

minga

July 2016

smart waste management

Unique Issue



Collective

WASTE MANAGEMENT

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#somosminga

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“MINGA”

**WORD USED BY COLOMBIAN INDIGENOUS
COMMUNITIES TO REFER TO**

**COLLECTIVE WORK
TOWARDS A COMMON
OBJECTIVE**

INTRODUCTION

By 2030, an anticipated 66% of the world population will live in urban areas (UN-DESA 2014, 1) and the majority will reside in megacities in the Global South such as Johannesburg, Mumbai and Bogota (UN-Habitat, 2010). Exponential population growth alongside an industrial-based modern lifestyle has resulted in higher levels of social exclusion and environmental affectations that raise serious questions regarding the development models implemented in the Global South (Beall & Fox 2009; Hardoy, Mitlin, & Satterthwaite, 2011). As the SDG N° 11 holds, local governments and local social actors need to be aware of problems associated with rapid and unplanned urban growth, such as the sustained increase of pollution levels, socio-economic exclusion and informal economies (UNDP, 2015).

Solid waste management is one of the most challenging issues faced by Global South cities. The rise of waste generation has led to the progressive implementation of effective waste management systems not only as a solution for inadequate landfilling (World Bank, 2013), but also as a social platform able to transform people's consuming behaviours and connect marginalised sectors of society with socio-economic dynamics in the city. However, recycling strategies for material transformation have not been fully embraced by local authorities and informal waste pickers remain as a vulnerable and excluded sector whose labour in the waste management chain is not fully recognized (Chi et al., 2011). Our proposal seeks to provide an alternative insight on how to improve waste management systems while promoting social inclusion and environmentally-friendly behaviours. We focus on the Bogota case, considering its rapid population and waste generation growth as well as the considerable cohort of waste pickers that currently work in the city.

Based on e-participation and behavioural transformation frameworks, we are confident it is possible to create a different, social approach towards the culture of recycling and the socioeconomic links associated with the waste management chain. In the document we argue that normalised social practices that include the stigmatization of vulnerable groups (in this case waste pickers) and incipient information guidelines on waste management practices result in a vicious disarticulation of the formal and informal waste management sectors (see also Ezeah, 2013). However, these practices can be mitigated through the appropriate usage of information and communication technologies (Mavropoulos et al., 2015) to provide a continuous and accurate flow of information between users and service providers (both from the formal and informal sector), and through the implementation of nudges and educational tools to modify entrenched social behaviours and norms towards waste separation and recycling (Dolan, 2012).

This proposal will analyse Bogota, Colombia for two main reasons. First, Bogota's rapid population growth –during the last 50 years from less than one million inhabitants to more than 8 million (DANE, 2012), is comparable to demographical tendencies in other Global South cities in Africa, Asia and Latin America. We expect this analysis and proposal to be considered and applied in other contexts where waste management and social exclusion are at the centre of local governments' discussions. Second, in Bogota landfills and waste disposal systems implemented during the 20th century

were insufficient alternatives to comprehensively address issues associated with waste production. Tellingly, recent debate around the implementation of an Integrated Waste Management System (IWMS) with modern waste management infrastructure that encourages citizens to modify their consumption practices has also referenced the crucial role that waste pickers play in mitigating environmental impacts through their organised labour.

Our proposal is structured as follows:

Section 1 provides a brief discussion about the current situation of waste generation and analyses patterns in solid waste management in the Global South.

Section 2 presents and discusses the evolution of solid waste management policies in Bogota, Colombia. This section also focuses on waste pickers' labour and their work within the solid waste management chain.

Section 3 presents MINGA, an alternative model that offers a set of two alternative, feasible and complementary strategies for solid waste management, environmental awareness, and social inclusion in Bogota: (1) a bridge between recyclers and users and (2) a recyclable schedule and yellow and green street squares for waste collection. This section also discusses possible challenges and a potential scenario of the proposal's implementation.

Finally, in **section 4** we provide general conclusions.

WASTE GENERATION AND SOLID WASTE MANAGEMENT IN THE GLOBAL SOUTH

SECTION ONE

The generation of solid waste alongside its treatment and final disposal displays at least four common challenges across countries in the Global South. Firstly, waste production in urban areas is exponentially increasing due to urban population expansion and the industrial-based modern lifestyle (UN-Desa 2014, World Bank, 2016); in fact, the amount of waste production is expected to double by 2025 in developing countries (World Bank, 2013). Although there are substantive differences in the amount of waste generated within regions of the Global South, existing infrastructure and public services provision are being challenged (Hardoy, Mitlin, & Satterthwaite, 2011).

Secondly, although some countries, like Brazil, have advanced in implementing multidimensional waste management schemes, achieving an integrated waste management system (WMS) is a common issue for local governments in Global South.

Lack of legislation and policies for long-term planning and policy-making, inadequate storage and limited collection, and lack of proper disposal are some of the common challenges faced by Global South countries when the solid waste chain is analysed (Hardoy, Mitlin, & Satterthwaite, 2011, Parnell & Walge, 2011). In terms of waste disposal, optimistic figures suggest that “only 30 - 70% of waste generated in cities of the Global South is collected for disposal” (Ezeah, 2013: 2511). Additionally, the use of landfilling and open dumps to contain waste disposals increase potential sanitary problems due principally to urban population growth, operational costs and lack of infrastructure and proper equipment (Hardoy et al., 2011). For example, it is estimated that over 96% of the total amount of waste in Algeria, Cambodia and Suriname is placed in open dumps, whilst landfilling is often used in countries such as Belize, Armenia and Chile (World Bank, 2016).

Thirdly, when it comes to waste collection, the role of waste pickers in separating and sorting solid waste is important (Scheinberg & Anschutz, 2006).

Waste pickers' activities can differ between countries and cities, yet their activities are mostly focused on collecting, sorting, recycling and selling material (WIEGO, 2012). Although statistical information about waste pickers in the Global South should be considered with a degree of caution (i.e.

Countries have different definitions to categorize waste pickers), there are an estimated 97 waste pickers organizations globally (WIEGO, 2012). Brazil (27%), India (19.6%) and, Colombia (13.4 %) have the largest amounts of people involved in this activity (WIEGO, 2012). Moreover, waste pickers are active agents in urban spaces and their activities impact several dimensions of urban life, yet their activity is often not formally recognized. According to Wilson et al. (2006), this informal sector is characterized by small-scale, labour-intensive, low-paid, unorganized/unplanned, and unregistered/unregulated work.

Nevertheless, various organizations have also pointed out waste pickers' role in achieving sustainable waste management in Global South. The German Technical Cooperation agency estimates that waste pickers reach high recycling rates at lower operational costs (GIZ/CWG, 2011) and reduce levels of energy production by the "extraction of raw materials and returning secondary raw materials to the production cycle" (GIZ/CWG, 2011, p. 20). Additionally, regarding urban municipal actions, waste pickers make

significant contributions in collecting over 50% of waste in most cities in the Global South without formal or direct costs to the local or municipal budget (UN-Habitat, 2010). They often collect discarded materials in informal settlements where municipal systems do not have access, and where a lack of proper sanitation services make them vulnerable to the spread of diseases (Campos & Zapata, 2014).

Finally, at the level of residential behaviours, rather than being "placed out for collection in separate containers [the waste] is first being 'mixed' together" (World Bank, 2016: 14). Citizens are not used to separating or sorting waste before taking it for disposal (World Bank, 2016: 14), which impacts the recycling process. Recyclable material recovered after being mixed tends to be 'contaminated', making the recycling process more expensive (World Bank, 2016: 14). It is relevant to take into account the treatment of organic material as it is composed mostly of waste, rather than of paper, plastics, and other inorganic substances. For instance, in Brazil, Mexico and Colombia, around 50% of waste is composed of organic material and from 12% to 28% is composed of recyclable sorting (Buenrostro and Bocco, 2003; Deus, Battistelle, & Silva, 2016). Massukado et al., 2013). According to Zhang et al., separation of solid waste at the household level is an important 'pre-requisite' for recycling, therefore positively impacting the factors that affect whether residents separate their waste can help in constructing effective recycling campaigns in a community and contribute to a more sustainable way of living.

INTEGRATED WASTE MANAGEMENT SYSTEMS

In the Global South, Waste Management Systems (WMS) are being transformed into Integrated Waste Management Systems (IWMS). New waste management programs are seeking to include waste pickers as ‘public servants’ and to motivate citizens to develop a ‘recycling culture’ (Beukering, 2006; Tang, 2011; Gunsilius, 2012). Improved waste management and recycling systems have demonstrated benefits in terms of environmental protection and social empowerment (Ezeah, 2013). Employment is generated, littering is reduced, and landfills have a larger functional life (Damghani et al., 2008). Indeed, recent waste management transformations occurring in the Global South aim to include the informal sectors associated with the recycling industry and create spaces to actively interact with citizens in the process (Wilson, 2006; Ezeah, 2013). This transition in some cases takes into consideration the social and labour inclusion of a sector of society that is traditionally excluded, transforming informal waste pickers into public servants attached to local waste management systems. .

For policy makers, this phenomenon implies the necessity of acknowledging the relationships between the assumptions and realities of the motivations that lead individuals’ behaviours (Le Grand, 2003:95).

Nevertheless, the work of relevant stakeholders such as local governments and development agencies has been uncoordinated. Many development projects designed to look after waste pickers understand waste collection and picking as an isolated phenomenon, detached from the impact of both local dynamics and global trends in consumption. This tendency conflicts with the work of researchers and public policy evaluators and developers who contend that the incomplete conceptual framework “would help them understand the roles and functions of waste pickers; the result is that pickers become objectified, and treated as a problem rather than as protagonists who can and do make choices and act strategically in cooperation with other stakeholders of waste management systems” (Scheinberg and Anschütz, 2006:257).

For instance, in the case of Bogota, through the implementation of new solid waste management policies in 2012 that emphasize the role of partnerships with waste-pickers cooperatives, the need to improve overall collection and recycling rates is also recognized. However, the procedure’s improvements demand extra resources, not only for more specialized waste management systems but also for waste-pickers (LSE Green Cities, 2015).

Moreover, in Colombia, the notion persists of waste pickers as informal street labourers with undesirable or deviant behaviours that does not coincide with traditional waste picking actors (Ezeah, 2013).

Taking into consideration that the informal recycling sector is environmentally and economically recognized for its skills at identifying

waste with a potential value and provisioning alternative solutions for waste transformation (Nzeadibe, 2009), the next section provides a state-of-the-art study around solid waste management in Bogota (Colombia). It analyses solid waste management policy-making and initiatives as well as the stakeholder's participation in the city.



Source: Superintendência de Limpeza Urbana

WASTE MANAGEMENT SYSTEM AND WASTE PICKERS' SITUATION IN BOGOTÁ

SECTION TWO



One of the challenges most commonly addressed in different urbanisation plans in Bogota, yet insufficiently handled by local governments or promoted by local communities, is referred to as the design of adequate WMS (Rodríguez, 2009). In the first place, WMS in Bogota have not responded to the increase of waste production in terms of waste collection infrastructure and waste separation educational initiatives. Since the beginning of the 21st century, the disposal of solid waste in rivers, open forests or domestic backyards as micro landfills was the common pattern of waste management in the city. This practice changed through the 20th century with the creation of open dumps and the development of landfilling, which also eventually resulted in public health emergencies . Although the implementation of these WMS attempted to address the increase of the waste produced mainly at household levels, it lacked a prevention component associated with educational initiatives to stimulate different consumption practices and an appropriate waste separation process.

Source: Bogotá City, 2014, www.bpgota.gov.co

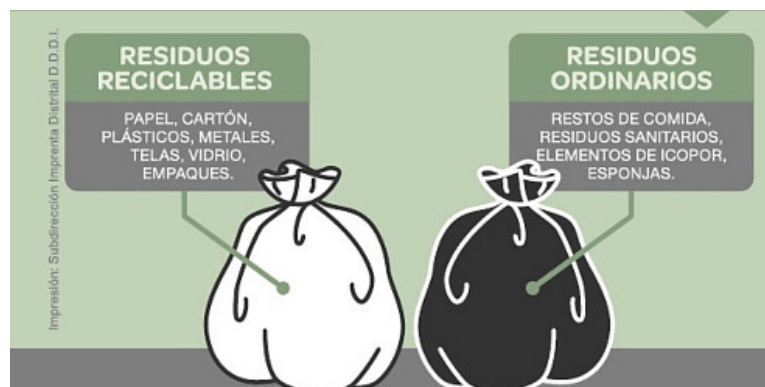
In the second place, the local governments during the last 20 years acknowledged the importance of implementing recycling schemes, however waste pickers were not allowed to formally and continuously participate in the WMS (Sentence T-387/2012). From 1994 to 1996, the Bogota Waste Pickers Association (Asociación de Recicladores de Bogotá – ARB) was temporarily hired to provide sanitation services in 10% of the city's neighbourhoods (ACL, 2011). Nevertheless, in 2002 the local government awarded to different private contractors the implementation of a new waste collection system. This new scheme did not consider the participation of waste pickers at any of the stages of waste collection. This episode led to the enactment of the constitutional sentence T-724/2003, which compelled municipal authorities to include waste pickers in the waste management process.

In 2012 the local government implemented the 'Basura Cero' ('Zero Waste') programme. This initiative was not only looking to comply with Constitutional Court orders, but also it attempted to configure an Integrated Waste Management System aligned with the 'Zero Waste' initiatives implemented in countries like Canada and the United Kingdom. This program had as main goals the following: "1) to minimize the impact of solid waste generated in the city; 2) to foster a cultural and educational transformation with regards to waste management at the household level; 3) to build a culture of waste separation, industrial recycling processes and minimization of solid waste disposal and 4) to eradicate social exclusion" (UAESP, 2013:3). In the process of consolidating the program a new public company was created to operate the WMS in 12 districts of the city, while in the remaining 8,

private operators provided waste collection services. An annual budget to pay for waste pickers' services of waste collection and transportation was allocated, and a new campaign to separate solid waste in two separate types of plastic bags was developed for households and schools. A more detailed explanation of these initiatives is hereby provided:

The White and Black plastic bags plan

to facilitate a differentiated collection and separation process for recyclers and collection trucks, the 'Basura Cero' programme developed a two bags procedure. Citizens were requested to allocate in a white bag all the material that could be potentially recyclable and reusable, and in a black bag all the material that corresponded to general waste. The rationale behind this strategy was the assumption that users would not be willing to buy different types of bags, but would rather use conventional groceries plastic bags as disposal devices. This was thought to be a simple system that could progressively derive into a more complex waste management structure with differentiated boxes and coloured plastic bags for various elements (UAESP, 2014).



Source: UAESP, 2013, www.participacionbogota.gov.co

Active Inclusion of Waste Pickers in the collection process



Source: UAESP, 2014, www.elescrutinio.com

In recent years, with the creation of the public company 'Aguas de Bogotá' (Waters of Bogotá), different associations of Waste Pickers were included in a formal payroll, and institutionally recognised for their labour as a complementary link in the waste management chain. Additionally, the Administrative Unit of Public Services defined geographical boundaries for truck collectors and recyclers to pick up waste bags in different schedules. Organised Recyclers would pick up the white bags twice a week before collection trucks, and the traditional waste collection service would do it three times a week (Bogotá, 2014). The incorporation of additional workers in the collecting process was meant to foster alternative sectors of industries such as low-cost manufacturing for local communities, and the potential provision of materials for local businesses (Chukwunonye et al., 2013)..

Educational Campaigns

in order to generate a more effective waste selection process, the recyclers' collectives would hold specific workshops in schools and private residences located along collection perimeter on how to separate general waste from recyclable material. This process would take place during a period of four months and was complemented by larger media campaigns sponsored by the Secretary of the Environment (UAESP, 2014). John et al. (2011) identified, for instance, that education and awareness campaigns were effective vehicles of participation and civil involvement around recycling initiatives.



Source: Alcaldía de Bogotá, 2013, www.bogota.gov.co

The 'Basura Cero' programme embodied a valid institutional and cultural intention to modify waste management procedures. From a legal and organizational perspective, the constitutional sentence evidenced a new understanding of the waste picking activity by governmental and judicial authorities as a necessary complement to alleviate the increasing production of waste in the cities, and facilitated a more organized movement of Waste Pickers associations to advocate in political scenarios. Nonetheless, from a practical perspective, the outcomes of the sentence implementation were insufficient to implement holistic strategies to the real inclusion of Waste Pickers in the WMS. For instance, the creation of private warehouses to collect, separate and sell recyclable material benefited only 800 out of the 15,000 waste pickers that work in the city and the creation of additional houses was not possible due to high costs of operation and the disarticulation of waste pickers processes with private investors (Pedraza & Moscoso, 2009).

Furthermore, the implementation of 'Basura Cero' came with social barriers and unexpected social behaviours that led into an incomplete implementation of the program in the short and mid-term. First, one of the most problematic social barriers in waste management has been the continued marginalization of waste pickers. They have even called 'disposable people' ('desechables'), in a kind of resemblance to the conception that users have of waste (Ramirez, 2000). As many waste pickers have been traditionally excluded, in the view of the most of the citizens, they are related to insecurity and drug consumption, making even more difficult the integration of waste pickers in the WMS. Second, the recycling areas were operated by a determined number of recyclers' organizations. As a consequence they openly competed for the most productive areas of potentially recyclable material, leaving some households unattended. Third, according to the yearly objectives there was a considerable decrease in the awareness and educational campaigns in most of the recycling areas. As a result, by the end of 2012 the level of delivered waste material in the local landfills had a reduction of 5,6%, the recyclable and reusable material levels increased only by 2%, which was considerably below the mayor's office projection (Bogota, 2013). By the end of 2014, the total amount of recycled and reusable waste increased to five hundred tons, but in percentage terms, it represented an increase of 2.2% (Bogota, 2014).



ONEAPP
ONECOMMUNITY

minga

**A WORD USED BY COLOMBIAN INDIGENOUS
COMMUNITIES TO REFER TO**

**COLLECTIVE WORK TOWARDS A
COMMON OBJECTIVE**

CONTEXT

OF IMPLEMENTATION

According to (Scheinberg, 2003) the IWMS framework is built on the consideration of three major pillars: stakeholders, waste system elements and sustainability aspects. In its very essence, ISWM are required to innovate, not only to specialize the process of waste transformation, but also to improve the living standards of those actors involved in the process, aiming for sustainability in ecological (physical) and social aspects in a holistic environmental view. Particularly, ISWM situate waste pickers and informal waste service providers in the overall socio-technical system of provision for waste management. In this sense, such a perspective overcomes the undesirable outcome of the modernization process (Scheinberg and Anschütz, 2006).

Social sustainability, as part of a broader concept of sustainability, can be achieved through the implementation of information and communications technology for development (ICT4D). Precisely, ICT4D is interested in creating spaces for citizens to actively communicate and participate in governance processes, under the continuous consideration of local traditions, differences within communities, empowering marginalized groups, sharing and associating

goals with local people and adjusting to changing community needs (Avgerou, 2010). In fact, during the last 10 years, there has been a notable increase in the amount of mobile applications and e-services, especially focused on ICT4D enhancing participation of user in public spheres (Ochara and Mawela, 2015). In the realm of environmental and recycling services, there have been some attempts to articulate the general waste and potentially recyclable waste procedures through online services. For instance, in the United Kingdom, the recycle app that operates in a local council level has provided effective services to users who need updated information on the waste separation procedures and the collection schedule by the council trucks. In Spain, the GuiaReciclaje has compiled in one platform an online guide on how to separate different types of waste produced in households. However, in Latin America and specifically in Colombia, due to the recent involvement of waste pickers community in the formal chains of the waste management systems, there remains an informational gap between their expected role as public servants and the perceptions from the household users, as well as the lack of updated guidance on waste separation.

In Colombia, significant investment and efforts in improving and expanding Information and Communication Technology infrastructure have taken place during the last 15 years. Recently, the national government has invested in building new ICT infrastructures, expanding mobile network coverage and improving broadband infrastructure, setting solid foundations to reduce the existing communicational and technological gap between several social sectors (MinTic, 2013). The efforts in improving the communications and technology infrastructure in Colombia are part of an extensive 10-year national strategy to improve the connectivity at household levels. The results are evident when regarding figures about new broadband and especially mobile users: from 2013 to 2016, the level of access and penetration of mobile users has steadily increased by an average of 12.3% per year (MinTic, 2016). In this scenario, the strengthening of waste management services provision through e-solutions in Colombia is claimed to have an impact on the economic development of waste pickers (Goldsmith, 2007). Increasing levels of participation of this socially excluded group is also likely to positively impact their welfare (Ochara and Mawela, 2015).

Nevertheless, e-solutions require taking on two fundamental challenges of e-participation in the Global South: the lack of partnership and collaboration across public, private and non-profit sectors (Ndou, 2004); and deficiency of e-readiness necessary for implementing e-participation initiatives.

Thus, some other e-solutions to motivate residents' waste separation behaviours should be considered in constructing effective environmental recycling processes and integrated solid waste management systems. As it was mentioned above, The 'Basura Cero' programme came across unexpected social behaviours that led into an incomplete implementation of the program in the short and mid-term. In order to motivate desirable behaviours around environmental-friendly policies, experts have acknowledged that individuals are not solely concerned with monetary incentives, but also non-monetary nudges associated to personal, moral and social norms (Abbott, 2012). E-readiness thus requires incorporating the necessary technical infrastructure, data systems, policy issues and legal environment, human capital and skills, and a supporting strategy to enhance the participation and cooperation processes of users and waste pickers in the waste management processes.

Indeed, regarding non-monetary nudges, several studies have found personal, moral and social norms are main predictors concerning intentions as well as determining behaviors towards waste separation (Zhan et al, Berglund, 2006, Oliver 2013). Particularly, Thøgersen (1996) reinforces the importance of social morals as well as emphasizes that social norms are more likely to be followed if a recognizable authority figure is the source of the social norm (Berglund, 2006), or if the impulses utilized appeal to an automatic cognitive processes (Oliver, 2013), namely an effective nudge.

Given this context, the MINGA project aims to develop a supporting strategy to enhance participation and user behaviours. The next section provides alternative insights on how to improve waste management systems while promoting social inclusion and environmental-friendly behaviours in Bogota. In doing so, the project first helps to reinforce social inclusion of waste pickers in Bogota by creating a bridge between recyclers and users. To do this, the model builds on the spread use of technology in Global South cities through an app that brings together waste pickers and city residents. Secondly, the project seeks to impact solid waste separation at the household level by incentivizing environmentally-friendly behaviours and city residents' awareness of these behaviours. This model draws on personal, social and moral norms and recognizes previous advances made in Bogota that have involved changes in citizens' behaviour. Therefore, the next section presents two main elements as follows:

- (1) a bridge between recyclers and users, and**
- (2) A recyclable schedule and street squares system.**

The next page includes an infographic with the expected impact of MINGA

Bridging recyclers and users' experiences

The MINGA App multi-platform mobile application system created to provide services of information, communication and up-to-date data on waste collection, waste separation procedures and improved recycling practices in Bogota. The MINGA project aims to approach some of the challenges stated above in the Bogota case, from a user's or stakeholder's (local and public authorities, private companies, Waste Picker Associations and any other actor related to IWMS) perspective, to underpin the potential benefits of articulating information and communication systems through mobile technologies. MINGA primarily is to be a platform that provides solutions from a user's perspective. In this sense, the main focus will be on the informational/educational, participatory and functional areas. From a stakeholder's perspective we will focus on two main areas where mobile apps can be applied: interactive communication, and m-administration. In the case of interactive communication, it is crucial to understand the necessity of articulating both stakeholders and users under common information sharing platforms. For m-administration, we expect this app to be a tool for waste pickers associations to keep updated data on geographical behaviours of waste production, separation and collection. Based on Mavropoulos (2015) typology of the different uses and services that mobile applications can potentially have in waste management systems, we will explain the features and benefits of MINGA.

SOLID WASTE MANAGEMENT



Current Scenario



Future Scenario
with MINGA

House



Unclassified
Disposals



Classified
Disposals



MINGA
app

Street



No relation
with the process



Waste Squares

New relation with the people
involved in process



Active communication-
with your Wastepicker



Lack of awareness of our
behaviour as citizens



Recycle assesment for neighbour-
hoods created by wastepicker

Statistics and Behavioural FeedBack

Conflict between formal and
informal providers



Organized Routes,
Schedules and picking hours

Schedules

Treatment
Plan

Inefficient Waste
Management Process



Increase volumen of recov-
ered material



USER PERSPECTIVE

INFORMATIONAL/EDUCATIONAL

These are applications that include “technical details, guidelines, sample calculations or even calculation tools. These type apps aim at creating spaces where information is fully available for all users” (Mavropoulos et al., 2015: 384).

Schedules and collecting points: MINGA will display updated information with regard to the times and places where recyclers will check and collect potential recycling material in the previously established points across the city. The system is intended to work both through mobile devices with GPS systems included, and analogue phones that receive location information through SMS.

Recyclable Items: as part of an educational process, the application will contain detailed information on the types of waste produced in households and its corresponding separation process, as well as the potential usage that the recycled waste has in different productive chains



INTERACTIVE/PARTICIPATORY

These applications are designed to use “bottom-up approaches and citizens’ participation. Through interactive applications citizens can send enquires, problems, comments or service requests in real-time to waste management authorities” (Mavropoulos et al., 2015: 384).

Creating Community - Recycling-friendly neighbourhoods: the application will encourage users to cooperate and actively communicate among each other through the platform. The idea is to create a space where users can share good practices in the recycling process through photographs, testimonials or frequently asked questions.

Direct contact with recycling cooperatives: the main added value of MINGA as a waste management and recycling application is the direct involvement of waste pickers as active agents in the transformation process; their role becomes that of facilitators, information distributors and solution providers. The users will have direct contact with the Recycling Cooperative and the recycler responsible for that area to coordinate eventual changes and specific requests to improve the recycling service.

USER PERSPECTIVE

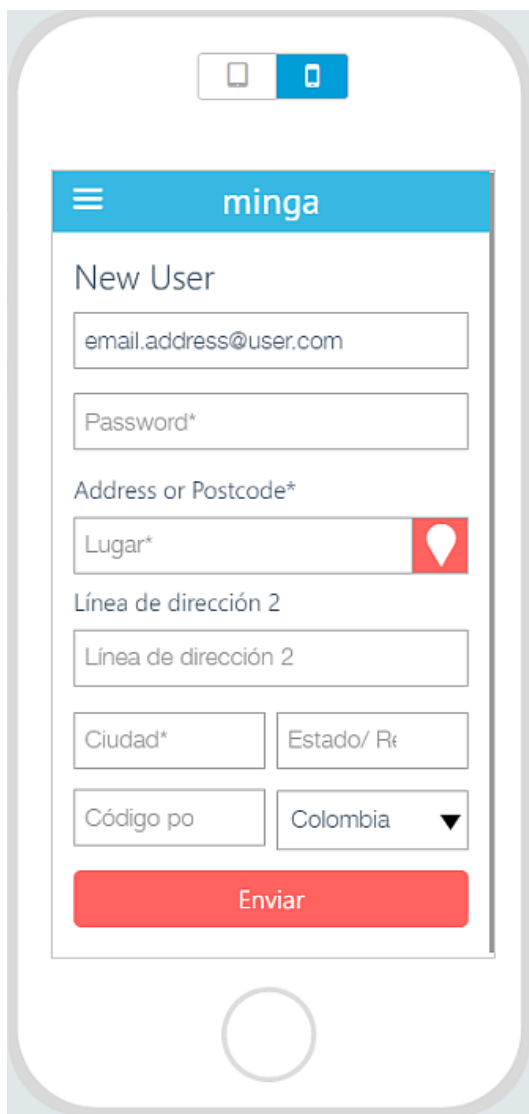
FUNCTIONAL

These applications “refer to tools that are designed to resolve specific waste management problems, for hands-on immediate solutions or estimations and they are mainly dedicated to professionals and decision-makers” (Mavropoulos et al., 2015: 384).

Collection Reminders: according to the area reported by the user, MINGA will be able to remind users on a daily and weekly basis of recyclers’ routes and collection times.

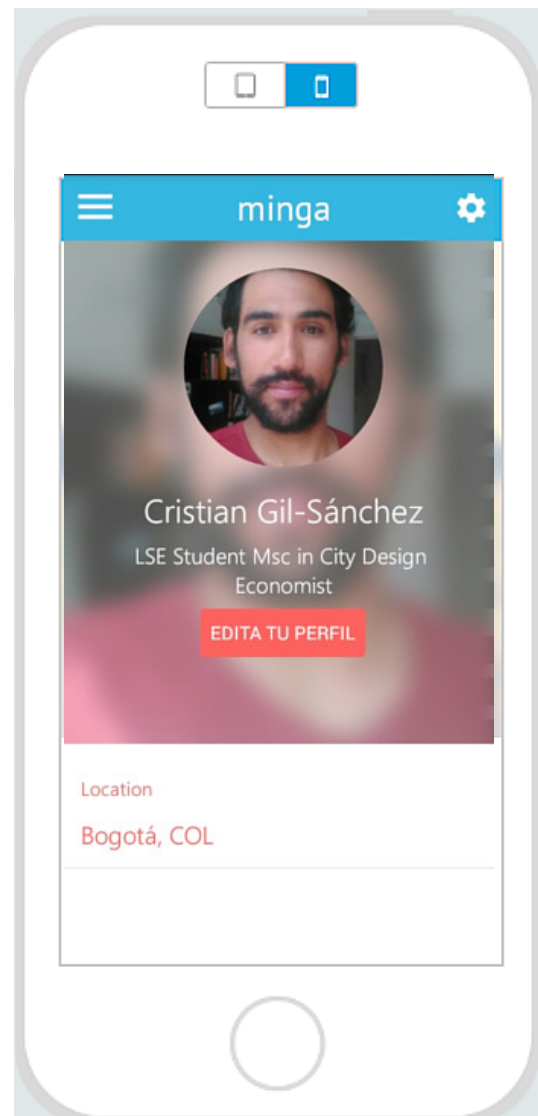
Recycling news and updates: the users will be provided with necessary information related to modifications in the waste collection processes, routes, schedules and even the recycling personnel from the cooperatives, to ensure a personalized and effective waste separation system.

Registration Form of a new user



The registration form is displayed on a smartphone screen. At the top, there is a blue header with the 'minga' logo and a hamburger menu icon. Below the header, the title 'New User' is centered. The form consists of several input fields: 'email.address@user.com', 'Password*', 'Address or Postcode*' (with a red location pin icon), 'Lugar*' (with a red location pin icon), 'Línea de dirección 2', 'Línea de dirección 2', 'Ciudad*', 'Estado/ R', 'Código po', and 'Colombia' (with a dropdown arrow). A red button labeled 'Enviar' is at the bottom.

Profile User



The user profile is displayed on a smartphone screen. At the top, there is a blue header with the 'minga' logo and a settings gear icon. Below the header, there is a circular profile picture of a man. Underneath the picture, the name 'Cristian Gil-Sánchez' is displayed, followed by the text 'LSE Student Msc in City Design Economist'. A red button labeled 'EDITA TU PERFIL' is positioned below the text. At the bottom, the location 'Bogotá, COL' is shown.

STAKEHOLDER PERSPECTIVE

M-ADMINISTRATION

It is of the interest of MINGA to create a platform where not only users but also service providers (in this case, waste pickers) can stay connected to the collection process from any sort of device. In this case, the application aims to provide up-to-date information about the collection records of the personnel involved in the process, the amounts of potentially recycled material. This is an opportunity for waste pickers associations not only to register data about their activity but also to evaluate their performance and elaborate strategies to improve the service and/or interaction with users.

• **Record of recyclers performance:** the application will serve mainly public and private waste management service providers, or more importantly, waste pickers' associations to track the routes assigned for weekly collection and control the time spent in the different collection tours.

• **Live collection statistics:** service providers will be able to register data of the collection spots in their assigned routes, associated with the amounts of potentially recyclable material, the levels of adequate waste separation and the performance of the blocks where waste is picked.

INTERACTIVE COMMUNICATION

When thinking about IWMS, "mobile devices can provide an important access channel for waste management authorities and citizens, and establish an interactive communication between these two entities. Without relevant information citizens are unable to form intelligent opinions and actions regarding issues such as active participation on recycling, clean up or collection activities" (Mavropoulos et al., 2015: 383). This is an opportunity for users to have updated information on the different changes associated to the collection process as well as for waste pickers,

associations to be able to provide feedback on the separation process happening within households.

• **Communication with users:** as it was explained from the users' perspective, the main intention of MINGA is to bring together the waste management experience of households and waste pickers. Through this feature, waste pickers will be able to send updates to households and neighbourhoods with regards to their waste separation activity (recommendations, reminders).

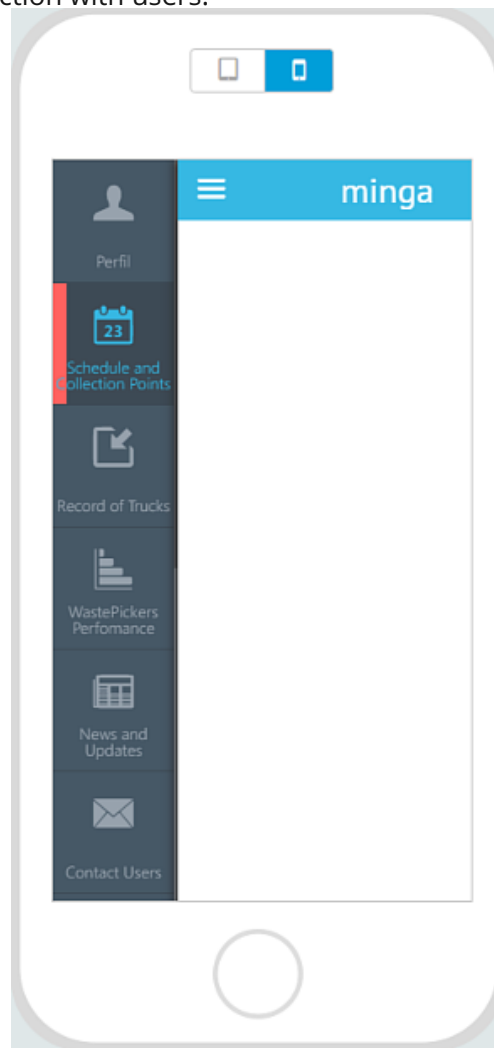




Figure1. Squares on the streets

HOW WILL WORK THE RECYCLING SQUARES?

A Recyclable Schedule and Yellow and Green Recycling Squares on the streets

As it has been mentioned above, in Bogota as well as in cities of the Global South, an adequate separation of organic and recyclable sorting at the households' level would allow not only the recovery of solid waste by composting and recycling but also the transformation of historic and cultural patterns regarding waste management (Barreira et al., 2008). Considering the initial attempt for separating organic and recyclable material conducted in 2012 in Bogota (See section 2), the model proposed in this study introduces an easier and more dynamic schedule while seeking to influence solid waste management that begins at the household level.

The 'Basura Cero' programme promoted a discourse of individual responsibility and responsiveness towards the environment; nonetheless, it omitted the scope of social norms and moral norms associated to place-related and environmental-friendly behaviours. On this matter, different field experiments on littering behaviour carried out by Cialdini et al. (1991) "showed the importance of distinguishing between, on the one hand, the individual perception of what other people think it should be done in a certain context or situation (injunctive norm) and, on the other hand, the individual perception of what the majority of others actually do in that context or situation (descriptive norm)" (Fornara, 2011:624).

PUT HERE

**RECYCLABLE
Material**

PUT HERE

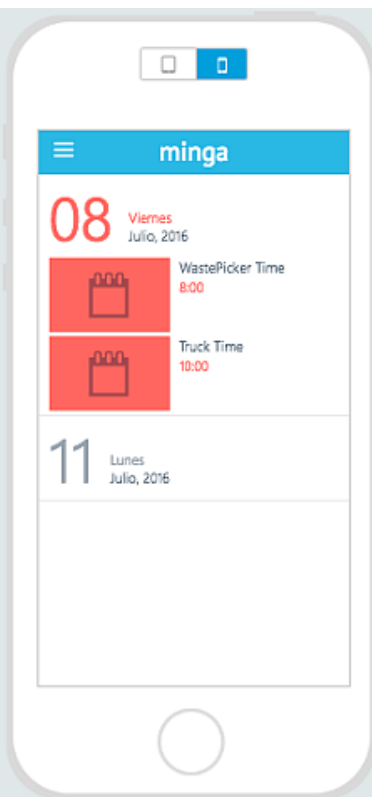
**ORGANIC
waste**





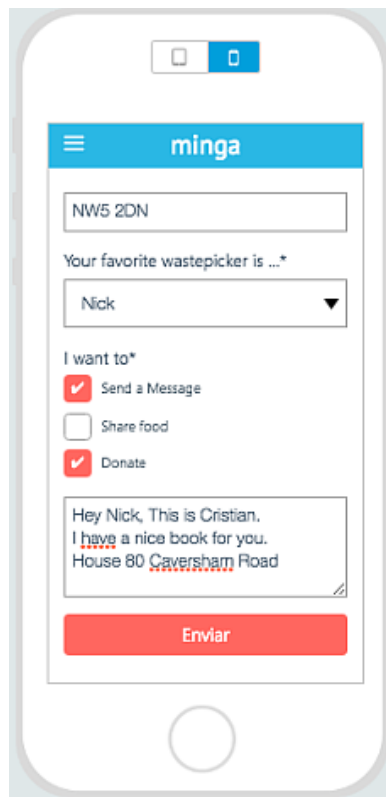
FOUR MORE KEY FUNCTIONALITIES OF MINGA

➔ Schedule



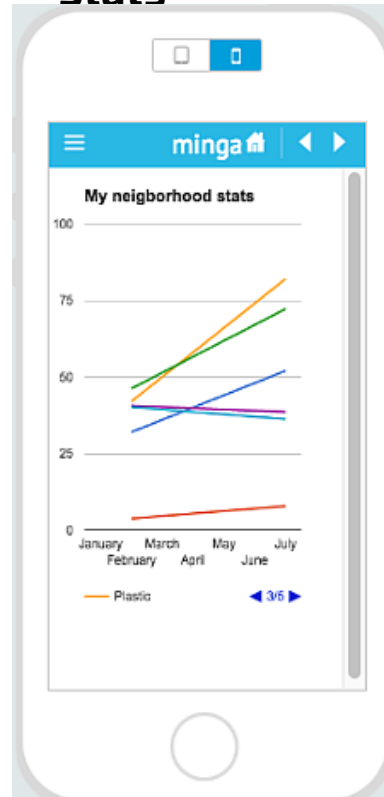
Reminders of the waste collection schedule.

➔ Waste Tricks



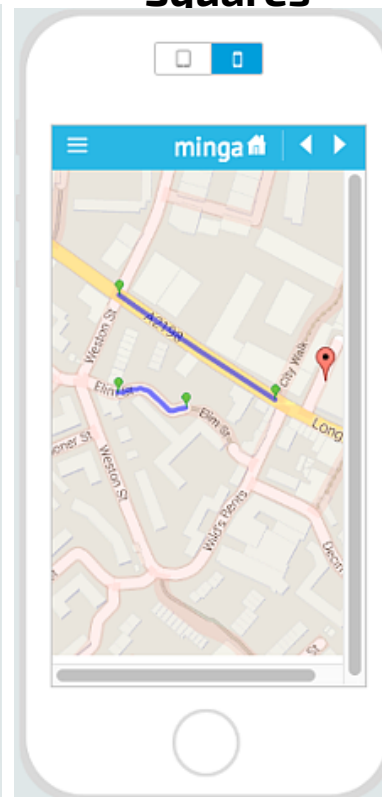
Easy contact between shareholders involved in the process.

➔ My neighborhood Stats

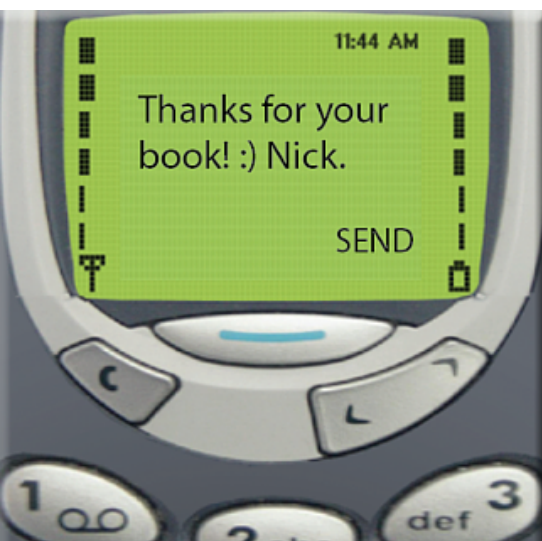


Access to Recycling Assessment created by the wastepickers.

➔ Recycling Squares

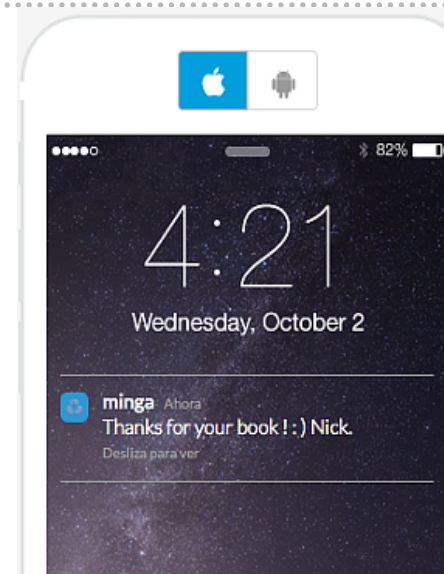


Easy access to all the Recycling Squares located next to the user's home.



➔ Direct SMS to Your Waste Picker

Multiplatform technology available for non-smart phones of wastepickers.



Building on the experience of Bogota regarding behavioural change policy-making such as “Cultura Ciudadana” program and the “pico y placa” system, the schedule schema designates specific and different days during the week for organic and recyclable sorting, respectively. Monday, Wednesday, Friday and Sunday are destined for Organic matter while Tuesday, Thursday and Saturday are for recyclable material (See figure 2). The schema suggests one more day for Organic rather than Recyclable matter due to the organic material’s decomposition time. This proposal seeks to cultivate, therefore, an environmentally-friendly culture in Bogota’s inhabitants while minimizing any additional burden when separating waste.

“Cultura Ciudadana” was a set of policies introduced in Bogota that look to encourage changes in behaviors within citizen culture. “Pico y placa” is a driving restriction policy aimed to mitigate traffic congestion. The system restricts traffic access into a pre-established urban area for vehicles with license plate numbers ending in certain digits on pre-established days and during certain hours

On the other hand, recognizing the social and environmental roles that waste pickers perform contributes to a wider understanding of a people-centred approach to development in the waste industry. As reported in the literature, the most common approach to modernization and development in the waste sector is financing and building of large-scale “infrastructure, privatization and mechanization, regardless of the impact these may have on the livelihoods of the urban working poor” (Dias, 2012: 13). However, by conceding waste pickers the rights to access, sort and recycle (Ruiz-Restrepo, 2008), a sustainable model of urbanization can nurture adequately

sustainable growth and development while coupling with people-centred development. Therefore, in enhancing the Bogota Municipality Plan to include waste pickers in the solid waste management system, this proposal can also positively impact waste pickers’ working conditions and efficiency. By separating wet and not-wet waste at the source level (households), the waste pickers’ activity to collect and sort waste can be facilitated by reducing time, allowing the amounts of ‘clean’ items to recycle to increase.

Figure2. schedules for collectors and waste pickers

Monday	ORGANIC SORTING
Tuesday	RECYCLABLE SORTING
Wednesday	ORGANIC SORTING
Thursday	RECYCLABLE SORTING
Friday	ORGANIC SORTING
Saturday	RECYCLABLE SORTING

Once household solid waste has been divided into organic and recycled materials, the separated waste material can be allocated in yellow and green squares that have been drafted on the streets (See figure 3 and 4). Following the same colours and schema of the schedule to recycle; the yellow squares are designed for recyclable matter while the green squares are destined for organic material. The allocation of the separated waste on the yellow and green squares drafted on the streets can be made by any member of each household or by residential and commercial buildings' security guards, as it has been done traditionally.

Although this proposal does not fully elaborate the educational campaign design, it acknowledges that pedagogical elements in stimulating the appropriation of the recyclable schedule and the use of the MINGA app and the yellow and green squares by Bogota inhabitant's impacts the proposal outcomes. Therefore, an educational campaign should take into account the follow elements related with the message:

- It must be clear to gain target's attention and the language used must be engaging.
- It must compel justification for personal motivation.
- It must focus on what can be gained and the potential losses of the activity's implementation. In doing so, the gaining can be framed in individual terms as well as the loss can be done under the perspective of social and moral norms.
- It must be precise, interesting, fresh and transmitted through several means taking into account different kinds of potential users such as young and adult people.

Various forms of media can be used to communicate the messages of the educational campaign such as radio, television, Internet, newspapers and social media. Additionally, experts argued that campaigns can be more effective when several ways of communication are used such as printed materials and formal and informal networks for information dissemination (Leonardi, Neely, Gerber, 2011), yet the program should take into account previous campaigns of behavioural change conducted in Bogota such as those related to 'Cultura Ciudadana' (Civic Culture). Indeed, it is important to acknowledge that it can be counterproductive to establish new educational behaviour campaigns without taking into account systems that already exist and patterns that are already incorporated in Bogota citizens' behaviours.



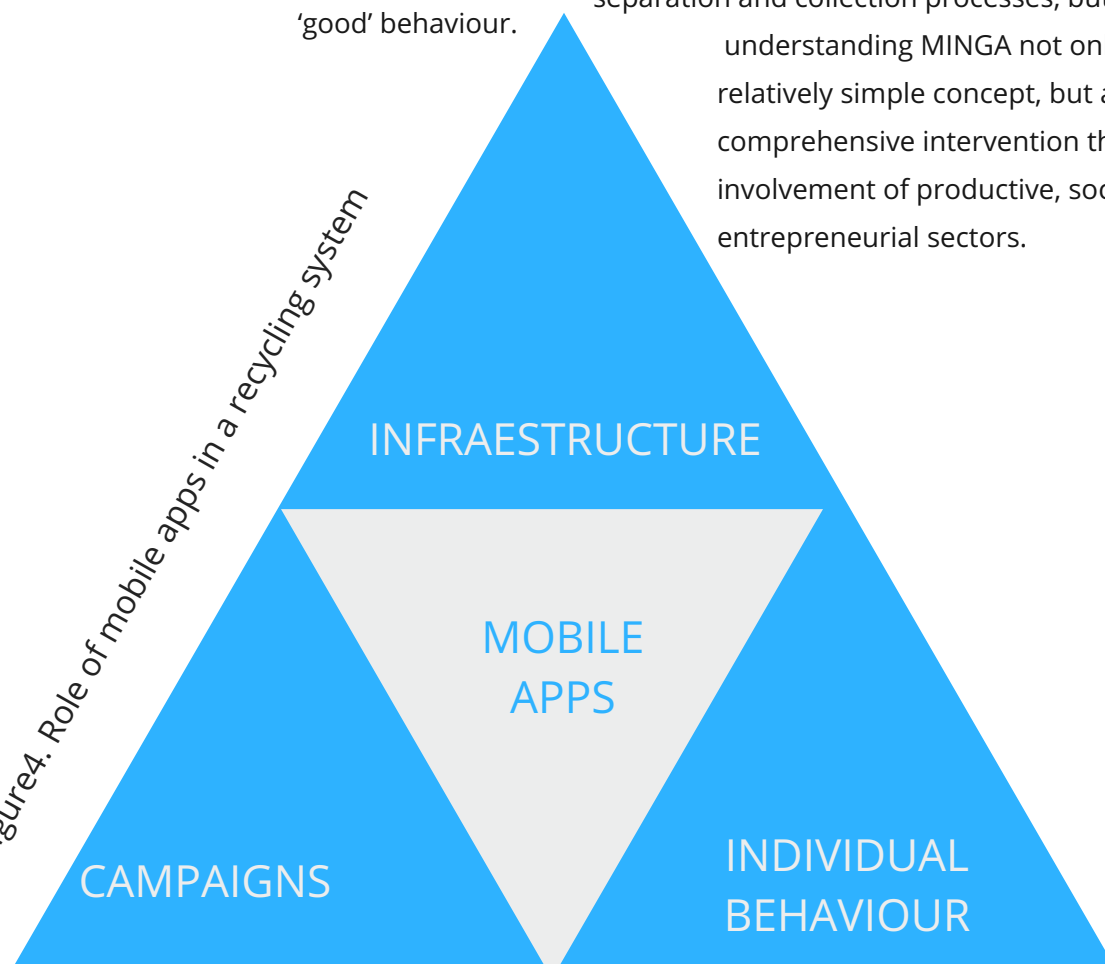
Last, but not least, an important element should be introduced in the educational campaign that involves the possibility of making visible recyclers' qualifications to neighbourhood households regarding waste separation into organic and inorganic materials and its disposal in the green and yellow squares. These qualifications will be classified in three grades as follows, and they will be also shown in the MINGA app:

- **Beginners:** when the neighbourhood do not adequately separate the waste produced and the waste is not well allocated in the yellow and green squares on the street. It will be given the red colour symbolizing a public 'disapproval' because of the 'bad' behaviour. •
- **Intermediate:** when the neighbourhood do not adequately separate the waste produced or the waste is not well allocated in the yellow and green squares. It will be given the yellow colour symbolising a public need of improvement because of the 'interest/commitment' behaviour.
- **Graduated:** when the neighbourhood adequately separate the waste produced or the waste is well allocated in the yellow and green squares. It will be given the green colour symbolising a public 'congratulations' for the 'good' behaviour.

Motivating residents' waste separation behaviours through an established and clear schedule helps in constructing effective environmental recycling processes and integrated solid waste management systems. Moreover, the possibility of making visible and public the squares and the recyclers' qualification based on each neighbourhood's behaviour, non-monetary nudges associated to personal, moral and social norms can be activated (Abbott, 2012). In other words, as it was mentioned before, non-monetary nudges that point out public 'un-proper' behaviours can help in changing intentions and pre-establish behaviours towards waste separation (Zhan et al, Berglund, 2006, Oliver 2013)..:

Mavropoulos et al.'s graphic (Figure 4.) is useful to understand the role of mobile apps, and compiles not only the benefits of a mobile solution to waste separation and collection processes, but also stresses understanding MINGA not only as a relatively simple concept, but a feasible and comprehensive intervention that requires the real involvement of productive, social and entrepreneurial sectors.

Figure4. Role of mobile apps in a recycling system



CHALLENGES FOR POLICY IMPLEMENTATION

Different obstacles exist or need to be considered and eventually addressed in order to provide an optimal ground for the project to be developed. In the first place, we consider that there is not enough understanding of the potential benefits that mobile solutions in the realm of waste management and recycling initiatives can bring. This situation, explained in the growing but still reduced market of opportunities for social innovations in Colombia, draws on the existing difficulties to acquire financial resources for research and engineering of the necessary systems that bring real results in improving the waste management sector. Moreover, there is a latent need to articulate funders, governments, financial institutions (Qiang et al., 2011), and most importantly, waste pickers and households need to agree on common points of cooperation to adequately implement the project. Without the proper articulation and involvement of stakeholders and users, MINGA risks being a residual solution to a difficult problem.

In the second place, Mavropoulos (2015) refers to the existing difficulties of implementing mobile solutions “in cases where smart phones are not used by a substantial amount of the population or in cases where both citizens and professionals may lack the means, knowledge and other capacities to utilize and develop such technologies” (Mavropoulos et al., 2015). However, after an assessment of the levels of e-connectivity and offline connectivity in Bogota (previously described in this document), we identified the potential of implementing MINGA as a tool to encourage a behavioural transformation in users through updated

information provision and personalized service. Simultaneously, from the waste pickers perspective, the use of a simple but illustrative set of data can significantly improve the service they are currently providing. At a global scale, we expect MINGA to also be a feasible solution, especially considering the current trends of connectivity and accessibility within mega cities in the developing countries. We expect the Bogota implementation of MINGA to be a successful model and a foundation for future waste management initiatives that are implemented through simple interventions and provide a substantive impact on people’s daily lives.

Finally, the most exciting challenge of MINGA is related to the design of the intervention under a standardised language not only in terms of data and information generated through waste collection processes in the app, but also in terms of the educational architecture that is required to make the process familiar to various users from different backgrounds. In the first case, this will allow different platforms –namely those associated to the aforementioned stakeholders, to cooperate, exchange information and be developed further in a way that responds to the specific needs of the context. In the second case, it is important to consider the different learning processes levels of literacy of citizens. Both the mobile application and the pedagogical tools related to the schedules and the waste disposal spots ought to be intuitive and developed under a simple system of words and symbols to guide users towards the adequate separation of waste and interaction with waste pickers.

It is important to consider that new recycling and waste management systems as well as public services provision have better chances of being effectively implemented if they entail a behavioural transformation in citizens and a recodification of social norms (Salah et al., 2011). Even if Bogota citizens are used to behavioural campaigns, there is the potential that they not appropriate the waste separation behaviour. The educational campaign as well as the motivation and social norms should be ready to be modified if the outcomes are not as desired. The local authorities and the project managers must take into account permanent ways to receive feedback and evaluate the project implementation. At once, it is crucial for the success of MINGA's implementation to design the technologic platform under a model that manages to motivate alternative behaviours in citizens towards better practices of waste separation. In this regard, the recent developments in mobile technology and the advent of the smart phones and "mobile applications seem to be one of the most promising methods/tools for delivering behavioural change interventions among different socio-economic groups" (Mavropoulos et al., 2015: 381)

PHASES OF PROJECT IMPLEMENTATION

- 1. Consultations with main stakeholders (public and private WMS providers and waste pickers' associations) to refine the application initiative and assess: it is important for the MINGA project's success to be understood as a holistic intervention that covers.
 - 2. Refine the online and offline software with mobile solution experts.
 - 3. Consolidate strategic alliances with stakeholders and potential investors.
 - 4. Project piloting in a number of neighbourhoods (to be defined according to initial investment resources).
 - 5. Institutionalise with local authorities the educational campaign for waste separation and the use of the application by households.
 - 6. Permanent project monitoring and evaluation.
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CONCLUSION

MINGA CONNECTS YOU WITH YOUR LOCAL WASTEPICKER

This project presents MINGA as an alternative insight on how to improve waste management systems while promoting social inclusion and environmental-friendly behaviours in Bogota. In taking into account problems associated with rapid and unplanned urban growth in developing countries such as the incensement in the levels of pollution, socio-economic exclusion and informal economies, MINGA underpins a kind of urbanization that effectively nurtures sustainable development.

MINGA, based on e-participation and behavioural transformation frameworks, seeks to generate a different social approach by households and citizens towards the culture of recycling and the socioeconomic links associated to the waste management chain. Although MINGA is designed to address the waste management in Bogota, Colombia, its potentiality resides in its replicability across Global South contexts that face similar challenges in constructing social practices towards inclusion of vulnerable and informal groups such as waste pickers and creating sustainable lifestyles in citizens.

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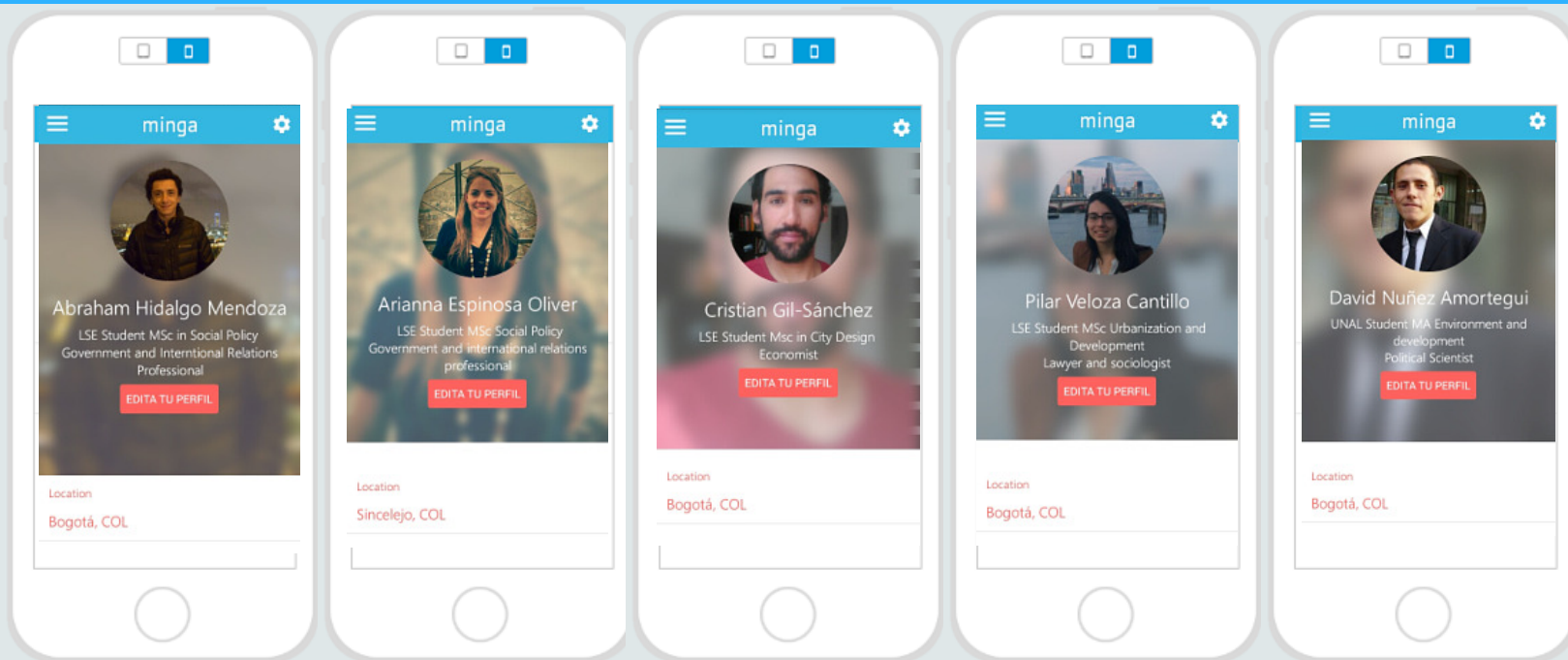
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#SOMOSMINGA



CHANGING
THE WORLD,
STREET BY
STREET



MADE IN LONDON