation and Supply Chain Development for Scaling Up Rural Sanitation in Hoa Binh Province". Research participants in Hoa Binh Province and Dien Bien Province are also thanked for their valuable time and contributions.

This research was funded by Australia's Department of Foreign Affairs and Trade through the Australian Development Research Awards Scheme.

Institute for Sustainable Futures
University of Technology Sydney
PO Box 123
Broadway, NSW, 2007
www.isf.edu.au

SUMMARY

This study examined the sanitation hardware supply chain in rural, low density settings in Indonesia and Vietnam. It presents actual costs along the chains to gain a better understanding of challenges and opportunities to support affordable sanitation in remote, rural locations.

Our research found that across both Indonesia and Vietnam, areas of high poverty often experienced high costs to build a toilet. Areas with higher poverty were also usually the more remote locations in both surveyed Districts. There may therefore be a case to target locations with high poverty rates and high costs of toilet provisions. Transport costs were highly variable depending on the location. In Vietnam, transport costs and logistical arrangements in obtaining sanitation products in remote villages were prohibitive for many households, presenting a barrier to poor, remote households in accessing sanitation. In Indonesia, significant increases in price were observed in remote locations, exacerbated by incidences of monopoly in the transport sector, where one service provider could set their prices without competition. There may be room to reduce transport costs through development of business models that include transport. This study did not specifically investigate areas without road access, however global data points to the typically low sanitation coverage of these areas (for example in Laos access to sanitation in rural locations without road access if 23% as opposed to 51 % in rural locations with road access) (JMP, 2012).

Our research also found that toilet costs were made up of costs of externally sourced items (for example, cement, iron reinforcement) subject to increases in costs along the supply chain and transport costs, and locally sourced items (for example sand and gravel) were subject to local variations. In the case of externally sourced items, there was little opportunity to optimise the supply chain. For example, in Indonesia, cement comprised 21-28% of the cost of a durable toilet and offered low profit margins to actors in the supply chain. In the case of locally sourced items (sand, gravel, rock, bricks etc.), it was found that price variations in these items were significant and could outweigh the variations in cost of externally sourced items. For example, in Muong Ang District in Vietnam, sand was readily available and cost was minimal, while in Mai Chau District, sand comprised up to 40% of material costs in some communes.

Lastly, sanitation products were not made available in a consolidated package to households in that there were almost no sales of toilet packages (with or without installation) in either Indonesia or Vietnam. This meant households had to source the various components of toilets themselves, requiring a degree of knowledge about what types and quantities of materials were needed. In addition, labour was a significant cost component, particularly in Indonesia, which presents an opportunity to consider how such costs might be subsidised or reduced. Finally, the cost of the upper structure of the toilet in Indonesia was significant, and represents a major opportunity to reduce costs and materials use through evolutions in design.

There were variable levels of business support available to actors in the supply chain. In terms of access to credit, enterprises in Indonesia and Vietnam were able to access loans through banks and cooperatives. In Vietnam, credit was also provided to enterprises through family and personal savings. In terms of broader support by government to enterprise roles or to sanitation, decisions about such support lay with local (in Indonesia) or provincial (in Vietnam) governments, and was highly variable. In many cases any available budget for sanitation was focused on raising demand rather than investing in supporting supply.

A range of actions are presented to improve the availability and affordability of sanitation for poor households. These include seeking opportunities to reduce costs of locally sourced materials; improving access to finance for customers; organising communities for collective purchasing and smart targeted subsidies. Such strategies have implications for both CSOs and government, who both have roles to play in enacting such approaches.

1. BACKGROUND AND INTRODUCTION

This study examined the sanitation hardware supply chain in rural, low density settings in Indonesia and Vietnam. The research involved a value chain analysis and examined strategies to improve the supply of affordable sanitation products. The research was undertaken in two districts in Indonesia: Timor Tengah Utara (TTU) and Manggarai Timur (MT) in Nusa Tenggara Timur (NTT) Province, and two districts in Vietnam: Muong Ang (in Dien Bien Province) and Mai Chau (in Hoa Binh Province). All districts represent rural and remote settings.

This study was undertaken by the Institute for Sustainable Futures, University of Technology Sydney in partnership with University Gadjah Mada and Plan Indonesia (for the Indonesian component) and SNV Netherlands Development Organisation (for the Vietnam component). For more detailed results see our Technical Reports (Willetts et al. 2015 and Gero et al. 2015).

The question addressed by this research emerged from practitioners in development agencies currently attempting to support development of supply chains for sanitation products in rural areas. They were concerned about how the low population density and difficult geographical challenges would affect the effectiveness of market-based approaches to improving access to products and services. This led to an interest to investigate the actual costs along supply chains and gain a better understanding of costs and logistics involved in such remote, rural locations.

2. METHODOLOGY

2.1 RESEARCH OBJECTIVES

There were three main research objectives:

1. To map and correlate latrine costs against poverty levels, toilet coverage and other socio-demographic dimensions in remote, rural areas;
2. To analyse the viability of market-based solutions for sanitation products in low-density, remote areas, including the impact of distance and transport cost, and
3. To identify strategies that could support availability of affordable, acceptable products for the poor in remote, rural areas, with a key focus on the enabling environment for pro-poor business development.

This research methodology was based on a value-chain analysis, working backwards from the costs of component materials to build toilets at households in each district. For externally sourced materials such as cement and toilet pans, we followed the links up the supply-chain to local materials shops, to district and provincial shops and distributors to producers and manufacturers. The study also considered the prices and availability of locally sourced materials.

2.2 RESEARCH FRAMEWORK

This research was based on a value-chain analysis (VCA). Originally used for business studies in 1980s, this type of analysis has recently become more popular in the area of development research. VCA depicts a sequence of related enterprises that conduct value-adding activity to a particular product, from its primary production, through its packaging and distribution, to the final sale of the product to consumers. By depicting the value-chain, it is possible to understand the work of the chain as a whole, the function of each link along the chain and the influence of parties outside the chain. The research mapped the value chain, and examined costs, outputs and the physical flow of commodities along the chain (Kaplinsky and Morris, 2001).

For reasons of scope, VCA in this research was started from the bottom-up, that is, from the end-user, tracing relevant products from the household level up through the supply-chain. In addition, and also for reasons of scope, a core focus was maintained on the supply chain rather than demand-side, such as willingness to pay or demand-side behaviour.

There are a number of key known issues for sanitation value chain actors. Based on a systematic literature review of enterprise engagement in water and sanitation (Gero et al., 2013) and political economy analysis of dynamics shaping enterprise involvement in Indonesia and Vietnam (see Murta and Willetts, 2014 and Gero and Willetts, 2014), the following areas were investigated as part of clarifying key issues affecting actors in the supply-chain:

- Access to credit
- Nature of personal and business relationships between actors in the chain
- Legal status of businesses (if legalised/formalised or not)
- Availability of and access to business support e.g. training
- Nature of current consumer demand
- Level of entrepreneurship, risk taking etc.

These issues are therefore considered in our analysis, and also in the examination of strategies to improve the supply of affordable sanitation products.

2.3 DATA COLLECTION AND SAMPLING

This research drew upon both quantitative and qualitative data, collected from primary sources through structured interviews with households, retailers, distributors, producers and local government officials. In Indonesia, this research focused on two districts in NTT, namely TTU and MT. These were selected amongst seven district locations where Plan International Indonesia was conducting sanitation programs on the basis of the following criteria: socio-economic status, sanitation coverage, accessibility and remoteness and population density. Within TTU and MT, 96 village locations were selected, including three villages per subdistrict (one close to the subdistrict capital, far from the district capital, and mid-way).

In Vietnam, the research focused on two districts, namely Muong Ang (in Dien Bien Province) and Mai Chau (in Hoa Binh Province). These were selected given SNV Vietnam was (or recently had been) conducting sanitation programs in these locations on the basis of similar criteria as for Indonesia. A secondary source of data was drawn upon in Vietnam from a parallel, led by the World Bank's Water and Sanitation Program (WSP) and supported by SNV (a partner on this research). WSP/SNV's project was also conducted in Hoa Binh Province (and in part, in Mai Chau district) and provided supplementary data on supply chain costs and supply chain actors. Across Muong Ang and Mai Chau, 26 village locations were selected (in a similar pattern to that followed in Indonesia, with three villages per commune, as well as five additional locations included within the scoping phase).

FIGURE 1 RESEARCH SITES IN TTU AND MT IN NTT PROVINCE, INDONESIA

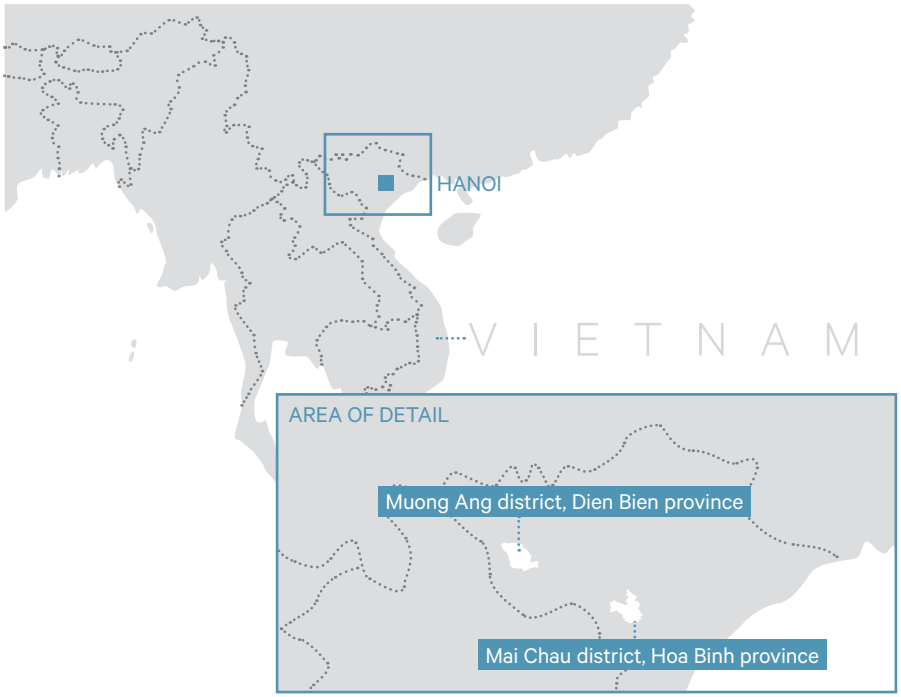

FIGURE 2 RESEARCH SITES IN MUONG ANG DISTRICT AND MAI CHAU DISTRICT, VIETNAM

Data on material costs and quantities were collected based on convenience sampling of households and masons in each selected village. The sample of retailers, distributors/producers, and transport and credit providers was chosen using snowball sampling, working from the household level up through the supply chain in 2-3 locations for each district or commune. A sample of local government officials (district agencies, subdistrict head and sanitarians) and sanitation entrepreneurs (in Indonesia) was chosen based on purposive sampling to include a cross-section of relevant key informants.

Data collection tools (in the form of questionnaires) were developed for each of the following groups: villages, masons, sanitation entrepreneurs (in Indonesia) materials shops, local government officials, transport providers and credit providers. Data collection tools and further details regarding methodology can be found in Willetts et al. (2015) and Gero et al. (2015).

In Indonesia, three main models of toilet were used for the purposes of the analysis (see Figure 3), where Model 1 represents a lined pit and upper structure built with local materials, Model 2 represents a brick-lined pit, cement middle and semi-permanent upper, and Model 3 represents a septic tank with water-sealed pan and permanent structure.

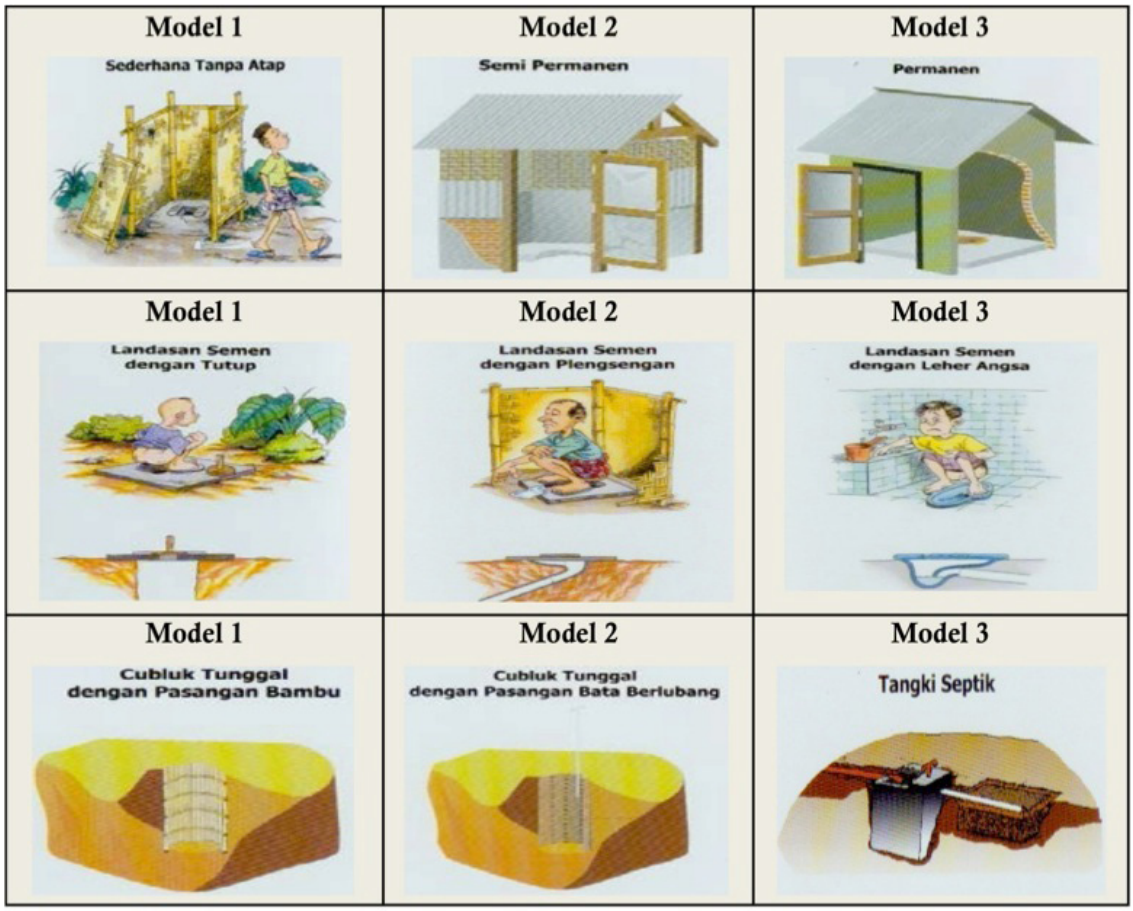

FIGURE 3 THREE MODELS OF TOILET, COMPRISING BOTTOM, MIDDLE AND UPPER PARTS (MOH OF INDONESIA, 2014)

For Vietnam, three government (Ministry of Health) approved toilet types were investigated. These were pit latrines (in the Vietnamese context, called ventilated improved pits – VIPs), double-vault latrines and septic tank latrines (see Figure 4). Costs for Vietnam toilets include a basic superstructure made from roof tiles (but not including bricks or concrete materials for walls).

2.4 DATA ANALYSIS

The data collected was used for value chain mapping, which illustrates the way the sanitation related products flow to end users from producers and presents how the market functions. To allow interactive information and to create multiple perspectives on the value chain map, the value chain mapping of the sanitation hardware supply in Vietnam was conducted using geographic information systems (GIS). Google Earth was used as the base layer for GIS mapping, with additional information such as administrative boundaries overlaid on to this.

In addition to the value chain mapping, qualitative data collected from the questionnaires with various groups are included as supplementary information, providing additional context to the complex situation regarding the sanitation supply chain.

Implications for (i) local, provincial and national government and (ii) CSOs/NGOs working to support enterprise development were also synthesised to provide insight into how to ensure access to affordable sanitation products for the poor.

2.5 LIMITATIONS

This study was designed to systematically examine costs along the supply chain including costs to remote village locations. Several challenges and resultant limitations should be acknowledged. Firstly, supply chain actors were not always open to discuss their profit margins and hence these had to be inferred from prices at different points along the chain and separate data collected on transport costs. Since transport costs can vary over time and depending on the relationships involved, this placed limitations on the estimation costs and profit margins. Secondly, costs of materials to build a toilet collected at village level relied on recall of interviewees. Data quality was found to vary considerably, and data was cleaned to adjust anomalous figures, using costs of materials at the nearest sub-district supply shop as a proxy. Thirdly, challenges were faced in mapping data from Indonesia using GIS due to changed village and subdistrict boundaries. Lastly, it was necessary to standardise the materials' quantities to allow for comparison of costs from one location to another for each toilet type. In reality there was very wide variation in quantities of materials used to build toilets since designs can vary and many permutations are possible.

FIGURE 4 VARIATIONS IN TOILET MODELS – FROM LEFT TO RIGHT: PIT LATRINE, DOUBLE VAULT LATRINE AND SEPTIC TANK LATRINE

3. RESULTS

3.1 INFLUENCE OF LOCATION ON COSTS TO BUILD A TOILET

a) Poverty, toilet coverage and costs to build a toilet

Across both Indonesia and Vietnam, areas of high poverty often experienced high costs to build a toilet. This was particularly evident in TTU (Indonesia) and Muong Ang (Vietnam).

Indonesia: In TTU, there was some correlation between level of poverty and subdistricts with the proportion households with durable toilets (Models 2 and 3), in that subdistricts with higher poverty had lower coverage of durable latrines. This was not the case in MT, where this relationship was found, likely because healthy toilet coverage across the entire district is very low (5-13%).

Vietnam: In Muong Ang, there was a strong correlation between poverty, low hygienic toilet coverage and high costs of toilets shows the relationship between poverty rates and toilet costs in Muong Ang's communes for the three toilet types. In the remote communes, poverty was highest and hygienic latrine coverage was lowest, corresponding to high toilet costs. In Mai Chau, correlation of these variables were less clear as data was collected for fewer communes; however the emerging pattern suggested the same results (i.e. correlations) as for Muong Ang.

b) Major cost components in building a toilet

In both Indonesia and Vietnam, the major cost components to build toilets were predominantly common construction materials. In Indonesia the largest cost components were cement and sand, and in Vietnam were bricks. The cost of a toilet pan relative to overall cost of a toilet was very low in Indonesia and Vietnam. Labour comprised a significant component of the cost, depending on the model of toilet being built.

Indonesia: The cost of a toilet pan relative to overall cost of a toilet was very low. In TTU the toilet pan comprised only 3.6% of the total materials cost, and in MT only 2%. In TTU, the main cost components were: (i) Model 1: bamboo and wood; (ii) Model 2: cement, sand, wood and rock: and (iii) Model 3: cement, sand, brick and reinforcing iron (see Figure 6 on page XX). In MT, the main costs were for: (i) Model 1: bamboo and wood (ii) Model 2: sand, cement, wood and concrete bricks; (iii) Model 3: sand cement, concrete brick and rock. The cost of labour in comparison with materials was significant (see Figure 7 on page XX). In TTU the labour cost was 28-39% of the cost, depending on the model and in MT 24-29%.

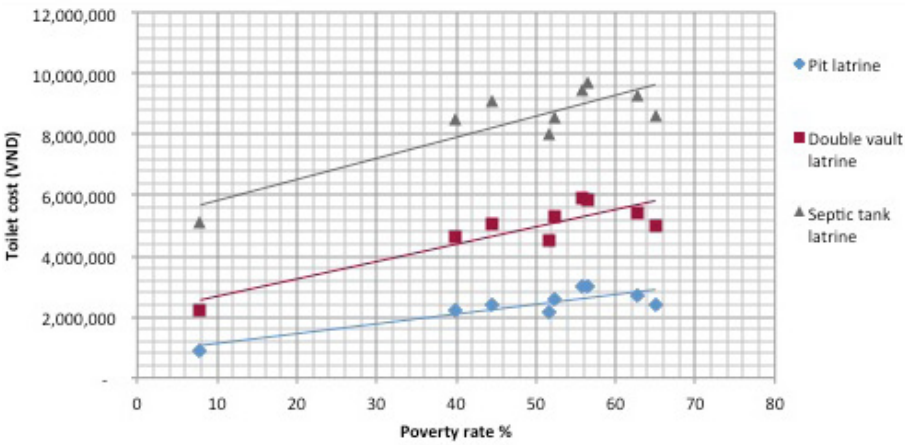

FIGURE 5 POVERTY RATES AND TOILET COSTS FOR MUONG ANG COMMUNES

Vietnam: The major material components to build toilets included cement, bricks, iron, sand, roof tiles (used for superstructure) and a toilet pan (only required for septic tank latrines). Apart from the toilet pan, these materials were common construction materials and were readily accessible in the district towns and in many commune centres. In both districts, the material that comprised the highest proportional cost was bricks. Whether made from cement (as in Mai Chau) or clay (as in Muong Ang), bricks made up an average of 50% of the cost in Mai Chau and 46% in Muong Ang for pit latrines. Figures for Muong Ang are presented in Table 1, while Figure 8 provides an example of material costs for pit latrines in Mai Chau locations, showing brick dominates costs in all locations. The cost of sand was negligible in Muong Ang due to ready access, however in Mai Chau comprised anywhere from 20 to 42% of the cost, therefore a significant cost component.

Consistent labour rates across both districts were used, estimated based on data collected. For pit and double vault latrines in both districts, the proportion of labour varied to similar degrees, being between 25-50% of total cost. The proportional cost of labour for septic tank latrines was less, around 30% of total cost in both districts.

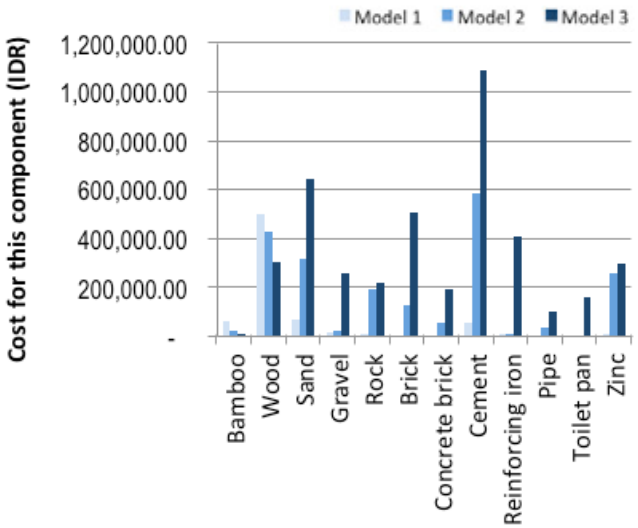

FIGURE 6: MATERIALS COSTS FOR TOILETS IN TTU, INDONESIA

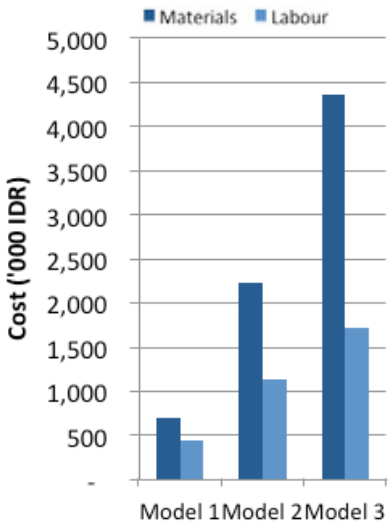

FIGURE 7: COMPARISON OF LABOUR AND MATERIALS COSTS FOR TOILETS IN TTU, INDONESIA

TABLE 1 PROPORTION OF COSTS ATTRIBUTED TO MAIN MATERIALS IN MUONG ANG FOR THREE TOILET TYPES

	CEMENT	BRICKS	IRON	ROOF TILE	TOILET PAN
VIP latrine	15%	46%	19%	20%	n/a
Double vault latrine	12%	61%	19%	8%	n/a
Septic tank latrine	5%	71%	17%	3%	3%

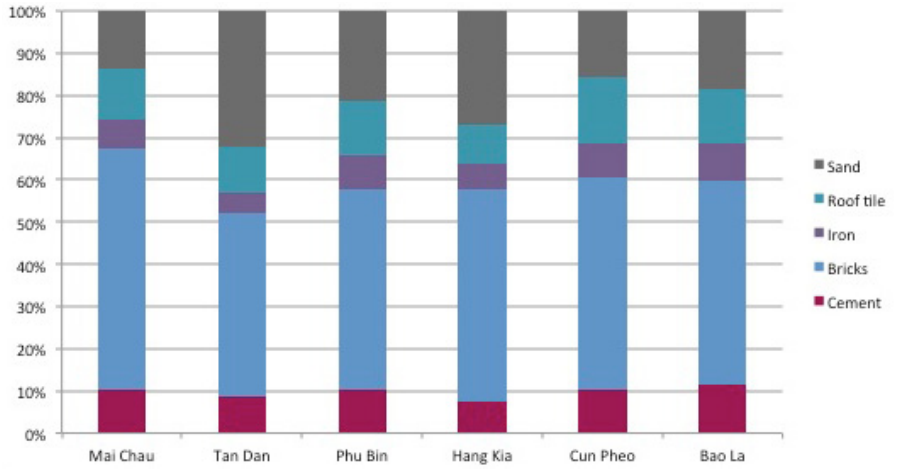

FIGURE 8: PROPORTION OF COSTS ATTRIBUTED TO MAIN ATERIALS OF PIT LATRINES IN COMMUNES IN MAI CHAU

c) Average costs in each district

Average costs for each toilet type in the two Indonesian sample districts varied considerably, with MT costs being close to double the costs in TTU, due to its increased remoteness. Costs in the two sampled districts in Vietnam were similar with Mai Chau showing costs that were about 125% of those in Muong Ang. Total costs to households in these districts are 120%-180% of those costs estimated by the Vietnam MoH.

Indonesia: On average, for all materials, but excluding labour, a Model 1 toilet in TTU costs US$53 (U 697,000), Model 2 costs US$ 169 (IDR 2,234,000) and Model 3 costs US$330 (IDR 4,371,000). If labour costs are taken into account, these rise to US$87 (IDR 1,148,507) (Model 1), US$253 (IDR 3,358,713) (Model 2) and US$459 (IDR 6,077,367) (Model 3).

The average materials cost in MT, of a Model 1 toilet is US$121 (IDR 1.6 million), for Model 2 is US$438 (IDR 5.8 million), and Model 3 costs US$574 (IDR 7.6 million). If labour costs are taken into account, these rise to US$158 (IDR 2.1 million) (Model 1), US$574 (IDR 7.6 Million) (Model 2) and US$792 (IDR 10.5 million) (Model 3). These costs including labour are found in Table 2.

Vietnam: The costs of toilets for households in this research far exceeded the Vietnam government's estimates. Total cost of materials for toilets were higher in Mai Chau district, which was in part attributed to the need to purchase and transport sand, given it was not locally available as it was in Muong Ang. Transport costs were also higher in Mai Chau district, however this can in part be explained by the selected locations where data was collected (more remote and difficult to access villages were included in Mai Chau, whereas in Muong Ang all communes were included). On average, the total cost for the three toilet types is provided in Table 3. Note that the data collection locations in Mai Chau consisted for more remote and difficult to reach locations (leading to higher costs from transport), thus the two districts should not be compared as equals. Also included are the estimates of toilet costs from the Ministry of Health, which includes labour, and is supposedly indicative of budget estimate for household latrine. These costs are well below the actual costs found in Muong Ang and Mai Chau – for pit latrines households pay up to approx. 2.75 times the government estimates in Mai Chai and 1.7 times the cost in Muong Ang. For double vault latrines, Mai Chau's remote households pay almost 3.5 times the cost of the government's estimates.

TABLE 2 AVERAGE TOILET COSTS FOR INDONESIAN DISTRICTS (INCLUDING LABOUR)

DISTRICT	MODEL 1 USD (IDR)	MODEL 2 USD (IDR)	MODEL 3 USD (IDR)
TTU	US$87 (1,148,507)	US$253 (3,358,713)	US $459 (6,077,367)
MT	US$158 (2,100,000)	US$574 (7,600,000)	US$792 (10,500,000)

TABLE 3 AVERAGE COST (MATERIALS, LABOUR, TRANSPORT) OF LATRINE TYPES IN MUONG ANG AND MAI CHAU DISTRICTS WITH MOH ESTIMATES INCLUDED

	PIT LATRINE USD (VND)	DOUBLE VAULT LATRINE USD (VND)	SEPTIC TANK LATRINE USD (VND)
Muong Ang	US$109 (2,369,846)	US$226 (4,921,031)	US$398 (8,674,240)
Mai Chau	US$135 (2,924,233)	US$278 (6,035,155)	US$521 (11,315,156)
MoH estimates	US$82 (1,790,858)	US$126 (2,737,929)	US$337 (7,352,275)

d) Costs in different locations

In both Indonesia and Vietnam, variation in costs in different locations is predominantly caused by:
1) transportation and supply-chain costs
2) accessibility of locally available products.

Indonesia: Variation in cost in different locations is caused by transportation and supply-chain costs which affect materials such as cement, reinforcing iron, pipe and zinc. Variation in cost is also caused by major differences in the accessibility and price of locally sourced materials including sand, bricks, gravel, rock and locally manufactured concrete bricks. In fact, the latter variations can outweigh the differences in costs related to transport and increases along the supply-chain for externally sourced materials. Figure 9 and Figure 10 illustrate the variations in cost for Model 3 toilet across the two districts.

Vietnam: Variation in costs across different locations were in part due to supply chain costs influencing the price of materials; accessibility of locally available products (e.g. where sand was locally available in Muong Ang, costs were significantly reduced); and competition between shops, which kept prices similar. An example of the range in costs for septic tank latrines in Mai Chau is provided in Figure 11 and Muong Ang in Figure 12 where areas further from main roads (dark black lines) are higher than those close to roads.

e) Transport costs

Transport logistics and cost were significant barriers to poor, remote households accessing affordable sanitation products in Vietnam. Transport also added significant costs in remote locations in Indonesia.

Indonesia: TTU households generally transported materials from the store themselves, with only 4% of households reporting that the materials were delivered by the store to their home. The majority (78%) paid to travel to go and buy materials (US$0.73 to US$5 (IDR 10,000 to IDR 70,000)). The most common transportation means to bring materials to villages was pick-up (60% of cases), followed by truck (27%). The condition of the roads of approximately half of the surveyed villages was reported to be poor or very poor. Surveyed village locations were up to 35 miles travel from their subdistrict capital (for example Maurisu Selatan in Bikomi Selatan), and were an average distance of 8 miles from the subdistrict capital. Transport costs in a pick-up from subdistrict supply shops to village locations were generally between

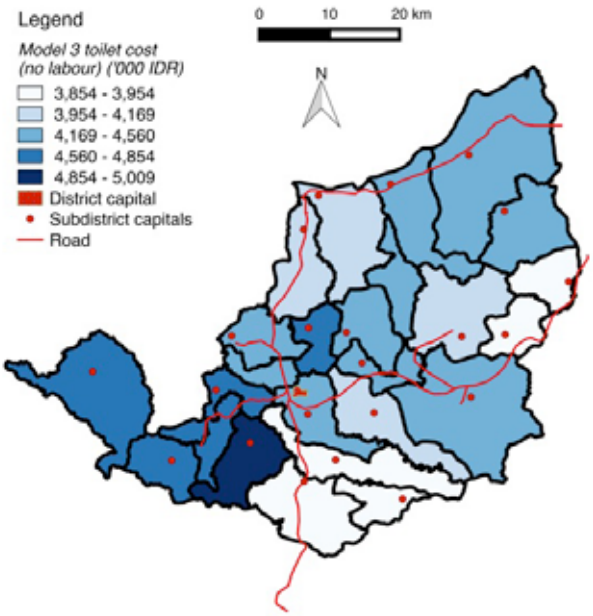

FIGURE 9 MATERIALS COST FOR MODEL 3 TOILET IN SUBDISTRICTS OF TTU

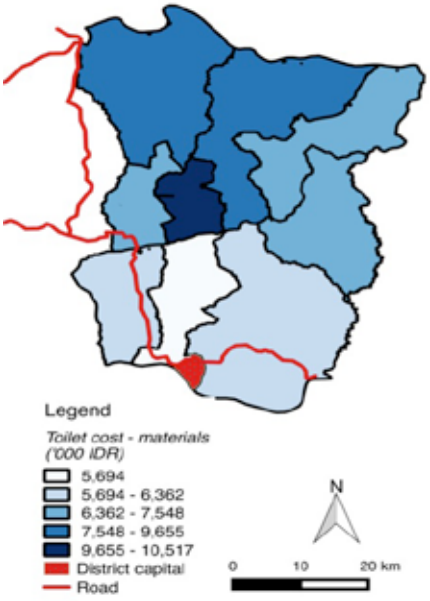

FIGURE 10 MATERIALS COST FOR MODEL 3 TOILET SUBDISTRICTS OF MT

FIGURE 11 SEPTIC TANK LATRINE COSTS FOR |COMMUNE CENTRES AND VILLAGES IN MAI CHAU

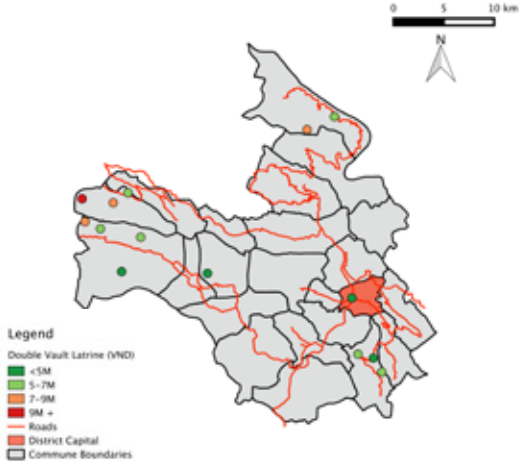

FIGURE 12 SEPTIC TANK LATRINE COSTS FOR COMMUNE CENTRES AND VILLAGES IN MUONG ANG

US$7.3 (IDR 100,000) and US$21.8 (IDR 300,000) across TTU, and were US$25.5 (IDR 350,000) for Maurisu Selatan. In the latter case, this transportation cost comprised 9% of the total cost of materials in that location.

From all households interviewed in MT, more than half (57%) must pay for transportation services. Nearly half (48%) of materials bought must be delivered using trucks and 19% use pick-ups. In addition, the large majority (89%) of respondents said that they must arrange their own transport to bring the materials to their villages. In MT the cheapest transport from a materials shop to surveyed subdistrict was US$12.6 (IDR 173,000) (Poco Ranaka) and highest was US$54.8 (IDR 753,000) (Elar Selatan). The very high transport cost in Elar Selatan is due to geographical challenges where it could took 9 or more hours to travel from Elar Selatan's subdistrict capital to Borong.

Vietnam: Households in remote villages faced barriers in transporting materials to their homes due to poor quality roads that were often inaccessible by truck and were steep, slippery and muddy (see Figure 13). Motor bike transport and access on foot common were means to transport materials to these remote locations. Costing the transportation of sanitation materials usually involved a combination of methods including formal truck transporters (to points where road access permitted), motor bike, boat and on foot using local labourers. Such transport was either self-arranged, where households took opportunistic approaches in doing so (i.e. coming home by motor bike with a load of materials after going to the village for other purposes) or through truck transporters, who acted as a middle-man in purchasing then transporting materials to as close as possible to the household.

Given the prominence of transportation by motor bike, it was important to understand the logistical requirements and scale involved in transporting materials for the three latrine types. Table 4 provides these details, including the weight of material required for each toilet type, and the number of trips required to transport materials using the local capacity of a motor bike (according to local data). Table 4 shows that even for a pit latrine, 42 trips by motor bike are required. Even for households living close to the village centre (or from the materials pick-up point), considerable time is needed to dedicate to this task, as well as fuel costs and potential missed labour time. This is a significant barrier to households accessing even the simplest of hygienic latrine options. For transportation of septic tank latrine materials, 229 trips are required which is unrealistic to think a householder would dedicate time towards.

FIGURE 13 DIFFICULT ROAD ACCESS TO VILLAGES IN HANG KIA COMMUNE, MAI CHAU DISTRICT

How these trips translate to time in Muong Ang District is illustrated in Figure 14. This time incorporates the multiple trips required to transport the standard quantities of materials for a pit latrine from the point of purchase to the household. In this figure, we assume a motor bike can travel not only on the main roads (which are shown as dark thick lines), but also virtually access anywhere else along small tracks away from roads. What can be seen is that for areas further away from the roads in the most remote locations, the time taken is the highest, adding to three full days of time, driving small, manageable quantities of materials from the point of purchase to the household. To dedicate this amount of time to such a task would require a high degree of motivation, as well as cost, since most householders work as labourers or farmers and three days transporting materials would equate to three days less wages, plus fuel costs.

TABLE 4 NUMBER OF TRIPS REQUIRED FOR TRANSPORTATION BY MOTOR BIKE FOR THREE TOILET TYPES

MATERIAL	VIP LATRINE	DOUBLE VAULT LATRINE	SEPTIC TANK LATRINE
Cement (P=100kg, DVL=200kg, STL=200kg)	2	3	3
Bricks (P=600kg, DVL=2000kg, STL=5400kg)	10	33	90
Sand (P=1600kg, DVL=3200kg, STL=8000kg)	27	54	133
Other (e.g. roof tiles, toilet pan)	3	3	3
TOTAL TRIPS	**42**	**93**	**229**

Note: Weights for materials are included for materials where P = VIP latrine, DVL = double vault latrine and STL = septic tank latrine.

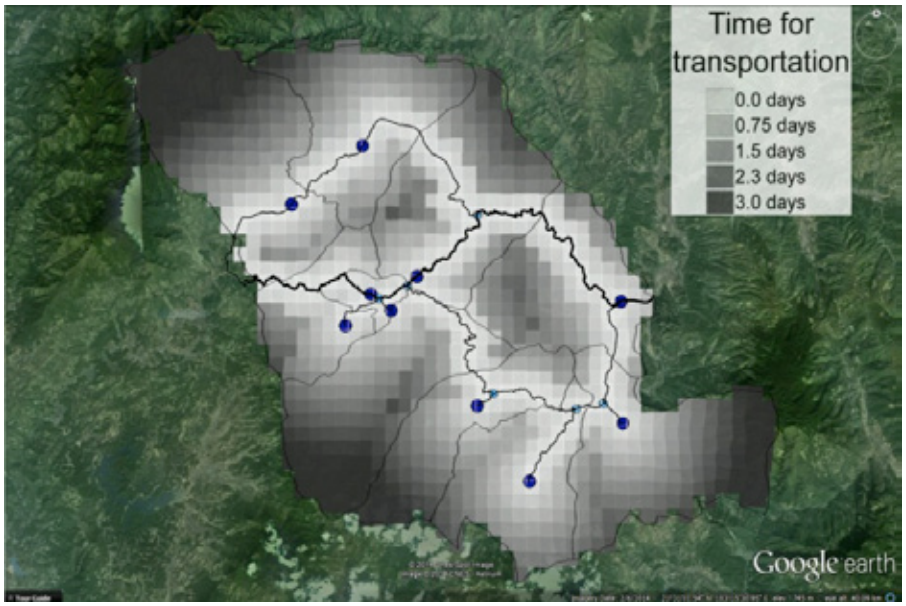

FIGURE 14 TIME FOR TRANSPORTATION OF MATERIALS BY MOTOR BIKE FOR PIT LATRINES BEYOND COMMUNE CENTRES IN MUONG ANG DISTRICT

3.2 SUPPLY CHAIN ACTORS AND ANALYSIS

a) Supply chains for externally sourced materials

Materials used to build toilets such as cement and iron are usually sold by distributors and retailers with low profit margins, meaning further discounts are often not possible, and it would be difficult to optimise the value-chain to reduce costs. Toilet pans had slightly higher profit margins, however they represent a very small proportion of the cost of a latrine and hence optimising this cost would not affect the overall cost.

Indonesia: Two main supply chains were examined, namely cement and toilet pans. The main supply chain for TTU is shown in Figure 15.

For TTU, cement was traced from South Kalimantan and Sulawesi to Kupang (where there is also a local producer), and sold by distributors with profit margins of 5-10% and district/ sub-district retailers for 3-5% and 2-4% respectively. Given the low profit margin, there was little room for developing economies of scale in the price of cement to reduce the cost of constructing a toilet. The last leg of the journey from a subdistrict supplier to a village was of variable cost depending on the distance and road conditions.

Toilet pans were manufactured in Java Island and transported and distributed through Surabaya. Local production of toilet pans in TTU had been initiated through support from Plan Indonesia (sold for US$3.6 (IDR 50,000)). Cheaper brands sold by manufacturers near Surabaya cost US$5.8 (IDR 80,000) per unit. See Figure 16 for the toilet pan supply chain for MT, including the mark-up costs due to transport from material supply shops in Borong.

Vietnam: In Muong Ang district, most cement was locally produced in Dien Bien Phu (the provincial capital). Profit margins for cement were typically very low for retailers (up to 7% in Muong Ang town). The more remote commune centres (e.g. Ang To) sold cement for higher prices (up to 40% higher than the

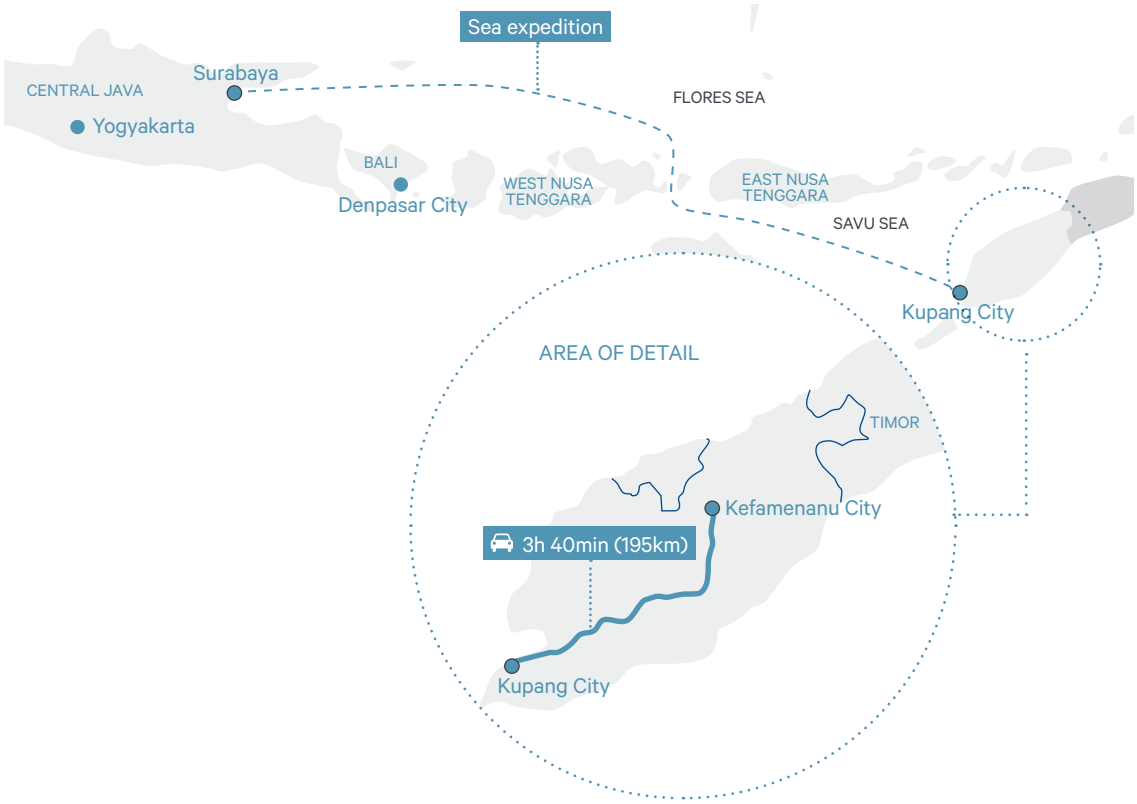

FIGURE 15 SUPPLY CHAIN FOR EXTERNALLY SOURCED MATERIALS IN TTU

wholesale price at the factory) to account for costs associated with transporting the material to their shop. In Mai Chau, profit margins were reportedly even lower than in Muong Ang, with 3% calculated at one Mai Chau retailer. Small discounts were provided for bulk purchases in some shops – dependent on the strength of the relationship between the customer and the retailer. Cement sold for US$1.35 (30,000 VND) higher than Mai Chau town in smaller, remote villages (e.g. Tao No).

Toilet pans were manufactured in provinces near to Hanoi, e.g. Thani Binh province. In Muong Ang District, one of the most significant costs involved in toilet pan purchase for locations outside the district centre was transport, for example, in Ang To commune, squat pans were sold at five times the price as in Muong Ang town (see Figure 17). In Mai Chau, one commune level shop owner noted the profit margin on squat pans sold was 5 – 7%. Squatting pans were preferred by households in both Muong Ang and Mai Chau, with brand name not important in deciding which to purchase.

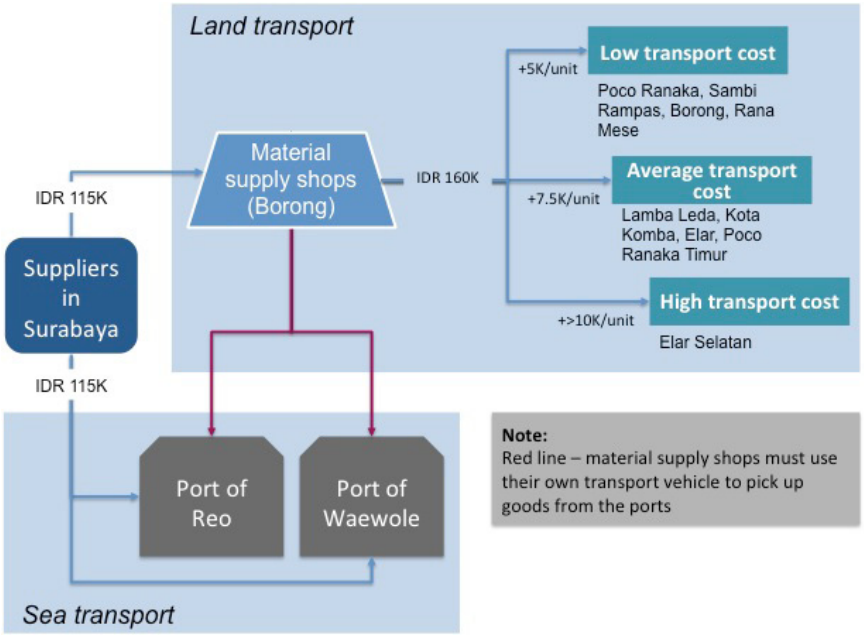

FIGURE 16 SUPPLY CHAIN FOR TOILET PANS IN MT

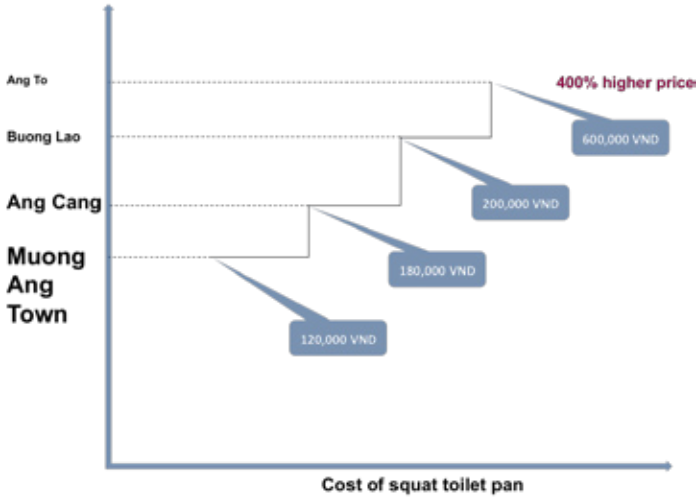

FIGURE 17 COST OF TOILET PANS FROM MUONG ANG TOWN TO MORE REMOTE COMMUNES

b) Locally sourced materials

In both Indonesia and Vietnam, major variations were found in the prices of locally sourced materials, such as sand and gravel. Given that these are major cost components when building a toilet, the overall cost of a toilet is significantly influenced by variations in such prices.

Indonesia: Variations in cost of locally produced materials in TTU were as follows: sand varies from US$2.9-US$14.6/m^3 (IDR 40,000-200,000/m^3); bricks vary from US$32.7-US$65.5/m^3 (IDR 450,000-900,000/m^3), concrete bricks very from US$27.3-US$54.6/m^3 (IDR 375,000-750,000/m^3), rock varies from US$3.6-US$10.9/m^3 (IDR 50,000- 150,000/m^3), gravel varies from US$3.6-US$18.2/m^3 (IDR 50,000-250,000/m^3). Bamboo can vary 25-fold and wood 5-fold.

In MT, similar variations were found as follows: sand varies from US$7.3-US$21.8/m^3 (IDR 100,000-300,000/m^3)(see Figure 18); gravel varies from US$5.1-US$29.1/m^3 (IDR 70,000-400,000/m^3) and rock varies from US$7.3-US$21.8/m^3 (IDR 100,000-300,000/m^3). Bamboo can vary 7-fold and wood 3-fold. In MT the government has introduced a fee for removal of sand, gravel and rock which affects prices for these items.

Vietnam: In Muong Ang and Mai Chau, there were local cement manufacturers and as such, the price of cement at each of the town centres was similar (US$6.1/100kg (135,000 VND/100kg)). Bricks were also produced locally in both districts. In Muong Ang, there were local producers of both cement and red (clay) bricks while in Mai Chau, only cement bricks were locally made (there was a red brick factory 65km away). The cost of cement bricks differed considerably between the two districts. In Muong Ang, cement bricks cost approximately US$0.06 (1,350 VND) per brick, while in Mai Chau they cost approximately US$0.11 (2,400 VND) per brick. Bricks comprise the largest proportion of material costs for both districts. The sources and flows of cement, from wholesalers in distant provinces and producers in the district, are illustrated in Figure 19.

Sand was locally available in Muong Ang district, and households were able to easily and cheaply procure enough sand for their household latrine construction such that costs were negligible. In Mai Chau this was not the case. Sand therefore added significantly to the overall costs of materials, also posing logistical challenges in transportation to remote households.

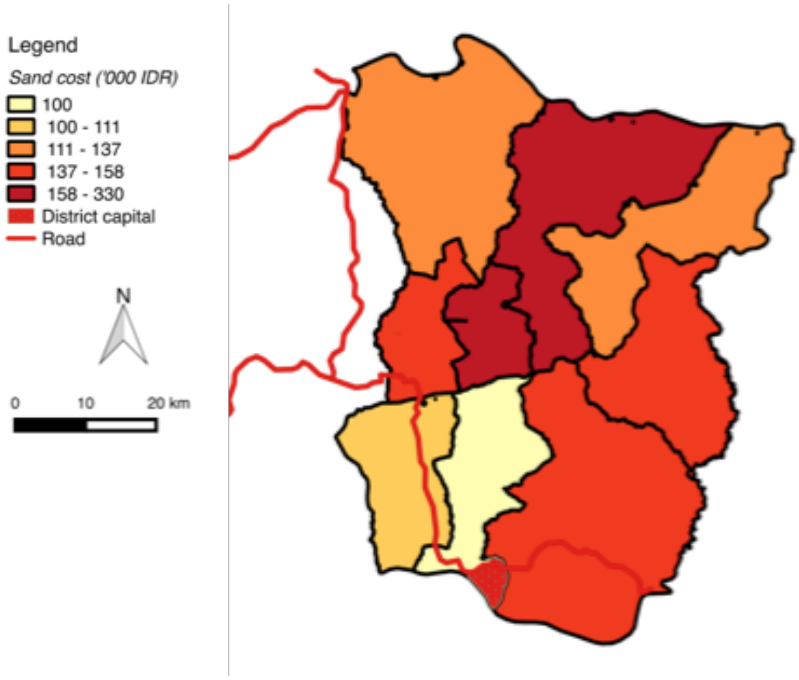

FIGURE 18 COST OF SAND IN DIFFERENT SUBDISTRICTS OF MT

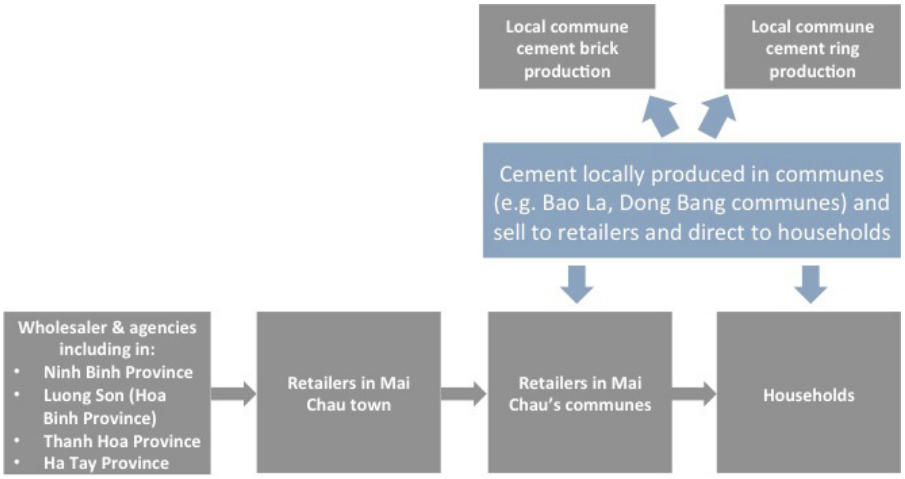

FIGURE 19 SOURCES AND FLOWS OF CEMENT AND CEMENT BRICK PRODUCTION IN MAI CHAI

c) Materials supply shops

Materials supply shops are important players in the value chain, influencing affordability and accessibility of sanitation products through provision of discounts and credit. Discounts and delayed payments were accepted only from trusted customers in Indonesia whereas material supply shops in Vietnam widely accepted credit as a form of payment from customers.

Indonesia: Materials supply shops interviewed in this study were all formally registered. Customer loyalty and trust were important factors in whether or not discounts or delayed payments were permitted. Competition between supply shops was more common in the district capitals, and some subdistrict supply shops noted they also competed with the bigger district shops who could offer cheaper prices. No supply shops had partnered with sanitation entrepreneurs or masons.

Vietnam: In both districts, shops were often family run, with some having formal registered status as enterprises and others being more informal. Both approaches were legal and had benefits and drawbacks depending on the perspective of the shop owner. Supply shops in the district towns and some communes were aware of other nearby competitor shops but none went to any lengths at deliberately marketing their products. All relied on their reputation such that their loyal customers would recommend them to others, and make return trips. The majority of supply shops accepted credit as a form of payment for their products and many noted that they were forced to do so as their customers were poor and unable to pay the full cost upfront. The terms of credit were negotiated and dependent on the trust and strength of the relationship. Shops accepting credit from customers placed a considerable burden on the business owner, since they were usually not permitted to pay their own costs to suppliers in the same way. This restriction of cash flow proved to be a barrier for businesses taking loans and expanding their business (see below). In Mai Chau, this had led to some shop owners being less willing to accept credit from all customers.

d) Transport businesses

Transport providers reported relatively high profit margins in both Indonesia and Vietnam. In Vietnam, there were increasing numbers of providers, driven by the lucrative nature of the business and the ability to arrange transport deliveries around other work. Strong competition amongst transport providers was also evident in district capitals in both countries, and over time may be expected to slightly reduce costs in remote, rural locations.

Indonesia: In TTU within the transport sector, high levels of competition exist at provincial and district level and serve

to maintain lower prices. Subdistrict transport businesses however reported on their monopoly status in their geographic location. The transportation business is known to be a profitable one. It was reported to be more profitable (10% profit) than owning a shop (1-2% profit) by a truck owner in Kefamenanu, and a driver reported that he could earn more than double the amount of an alternative job he had renting tables and chairs.

The transportation business in MT is very competitive with around 30-50 transport providers, thanks to the availability of new and cheaper cars. Within the district and sub-districts, generally otocalls or trucks are owned by an individual who focuses in serving a small share of the market (1-2 routes). There are no transport companies who own several transport units serving several routes. Therefore, for a given route there is no price variation. Prices haven't changed significantly in the last 5 years, even when fuel price increased in 2010. Consequently, some transport owners said that they decided to move away from transportation services.

Vietnam: In both districts there were an increasing number of truck transporter businesses emerging, providing services to both supply shops and households for delivery of materials. While profit margins were reported high (e.g. up to 69% in Muong Ang), the increasing competition was driving prices down. The prices charged by transporters in both locations were also negotiated between the customer (either shop owner or householder) and the transporter business owner, and relied on the strength of the relationship and the transporters knowledge of the delivery destination (e.g. distance, condition of the road).

In Mai Chau district, a key difference to Muong Ang was the presence of transporters who householders called upon for both the purchase and delivery of materials. Some householders preferred this option when they were unfamiliar with the types and quantities of materials available/required for latrine construction, and/or those who saw their distance from supply shops as an obstacle to obtaining materials. The transporter acted as a 'middle man' who bargained prices with the shop and with the households.

Profiles of transport providers across all four districts are provided in Table 5, page 21.

e) Access to credit and loans for enterprises

Access to credit was not a constraint for enterprises in the supply chain. Enterprises in Indonesia and Vietnam were able to access loans predominantly through banks and cooperatives. In Vietnam, credit was also provided to enterprises through family and personal savings.

Indonesia: In both TTU and MT there was ready access to bank BRI loans (1-1.25%/month repayment) and to cooperatives with higher rates (2.1%/moth but longer repayment rates. In TTU it was reported that Department of SME's and Trade (DSMET) were attempting to make access to credit more accessible through easing the need for guarantees, and also trying to offer cheap loans (0.7%/month) through LPDB (Lembaga Pengelola Dana Bergulir) a credit provider organisation.

Vietnam: Enterprises in both districts accessed loans from banks such as the Vietnam Bank for Agriculture and Rural Development for establishing or expanding their business. One shop owner in Muong Ang did note that the loan – while used for the business – was actually taken out under terms supposedly for agricultural purposes. Enterprises also accessed credit and loans from family members, while others drew upon their own personal savings. As noted above, despite offering credit to their customers, most shop owners were required to pay their own suppliers and agents in cash. Managing their debts was therefore a challenge for some businesses.

f) Government and policy environment

National Ministries of Health were responsible for sanitation in Indonesia and Vietnam. Decentralised governance allocated much of the budgetary decision making to subnational governments, where commitment to implementing policies to promote sanitation (and private sector engagement in sanitation) varied. In addition, governments remained

BOX 1 EXAMPLES OF TYPES OF TRANSPORTATION BUSINESSES IN INDONESIA AND VIETNAM

Province capital materials shop transporter in Kupang (TTU, Indonesia)

Operates 10 trucks (eight 5T and two 10T), most business is local, within the area of provincial capital (Kupang).

Charges US$127.4 (IDR 1,750,000) for Kupang-Kefa and US$145.6 (IDR 2,000,000) to surrounding area of Kefa, Wini or Atambua for 5T load.

Experiences significant competition: *'there are hundreds of trucks'* which has reduced tariffs over last years and therefore reduced profits.

Muong Ang transport provider

Small business, (one 2.5 tonne truck) and unregistered, with the main customer base across Muong Ang District. The owner had an agreement with a local supply shop to deliver their goods, guaranteeing him a level of customers. 30% of his customers came through the shop, while 70% were from his own private business. For privately arranged transport (i.e. unrelated to the supply shop), prices were negotiated between the customer and the transport provider, who noted *"Prices depend on negotiation with the customer. This means how well you know the person. It is a bargaining process."* Households in remote villages were required to pay in cash on delivery of materials, whereas the transport provider accepted credit for households closer to the commune capital.

The transport provider also works for a construction company and was able to balance work between the two roles. The transport provider noted that while he often provided discounts to poor customers, he was sure to never make a loss: *"We have to cover our own costs. We don't charge labour [for poor customers] but we have to cover other costs like fuel"*.

focused on the demand side (raising demand for toilets) rather than the supply side which represented new and unfamiliar territory.

Indonesia: Government's role was mainly related to promotion of healthy sanitation, which was under the auspices of Department of Health (DoH). District governments played no direct role with respect to the supply chain of sanitation materials. While in some ways this was understandable, as the supply chain of sanitation materials was market based, support from government could help optimise the supply chain, support sanitation entrepreneurs, and reduce costs for the poor.

In TTU, attention had been given to sanitation over recent years, particularly through the support of Plan Indonesia working with DoH staff at district and subdistrict levels. There had been limited coordination between departments to support the supply chain, and ad hoc spending of government budget to support materials for toilets had occurred. Examples of this include the way materials had been provided directly to small numbers of households, which can reduce demand (households decide they will 'wait' until they too are provided for) and also reduce the viability of the supply chain (if purchase of materials is focused at district level and by-passes subdistrict shops). Recent changes to the definitions of a healthy toilet has affected monitoring of toilets and may serve to increase the focus on building durable rather than make-shift latrines. Lastly, while sanitation entrepreneurs had not received support through DSMET, they could collectively apply in the future for support to develop their businesses.

In MT, sanitation was not a priority until recently when Plan commenced support for implementation of the National Strategy for CLTS in 2008 (Sanitas Total Berbasis Masyarakat – STBM). The Department of Industry, Trade, Cooperatives, and SMEs (Disperindagkop

& UKM) had allocated funding for training of sanitation entrepreneurs in their 5-year budget plan proposal, which was subject to approval by the legislative, targeting 30 trainees/year for 3 years (2015-2018). Budget commitment was: US$18,201.7 (IDR 250 million) (2015), US$ 18,929.7 (IDR 260 million) (2016), US$ 19,293.8 (IDR 265 million) (2017), and US$ 19,657.8 (IDR 270 million) (2018). Plan and the District Department of Industry, Trade, Cooperatives, and SMEs had been advocating with the legislative and was hoped this would result in the approval of the budget plan for sanitation marketing activities.

Vietnam: Responsibility and authority for sanitation at the national level lay with the Ministry of Health. At the local level, government commitment to improving hygienic latrine coverage varied. In Muong Ang and Mai Chau where SNV had worked at the provincial, district and commune level, there was some degree of commitment; however this was hampered by budgetary allocations to sanitation which relied upon provincial decision makers (see Gero and Willetts, 2014).

Support for private enterprise was also present at the national level (however a policy was still lacking), including support for enterprise engagement in sanitation. It remains to be seen how this support will flow to sub-national levels of government where much of the decision making power lies, and hence the reality for businesses depends on the provincial interpretation of national support.

4. DISCUSSION

A) KEY FINDINGS

This research has provided insights into the realities associated with sanitation value chains in rural, low density settings in Indonesia and Vietnam. Key findings are presented below, followed by strategies to improve the availability and affordability of sanitation products and services in these locations.

Firstly, across both Indonesia and Vietnam, areas of high poverty often experienced high costs to build a toilet. Areas with higher poverty were also usually the more remote locations in both surveyed Districts. There may therefore be a case to target locations with high poverty rates and high costs of toilet provisions. Transport costs were highly variable depending on the location. In Vietnam, transport costs and logistical arrangements in obtaining sanitation products in remote villages were prohibitive for many households, presenting a barrier to poor, remote households in accessing sanitation. In Indonesia, incidences of monopoly in the transport sector were found, where one service provider could set their prices without competition. There may be room to reduce transport costs through development of business models that include transport. This study did not specifically investigate areas without road access, however global data points to the typically low sanitation coverage (for example in Laos access to sanitation in rural locations without road access if 23% as opposed to 51 % in rural locations with road access) (JMP, 2012).

Secondly, toilet costs are made up of costs of externally sourced items, subject to increases in costs along the supply chain and transport costs, and locally sourced items which were subject to local variations. In the case of externally sourced items, there was little opportunity to optimise the supply chain. For example, in Indonesia, cement (an externally sourced product) comprised 21-28% of the cost of a durable toilet and offered low profit margins to actors in the supply chain. In the case of locally sourced items (sand, gravel, rock, bricks etc.), it was found that price variations in these items were significant and could outweigh the variations in cost of externally sourced items. In Vietnam, sand was readily available in Muong Ang district and cost was minimal, while in Mai Chau District, sand comprised over 30% of material costs in some communes.

Thirdly, sanitation products were not made available in a consolidated package to households in that there were almost no sales of toilet packages (with or without installation) in either Indonesia or Vietnam. This meant households had to source the various components of toilets themselves, requiring a degree of knowledge about what types and quantities of materials were needed. In addition, labour was a significant cost component particularly in Indonesia, which presents an opportunity to consider how such costs might be subsidised or reduced. Finally, the cost of the upper structure of the toilet in Indonesia was significant, and represents a major opportunity to reduce costs and materials use.

B) STRATEGIES TO OPTIMISE THE VALUE-CHAIN

Based on these key findings, the following strategies could be considered by government and other development agencies to improve affordability and accessibility of rural households to sanitation products and services.

Seek opportunities to reduce costs of locally sourced materials: Further investigation into the costs of locally sourced materials and reasons behind large variations in their cost may reveal strategies to reduce costs. As a minimum, if collective purchasing of materials could be arranged then costs for these materials (and related transport costs) may be able to be reduced.

Access to finance for customers: Approaches that can reduce the outlay for households, including rotating funds, and in Indonesia, credit from sanitation entrepreneurs should be considered.

Organising communities for collective purchasing: Communities could be encouraged and supported to buy materials as collectives to reduce costs. Both community leaders and government staff could promote this approach,

and apply incentives (such as time-bound financial support) to support development of momentum and action.

Smart targeted subsidies: Given the need to support the poor, thought must be given to how to address affordability concerns, whilst avoiding undermining private sector actors (e.g. material supply shops, and in Indonesia, sanitation entrepreneurs) by providing non-targeted subsidies. In many countries the need to develop 'smart' subsidies has been discussed (and in some cases trialled) to look to overcome this inherent tension. Design of a 'smart subsidy' involves considering issues in the local context in choice of subsidy, and 'designing-in' mitigating strategies for any disadvantages. Some subsidies that involve partnerships or contracts with supply shops and require several steps in their development to ensure equitable participation of supply chain actors and ensure agreements are transparent and upheld. In some other country contexts methods to 'accredit' certain suppliers have been adopted, involving suppliers agreeing to criteria around product quality, amenability to bulk delivery, price guarantees and guarantees to only provide services to eligible households.

Key strategies for Vietnam:

Access to finance for customers through VBSP loans: Approaches that can reduce the outlay for such households, including better managed loans from VBSP with facilitation assistance from mass organisations, may help poor households to access sanitation. Gero and Willetts (2014) noted how VBSP loans had mixed degrees of uptake across rural provinces, in part due to the poor's awareness of the loans, how well the loans targeted poor households and also if and how the mass organisations played a facilitation role. Strengthening the VBSP loan programs such that they do provide an effective means through which the poor can access finance for sanitation could overcome some of the challenges faced by poor households in paying for sanitation.

Targeting transportation of sanitation materials: The results from this research in Muong Ang and Mai Chau districts illustrate the major increase in the cost of latrines in remote locations is due to transport and distance. As well as the barrier of cost, there is also the practical barrier of arranging the physical transportation of the materials to remote households with highly challenging logistics. Government estimates of toilet costs are far below the costs households in this research are required to pay in reality. Targeted government subsidies for this specific case (i.e. transporting sanitation products to remote locations) could be developed to assist in removing this barrier. Consistent support across Vietnam's provinces, even if targeting the poor, will not work as the challenges in mountainous, remote locations are not present in the coastal plains. Furthermore, sanitation marketing or market based approaches will not increase access to hygienic sanitation for remote households unless additional support is provided which addresses transport and logistical challenges at the same time.

Target bricks as the most costly component of toilet costs: The high proportional cost of bricks compared to other core material components shows that influencing the cost of latrines may involve investigating alternate materials (e.g. concrete rings – however logistical challenges relating to transport cannot be overlooked here either). These results have implications for the ways to support or subsidise costs for the poorest households, however this would need to be carefully managed due to toilet materials being common construction materials.

Improve community understanding of hygienic sanitation options: In remote villages, households had limited awareness of the types of affordable sanitation options that were available. There were cases of wealthy households building expensive septic tank latrines with adjoining bathrooms, and this was the only example of hygienic sanitation for poorer households. Local government and CSOs, together with Women's Union staff could therefore work to raise the understanding of poor, remote households of the various more affordable types of sanitation that are available.

Research into new innovative products: In addition to investigating alternatives to bricks, other options for core components of toilets could be examined, e.g. durable plastic to replace the concrete slab. Such options have been trialled elsewhere, and CSOs and government could assess the viability for remote locations in Vietnam.

Key strategies for Indonesia:

Supporting further design development of the upper structure: Given large cost for 'upper' structure there is a need to examine other design options to reduce the costs involved this part of the toilet. It is unnecessary (in terms of providing a hygienic latrine) to have a building made of heavy materials such as bricks, reinforcing iron and cement, however in Indonesia and elsewhere it is understood that this structure is important from a consumer perspective. Ideally, a structure that uses durable locally produced lightweight materials would represent a sustainable option.

Supporting sanitation entrepreneurs to rethink their business model: There is a need to move beyond a focus on the toilet pan, which comprises such a small proportion of the overall cost of building a toilet. In particular, new business models that combine the following elements should be considered:

- focus on 'packages' for consumers that consolidate all the items required (ensuring that multiple 'packages' of different cost and quality are included), both with and without installation
- integration of transport within the business (given that monopoly on transport businesses in subdistricts of TTU and throughout MT increases transport costs)
- development of 'partnerships' with materials suppliers and sellers of locally produced materials to support reduced costs for the entrepreneur and increased bulk purchasing sales for the suppliers

Association of sanitation entrepreneurs: The value of a collective organisation to support sanitation entrepreneurs has been established through another study (Murta et al. 2015), and represents an opportunity in TTU, and potentially MT, to provide support for entrepreneurs to develop the above described or alternate business models. Funding support may be requested through DSMET, and could be focused on development and implementation of new business models. An association can also support sharing of skills, and developing economies of scale for entrepreneurs etc.

Subsidised labour costs: Given the high labour costs in Indonesia for building toilets, one potential target for a subsidy could be the labour component. Such a subsidy could be funded through government funds, but implemented by another organisation (e.g. a non-governmental organisation) and could involve a variety of models, from directly employing masons to build toilets in a cost-sharing arrangement with poor households, to vouchers provided to households to support labour costs. One advantage of a focus on subsiding labour costs might also be the chance to allow oversight of the technical quality of toilets build, such that payments are only made for constructions of sufficient quality (including the underground section which is most critical for protecting the environment.

5. CONCLUSION

The findings from this research highlight the need to understand the various factors contributing to the cost and uptake of hygienic sanitation in specific rural and remote areas. In some locations in the districts in Indonesia and Vietnam, low hygienic sanitation coverage corresponded to both high levels of poverty and high costs of toilets. Low hygienic sanitation uptake was not the result of weak supply chains, as materials to build toilets were commonly available in all district towns and commune centres. Rather, it was challenges associated with high costs of materials (including locally produced materials) and labour, especially in Indonesia. In Vietnam, it was transport that posed significant barriers to remote households in accessing even simple sanitation options. While transport costs were high, it was also the compounding logistical challenge of physically moving the materials by motor bike or on foot that posed the major barrier. Households needed to invest considerable time using their private motor bike (or employing local labourers) travelling to- and fro- and along difficult roads or paths multiple times to carry loads of cement, sand and bricks to their household.

The total cost of materials varied between the districts, partly as a result of transportation and supply-chain costs which influenced total costs significantly. Variation in cost was also caused by major differences in the accessibility and price of locally sourced materials.

Assessing other elements of the supply chain revealed that costs of materials at supply shops were generally optimised, in that very low profit margins are accepted by shop owners and payment by credit was commonplace.

To fulfil the objective of improving the availability and affordability of products and services to build toilets, particularly in areas of higher poverty, there are a range of actions which can be considered. The findings of this study can inform development of such strategies, which include seeking opportunities to reduce costs of locally sourced materials; improving access to finance for customers; organising communities for collective purchasing and smart targeted subsidies. Such strategies have implications for both CSOs and government, who both have roles to play in enacting such approaches.

6. REFERENCES

Gero, A., Carrard, N., Murta, J. and Willetts, J. 2013, *'A systematic review of current evidence', Private and social enterprise engagement in water and sanitation for the poor – Working Paper 1,* Institute for Sustainable Futures, University of Technology, Sydney.

Gero, A. and Willetts, J. (2014) *Incentives for enterprise engagement in Vietnam, Private and social enterprise engagement in water and sanitation for the poor – Working Paper 2b,* Institute for Sustainable Futures, University of Technology, Sydney.

Gero, A., Willetts, J., Murta, J., Doan Trieu Thanh and Mohr, S. (2015) *Sanitation value chains in low density settings in Vietnam, Enterprise in WASH – Research Report 3,* Institute for Sustainable Futures, University of Technolog, Sydney.

JMP, 2012 WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation Progress on Drinking Water and Sanitation: 2012 Update

Kaplinsky, R. and Morris, M. (2001) *A handbook for value chain research.* IDRS, Ottawa.

Ministry of Heath (MoH) of Indonesia (2014) Community Based Total Sanitation (Sanitasi Total Berbasis Masyarakat – STBM) National Policy.

Murta, J. and Willetts, J. (2014) *'Incentives for enterprise engagement in Indonesia', Private and social enterprise engagement in water and sanitation for the poor – Working Paper 2a,* Institute for Sustainable Futures, University of Technology, Sydney.

Murta, J., Indarti, N., Rostiani, R. and Willetts, J. (2015) *Motivators and barriers for entrepreneurs and enterprises in Indonesia, Enterprise in WASH - Research Report 2,* Institute for Sustainable Futures, University of Technology Sydney.

Willetts, J., Susamto, A.A., Sanjaya, M.R. Murta, J. and Carrard, N. (2015) *Sanitation value-chain in Nusa Tenggara Timur Indonesia, Enterprise in WASH – Research Report 1,* Institute for Sustainable Futures, University of Technology, Sydney.