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# PROMOTING SUSTAINABLE SOLID WASTE MANAGEMENT: A CRITICAL ANALYSIS OF DEVELOPMENT SUPPORT COMMUNICATION INITIATIVES FROM DIVERSE REGIONS

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## ABSTRACT

This research paper provides a critical overview and analysis of development support communication initiatives implemented across various countries worldwide. The DSC project focused on inducing behavioral change to lead towards sustainable solid waste management practices are the main area of concern for this research paper. The study scrutinizes a total of 10 Development Communication Support (DCS) projects executed in diverse regions over the past decade (2013-2023). Five categories and coding framework is developed to analyze the contents of the selected DSC projects for this research study. The main categories include goals, communication strategies, stakeholders involved, behavioral change initiates and impact indicators. The analysis of the selected projects revealed that in many countries of the world, authorities are making use of advanced communication tools to bring sustainability in the solid waste management system. The analysis also helped in identifying that there is considerable shift in the communication approach of DSC projects concerning solid waste management as the behavioral change of citizens has become a main area of concern for the policy makers and authorities. The research paper concludes the DSC projects are significantly working on fostering behavioral change among the masses all over the world because the global community has realized that without active participation and attitude change of citizens, it is not possible to anticipate sustainability within the solid waste management systems. However, there is still need of giving more attention towards behavioral change among citizens and promoting waste sorting at user end to support recycling sector and organic compost practices.

**Keywords**: Sustainability, Development Support Communication (DSC), Solid Waste Management (SWM), Social Change, Behavioral Change

## INTRODUCTION

Development is a complex and multifarious phenomenon that requires integrated exertions and strategies (Heider & Flanagan, 2017). The role of communication in augmenting development process is widely recognized and social scientists believe that the designs of development plans must consider maneuvering human behavioral factors. This recognition is based on Quebral's explanation of concept of development support communication (DSC) which anticipates the progression of development through the circulation of meaningful information and knowledge among the masses (Adedokun, 2020). This transmission makes people aware and mobilized towards the attainment of development goals. Development Support Communication (DSC) assures efficient and effective participation and engagement of all the stakeholders in the development process. Lack of adequate communication can be a defining factor behind the failure of a development project. Therefore, it is imperative to integrate communication and its various types into the development plans because the broader purpose of mass media and all other means of communication is not merely the provision of information and entertainment, but all the communication channels possess great potential to act as device for inducing and monitoring social and behavioral change required for development (Agunga, 2022).

The importance of communication for development has widely been recognized across all sectors because it enables behavioral and social change through utilization of different strategies (Anshassi, Laux & Townsend, 2019). During the last few decades, industrial growth coupled with population upsurge has produced several challenging avenues for the global community. The volume of solid waste generated daily is rapidly increasing, and both developed and developing worlds are struggling to manage the towering solid waste (Kala, Bolia & Sushil, 2020). Social scientists are taking special interest in determining the potential of communication design in altering the behaviors of individuals and communities related to their solid waste management (SWM) practices. Debrah, Vidal &Dinis (2021) studied the effectiveness of communication as a tool to improve waste management system and found that if government or organizations want to bring sustainability within the waste management practices, it is imperative to formulate communication strategies to promote better practices within communities. The level of communication design effectiveness can play a critical level in determining the outcomes of the efforts aimed at improving waste management system. DSC projects can also work as a tool for policy advocacy which is essential for development goals (Garrison, DeLeon & Smedley, 2017). As Puri (2017) believes that it is high time that people must replace the convention belief about waste that it is 'just waste' with the belief that 'waste is a resource' now. The role of communication can play a vital role in changing the perception of all stakeholders about waste. The researcher lists out ways through which communication can be used as vehicle of change in solid waste management sector. Deepa, Subramani & Shaanvanthi (2020) advocate the use of traditional and new media integrated with face-to-face communication strategies to change the way society views waste. Based on this understanding, there have been several initiatives designed and implemented in different countries of the world to deal with the issue of solid waste management.

This research study presents overview of ten different development support communication initiatives that were implemented in different countries of the world during the last decade (2014-2024) with the objective of examining the effectiveness of communication in bringing behavioral change within the domain of solid waste management. The core objective of this research paper is to contribute to the ongoing discourse on sustainable development by providing a comprehensive examination of global efforts to induce behavioral change for sustainable solid waste management. The analysis of the selected DSC projects has been conducted to provide insights that can inform policymakers, practitioners, and researchers in refining future communication strategies for sustainable development goals.

**Literature Review**

Khatib (2011) noticed that the success of initiatives relating to solid waste management hefty depends upon the level of public awareness, participation, and engagement. Hence there is essential need to design and implement DSC projects in solid waste management sector that can foster behavioral change among the citizens who are the main stakeholders and major producers of the solid waste. Rapid growth of urban population over the decades has put immense pressure upon the solid waste management systems. In present time, it is not possible to manage solid waste without active and meaningful engagement of the citizens and thus, communicating sustainability messages to the masses is especially important for adequate solid waste management. Solid waste management has evolved as a pressing issue not only at local but at global level.

Kaza et al (2018) with reference to The World Bank report “What a Waste 2.0” explains that every living being is affected by the aftermaths of this growing problem. However, despite being intricately linked with the problem, the population all over the world is not adequately responding towards sustainability interventions. Debrah, Vidal & Dinis (2021) explain that solid waste management has a substantial role to play in the quality of life, especially public health in big cities. People often consider that solid waste management is the responsibility of the government and related authorities. But adequate management of solid waste is only possible when all the stakeholders including the public are also actively engaged in the process with complete responsibility. Sultana et al. (2021) identified the communication gap that exists within solid waste management systems, especially in the developing countries. The researchers believe that the primary generator of solid waste is the public, so the solution also requires their participation. As a result of communication gap between the public and government, solid waste is

often not adequately managed in many countries, The public policies also fail to fill the communication gap between the government and the public. It is, therefore, essential need of the time that the public and authorities must come on the same platform to resolve the problem of solid waste.

Iqbal et al. (2022) observed that solid waste management is an especially key area of concern for the developing countries like Pakistan. The government, however, never considers it as a high-priority area when allocating budget and other resources. Consequently, the waste remains mismanaged and draws detrimental impact upon the environment, public health, and economy. The dumping of solid waste at undesignated placed without segregation result in informal waste picking at multiple points. The households use to dump their waste in single bin which is handover to the garbage collectors in some areas whereas in some areas, there is no system of door-to-door collection and citizens commonly throw their waste at nearby streets or empty plots etc.

Due to lack of awareness among the citizens about the importance of waste sorting at their end, a substantial amount of recyclable waste becomes valueless. The researcher concluded that inadequate government policies coupled with the behavior of people and their careless attitude towards waste management practice is one of the major hurdles that block the path to sustainable solid waste management in the country.

Majid, Jamal and Asghar (2022) found that the solid waste is poorly managed in Pakistan due to which the waste has become a source of land, air, and water pollution. All over the world, there is an elevated level of mindfulness that effectively managed waste can help in generating revenues through recycling and repurposing. However, it seems exceedingly difficult in Pakistan because there is no proper mechanism of waste collection and disposal. Along with the growth of population, the amount of waste generated in the country is also mounting. There is a lack of planning and resources to tackle the increasing amount of waste and consequently, the waste has evolved into a critical problem being faced by the citizens in all the cities of the country. The researchers focused on the waste management crisis in Karachi and proposed that Zero Waste Strategy (ZWS) could help in solving the problem. The proposed strategy is based on the preposition that public behavior, recycling plan and reduction of waste can help in dealing with the waste management issue in the city.

Ojeda-Benítez, Carolina & Ysabel (2019) believe that the behavior of community members plays a key role in determining the waste related behaviors of a place. They observed that there are many individuals and households who keep their waste separated so that it could be reused and recycled. On the other hand, other people do not keep their waste segregated. This variation in public behavior is due to lack of awareness and information. People often do not realize the importance of segregation at source therefore, they do not engage in this practice. The problem of waste management could never be resolved until and unless the generators of waste learn to segregate their waste instead of throwing all types of material in the same place. The change in behavior is the key to sustainable waste management.

**Methodology**

This research is based on content analysis of ten DSC projects focused on solid waste management. The projects launched during last ten years (2013-2023) in different countries of the world are selected and labeled as P1 to P10. The data about these projects is collected through project reports, project websites, communication design and other relevant material. A coding framework is developed that consists of five predefined categories and relevant goals as shown in Table 1. The selected DSC Projects are analyzed according to these categories.

**Table 1**
*Categories and Codes for Content Analysis of selected DSC Projects*

| Category | Code |
|---|---|
| Goals | 1. Waste Reduction<br>2. Recycling Promotion<br>3. Public Awareness<br>4. Behavior Change<br>5. Policy Advocacy |
| Communication strategies | 1. Community Engagement/ Educational Programs<br>2. Legal framework disclosure<br>3. traditional media messages<br>4. Digital Media Campaigns<br>5. Technology Adoption (Applications, portal) |
| Stakeholder involved | 1. Government authorities<br>2. Waste collection companies.<br>3. Waste Collectors<br>4. Recyclers<br>5. Citizens |
| Behavioral Change Acts | 1. Waste sorting at user end.<br>2. Waste Self-disposal at designated sites.<br>3. Utilization of assorted color bins<br>4. Selling recyclables<br>5. Recycling/composting at home |
| Impact indicators | 1. Waste Reduction<br>2. Behavior Change<br>3. Community Engagement<br>4. Environmental Impact<br>5. Policy Influence |

**Findings and Analysis**

Different research reports, conferences proceedings, research papers, review articles, websites, and relevant materials were accessed and reviewed to prepare a list of 10 DSC projects concerning solid waste management implemented in different countries of the world during the period of 2013-2023. Following is the overview of ten DSC projects selected for this research study.

**P1 - SWM project in Yangtze Delta Region, China (2022):** The government launched sustainable solid waste management campaign in Yangtze Delta Region, China to promote sustainable waste management behavior among the masses. The authorities used mass media for publicity of the campaign and educate the citizens about waste sorting (Stanley, 2022). The authorities communicated through print and electronic media messages that the citizens are supposed to keep specific types of waste in respective bags. Along with mass media messages, the authorities also arranged for face-to-face awareness program and deployed supervisors at various waste dumping points. When the people come to throw their waste, the supervisors guide them about the proper placement of waste in the respective color bag. After one month of supervision and publicity, the collected waste was analyzed. The analysis of waste composition revealed that in the areas where supervision was available, the behavior of the citizens changed very positively. On the other hand, in the areas where publicity was done but no face-to-face supervision and guidance was provided, the behavior was not changed significantly. The supervision was withdrawn from the areas after one month and the waste was reanalyzed. The second time analysis revealed that in the absence of supervisors, the citizens revert to their previous behaviors and practice and very few continued the practice communicated to them through publicity and supervisors earlier. It implies that integrated use of

multiple channels of communication is mandatory to bring sustainable change in the behaviors of the citizens. One side communication through mass media is not effective enough to bring long term change until and unless it is supported by participatory communication strategies like on spot supervision (Li et al, 2022).

**P2- ZOATAKA - Mobile App based SWM Project launched in Tanzania (2022):** A mobile phone based SWM project was launched on pilot basis in a district of Tanzania. It was aimed at improving the practice of solid waste management and finding avenues for revenue generation. The project application has three interfaces including user interface, waste collector interface and municipal official interface. The app brings all these three stakeholders to a single platform for smooth operations. The users can request the service of waste collection from their place by creating an account and adding their location on the app. They can also make the payment through the app for the service. The waste collector upon getting the service request and payment through the app can see the location of the user to manage their operation accordingly. They can also generate bills for the users and address the complaints raised by the user. The municipal officer manages the entire operation starting from service requirements to the resolution of the complaints raised by the users. They make sure that the work is conducted smoothly, and the issues are resolved in a timely manner. Additionally, they also have the record of revenue generated from the service fee paid by the users and the figures related to the waste collected by the service providers. The model was developed and evaluated in the target area by onboarding the households, waste collectors and municipal officials. The system was run on a trial basis to evaluate the functionality of key modules. The mobile app successfully passed the evaluation test. It was revealed that all the stakeholders were satisfied with the processes offered by the app including user verification, news, notification alerts, service request, payment process, complaints, and accessibility by all three types of application users (Hussein, 2022).

**P3 - Pick My Plastic – SWM App launched in Karachi, Pakistan (2022)**

Pick My Plastic is a real-time location-based smartphone application launched in selected areas of Karachi in 2022. The app aims to optimize the collection of plastic waste from the household and commercials users without letting the plastic become part of garbage. The application allows the users to select time and day for the pickup of their waste. Additionally, the users can also drop their plastic waste at the locations mentioned in the app as drop-off points. It is based on a reward mechanism. When the user handovers the plastic at drop-off points or gives them to the collection team, they get some points according to the weight of the plastic waste. The app offers bank transfer, vouchers, and discounts that the users can avail to redeem the points they get in exchange for the plastic waste. The app is a communication platform between the users and administrator who runs a plastic recycling facility in the city. The users register with their location, name and mobile number and become part of the system. The application allows the users to schedule a pickup of their plastic waste. The users must take a picture of their waste and upload it on the app. They also must mention the type and quantity of the waste that they want to be picked. The more plastic waste users collect and handover, the more points they get. The points are added to the user account every time they give waste to the collector or drop it at designated locations. The users can avail different vouchers and discounts, or they can ask for cash through bank transfer when they want to redeem the collected points (Rizwan, 2023).

**P4 - 3R campaign in Iran (2019):** The 3R campaign launched in Iran targeted households and convinced them to sort their waste instead of dumping it in single dustbin. The campaign also included students at primary school in Iran. The campaign aware the households that through segregation of waste they can not only support the recycling processes, but they will also be able to use organic or kitchen waste for the composting purpose. To spread awareness about the significance of sustainable waste management practice, the campaign included a variety of communication channels and tools. The messages were transmitted through posters, brochures, and social media posts. In this way, communication design helped in reaching the target audience and the benefits of waste segregation at user end was

conversed to them. This helped in changing the behavior of the household and the campaign concluded with positive outcomes, reporting that some households in the target community adopted the practice of waste sorting at their homes (Rupani et al, 2019).

**P5 - AAKRI – Waste Management Application based SWM Project Launch in Kerala, India (2019)**

The AAKRI App was launched in Kerala, India in 2019 by a startup working for bringing environmental sustainability. The purpose of the app is to provide households with a system through which they can segregate the waste and prepare it for recycling instead of dumping in the landfill sites. The application connects the users with the AAKRI team. The users can register with their basic information and location to become part of the system. When the users want to handover the trash, they can contact the team through an app to fix a time for trash pickup. The team visits the users at the decide time for the pickup of their waste. The team segregates, weighs, and enters the details of the waste in the app. The rate chart included in the application provides an estimate of the value of the trash handover by the user. After the team enters the trash details, the application generates an invoice talking about the amount payable to the users in exchange for their trash. The team member makes the payment on spot and the waste is transferred to the recycling facilities that have collaborated with AAKRI team (Shah, 2022).

**P6 - Municipal Solid Waste (MSW) classification policy in China (2019):** The government implemented Municipal Solid Waste (MSW) classification policy in China in 2019. The policy came into effect in 2019 and Shanghai was selected as the first city to launch the plan on pilot basis (Zhou et al, 2020). As per the policy implemented by the government, the citizens were made aware about the importance of waste segregation. They were trained to classify and handover the waste in four different portions including recyclables, hazardous, wet, and dry. The municipal corporation set up new waste collection units across the city where four assorted color bins (red, blue, black, and brown) were planned, and the citizens were required to throw the waste in respective bins only. The unclassified waste was not collected from the citizens, so they were left with no other choice but to keep their waste sorted as per the given classification. The citizens were also trained to maintain the schedule for throwing waste at designated places only otherwise they must face hefty fine for violation of rules. The authorities deployed volunteers at all the waste dumping units to assure that the households get proper information and training to put the waste inside the correct bin. Eventually, the city reported that the system helped in recycling 5600 tons of garbage daily in 2019 which was five times higher as compared with the waste recycled in 2018 (Yang et al 2020).

**P7 - PAC Waste Tracker introduced in Bengaluru, India (2017)**

In Bangalore, India the Public Affair Center (PAC) launched a Waste tracker system to keep systematic record of the waste collection from different areas of the city. The application was built with the intention to work on citizen science and visual mapping to identify the issues related to waste management in Bangalore. The core objective of the application was to monitor the waste collection and treatment operations by building a connection between the citizens and municipal officials. The users can register with their name, mobile number, and location. Once the user logs in, they can answer the questions about the waste collection from their houses daily. This information includes the time of waste collection and the procedure adopted by the waste collectors. The app also collects information if the garbage collectors collect the waste in segregated form or if all type of waste is dumped together. Moreover, the users can also inform about any problem faced in the waste collection process. The application was launched on a trial basis and remained functional for 9 months. During this time, the application helps in collecting data about the time, procedure, and problems in relation to waste management practice in Bangalore. It was unveiled from the data collected through the app that the waste management system is poorly managed in the city. The waste collectors often do not collect the waste at regular intervals. The citizens or the waste collectors never segregate the waste due to which all types of waste material are dumped and wasted. The data also show a high number of complaints and non-compliance issues indicating the need for major reforms in the existing system (Nagendra, Lakshmisha & Agarwal, 2019).

**P8 - KITAR – Mobile App for E-Waste Recycling launched by MCMC, Malaysia (2017)**

Malaysian Communication and Multimedia Commission (MCMC) launched mobile application for e-waste recycling in 2017 that was rebranded at KITAR in 2022 (Bernama, 2022). The objective of this app is to provide a mechanism to the households through which they can handover their e-waste to registered sellers only. The initiative prevents e-waste dumping with other types of waste that eventually causes air and land pollution. This mobile application enables users to perform tasks of scanning of the electronic equipment they have at home and no longer using. It uses the location map to find out the collection center nearest to their place and share the details of their items on various social media platforms. The application not only connects the users with the buyers of e-waste but also works to increase the sense of responsibility among the citizens about adequate handling of their waste. The application connected waste generators, authorized waste collectors and administrators on a single platform. The project works under the slogan 'Kitar – Old Device, New Breath' that communicates that the core objective of the program is to use technology for the promotion of recycling practice by engaging the generators of the waste. The launch and functioning of this application are an attempt to align with the Sustainable Development Goals (SDGs) communicated by the United Nations. The government claims that the program successfully collected and disposed/recycled 4.7 metric tons of waste with the cooperation of all stakeholders (Azmi et al, 2020).

**P9- SWM project in Ga Mashie, Ghana (2014):** A solid waste management project was launched at Ga Mashie, which is a community in Ghana. In the beginning the community waste was analyzed, and figures were collected to estimate the number of recyclable materials that the households can save and handover to the recyclers rather than throwing and dumping in the garbage. The community was then trained to keep the waste separate as per type of material through different community programs, sessions and print media messages (flyers and posters). The evaluation phase of the project shows that the community can turn the waste into a potential source of income by selling the plastic, paper and metal that is thrown in the garbage otherwise because after the community engagement programs there was significant reduction recorded in the overall volume of solid waste. Moreover, the recyclers earlier found in the dumped waste also reduced significantly. The project implemented in the Ga Mashie community helped in discovering that a considerable proportion of waste could be prevented from being part of the waste by identifying it as recyclable in the first place (Owusu, 2014).

**P10- Social Marketing SWM Campaign in Mexico (2014):** A nongovernmental organization in collaboration with related authorities launched a social marketing-based campaign relating to SWM in Mexico. The campaign was aimed at promoting sustainable waste management. The campaign was based on community based social marketing in which awareness sessions were arranged to make people aware of the importance of 3R (Reuse, Recycle and Reduce). The campaign was launched at university level and used a variety of communication channels including awareness programs within the community, door-to-door visits and meetings, brochures, posters, and social media content. The campaign made people realize that they can take an active part in environmental sustainability by making positive changes in their own behaviors and practices. The project ended with the conclusion that waste segregation practice is especially important for sustainable solid waste management and requires the utilization of multiple communication methods for promotion among citizens (Carolina et al, 2016).

**Discussion**

Table 2 presents the analysis of the selected DSC projects (P1-P10) according to predefined categories and codes.

**Table 2**

*Categorization and coding of selected DSC projects*

| | Goals | | | | | Communication strategies | | | | | Stakeholder involved | | | | | Behavioral Initiatives | | | Change | | Impact indicators | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Codes** | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** | **1** | **2** | **3** | **4** | **5** |
| P1 | x | ✓ | ✓ | ✓ | x | ✓ | x | ✓ | x | x | x | ✓ | ✓ | x | ✓ | x | ✓ | ✓ | x | X | ✓ | ✓ | ✓ | ✓ | x |
| P2 | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | x | X | ✓ | x | ✓ | x | x |
| P3 | ✓ | ✓ | ✓ | ✓ | x | x | x | x | ✓ | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | X | ✓ | ✓ | ✓ | ✓ | x |
| P4 | ✓ | ✓ | ✓ | ✓ | x | ✓ | x | ✓ | x | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | x | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | x |
| P5 | ✓ | ✓ | ✓ | ✓ | x | ✓ | x | x | ✓ | ✓ | x | ✓ | ✓ | ✓ | ✓ | x | x | x | ✓ | ✓ | ✓ | x | ✓ | ✓ | x |
| P6 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| P7 | ✓ | x | ✓ | x | ✓ | x | x | x | ✓ | ✓ | x | ✓ | x | ✓ | ✓ | x | ✓ | x | x | X | ✓ | x | x | x | x |
| P8 | x | ✓ | x | ✓ | ✓ | x | ✓ | x | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | x | x | X | x | ✓ | ✓ | ✓ | ✓ |
| P9 | ✓ | ✓ | ✓ | ✓ | x | ✓ | x | ✓ | x | x | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | x | x | ✓ | ✓ | ✓ | ✓ | ✓ | x |
| P10 | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | x | ✓ | x | x | ✓ | x | ✓ | x | ✓ | ✓ | ✓ | x | x | X | ✓ | ✓ | ✓ | ✓ | x |
| Total | 8 | 9 | 9 | 9 | 5 | 6 | 2 | 5 | 6 | 5 | 4 | 8 | 9 | 8 | 10 | 6 | 5 | 3 | 2 | 4 | 9 | 7 | 9 | 8 | 2 |

The researcher defines five categories defined for the analysis of the content of selected DSC project and constructed five codes for each of the five defined categories. The analysis of these projects according to these categories and codes is as follows:

**Goals:** First, the goals of the selected projects were determined. Table 2 shows that the DSC projects have major focus upon waste reduction, recycling promotion, public awareness, and behavioral change as 8 to 9 out of ten project mechanisms were based on the objective of achieving these goals. This is an incredibly positive sign that the projects are targeting citizens and are working to raise awareness among the masses that they need to play an active role for the improvement of the SWM systems. Without giving importance to these issues, a sustainable SWM system cannot be achieved. However, a crucial element which is policy advocacy is considered by half of the project whereas the other five projects are not working for it. Policy advocacy is an especially essential element to consider while setting the goals and objectives of a DSC project because it can influence the policy makers and their decision-making process. It can put pressure upon the authorities to formulate adequate policies and immediately address the issues affecting the development process (Garrison, DeLeon & Smedley, 2017). Unfortunately, despite the need to focus upon policy advocacy the projects merely put all efforts on waste reduction, awareness, and behavioral change only. Without adequate policies and authorities' involvement, it would not be possible to bring sustainability in the solid waste management system only through public awareness and behavioral change. Although these goals are especially important but these need to be backed by policy framework also. Therefore, lack of focus upon policy advocacy is a weak area found in the selected DSC projects and it is essential that the projects formulated in future must give considerable importance towards influencing the policy making process as well.

**Communication strategies:** The communication strategies adopted in the selected DSC project are diverse in nature. The coding of the project contents shows that over the year, there is more inclination towards the use of advanced communication technology methods like digital media campaigns and smart phone applications in SWM projects.

Community engagement programs have the tendency to influence the behavior of community members (Adedokun, 2020) and six out of ten projects conducted activities for community engagement and education. Similarly, the realization about the importance of traditional as well as digital mass media campaigns and messages is clearly visible in the communication strategies adopted in these projects. The use of advanced communication technology in form of smartphone application is also a positive indication that the communication experts are giving importance to advancements in the communication field as well and they are using new and advanced means to reach people with the development messages. The missing elements in the communication strategy in these projects is the disclosure of legal framework. As discussed in the analysis of project goals, the selected DSC projects lack policy advocacy. Eventually, there is little attention towards the legal framework as well and just two out of ten projects have included the disclosure of legal framework in their communication design. The legal framework, policies and laws can play an amazingly effective role in keeping the citizens on track regarding their SWM practices. But these projects do not consider the importance of legal framework. Therefore, neither they have the goals of policy advocacy, nor do they talk about the legal framework to convince people about sustainable practices and making them aware about the consequences of inadequate actions.

**Stakeholder involved:** The main purpose of DSC projects is to bring all stakeholders together and exert combined efforts towards the attainment of development goals (Owusu, 2014). The developers of these projects effectively worked to unite the stakeholders of SWM system through their projects. All the projects have a focus upon the citizens and these projects have developed platforms where the citizens interact with recyclers, waste collectors and companies operating in the field. The government who is major stakeholder in the entire process is not involved in six out of ten projects and this lack of government involvement can have a major impact upon the success and functionality of these projects in the long term. Solid waste management requires huge infrastructure and policy implementations that it is not possible to run any project relating to SWM without the support, engagement or participation of the government and authorities. It implies the projects under discussion have a major flaw in terms of noninvolvement of government in their mechanism.

**Behavioral Change Initiatives:** Bringing positive change in the behaviors of the citizens relating to their SWM practices is a major requirement of today's world (Debrah, Vidal & Dinis, 2021). Without this citizen positive behavior, the authorities cannot manage increasing volume of solid waste. Table 2 shows that there are diverse types of behavioral change initiatives that the selected DSC projects intended to promote among the citizens. The focus of six out of ten projects upon promotion of waste segregation practice among the citizens whereas five projects also attempted to convince citizens to drop their waste at designated sites. The use of colored bins is however, proposed in three projects only. Use of sorted color bins is an effective way to keep the waste segregated. Although six projects convinced people to segregate their waste but only three suggested the use of colored bins. Similarly, the projects do not suggest the treatment of organic waste at home which is a major source of land and air pollution. Composting with the help of kitchen waste can significantly help in reduction of solid waste volumes (Agunga, 2022). but this element is missing in eight of the projects and these projects do not provide any solution to the kitchen waste which is a major component of the solid waste generated at household level. It shows that an essential element is missing in these projects and there is need of redesigning the project by adding the call for behavioral change with the suggestion of using organic waste for composting. Similarly, the use of color bags or bins and selling the recyclable items to the recyclers are also two important initiatives that the DSC projects need to add in their communication strategies.

**Impact indicators:** There are varied factors that determine the effectiveness of a DSC project depending upon the goals set for these projects (Adedokun, 2020). In this study, the researcher used impact indicators including waste reduction, behavior change, community engagement, environmental impact, and policy influence to examine the effectiveness of the selected DSC project. It has been revealed from Table 2 that nine out of ten projects successfully exhibited the outcomes in terms of waste reduction and community engagement. seven projects claimed that

a change in behavior of the individuals occurred because of their intervention whereas eight projects also show positive results in terms of environmental impact. Only two out of ten DSC projects claimed to draw policy influence. This is because policy advocacy was not in the agenda of other eight projects. These projects did not talk about legal framework and the government was also not engaged in eight of these projects. Based on these facts, it was obvious that the projects will not be able to bring any impact in terms of policy influence because the mechanism of these projects did not cover this area adequately. Hence, the negligence of this key area makes the impact of these projects extremely limited, and it is imperative that the project planners and policy makers must give due importance to policy advocacy and legal framework by including government in these projects.

## Conclusion

The research paper presents the overview and analysis of ten SWM related development support communication projects implemented during 2013 to 2023 in diverse regions. The analysis of the selected projects according to the predefined categories revealed that the DSC projects are effectively working for waste reduction, environmental sustainability, and behavioral change through community engagement. These projects have utilized diverse communication channels including traditional and advanced communication means to reach the target audience and stakeholders. However, the analysis shows that these initiatives are more focused on citizen behavior and community engagement while they give less importance to government, policy advocacy and legal framework disclosure. In the field of solid waste management, focus upon community and their behavior is a mandatory requirement but in the absence of government input, cooperation and policy support it would never be possible to bring sustainable change in this area. Hence, the analysis of these projects identified critical need of focusing upon legal framework, policy advocacy and working alongside government and related authorities.

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