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1 **Diagnostics for assessing city-wide sanitation services**

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11

12 **Abstract**

13 This paper presents results of research that has developed a set of diagnostic and decision-support
14 tools for assessing sanitation services city-wide. It highlights features of the tools and illustrates key
15 results from their validation through application in five cities worldwide. Collective use of these tools
16 reveals and explains the complexities of the enabling environment and political economy within
17 which sanitation services are delivered. Results present not only the *status quo* of services but also
18 reasons for them being so. The tools have proven effective in guiding the collection, analysis and
19 discussion of evidence, as a precursor to detailed feasibility studies, necessary to ultimately plan
20 appropriate city-wide sanitation interventions.

21 **Keywords**

22 *Diagnostics; enabling environment; faecal sludge management; political economy analysis;*
23 *sanitation service chain; service delivery assessment*

24

25 **Introduction**

26 Urbanisation presents both significant opportunities and huge challenges in achieving access to
27 urban infrastructure and services (Allen, 2009; United Nations, 2018). Urban sanitation development
28 is complex, requiring consideration of broad factors affecting service and infrastructure needs and
29 opportunities, particularly for those without access to even basic services whose lack of property
30 rights, tenure security and official recognition disincentivises investment in, for example, upgrading a
31 toilet (Cotton and Franceys, 1988; McGranahan et al., 2016; Scott et al., 2013).

32 To achieve Sustainable Development Goal target 6.2 of “access to adequate and equitable sanitation
33 and hygiene for all” (WHO/UNICEF, 2017), requires detailed understanding of the status of
34 sanitation services, to inform actions that can achieve universal access to facilities and safely
35 managed excreta. Collignon and Verzina (2000) represented the various on-site sanitation services
36 delivered by independent providers to residents of low-income settlements in many of Africa’s large
37 cities, in a bid to better understand their complexity. The representation of these services within the
38 ‘sanitation service chain’ provides a valuable overview of services but cannot adequately portray the
39 complexity of urban sanitation functions and management requirements. To function, each service
40 chain needs to be socially, financially and technically sustainable within the wider urban context of
41 city management and governance (Medland et al, 2016; Okurut et al., 2015).

42 Recognising that limited attention to the management of faecal sludge from on-site sanitation
43 systems was hindering sanitation improvements in poor urban communities, the World Bank
44 commissioned a global desk-based review of faecal sludge management (FSM) in 12 cities (Peal et
45 al., 2014a). The diagnostic tools developed from this study – a faecal waste flow diagram (also
46 referred to as a Shit Flow Diagram, or SFD) and a service delivery assessment (SDA) – present a clear
47 overview of the sanitation context, exposing weaknesses in FSM services and proposing ways to
48 improve them (Peal et al., 2014b). The study highlighted the value of combining tools to help
49 decision-makers identify strengths and weaknesses of FSM services and the systems supporting
50 them, while also identifying opportunities to refine the tools and use primary research to enable
51 greater data disaggregation (ibid, 2014b). These and other available tools were also noted as lacking
52 explicit analysis of political dynamics (Kennedy-Walker et al., 2015), one reason investment projects
53 fail to deliver their intended outcomes (Harris et al, 2011). Assessing the political economy of
54 sanitation allows the root causes affecting delivery of urban sanitation services, and their prospects
55 for development, to be presented more openly and responded to (WSP, 2011).

56 This paper presents results of research conducted in 2014-16 whose purpose was to validate the
57 existing diagnostic tools (i.e. the SFD and SDA) using primary data through field testing, while
58 incorporating political economy analysis (PEA) as an integral part of the process in recognition of
59 how challenging reforming FSM services is. The research also produced new decision-support tools
60 and guidelines, informed through the evidence-based findings, which this paper introduces. Other
61 assessment tools and processes evolving at the time,¹ highlighted the significant gap in
62 understanding how to assess FSM services as integral to citywide sanitation services.

63 **Research methods**

64 Taking forward recommendations from the desk-based study, the World Bank commissioned
65 research to establish a suite of diagnostic and decision-support tools that could guide the
66 identification and means of implementing improved FSM service options. The research process
67 applied the existing SFD and SDA tools in the field, drawing on primary data notably from household
68 surveys, focus group discussions and structured transect walks. Simultaneously a political economy
69 analysis (PEA) process drew on primary data from key informant interviews and observations of
70 service providers and facilities. Adopting a PEA process as an integral and iterative part of the SDA
71 process would help to better understand *why* sanitation services operate in the way they do. The
72 research process eventually translated the political economy analysis into a “*prognosis for change*”
73 for improving sanitation services. Table 1 summarises the tools used, their objective, status and
74 application to the research.

75 Studies were conducted in five cities to validate the tools, in Balikpapan, Indonesia; Dhaka,
76 Bangladesh; Hawassa, Ethiopia; Lima, Peru; and Santa Cruz, Bolivia.² Quantitative and qualitative
77 data were collected on each city’s sanitation situation relating to faecal sludge management, but
78 within the city-wide sanitation context. For the household survey, sampling was cluster-based, as the
79 most cost-efficient way of drawing conclusions about a population. Using two sub-samples, the first
80 was designed with 30 clusters to provide representative estimates at the city-wide level, while the
81 second did the same for specific geographic areas identified as being low-income. This is described
82 more fully in Ross *et al* (2016).

¹ For example, the Citywide FSM assessment and planning toolkit of the PAS (Performance Assessment System) Project at CEPT University, India (<http://ifsmtoolkit.pas.org.in/home>) and the FSM Toolbox including situational and stakeholder analysis, financial and technology assessments (<http://www.fsmttoolbox.com/>)

² Cities were selected to offer a geographical spread, range of population size and environmental conditions. Each city was also connected to past, ongoing or potential World Bank Technical Assistance or city sanitation investment projects.

	Tool	Objective	Status & application
Diagnostic tools	1. Faecal Waste Flow Diagram (SFD)	Represents the proportion of faecal waste that is managed and where the unmanaged portion ends up.	Existing: SFD applied in its current format
	2. City Service Delivery Assessment (CSDA)	Assesses the enabling environment ¹ for sanitation and quality of services through the sanitation service chain. Indicates areas for action.	Existing: SDA modified slightly before use
	3. Prognosis for Change (Political Economy Analysis)	Identifies interests and incentives that can prevent action, with possible entry points to overcome them.	Existing: PEA methods applied. Results analyzed as a Prognosis for Change
Decision-support tools	4. Service Delivery Action Framework	Helps to identify actions relative to the enabling environment to deliver improved outcomes.	Developed during the research: draws on results of Tools 2&3
	5. Intervention Options Assessment	Helps to identify technical interventions through the sanitation service chain. Can guide programme design.	Developed during the research: draws on results of Tool 1

84 ¹ The policy, legal, regulatory, institutional, programming, monitoring and evaluation, capacity and financial factors bearing
85 on sanitation service provision

86 **Table 1: Tools and their Objectives**

87 To calculate the sample size, the frequency of the outcome of interest, the proportion of households
88 using on-site (non-networked) sanitation, was assumed to be 80% (a typical figure for cities in low-
89 income countries).³ With population size taken to be 'infinite', margin of error 5%, design effect 2
90 and a confidence level of 90%, the resulting cluster size was 12. Selecting 12 households at random
91 for 30 clusters in each sub-sample resulted in 720 household interviews per city. The sub-sample in
92 low-income areas produced results of relatively high confidence for the defined geographical area,
93 although with purposive selection of these areas they would not be statistically representative.

94 Over 2,600 household questionnaires contributed to the primary data set across the five cities.
95 Household survey data was analysed using STATA, while qualitative data from transect walks,
96 observations, focus group discussions held with community members in low-income areas and key
97 informant interviews was analysed using coding and thematic categorisation, counting frequencies,
98 and other descriptive analysis of responses. Secondary data was obtained from consultancy reports
99 and government documents including policies, strategic plans for sanitation improvements, building
100 codes, bylaws and standards.⁴

³ The household surveys identified on-site sanitation coverage as: 100% in Hawassa, 89% in Balikpapan, 54% in Dhaka, 51% in Santa Cruz and 7% in Lima (an average of 60%). Cities in Latin America tend to have higher sewerage coverage than in sub-Saharan Africa and Asia (as Lima and Santa Cruz highlight), although heavily skewed by wealth quintiles. In Santa Cruz for example, almost 60% of the population in the three lower wealth quintiles use on-site sanitation (2012 National Census).

⁴ Local survey firms conducted the household survey, focus group discussions and transect walks in each city, while local and international consultant teams conducted key informant interviews, observations and document reviews.

101 Stakeholder consultation supported data verification and finalising the case studies, with workshops
102 held to present, discuss, adapt and validate the findings before final reports and recommendations
103 were agreed. Allocating sufficient time and resources to facilitate inclusive and comprehensive
104 stakeholder consultation – including consideration of what to do in response – raised stakeholders’
105 awareness, understanding and interest in both city-wide services and sanitation services to poor
106 urban communities. More direct community engagement, essential for later planning tools and
107 processes (Lüthi, McConville, & Kvarnström, 2010), was not deemed necessary for this pre-feasibility
108 assessment.

109 **Ethics**

110 Ethical approval for the research was issued by Loughborough University’s Ethics Approvals (Human
111 Participants) Sub-Committee. Approval was also granted from the Bureaux of Statistics in Dhaka and
112 Hawassa to conduct an independent study. Data collection in Balikpapan, Lima and Santa Cruz was
113 linked to ongoing studies.

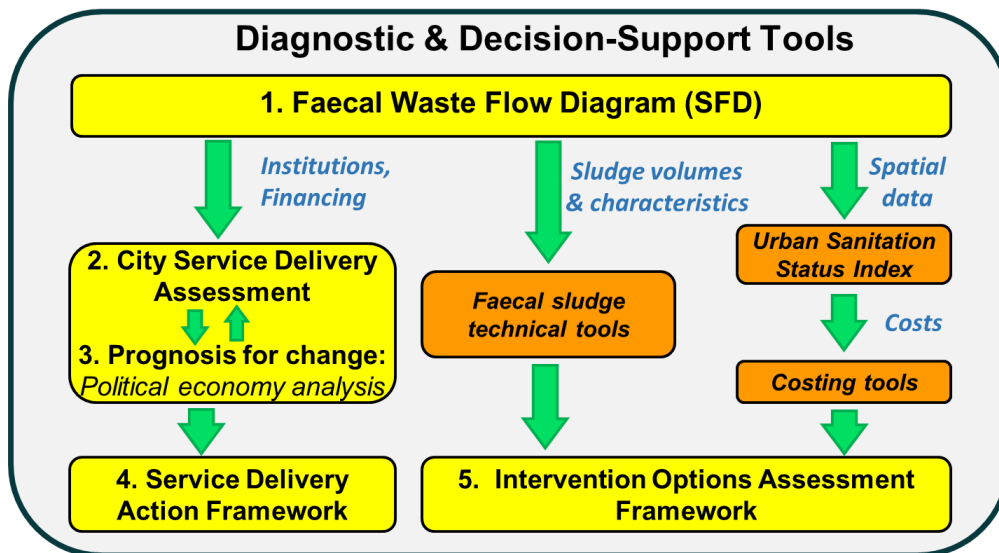
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115 **Results and Discussion**

116 Full research outputs comprise: five detailed city reports, the diagnostic and decision-support tools
117 themselves, data collection instruments and protocols, and Terms of Reference for future studies.
118 This section presents an overview of the suite of tools, with some key findings from their application.

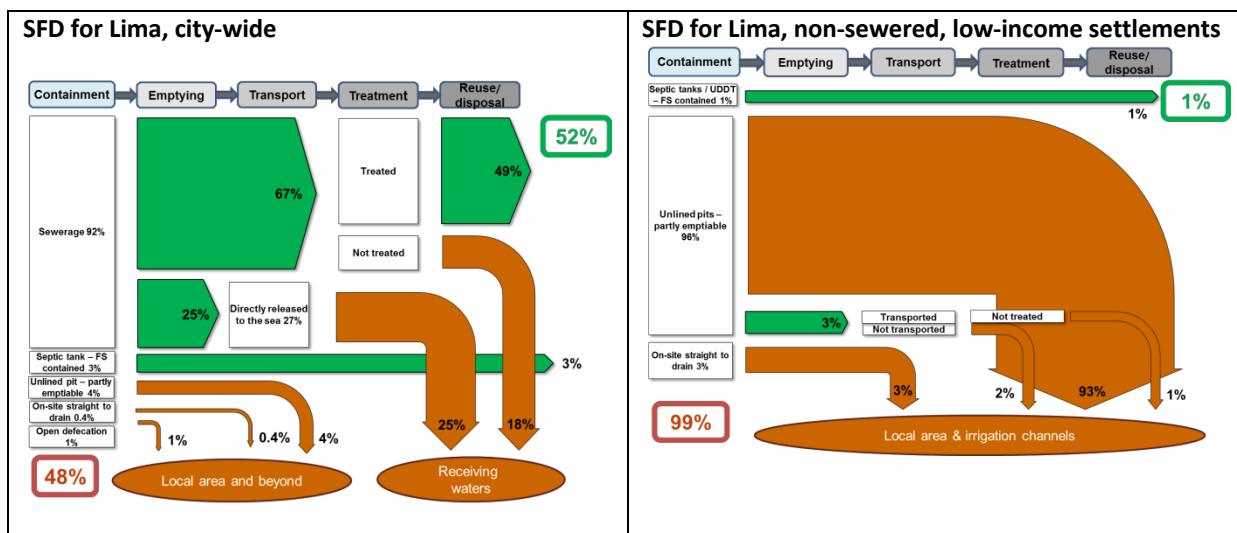
119 While the research sought to emphasise the complexities of faecal sludge management services,
120 functionality of all service chains feature in the tools – most notably in the resulting SFD. Figure 1
121 maps the interrelations between the pre-existing tools (the faecal waste flow diagram, Tool 1; and a
122 modified city Service Delivery Assessment, Tool 2) together with the integrated Political Economy
123 Analysis (adapted as a Prognosis for Change, Tool 3) and tools developed and incorporated into this
124 research (Tools 4 and 5).

125 Applying these tools together has provided the evidence base for far greater depth of analysis than
126 previously achieved. The strength of analysis and resulting prognosis is guaranteed by
127 comprehensive evidence from primary data sources, validated by consideration of secondary data
128 and triangulation between varied data sets. When considered with results of tools that were being
129 concurrently developed under other initiatives (unnumbered boxes in Figure 1), they achieve a
130 comprehensive assessment of the *status quo*, as well as provide a basis for recommending future
131 actions. These actions include institutional, systems-based interventions accounting for the broader
132 enabling environment (Tool 4), aligned with intervention options that address technical and
133 financing aspects in support of comprehensive investment programmes (Tool 5).



134 **Figure 1: How the Tools fit together**

135 The ability to disaggregate data into the two sub-samples allowed stark differences between services
 136 at city-wide scale and those experienced in low-income settlements to be highlighted using faecal
 137 waste flow diagrams (SFDs). For example, in the results from Lima, Peru (Figure 2) over 90% of
 138 people city-wide are connected to a sewer. The majority of the 48% of faecal waste which is unsafely
 139 managed results from poor functioning of these sewers. In low-income settlements, the SFD
 140 highlights both the total absence of sewers and the almost total lack of FSM services, in the form of
 141 safely managed emptying, transport and/or treatment of faecal sludge. The result is that 99% of
 142 faecal waste is returned unsafely to the local environment. A distinct SFD for low-income areas can
 143 reveal the extent of poor services, otherwise ‘masked’ in aggregated city-wide results.



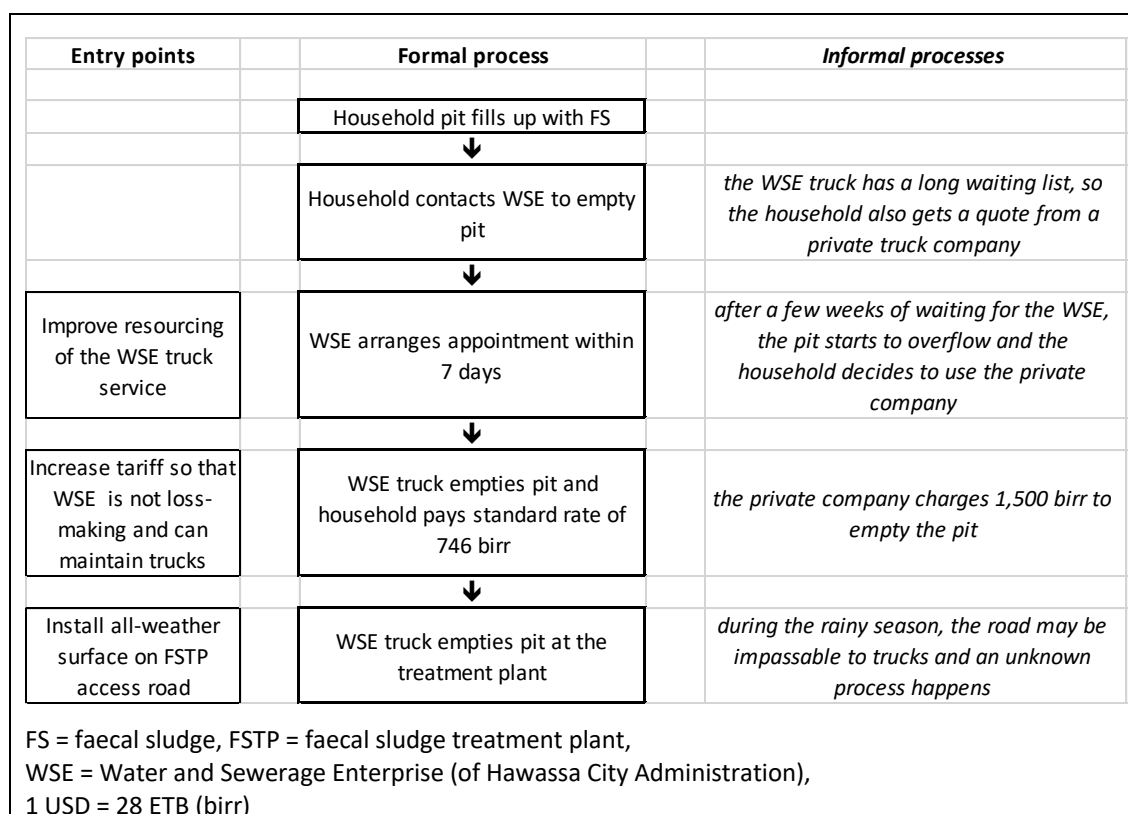
144 **Figure 2: SFDs for Lima, Peru showing contrasting results city-wide and for low-income settlements**

145
 146 Using a slightly adapted form of the service delivery assessment (SDA) question and scoring
 147 methodology developed by Peal et al (2014a), a city SDA scorecard was prepared for each city.
 148 Significantly, this research undertook the city service delivery assessment (CSDA) process in each city
 149 in direct consultation with key city stakeholders. The resulting scorecard, however, does not explain
 150 the *reason* for the current situation, or identify specific barriers needing to be overcome to make
 151 improvements. The CSDA was therefore conducted in conjunction with an analysis of the political
 152 economy of FSM in the city, to understand and identify three major elements: i) how key institutions
 153 (both formal and informal) function, ii) the incentives provided to stakeholders by those institutions,

154 and iii) the power (again, formal or informal) they have to exert influence over service provision.
 155 Assessing the CSDA and PEA findings iteratively enabled an understanding to emerge around the
 156 status quo and realistic future options, responsive to otherwise hidden realities. By accounting for
 157 underlying political economy factors, proposed interventions, represented as a Prognosis for
 158 Change, are more likely to succeed. The process adopted methods used in multi-country political
 159 economy analysis (PEA) studies conducted by the World Bank Sanitation Global Practice Team (WSP,
 160 2011) primarily: stakeholder mapping, stakeholder influence analysis and process mapping. Results
 161 from applying the methods were used to 'evidence' and inform the eventual Prognosis for Change,
 162 while in many cases they did not form an explicit part of the city reports themselves.

163 In the Hawassa study, a process map was prepared to illustrate the formal and informal processes
 164 followed when households need their pits emptying (Figure 3). Highlighting the extent to which the
 165 formal processes (central column) are side-stepped in practice (right column) helped to inform
 166 recommendations (left column) affecting the reform of service tariffs, licensing private vacuum truck
 167 operators and improving access to the existing faecal sludge treatment plant (FSTP). These
 168 recommendations were subsequently considered in light of the results from the stakeholder
 169 influence analysis, to identify the likelihood of reforms being acceptable to key stakeholders.

170



171 **Figure 3: Example of a process map: emptying a household latrine pit in Hawassa, Ethiopia**

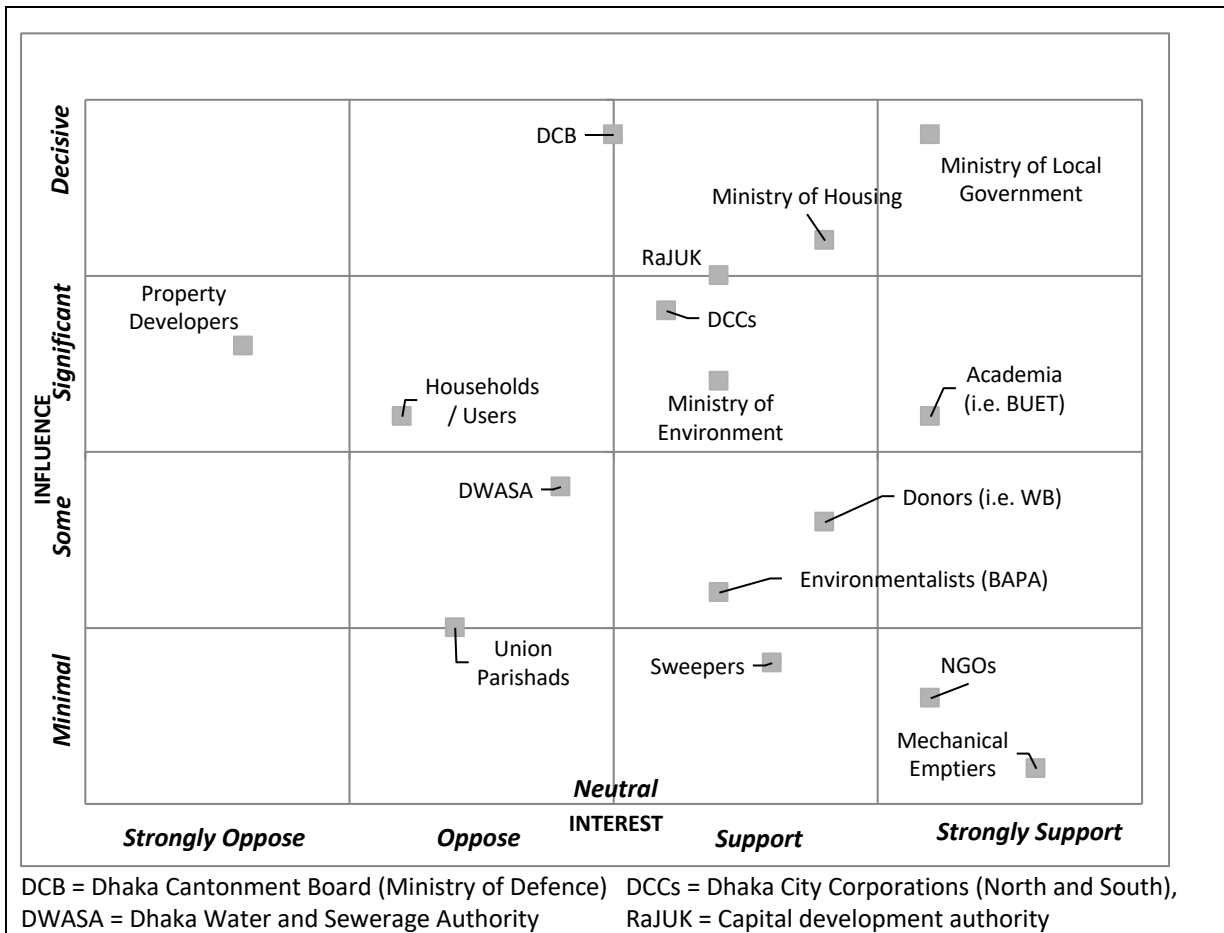
172 In the Dhaka study, a process mapping activity investigated the processes followed during the
 173 construction of a new building in the city. It identified and helped to explain both the formal
 174 permissions process affecting service connections for new buildings, alongside the more prevalent
 175 and informal process with permissions not being granted by the capital development authority
 176 (RaJUK) to property developers. One outcome from this informality is the continued absence of
 177 correctly constructed septic tanks for new developments. A stakeholder mapping matrix for this
 178 process in Dhaka (Figure 4) showed the perceived likelihood of stakeholders' support or opposition
 179 to following the *formal* procedures, and their likely influence over the outcome. Preparing this
 180 matrix alongside the service delivery assessment helped to identify the incentives, influence and

181 interests that certain stakeholders either exert, or need to exert, on current processes. This went
 182 some way to explaining why *informal* processes continue to dominate and identifying the challenges
 183 that need to be overcome to improve outcomes.

184 The combined result of integrating PEA tools and data analysis alongside the faecal waste flow and
 185 service delivery analysis tools and data analysis, forms a rich situation analysis of a city and its
 186 prognosis for change. The narratives were focused around realistic and achievable actions towards
 187 improvements, starting from and informed by the status quo.

188

189



193 **Figure 4: Example of a stakeholder matrix: new service connections in Dhaka, Bangladesh**

194 Additional decision-support tools were developed. These take information and evidence generated
 195 by the diagnostic tools and identify appropriate interventions to address highlighted priorities. The
 196 Service Delivery Action Framework (Tool 4) recommends institutional actions to be considered based
 197 on the combined results of the service delivery assessment and political economy analysis. These
 198 actions start from the current reality in the city and recognise that progress will be gradual. The
 199 Intervention Options Action Framework (Tool 5) recommends appropriate technical interventions to
 200 be considered based on the faecal waste flow diagram (SFD), drawing on experience of good
 201 sanitation and faecal sludge management practices appropriate to the city context. A Service
 202 Delivery Action Framework was found to emerge promptly, through carefully facilitated consultation
 203 with key stakeholders reflecting on institutional weaknesses and opportunities resulting from the
 204 CSDA and Prognosis for Change. The Intervention Options Assessment Framework could also initiate
 205 early dialogue around priority needs revealed in the SFD graphic, with possible technical
 206 interventions to address them – subject to further detailed investigation. In the Santa Cruz study,
 207 recommended actions included encouraging competition amongst the emptying and transport
 208 service providers to increase service access to the poor, coupled with enforced technical

209 construction standards and good maintenance practices of on-site facilities. In Dhaka, priority actions
210 for improving the service delivery context included segregating the roles for regulating, issuing
211 licences to and having management oversight of service providers. These would be supported by
212 enforced standards for containment infrastructure that both enable upgrades to existing systems
213 and ensure containment facilities for new buildings are built to those standards. In Hawassa,
214 proposed key actions included identifying equitable and appropriate service level improvements for
215 rapidly densifying settlements in central, industrial and low-income locations, reforming service
216 provider roles to distinguish them between household-level and public services, and improving
217 faecal sludge treatment facilities through location and access at a new site, with better treatment
218 and management oversight. In moving from these analytical conclusions to prioritising investment
219 options, municipal authorities would need to assess costs and other technical aspects such as sludge
220 volumes, characteristics and spatial issues.

221 **Conclusions**

222 An approach to diagnose the complexity of multiple sanitation service chains operating within a city
223 has been tried and tested, as well as being linked to an achievable way forward in each case.
224 Applying a broad set of data collection instruments has captured information about all sanitation
225 service chains in five cities, with emphasis on faecal sludge management services. Extensive analysis
226 of qualitative and quantitative data has enabled contextualised recommendations to improve
227 services in each city, with stakeholder engagement and consultation helping build common
228 ownership of them. Integrating political economy analysis into the process provides a mechanism to
229 capture implicit knowledge, analyse and articulate it clearly. Preparing a Prognosis for Change for
230 each city has helped to channel varying experiences and perceptions of the problems from different
231 stakeholder perspectives into a coherent framework for action. Being strongly evidence-based,
232 resulting recommendations can challenge prevailing opinions, while handling communications
233 around such topics delicately to avoid alienation.

234 The suite of tools, applied collectively, provides a means to collate evidence as a pre-feasibility
235 activity. Results can enable dialogue amongst key stakeholders such that all aspects of sanitation
236 services within the city will be addressed at detailed feasibility stage. To apply the diagnostic tools
237 effectively in other cities requires time, resources and expertise in urban sanitation. However, they
238 contribute to a growing set of complementary sanitation assessment and planning tools that are
239 maturing within the sector to help engagement with an otherwise seemingly intractable challenge.
240 Further detailed planning processes, such as applied to developing City Sanitation Plans in India or
241 broader urban planning initiatives, are amongst the complimentary tools for this next detailed stage.

242 Drawing on model Terms of Reference, the tools themselves and data collection instruments (Ross
243 et al, 2016), the process has been subsequently applied in Port Harcourt (Nigeria), Kigali (Rwanda)
244 and Port-au-Prince (Haiti).

245 Many cities are desperately seeking pragmatic, workable solutions to improve sanitation services
246 through addressing faecal sludge management and sewerage services alike, to realize equitable
247 access to sustainable sanitation services for all. These diagnostic and decision-support tools offer a
248 means to bring clarity in understanding urban sanitation contexts and complexities in low- and
249 middle-income settings. The research demonstrates that applying the tools, analysing results and
250 reaching agreement on the implications, with close stakeholder consultation, is workable and
251 effective.

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262

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