HARVARD Kennedy School
Building State Capability

CASE STUDY C-015

Using PDIA to Improve Waste Management in Amman[1]

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March 2025

In early 2022, Omar Arabiyat, the Head of the Department of Environmental Studies for the Greater Amman Municipality (GAM), recognized an opportunity to transform Amman's waste management system amid the city's rapid growth. With the population reaching 4.5 million, GAM faced the challenge of adapting its waste management to meet increasing demands. Existing collection routes required optimization, and enhanced coordination between departments was necessary to improve efficiency. Managing waste across 22 districts with a workforce of 20,000 civil servants, GAM handled approximately 3,000 tons of solid municipal waste daily—half of Jordan's total. While administrative processes are complex, he saw this as a critical moment to introduce innovative solutions, streamline operations, and drive meaningful reforms to enhance sustainability and service delivery.

When the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) proposed using Problem Driven Iterative Adaptation (PDIA) to confront these challenges in 2022, as part of the Solid Waste Management in Jordan (SoWas)[3] project funded by the German Federal Ministry of Economic Cooperation and Development, the suggestion emerged from clear evidence of systemic problems. With advice from the German Institute of Development and Sustainability (IDOS) and Technical University of Darmstadt, GIZ suggested trying PDIA as a different way forward. This proposal was met with some initial skepticism illustrating one of the key challenges the initiative would face: resistance from officials to trying out a new reform method, particularly given their experience with previous approaches. While Omar and his team were excited to try PDIA to address what they saw as a critical constraint - long process and decision-making timelines - some employees and managers who had lived through the earlier reform efforts would need to be convinced of PDIA's added value, requiring significant effort to help them understand how its emphasis on iterative learning, stakeholder engagement, and data-driven decision-making could overcome the entrenched problems they faced.

Ultimately, the experience of implementing PDIA would demonstrate a crucial lesson. While an agile and participatory approach like PDIA can be challenging to implement in any hierarchical and complex bureaucratic system, meaningful results are possible where there is openness to new methods and strong support from leadership. After approval by His Excellency (H.E.) the Deputy City Manager and directors, the plan finally took shape after confirmation by H.E. the Mayor of Amman and H.E. the City Manager. The authorization process highlighted the importance of building and maintaining leadership. All team members would later agree that having senior leadership backing the initiative made a crucial difference. Osama Abu Rumman, Head of the Environment Department, said that the "commitment of the mayor and city manager to attend PDIA meetings was instrumental, showing the administration's serious support and boosting

team morale." The team utilized several effective strategies for maintaining this leadership. They prioritized regular presentations to the City Manager and Deputy City Manager, documenting progress and demonstrating key improvements at each stage.

The Problem

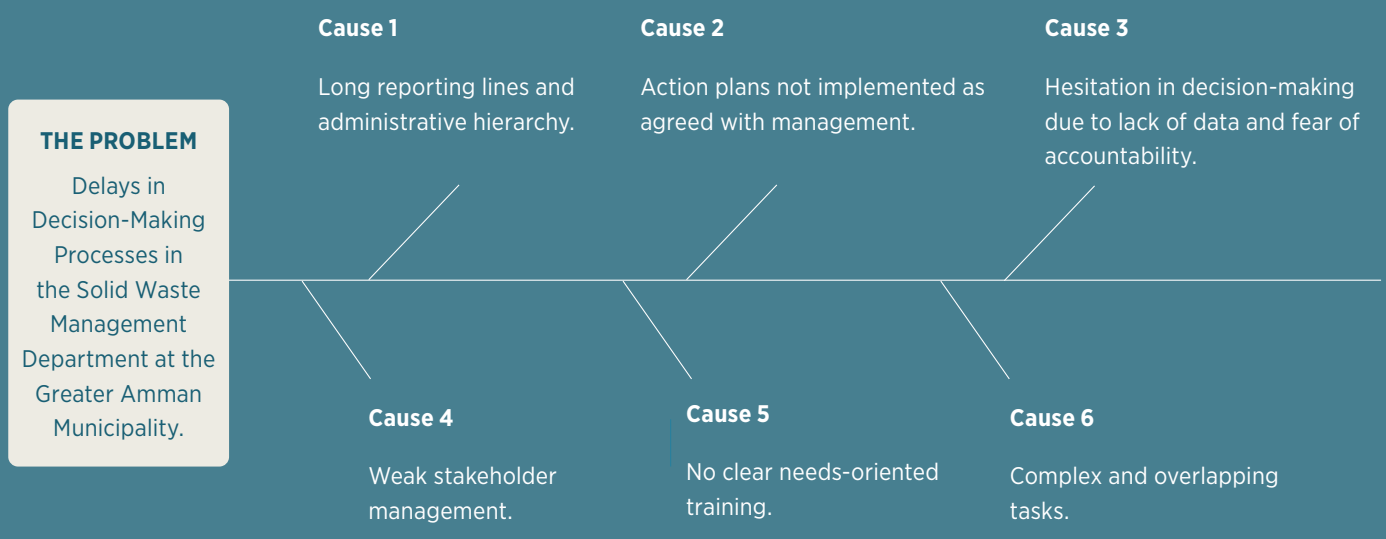
The challenge of waste management in Amman was significant. Studies show that the city generated approximately 0.81 kg of municipal waste per person per day, totaling approximately 1,212,878 tons[4] in 2022. While this was lower than the regional average of about 1.1 kg per person per day in the Middle East, Amman's rapid urbanization meant the total volume was growing faster than existing systems could handle. Meanwhile, GAM faced multiple interconnected operational challenges. While insufficient data and routes were a serious issue, the problems ran much deeper. Operational teams not only lacked accurate information about container locations and collection schedules, but also struggled with fragmented decision-making processes, unclear lines of authority between districts, and limited coordination between the various departments involved in waste management. The Environmental Studies Department might plan one approach, while district operational teams followed different practices, and the tendering department worked on parallel solutions, all without effective mechanisms to align their efforts. This resulted in inefficient routing, duplicated efforts, and significantly higher operational costs across the waste management system.

A survey conducted at a workshop at the start of the PDIA process in August 2022 revealed troubling disconnections within the organization. Despite their important role in waste management in Amman, 66.6% of relevant staff reported having little to no previous involvement in waste reform efforts. No respondents had led reform efforts in the sector. Meanwhile, more than half of the respondents saw mixed success or more failures than successes in past waste management reforms in Amman. This disconnect between departments and the lack of data demonstrated the difficulty in implementing effective reforms.

Building the Team and Constructing the Problem

In August 2022, Omar and the GIZ team organized a 4-day workshop with 30 representatives from 12 departments, incuding Environmental Studies, Geographic Information System (GIS), Training, Tendering, among others.. Using PDIA tools like the fishbone diagram, the group worked through problem construction and deconstruction. They first established why their problem was important: long processes and ineffective decision-making were hindering GAM's ability to manage waste for all residents. The costs were financial and environmental.

FIGURE 1: SIMPLIFIED VERSION OF FISHBONE DIAGRAM



Through intensive working sessions and debates, the group identified six main root causes:

1. Long reporting lines and administrative hierarchy
2. Action plans not implemented as agreed with management
3. Hesitation in decision-making due to lack of data and fear of accountability
4. Weak stakeholder management
5. No clear needs-oriented training
6. Complex and overlapping tasks

Following the workshop, participants expressed both enthusiasm as well as uncertainty about the path forward. The collaborative analysis had helped them better understand their shared challenges, but people still wondered whether the new approach would help to overcome entrenched systems. The initial survey showed that no single participant viewed previous reforms as "very successful," highlighting the magnitude of the challenge and the need for a new approach. Despite mixed reactions, the energy and insights generated during the workshop convinced the leadership to move forward.

Through this collaborative problem analysis process, departments that had rarely worked together began identifying shared challenges and potential solutions. As Rama Aladwan, a Chemical Engineer in the Department of Excellence of Institutional Excellence in GAM, noted: "[D]ifferent departments worked together to [hasten] the process and … make quicker decisions and [find better] solutions."

The collaborative problem analysis process yielded several important early lessons. Omar reported: "For example, using the fishbone diagram in the SoWas project and other projects has helped support GAM in streamlining procedures. Through brainstorming sessions with other departments in the Task Force, we were able to identify problems and challenges that affected interdepartmental work. In our workshops, we analyzed these issues and found solutions. It was truly a group effort."

PHOTO 1: THE FIRST PDIA WORKSHOP IN 2022

The process clarified how PDIA's emphasis on using local resources and existing systems was key to solving complex challenges. Unlike many donor-funded projects that may rely heavily on outside experts, PDIA encouraged the Task Force to leverage existing personnel, expertise, knowledge, and resources while working within and through existing systems and networks. Task Force members did almost all the work themselves, without relying on international consultants to analyze deficits and possibilities.

Another key lesson emerged around the importance of staying flexible in the face of organizational changes. When a new Deputy City Manager reduced the Task Force from 30 to 14 people in early 2023, while there were some initial disruptions, the team was also forced to focus their efforts strategically. It was made sure that the smaller team still included representatives from the most important departments, ensuring that critical perspectives were still represented.

Thanks to the adoption of PDIA, the smaller team became increasingly methodical in its approach to problem-solving as a group and was better able to collaborate across departments. The strategic composition of the new team would become crucial as they moved toward implementation, allowing for quick decision-making while maintaining cross-departmental collaboration.

Finding Entry Points and Iterating on Ideas

In May 2023, the streamlined Task Force faced an important question. Of the six identified causes of delayed processes, where would they begin? Using the PDIA change space analysis, they systematically evaluated their authority/support, acceptance, and ability to act on each cause.

As Muhannad Majali, the Director of the Planning and Budget Unit for the Regions and Environment Sector in GAM, indicated, this was a difficult process: "The biggest challenge we encountered was determining which main reasons to prioritize. Ultimately, we focused on the primary reasons and then reviewed them all, as there was some overlap and differences between the reasons that made the process more complex."

The team understood that PDIA's emphasis on iteration offered a powerful advantage: It allowed them to learn from small initial steps before making larger changes. Muhannad noted that "PDIA … helped us iteratively tackle root causes in waste management by adapting ideas at each stage." The prioritization process reinforced another essential lesson about the value of iteration in implementing PDIA. Rather than attempting to solve everything at once, the team opted to start with specific entry points where they had identified the greatest opportunity for change.

Ultimately, the analysis revealed two causes had the strongest potential:

- **Cause 3:** Hesitation in decision making due to lack of data
- **Cause 5:** No clear needs-based training

PHOTO 2: THE NEW TASK FORCE DURING THEIR FIRST ITERATION WORKSHOP

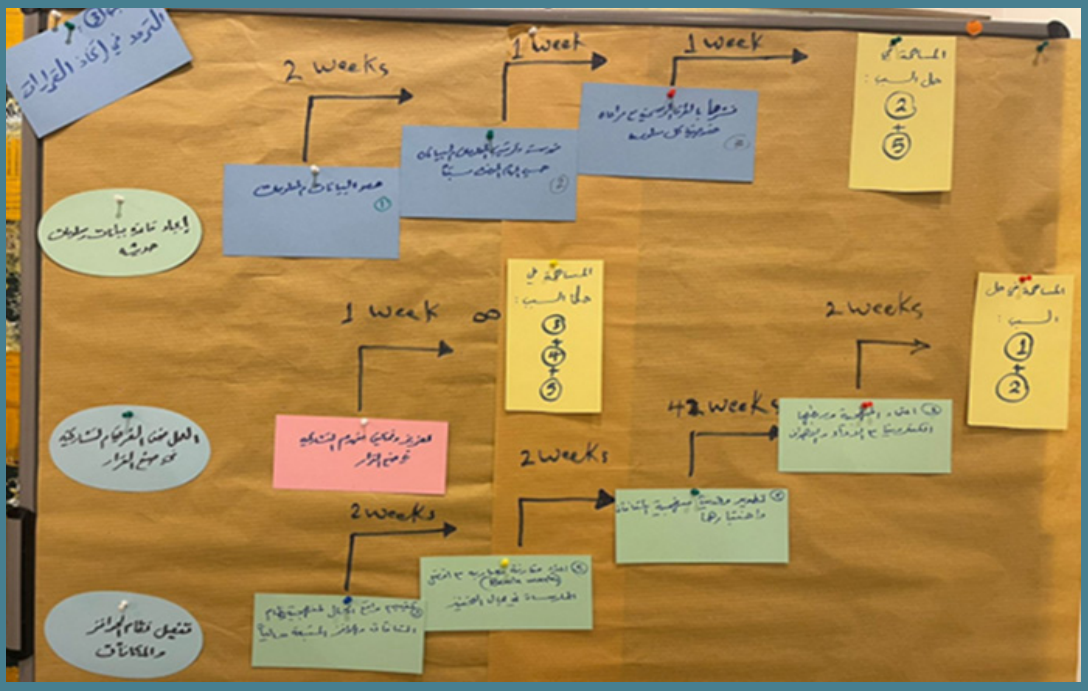
For cause 3, the team determined that better data was essential for confident decision-making. As team members believed they had strong support from their authorizers who needed better data to ensure better decision making, the necessary skills to work on these issues, and colleagues who would generally welcome support to make better decisions, this seemed a promising entry point.

The team decided to create two iteration teams. One, led by Manar Nabeeh Haddaden, the Director of the Tender Department, would work on cause 3. The other, led by Muhannad, would work on cause 5. For cause 3, they prioritized updating the database and creating a digital map of GAM's waste infrastructure. The team realized that accurate data for waste containers and recyclables would allow for easy aggregation of information and quick, well-informed decision making.

Through close cooperation between different departments, they began to build the system. The following teams were involved:

- The GIS department, coordinated by Wafa and Salsabil
- The Environmental Studies Department
- The Environmental Directorates of each district
- The team from the new municipal company "Amman Vision Company for Recycling and Treatment"
- The waste truck teams who collected data via an application
- Manar, the Director of the Tender Department, who helped organize the work on the dataset and communicated progress to authorizers

PHOTO 3: BREAK-DOWN OF SOLUTION INTO ITERATION STEPS



Results and Impact

The impact was significant across multiple dimensions.

Data-Based Decision Making

By April 2024, they had mapped more than 41,000 containers across 22 capital districts. The system now has comprehensive information including:

- Container locations and the quantity
- Container type (residential, commercial)
- Collection schedules and routes
- Waste quantities and types

This information was previously unavailable to decision-makers. In the city government, the GIS data has made the work easier. According to Salsabil: "We now know the locations and number of containers in each neighborhood, as well as their classification (e.g., industrial, residential, etc.). This has improved the waste collection routes. Previously, waste was collected randomly, but now it follows a fixed schedule and system."

The GIS implementation demonstrated the value of iteration. Starting with basic container mapping in pilot areas allowed the team to learn what worked, adapt their approach, and gradually expand to all 22 districts in Amman.

FIGURE 2: GIS MAP OF WASTE CONTAINERS IN AMMAN

Eventually, the GIS system has enabled several improvements, including:

- Better planning of collection routes
- Evidence-based container distribution
- Faster data sharing between departments

The impact is particularly visible in the Zahran district, which served as a pilot for using the GIS map. Routes became shorter and better planned, showcasing the system's potential for improved operational efficiency. As Khaled Al-Khaldi, Head of the Environment Department, explained: "One of the most expensive things in solid waste collection is collection and transportation, so it is essential for anyone who wants to work in this field to use the GIS maps in order to be aware of any changes in the locations of containers, and the greatest reliance in the route of waste collection vehicles is the GIS maps. ... It is certain that following up on something organized produces better things than following up on something random." This early pilot in the Zahran district of the SoWas project demonstrated significant cost savings potential of the GIS system. In fact, total annual waste collection costs decreased by over 31% compared to the older system, driven largely by a 65% reduction in fuel costs to better routing. The unit cost for waste collection dropped 35%, from 88 USD/t to 61 USD/t. This is a great success in two ways, first financial, and second because it shows that the data are actually being used for making decisions. This is contrary to the experience of projects which set up elaborate digital systems to produce data which are often not practicable and user-friendly enough to be used for service improvements. GAM used its already existing GIS system to improve its operations. This showed that the map is useful to planners at headquarters and in the districts. In addition, a review of waste collection statistics from the whole city revealed that while collection times and efforts have increased due to Amman's urban expansion, as evidenced by 9% more collection time, 4% more waste volume, and 17% longer collection distances compared to 2023, fuel costs have only increased by 3%. This represents a steady but continuous improvement in waste management by the district's agents. But as Omar Arabiyat, now Executive Director of GAM's environmental sector, points out: "Much like the PDIA process, routing is an iterative process where best guesses are made based on the data points, and routes are rearranged based on the actual experience of the collection teams in a learning-by-doing fashion." This was made possible by using the GIS data points as a reference system.

Needs-Oriented Training and Knowledge Management Reforms

The PDIA Task Force introduced reforms in training programs that were more tailored to the needs of specific departments. Surveys found gaps in technical knowledge and role-specific skills for waste management and environmental services. Thus, the Training Department, headed by Muhannad, Feras, Rama and Rawan, created dynamic trainings focused on topics such as GIS data collection, waste management strategies, and project management. The programs were created to evolve based on feedback from departmental teams. The shift led to increased interest and participation in training. The Training Department also began integrating GIS data collection and usage into their programs to support the new data-driven approach.

The team implemented a new digital knowledge sharing platform within GAM's online portal. Now, officials must submit reports on training learnings within 30 days or face the consequence: Being blocked from courses for a year and receiving lower performance ratings. This has resulted in a 98 percent compliance rate for knowledge sharing after training. As a result, everyone in GAM can now benefit from the valuable knowledge gained from colleagues during trainings, which was often kept within individuals or teams. These skills are now available to everyone in GAM.

Solving Challenges in the Recycling Pilot Areas

In September 2024, the Environmental Studies Department, now under the leadership of Basem Al Souliman, began using "Small PDIA" to solve operational challenges in the pilot areas where GAM is testing various waste separation and recycling concepts. Of course, this complex innovation in the waste management system is still under improvement and is accompanied by many challenges. Through a PDIA exercise, they agreed on the barriers (and the reasons behind them), prioritized them, and tried to find the most easily applicable solutions. After this planning workshop, the team made progress in improving the monitoring of recyclables collection, container maintenance, and stakeholder awareness and feedback.

Overlapping Tasks of Departments and Scale-Up

Following the successes in cause 3 and 5, the GAM leadership approved not only the continuation of the Task Force in October 2024, but also its expansion. They approved that the planning departments of all six sectors of Amman, which are the main coordinators of all activities within the municipality, are now mandated to work with the team and expand PDIA beyond waste management. They are now part of the iteration teams and have started working on new causes of the challenge: Long

reporting lines and administrative hierarchy (cause 1) and complex and overlapping tasks within the environmental sector (cause 6). Here, the team conducted an analysis of the existing hierarchy and how tasks were distributed across departments. Based on their analysis, the team redesigned the responsibilities, goals, and key performance indicators between teams to be much clearer. This new division of labor was approved by GAM's leadership and is helping to make the business more effective and efficient. The new team members not only enriched the discussions with their knowledge but also made it easier to expand the ideas of a problem-solving and learning organization. Based on the progress and a presentation of the team's progress, they were asked by the mayor to present and train all managers within GAM on PDIA to solve more complex problems in the future. Thus, the idea is being scaled up with the Amman administration and gaining legitimacy through steady progress.

Organizational Changes

The PDIA process had a significant impact on the way departments work together. The GIS data collection effort itself demonstrated this new collaboration, with environmental studies staff, GIS experts, district teams, truck crews, and management teams working together in new ways.

The team's approach to streamlining bureaucratic procedures proved critical. They obtained letters from senior management that removed administrative barriers. For example, the GIS department was given permission to share data with the waste management teams without requiring individual approvals for each request. This institutionalized new collaborative practices while respecting formal authority.

Ultimately, interdepartmental collaboration improved significantly through changes in working practices rather than formal restructuring. These changes emerged directly from PDIA problem-solving sessions, where team members identified that bureaucratic approval chains were less of an issue than knowing who had authority for specific decisions. Through their PDIA analysis, they discovered that creating direct communication channels between key decision-makers could dramatically improve efficiency without requiring structural reorganization.

The team institutionalized these new ways of working through formal authorizations from senior management, which officially permitted direct department-to-department communication for specific processes. A survey conducted in April 2024 among Task Force and their divisions' colleagues found that 74% of respondents experienced improved interdepartmental collaboration, resulting in faster and more effective decision making. One concrete example was the reduction in tender processing time from three months to one month, achieved by establishing direct coordination between the Tendering and Environmental Studies Departments.

Salsabil, as staff member in the Department for Environmental Studies, explained how this worked in practice: "Engineer Manar is in charge of tenders. If we need any service from the Tender Department at any time, we go directly to Engineer Manar and don't have to go through anyone else. The PDIA methodology has made us more aware of each person's responsibilities and who to contact when we need assistance in a particular area. This, along with saving time, has improved the cooperation among employees." Interestingly, this was more of a by-product of the PDIA Task Force. By coming together as a team, new understandings and contacts were forged. Lengthy written requests were replaced by newly established rules to ease cooperation, phone calls and chats to solve problems. This established a new logic between departments to cooperate beyond their own scope of work. The sustainability of these changes was ensured through formal documentation of new procedures and regular monitoring of processing times. The improvements were anchored in officially recognized protocols while maintaining necessary oversight and accountability structures.

Challenges

Despite many successes, the team nonetheless faced obstacles that slowed progress:

The implementation process highlighted many challenges in leveraging PDIA within a large bureaucracy. One of the biggest practical issues was managing the availability of Task Force members. All officials had many responsibilities, full schedules, and ongoing projects they couldn't abandon. Therefore, the implementation schedule frequently needed to be adjusted to accommodate these constraints. Meanwhile, the reduction in personnel from 30 to 14 in early 2023 limited the team's capacity to work on multiple solutions simultaneously.

Long administrative processes and bureaucratic delays also slowed progress. In fact, initial implementation was delayed by about eight months due to leadership changes and approval requirements. Team members also struggled at times to balance their regular duties with PDIA work, leading to inconsistent attendance at meetings. There was also initial skepticism from some staff members about adopting a new reform methodology, requiring significant effort to build buy-in.

The meta-problem of long processes that the Task Force had identified as a root challenge impacted the PDIA implementation itself. Delays in getting approval from managers and changes in key authorizers delayed the start. Further, slow response times from some departments led to unpredictable delays that could only be resolved through additional meetings, calls, or decisions from higher ups that also took time to arrange.

Even so, the team's persistence and dedication to the cause, in addition to strong, outstanding support from senior leadership, helped everyone overcome these obstacles. Implementing PDIA in a hierarchical bureaucracy is demanding, but it can succeed when there is openness to new approaches and consistent leadership backing.

Conclusion and Way Forward

The GAM Task Force has been recognized as a model for innovative reform within the Jordanian public sector. Municipalities and government organizations, inspired by GAM's successes, have shown interest in adopting the PDIA approach themselves. In fact, the GIZ Governance PARtner project has begun promoting the Task Force's methods as best practices in public sector organizations. In December 2024, representatives of the Task Force were invited to present their work to the King Abdullah II Center for Excellence (KACE), the leading government think tank and evaluator of public sector reforms. This was a departure from the usual logic of KACE evaluators and consultants advising GAM and other public institutions on how to improve their organization. Other institutions, such as the influential Academic Council, a group of former ministers and academics that advises the government to modernize the public sector, heard about PDIA and its promising application within GAM. They decided to incorporate PDIA's ideas of iterative learning and collaborative problem solving into their work and advice to ministries.

The Task Force has made tangible progress in speeding up and improving waste management over the past two years, but they have not solved all causes of the problem so far. Though they made progress in causes 1, 3, 5 and 6, two causes and many solution ideas still need to be implemented and tested. However, given the scope and complexity of the problem and how long it remained unresolved, these first steps represent immense progress. Most importantly, PDIA has indicated that there is a viable path forward for addressing these challenges through existing personnel, expertise, ideas, and resources. The improved management capability provides a solid foundation for tackling the remaining challenges.

The Task Force continues to institutionalize PDIA in GAM as a fundamental problem-solving and reform tool. Training staff are preparing PDIA training sessions and have begun distributing Arabic translations of PDIA materials through GAM's online portal. The team is also considering expansion to address some of the root causes identified in the initial analysis.

Encouragingly, the April 2024 survey found that 84% of former and current Task Force members believe they and GAM will continue to use PDIA in the future. This suggests that a cultural shift toward more collaborative, iterative problem solving will become an enduring organizational practice.

Overall, GAM's experience shows that it's possible to achieve tangible results by leveraging existing capabilities, starting with carefully selected entry points, and maintaining buy-in through regular engagement with leadership. In Jordan, this approach has positioned GAM as a model for public sector reform.

PHOTO 4: THE PDIA TASK FORCE/TASK TEAM, INCLUDING SOME FORMER TASK FORCE MEMBERS APRIL 2024

Endnotes

1 Any views expressed and opinions stated are those of the authors and do not necessarily represent the positions of their employers or other organizations, for example GIZ, IDOS, Germany's Federal Ministry for Economic Cooperation and Development or Jordanian authorities.

2 Tim Lukas Kornprobst – Technical Advisor at Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and Research Fellow at Technical University of Darmstadt, Michael Roll – Senior Researcher and Project Lead at German Institute of Development and Sustainability (IDOS), Adin Becker – Student at Harvard University, Omar Arabiyat – Executive Director at Greater Amman Municipality (GAM), Muhannad Khaled Al-Jadeed Al-Majali – Former Director of Department at GAM, Manar Nabeeh Haddaden – Executive Director at GAM, Osama Abu Rumman – Former Head of Department at GAM, Salsabil Saif Al-Din Muhammad Obeidat – Administrator/Logistical Support Manager at GAM, Esraa Saieed Hajjawi – Director at GAM, Rama Mohammad Al-Adwan – Engineer at GAM, Rawan Zeyad Abu Hussein – Training Coordinator at GAM, Wafa Abdul Karim Al Ghurair – Head of Department at GAM, Feras Fahed Al Husami – Director at GAM, Mohannad Abuazizieh – Technical Advisor at GIZ, Basem Al Souliman – Director of Department at GAM, Omar Alhadban – Engineer at GAM, Hala Al-Adwan – Implementation Manager at GIZ. We would also like to thank Mr. Ulrich Thüer and Mr. Levent Toprak of GIZ for their support in using the PDIA approach. We are also grateful for the support of the team from the Building State Capability Program and Markus Lederer from the Technical University of Darmstadt.

3 The GIZ SoWas Project is funded by the Federal Ministry of Economic Cooperation and Development and co-founded by the European Union. More information about the project: https://www.giz.de/en/downloads/giz2024-en-factsheet-SoWas.pdf

4 Hayajneh, B., Makhamreh, Z., & AL-Souliman, B. (2024). Analysis of the pattern of solid waste production in Greater Amman Municipality, Jordan. Environmental Quality Management, 33(4), 855-867.