Short communication

Kolochilikélan: A digital opportunity for Malian emptying operators to boost their business

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ABSTRACT

In Bamako District, capital of Mali with 2.2 million inhabitants, 98.5 % of the population resorts to autonomous sanitation. This results in a considerable production of fecal sludge, accounting for more than 600,000 m³/year. This article shows how a smartphone application can support and facilitate the management of emptying services. It is based on the experience of Join For Water & PRACTICA who have designed a smartphone application, called ‘Kolochilikélan’ which in Bambara means ‘the controller’, to allow all partner emptying operators to monitor and control their activities.

1. Introduction

Demographic pressure in Africa is set to rise significantly over the next decades reaching 2.4 billion by 2050 (Jeune Afrique, 2013). In Mali, the population of Bamako has doubled in just 15 years (Mukim, 2018). Moreover, demographic pressure on the city is expected to increase to over 13 million people by 2050. The study also shows that in Mali, the rate of urbanization has exceeded 40 % in recent years. The annual urban growth rate of 4.9 % is much higher than the population growth rate.

The implication is that there will be pressure on natural resources, land, housing, intra-urban transport, water and sanitation, electricity. If this pressure is not properly managed and planned for, it could potentially exacerbate urban poverty, unemployment, especially among youth, and growth in slum population.

Rapid population growth and urbanization rates, poor sanitation, and inadequate waste treatment infrastructure are linked to pollution. Discharge of wastewater or raw sewerage into the Niger River is a major source of pollution.

In Bamako District, capital of Mali with 2.2 million inhabitants, 98.5 % of the population resorts to autonomous sanitation. This results in a considerable production of fecal sludge, accounting for more than 1650 m³/day (DNACP, 2007). This represents a major threat to public health, wildlife as well as livelihood resources for those who make a living from fishing and tourism.

The inadequacy of sanitation has a significant impact on Mali’s economic development and contributes to the degradation of the environment. Waste has an estimated impact of 0.46 % of GDP, or 15.64 billion FCFA/year on the health and quality of life of the urban population in Mali and 0.23 % for rural areas (AfDB, 2013).

Therefore, the country needs a comprehensive review of its waste management system and the strengthening of capacity for effective waste management.

This is even more valid as sanitation services, particularly sewage sludge collection, provide an opportunity to strengthen local economies to improve the self-financing capacities of cities and to combat under-employment and poverty. Yet, in Mali, the finance allocated to sanitation improvements are insufficient to meet the national SDG 6 target (Lamizana and Zennaro, 2019).

For the emptying and transport of this sludge, Bamako District relies mainly on private manual and mechanical emptying operators. The emptying profession faces many difficulties, mainly of technical, organizational, administrative and financial nature.

Despite the multiple constraints, based on an analysis by PRACTICA before introducing the app, the emptying and transport of sludge is a profitable business, with a potential market of 0.5–1.6 billion FCFA (0.9–2.4 million euros) of annual revenues in Bamako for both mechanical and manual emptying services.

In order to strengthen the toilet sludge emptying and transport market, it is important to ensure its financial viability, as well as the
quality and accessibility of the services offered, while preserving the environment. A system that encompasses the entire sludge chain and involves both the public and private sectors must be put in place. In this process a mobile application can help.

Although mobile is at an early stage of integration in sanitation (Nique and Smertnik, 2015), the sector can already benefit from mobile to improve the efficiency of its value chain. This article will show how the innovative experience of the ‘Kolochilikélan’ application, used by some manual and mechanical emptying operators in Bamako, may provide solutions to improve emptying, transport efficiency and service to customers, as well as collect reliable data on operations to identify gaps and inform policy decisions.

A smartphone application can support and facilitate the management of the emptying services: technical and financial monitoring of the service, analysis of the results obtained for a continuous improvement of the service performance and quality.

2. Materials and methods

2.1. Design of a mobile application to analyze sludge emptying services’ performance

To allow all partner emptying operators to monitor and control their activities, JOIN FOR WATER and PRACTICA designed a smartphone application, called ‘Kolochilikélan’ (Sow and Traore, 2018), integrating two distinct tools, namely:

- The data entry tool used by the emptying operator, making it possible to enter data regarding trips and drainage performance. This tool is meant to be used by the truck driver or his apprentice.
- The supervision tool allowing real-time monitoring of truck positions and analysis of monthly/annual results for each truck. This tool is intended for the manager or owner of the drainage truck.

In practice, this application can be installed on any Android smartphone that is easily found on the Malian market for around forty euros. As the driver is always with his phone, this makes it possible to automatically record time and position data at regular intervals. Then the driver uses it to insert commercial data relative to client contact details, drained volume, cost of service, client satisfaction, etc. (Fig. 1).

The application was designed in order to be easily used by the truck drivers having a low educational background. Efforts were made to ensure the intuitive interface, external readability, and compatibility with limited internet network. Several individual and plenary sessions were held with the partner users to arrive at the current version (V1.4), the ergonomics and functionality of which could be validated by the partner drainers.

The app can be used without internet connection; the data are automatically sent to a server once the phone is connected. Once on the server, data are accessible at any time with a phone, a tablet or a computer. Entitled persons can then consult all the data in a raw version or organized on a map or dashboard. It is possible to select one or several trucks and to consult the data on a variable time frame (past year, current year, current month and current week). The architecture of the global app is shown in Fig. 2.

The data collected and analyzed by the mobile application are for the following indicators:

- **Monitoring indicators**: Distance, number of customers, sludge volume, revenue, average number of operations (trips/day);
- **Performance indicators**: Satisfaction (%), efficiency (m³/hour/trip), profitability (FCFA/km/m³).

2.2. Identification and selection of the emptying operators

The launch of the application was based on the field expertise of JOIN FOR WATER and its local partners (BÉSE, COPIDUC, ADéCB-Mali and AMASBIF). The long-standing confidence developed by these structures with the National Union of the Spiros Drivers of Mali (SNCSM) made it possible to collaborate on the identification of the mechanical emptying operators active in Communes I and IV of Bamako District, and the selection of 7 of them according to their ability to adopt the application (interest, level of education, etc.). Furthermore, two semi-mechanical drain services in commune I and supported by the project also joined the testing pool.

2.3. Training of truck owners and their drivers giving them incentives to use the app

A total of 14 agents (drivers, managers, owners) of the 9 partner emptying services were trained on the use of the application, together...
with all local partners in charge of monitoring and supervision of these emptying operators. This training confirmed the right level of intuitiveness of the application, all participants knowing how to use it after a few hours of training.

The training not only focused on use of the app but also on the importance of the data collected to improve the financial sustainability of the operators’ activity. It was critical to make sure the drivers understood the interest of the app and that they would inform the indicators with reliable data. For key data, like the volume of sludge emptied, special training was organized to make sure they could measure well and that an appropriate tool was given to them.

Moreover, these trainings were a good opportunity for PRACTICA to review the most common errors in use made by the drivers and to adapt the design of the app. This contributed to refresh the drivers’ interest for it. Several adaptations were introduced to make the back office easier to consult. The online interface allows to consult the data collected with the smartphone application.

To encourage the owners to be conspicuous in follow-up they received management training. This was also to encourage them to give more attention to the efficiency and cost-effectiveness indicators of their activity.

Finally, the drivers received a digital tablet with the app at the end of the first training.

The emptying operators integrated the use of the application into their routines after about 4 months of use, when the database began to be fed continuously. At this stage, it seemed essential to motivate the operators to use the tool in order to overcome the negligence (accurate measure of sludge pumped) and apprehensions to publish the details of their business. The idea was to present the application as a game, with performance reports sent to the operators at the end of each month so that they perceived the meaning and interest of the data collected at their level.
Therefore, in the early phases of the project, in order to start using the application, Join For Water provided technical support to the partner operators through the implementation of an innovative system that consisted of organizing a weekly competition between app users and subsequently distributing prizes (personal protective equipment, fuel tickets, etc.) for those recording the best performances (Fig. 3).

2.4. Involvement of local authorities and technical services

As the data collected with the app can be used to a large extent by the authorities in charge of regulating waste disposal, it was proposed to extend the use of the application through sharing a refresher on service coverage with the authorities in charge of sanitation and organizing a presentation of the app to the authorities.

Among the key indicators that could be followed up on by the local authorities are volume of sludge drained, localization of draining services, rate of fees, and place of discharge.

3. Results

From the start, partner managers were trained to consult the on-line dashboards which allowed to follow the raw indicators and their evolution compared to a previous period (Fig. 4). With trend indications, emptying operators quickly visualized whether they were in the process of improving their performance or not.

According to the partner managers, the tracking function made it possible to better control vehicle use and to reduce some difficult to tackle abuses (drivers’ side businesses). In this sense, the use of the tool has contributed to improving the profitability of services.

At the end of 2017, the statistics showed a good level of use and adoption of the application by the partner emptying operators (Fig. 5):

- More than 75 % of partner emptying operators continued to use the application. The main functionalities used by managers were the vehicle control map and the summary table of the number of emptying operations.
- 2,984 emptying and 2,500 spill operations were recorded. On average, close to 300 dump operations were recorded each month.

From the first months, the data collected enabled us to better understand the pricing structure of emptying operators (flat rate at 15,000, 20,000 or 25,000 FCFA in more than 80 % of the cases, without taking into account volume or distance), to identify average service costs (5400 FCFA/m³ and their very high variability (between 2500 and 14,500 FCFA/m³).

The application also provided information on total drained flows (11,500 m³ of sludge from March to December 2017) and their origins (35 % of the volumes from pit latrines versus 65 % from flush toilets). On the other hand, 60 % of the emptying carried out had a volume between 1 and 3 m³, with the drains of 3 m³ representing 25 %.

Finally, more than 20 uncontrolled dumping sites have been identified. In the end, it shows that most of the planning and control parameters for the management of sewage sludge can therefore be compiled, at a lower cost, just using the application (Fig. 6).
Unfortunately, from January 2018 onwards, the use of the app has dropped. In July 2019, only one emptying operator continued to use the tool. This is related to an error on the application’s end-user target. Indeed, the data on emptying are potentially useful for truck owners, who should be concerned about profit making and maintenance cost recovery of their trucks, and for the authorities in charge of the planning of the remediation. However, we essentially worked with truck drivers who usually do not have an employment contract and are poorly paid.

To counter this issue, we organized workshops to reorient the application to owners with a view to change the targets.

What we learnt is that the owners of ‘spiros’ trucks are satisfied with the current mode of management, where drivers are the master of the vehicles and the profitability is approximate. Their concern seems to be to maintain an informal activity, which is difficult to control by tax and environmental inspectors.

4. Conclusions

The results obtained confirm the potential of this type of tool to help professionalize sewage sludge management at both the public and private sector level as well as service to the customers in Bamako, but not the emptying as such. At a very low cost, this technology could help emptying operators to secure the entry and storage of their technical and financial data, essential aspects for optimizing their activity, or reporting to the regulatory authorities, when the sector becomes structured. More efficient sludge emptying, by reducing the distances covered, can lead to lower prices for emptying thus benefiting the customers.

In 2017, the application was able to demonstrate its potential as a tool for regulating the emptying sector. It makes it possible in a simple and economical way to quantify the flows of emptied sludge, to visualize geographically the service level, to analyze the profitability of the emptying services, and to supervise the spill sites. In particular, the data collected represent a wealth of new information that could be shared for use in the short and medium term (application procedures for operators, design of future sewage sludge treatment plant). Sector regulation and infrastructure design could gain a lot in terms of impact and costs.

The two semi-mechanical services continue to use the app, thus providing services to the poorer customers in a QHSE approach. Unfortunately, we did not achieve to obtain the support from truck owners as most of them remain discreet and traditional in their management. Therefore, the margins for the use of this tool at their level still appear to be narrow.

Despite their interest in the application, the authorities could not help us with the imposition of this tool, nor do they have the human resources to do this. In fact, at the present stage, the modernization of sewage sludge management in Bamako is mainly blocked by the absence of a treatment plant. Without changes at this level, the sector seems bound to remain informal, which basically undermines any margin for progress.

The two main causes of low penetration and use of this application with the emptying operators can therefore be summarized as follows:

1. The drivers of the emptying trucks do not want to be controlled by the owners so they can do their “small business” next door. Only owners who directly manage their trucks have an interest in using Kolochilikélé.
2. The owners of emptying companies prefer to manage their business traditionally and informally. The possibility that the authorities may have access to the data of the application is not accepted by these owners, because the lack of official dumping and treatment sites forces them to work in a certain illegality.
To cope with these constraints, Join For Water now seeks to work only with owners who manage their business themselves and wants to put on hold the possibility for the authorities to have direct access to the data of the application. However, an anonymous report on the quantities emptied, the spill sites used, the turnover generated, etc. could be transmitted to them periodically.

**CRediT authorship contribution statement**

**Fabrizio de Georgio Ferrari Trecate:** Conceptualization, Methodology, Validation, Writing - original draft. **Céline Jacmain:** Conceptualization, Methodology, Validation, Writing - original draft. **Harald van der Hoek:** Writing - review & editing.
Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.envsci.2020.01.012.

References


