

Promoting decent work for sanitation workers through digitalization innovation in cleaning technologies in Tanzania: A case of selected higher learning institutions in Dar es Salaam

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ABSTRACT

This study explores how digitalisation and innovation in cleaning technology can promote decent work for sanitation workers in Tanzania using selected Higher Learning Institutions (HLIs) in Dar es Salaam. In Tanzania, sanitation workers are a marginalised group, with no or minimal trade union representation and little or no technological deployment in the cleaning industry. The study is conducted by considering the United Nations Sustainable Goals (SDG) 8 and 12, which emphasise decent work and responsible consumption and production, respectively. Furthermore, the study was guided by the psychology of work and sociotechnical systems theories, which entail human behaviours, emotions and attitudes towards the work environment and the interdependent relationship between social and technical components of work, respectively. This study deployed a cross-sectional survey design which integrated qualitative and quantitative approaches. Multi-stage and purposeful sampling were used to select a sample from the targeted sanitation workers, facility managers working in HLIs and TUICO representatives in Dar es Salaam. Whereby, structured, semi-structured, thematically aligned, and digitally designed data collection tools were used. Using a cross-sectional survey approach, we assessed working conditions, identified technological opportunities, and examined systemic constraints and enablers. A sample of 39 sanitation workers, 10 facility managers and 2 TUICO representatives participated in this study. Microsoft Excel and Python's Pandas library were used to analyse data by generating descriptive statistics. Crosstabulation was deployed to find patterns across gender, level of education, employment status and others. The findings reveal precarious deficits in decent work: 67% of workers report irregular pay, 92% find their income insufficient, and 95% lack written contracts. Furthermore, 85% receive no social benefits, and 97% work beyond 8 hours daily without overtime reimbursement. Notwithstanding these conditions, there is strong receptivity to innovation, though adoption remains low due to cost, lack of training, and poor institutional prioritisation. Managers declared budget limitations yet conceded potential gains from mechanised equipment and digital tools. The absence of unionisation and grievance mechanisms intensifies workers' vulnerabilities. Conversely, opportunities exist through policy reforms, inclusive procurement practices, training programmes, and stakeholder collaborations. This study upholds that digitalisation can catalyse decent work, but only when integrated with fair labour practices, technological capacity-building, and institutional accountability. The findings stipulate actionable insights for policy, engineers, academia, and labour advocates working towards transforming informal service employment.

Keywords: Cleaning Technologies, Decent Work, Digitalisation, Higher Learning Institutions, Sanitation Workers

I. INTRODUCTION

Digitalisation and innovation of cleaning technologies can improve sanitation workers' working conditions, contributing to decent work (Sustainable Development Goals [SDG] - 8). Decent work emphasises sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all by 2030 (United Nations, 2025). Decent work involves opportunities that are productive and deliver a fair income, security in the workplace, and social protection for families, as well as better prospects for personal development and social integration (Brill, 2021). It also entails freedom for people to express their concerns, organise, and participate in decisions that affect their lives, and equality of opportunity and treatment.

The 2019 World Employment and Social Outlook (WESO) report showed that around 3.3 billion people employed globally in 2018 had inadequate economic security, material well-being, and equality of opportunity, hence, hard-working conditions. Sub-Saharan Africa is the most vulnerable region in the world, with 70% of its employees experiencing poor working conditions, including limited access to social protection, low earnings, and the absence of job contracts (International Labour Organisation [ILO], 2016).

Sanitation workers are often neglected, despite their invaluable service to many of us (World Bank [WB] et al., 2019). Apart from working in unsafe and risky environments, sanitation workers also face stigma and social discrimination resulting from the nature of their work (ILO & WaterAid, 2019). Despite carrying a disproportionate burden of health risks, common to many workers of the informal economy, sanitation workers rarely have affordable

and proper access to preventive and remedial health care or social protection (Phillippe et al., 2022). Globally, a few international standards apply to sanitation workers, such as the World Bank Environmental and Social Standards and the International Standards Organisation [ISO] Sanitation Standards.

Moreover, context-specific standards and regulations are lacking in most countries (ILO, 2025). Furthermore, many sanitation workers operate in the informal economy and cannot benefit from any protections that may exist. Evidence of sanitation working conditions in nine countries shows that in Kenya, Burkina Faso, Haiti, and Uganda, sanitation workers belong to the informal sector and are exposed to hazardous gases and biological and chemical agents in septic tanks, sewers, pumping stations, and treatment plants; they are unregulated and work manually (World Bank et al., 2019). In the case of South Africa, some sanitation workers belong to the formal sector, where they are protected by the legal framework. Regarding digitisation and innovation of cleaning technologies, the developed and some developing economies are transitioning from manual cleaning to innovative technologies. For instance, in India, sanitation workers in the formal sector use technological and robotic innovations to replace manual tasks, such as robotic sewer cleaners. In South Africa, emptiers use shovels as well as technological innovations to avoid having workers enter pits (ILO, 2019). Mostly, other countries still use traditional equipment, endangering the lives of sanitation workers.

In Tanzania, reports show that most informal workers in Mainland Tanzania have little or no social protection, low salaries, no social security, and a poor physical working environment (Masanyiwa et al., 2020), limiting efforts in the attainment of SDGs, particularly Goal 8 on decent work and economic growth. Employees in this sector are exposed to occupational accidents, chemical hazards, and dermal & respiratory effects (Nzali et al., 2023). The National Strategy for Growth and Reduction of Poverty (NSGRP or MKUKUTA) identify employment as an important policy and strategic issue in poverty reduction. MKUKUTA sought to create decent job opportunities for the unemployed by creating jobs that are free from appalling working conditions, providing an income that is sufficient to cater to basic social and economic needs, balancing the needs and rights of both workers and employers and providing a commitment to social dialogue. Tanzania has not ratified the Employment Policy Convention of 1964 (No.122). It has, however, formulated a National Employment Policy (2008), which sets out the national strategy for employment promotion. Concerning decent work, Tanzania has ratified several ILO conventions and Protocols that underpin the ILO Declaration on Fundamental Principles and Rights at Work, and which form a cornerstone of the ILO Decent Work Agenda.

Accordingly, and as per the ILO Decent Work framework, the implementation of a decent work agenda should be implemented at a country level through the Country Decent Work Program (DWCP). In response to this, Tanzania developed its first time-bound DWCP for 2006 - 2010 and a second for 2010 - 2016. The two programs outlined several priorities to enhance decent work, such as extending social protection coverage for all, promoting the creation of productive employment, improving compliance with labour standards and rights at work, and strengthening social dialogue mechanisms at the national and sectoral levels (ILO, 2025). The above strategies do not specifically cover sanitary workers under poor working conditions (Nzali et al., 2023). Moreover, the Occupational Safety and Health Authority No. 5, 2003 segregates sanitary workers as it only covers the safety of employees in the formal sector. Overall, the challenges of sanitary workers are multifaceted, ranging from a lack of legal protection, limited skills, and the use of traditional equipment.

This study argues that the use of digitisation and innovation of cleaning technologies may promote the dignity of sanitary workers. Technologies are expected to improve the quality of services, streamline cleaning processes, and, above all, streamline the cleaning business models. Digitalisation facilitates communication to increase the reach in areas that need special attention. Digitalisation improves the overall management of sanitation workers, equipment, financial resources, and client relations. Capacity-building, learning processes, and opportunities are expected to be improved through digitalisation (de Vette & van der Voorden, 2023). Thus, this study focuses on how digitalisation and innovation of cleaning technologies can promote decent work for sanitation workers who mostly belong to the informal sector, which is unregulated and under poor working conditions.

1.1 Statement of the Problem

There have been global efforts to promote decent work for all (ILO, 2025). Additionally, Tanzania has ratified several ILO conventions and protocols to promote decent work. The government of Tanzania has recently made efforts to reform its legal framework (The Employment and Labour Relations Act, 2017 and Social Security Fund, of 2018 to enhance decent work for all workers. Tanzania, like many other developing nations, is increasingly utilising technological devices in various areas, including communication, transportation, finance, and human resources, among others. Documented practices of working conditions among sanitation workers in higher learning institutions are limited. Furthermore, research on the use and uptake of digitalisation in the cleaning industry is limited. Technology is said to help eliminate manual scavenging by providing efficient replacements for manual sanitation workers to promote their dignity (World Bank et al., 2019). Comparatively, there has been an insignificant development in terms of software and equipment that make jobs easier, better and generate value for businesses in the cleaning industry (Aron, 2023). Nevertheless, innovation in cleaning technologies and digitalisation of cleaning equipment seems to be growing very slowly compared with other industries, leading to slower advancements in cleaning practices.

While there are various work deficits in the cleaning industry, such as legal framing, social security schemes, modern and advanced cleaning equipment and tools, and social dialogue (World Bank et al., 2019), this study focuses on digitalisation and innovation among sanitation workers to promote decent work. The study's findings are significant to help the government and other stakeholders make appropriate interventions in the informal sector by designing and implementing a country's decent work program that addresses decent work deficits on the ground. The study's findings are crucial in developing context-specific operational guidelines for sanitation workers. Furthermore, the study helps in the adoption and use of digital equipment and innovations. Specifically, this study explored the working conditions of sanitation workers, available innovations and technological opportunities for sanitation workers, and examined existing constraints and opportunities for the attainment of decent work for sanitation workers through technologies.

1.2 Research Objective

- i. To explore the working conditions of sanitation workers,
- ii. To explore available innovation and technological opportunities for sanitation workers, and
- iii. To examine existing constraints and opportunities for the attainment of decent work for sanitation workers.

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Psychology of Work Theory

The Psychology of Work (PWT) theory explains diverse individuals' work experiences. The theory aims to predict access to decent work based on experiences of marginalisation and discrimination. It is a key factor in determining a person's overall well-being at work (Autin & Duffy, 2020). Blustein argues that most people around the world have no choice but to take whatever work they can find. According to Blustein, there are three aspects of work: it helps us survive, provides social connection, and allows us to pursue self-determination. Together, these aspects contribute to dignity. However, the theory suggests that people will often accept any work regardless of the working conditions. Based on this theory, sanitary workers continue to work in poor environments to maintain a sense of life and livelihood. Therefore, it is wise to develop strategies to enhance their dignity through innovative technologies.

2.1.2 Sociotechnical Systems Theory

On the other hand, the Sociotechnical Systems Theory (STS) examines the interplay between people (the social system) and technology (the technical system) within an organisational context (Okolo et al., 2019). It emphasises that both social and technical aspects must be jointly optimised to achieve effective organisational performance and improve the quality of work life. The key concepts of this theory are joint optimisation, work system design, autonomy and control, meaningful work, and adaptability. This theory can be used in organisational change and innovation, whereby it guides the introduction of new technologies and processes within the organisation to ensure organisational goals while satisfying workers' needs. It can also be applied in designing a work environment that promotes creativity, productivity, and collaboration by making sure that there is a balance between technical tools and social interactions. Moreover, the theory can satisfy the promotion of safety and well-being by designing safety-critical systems where both human and technical factors are considered in preventing accidents and ensuring well-being (Okolo et al., 2019). The theory is central to this study as it promotes innovative technologies for enhancing safe and healthy work systems, thereby promoting decent work among workers, including sanitary workers.

2.2 Empirical Review

The World Health Organisation (WHO) defines sanitation workers as all individuals, employed or not, who are responsible for cleaning, maintaining, operating, or emptying a sanitation technology at any point in the sanitation chain. In the context of this paper, sanitation workers include toilet cleaners, pit or septic tank emptiers, sewer cleaners, and treatment plant operators. Sanitation workers provide a vital public service that is fundamental to achieving the ambitious global target for safely managed sanitation services outlined in SDG 6.2.

2.2.1 Working Conditions of Sanitation Workers

Empirical literature suggests that working conditions for sanitation workers in Tanzania are often poor and hazardous. Sanitation workers provide a critical service to the public and private sectors. They enable these sectors to reach goals and bring about countries' development, and yet they do all these at the cost of their dignity, safety, health, and living conditions (Njee et al., 2022). Studies show that sanitation workers opt to use face masks and gloves just to reduce the impact on their health. Furthermore, some of them wash their Protective Equipment (PPEs) and dry them for the next use. On the other hand, sanitation workers are stigmatised as they are perceived to be dirty, uneducated, or of the lower classes. The poor working conditions include lower salaries, working with no contracts, working without proper training, the use of improper tools, no respect, and having no sanitation workers' association (Nzali, et al., 2023).

As a result of stigma and harsh working conditions, some have resorted to substance abuse (Njee et al., 2022). Sanitation workers in Tanzania use traditional working tools (shovels, spades, ropes, buckets, hoes, pickaxes, chisels, and ladders), leading to direct contact with faecal sludge (Njee et al., 2022).

2.2.2 Available Innovation and Technological Opportunities for Sanitation Workers

Since the beginning of the new millennium, there has been a significant increase in digital technologies globally, particularly in Africa. The fourth industrial revolution brings innovations that reinforce one another by bringing machinery that is powered by machine learning, Artificial Intelligence (AI), based on big data, consequently, simplifying work, resulting in global connectivity and economic development (Melia, 2020). Digitalisation in the workplace covers a wide range of digital technologies and applications, such as digital communication and information tools (ICT), robots, and AI. These technologies shape workplaces differently by providing platforms, algorithmic management, and digital surveillance. Most of these technologies change how we operate and move from labour-intensive to more technology-intensive types of work and organisations (Giebel et al., 2024). Technological innovation in cleaning not only cuts down the cost of chemicals, equipment, personnel, and overhead but also provides a healthy and safe working space (Ramos & Melgar, 2022). In intelligent cleaning, cleaning equipment integrates the Fifth Generation of Mobile Network Technology (5G) and provides strong cleaning hardware support. Equipment such as unmanned road sweeping vehicles, medical disinfection robots, cleaning robots such as vacuuming cleaners, home sweeping robots, garbage sorting and recycling systems, and many more are being used to facilitate cleaning (Ji & Huang, 2021). Given the experience of COVID-19 and the probability of others in the future, it raises questions about whether sanitation workers have adequate protection from contact with chemicals or high exposure, considering the nature of their work.

2.2.3 Existing Constraints and Opportunities for the Attainment of Decent Work for Sanitation Workers

Making efforts to promote decent work for all as per SDG 8, including sanitary workers, is crucial to achieving this goal. However, only 47% of the population in urban areas use at least basic sanitation facilities (Hollis, 2020), which suggests that nearly half of the sanitation facilities in urban areas have weak or no pit lining or slab cover, increasing the risks for sanitation workers. Among other strategies for promoting decent work for sanitary workers are digitalisation and innovation of cleaning technologies. Studies in Tanzania reveal that insufficient infrastructure, including Faecal Sludge Treatment Plants (FSTPs) and office space, negatively impacts the dignity of sanitation workers. Manual emptying is still evident. Nevertheless, efforts have been made to improve equipment for manual emptiers by introducing innovative small-scale emptying equipment such as the MAPET, the Vacutug, and the Gulper. However, these technologies have yet to reach scale, and manual emptying practices persist using traditional tools (Phillipe et al., 2022). So, the need to promote new innovative equipment for sanitary workers is envisioned to help promote the dignity of sanitary workers (Tirivayi et al., 2023). It is also questionable whether sanitation workers are facilitated in terms of the use of digitisation and innovative cleaning technologies in making their working environment better and decent. It is with these concerns that this study analysed the work conditions and available opportunities and challenges for sanitation workers to attain decent work using digitalisation and innovative technologies.

III. METHODOLOGY

3.1 Research Design

This study deployed a cross-sectional survey design which integrated qualitative and quantitative approaches. This approach is appropriate for capturing diverse variables at a single point (Pourhoseingholi et al., 2021). The mixed method was used because it allows the triangulation of data to enhance its credibility (Creswell & Hirose, 2019).

3.2 Study Location

This study was conducted in Dar es Salaam. Dar es Salaam City was chosen because it is the main cosmopolitan and commercial centre in Tanzania and one of the fastest-growing cities in Africa. According to the 2022 National Population Census, the City Region had a population of about 5.3 million, an increment of about 23% from the 2012 census. Moreover, the rate of growth of the informal settlements is almost twice the average urban growth rate in the city. Being densely populated with informal settlements, the working conditions of sanitary cleaners are likely to be more hazardous. Moreover, we purposefully selected Dar es Salaam because it is a commercial city with many private cleaning companies offering cleaning services to organisations, including higher learning institutions.

3.3 Study Population and Sample Size

This study targeted sanitation workers (120), facility managers (10) working in HLIs and TUICO representatives (2) in Dar es Salaam. Additionally, the Dar es Salaam Region is the proposed location because it contains a relatively high number of targeted institutions. The region hosts more than a quarter (28%) of the total Higher Learning Institutions (HLIs) (Tanzania Commission for Universities, 2019). Since the sanitation work is not formalised, it was

not easy to estimate the number of workers in the region. In this regard, respondents were picked in a manner that the data started to repeat itself among respondents. In most cases, more than half of the workers in the targeted institution responded to the study.

3.4 Sampling Techniques

Multi-stage sampling was conducted by identifying HLIs with a good concentration of sanitation workers, and later, a purposeful sampling was used to target institutions by involving respondents who were willing to participate. We had respondents clustered in three groups: 39 sanitation workers (59% female, 41% male), 10 facility managers, and 2 TUICO officials. These respondents were selected based on their relevance to the study objectives. This approach was based on best practices in implementing research where priority is placed on depth and relevance rather than randomisation (Palinkas et al., 2023).

3.5 Data Collection Instruments

The study used three structured and semi-structured, yet thematically aligned, digitally designed questionnaires. These tools were solely tailored for a specific group to capture specific data (Kothari & Garg, 2019). For sanitation workers, the tool collected demographic data, employment status (contract/casual), occupational health and safety, access to training, union affiliation, use of cleaning technologies, digital literacy, and perceptions of decent work. On the other hand, data from facility managers responds to worker conditions, managerial practices, technology adoption, training availability, and institutional constraints. Finally, data collected from TUICO officials answered questions related to labour rights advocacy, unionisation, digital innovation in sanitation, and barriers to achieving decent work.

3.6 Data Analysis Methods

Microsoft Excel and Python's Pandas library were used to analyse data by generating descriptive statistics. Crosstabulation was deployed to find patterns across gender, level of education, employment status and others. Based on the number of respondents, the statistical data are not meant to give a statistical generalisation. On the other hand, qualitative data were coded thematically by following Braun and Clarke's reflexive method, identifying key themes such as "low pay," "lack of protective gear," "delayed wages," "absence of training," and "need for modern tools." This methodology is meant to provide insight into the research objective by providing real-time insight into the working conditions and technological practices in the institutions. The mixed-methods, multi-stakeholder involvement design corresponds with recent labour studies that explore innovation, informality, and workplace equity in developing contexts.

3.7 Ethical Consideration

Informed consent was obtained from all respondents before data collection. Confidentiality and privacy were ensured throughout the research process. Ethical authorisation was sought from the relevant institutional review boards (Tirivayi et al. 2023).

IV. FINDINGS & DISCUSSIONS

4.1 Demographic Profile of Sanitation Workers

This section presents the demographic characteristics of the surveyed sanitation workers, specifically highlighting their gender, age, and education distribution as illustrated in Figure 1.

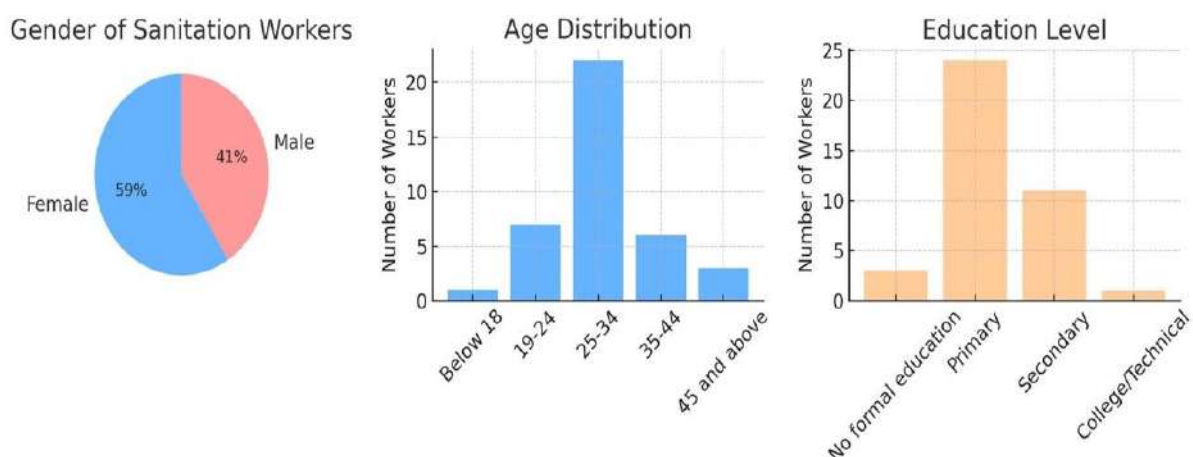


Figure 1

Gender, Age, and Education Distribution of Surveyed Sanitation Workers

Data shows that out of 39 sanitation workers who responded to this study, 59% were female and 41% were male. Also, when looking at age distribution, the majority of respondents, 56% were between the ages of 25 and 34; otherwise, the other age groups are as presented in the central image. Lastly, when looking at the age distribution of respondents, it was seen that nearly two-thirds (62%) of respondents had a primary school education, and only 28% attained secondary school education, and 3% had college or technical education, as shown in the right-most chart in Figure 1. Other demographic data that were captured show that 95% of workers are casual workers. The only 5% who have contracts are the workers aged between 25 and 34 and have a secondary education.

4.1.1 Working Conditions: Wages, Contracts, and Hours

Figure 2 summarises key indicators of working conditions among sanitation workers, including the regularity of wage payments, the sufficiency of income to meet family needs, and access to social security or health benefits.

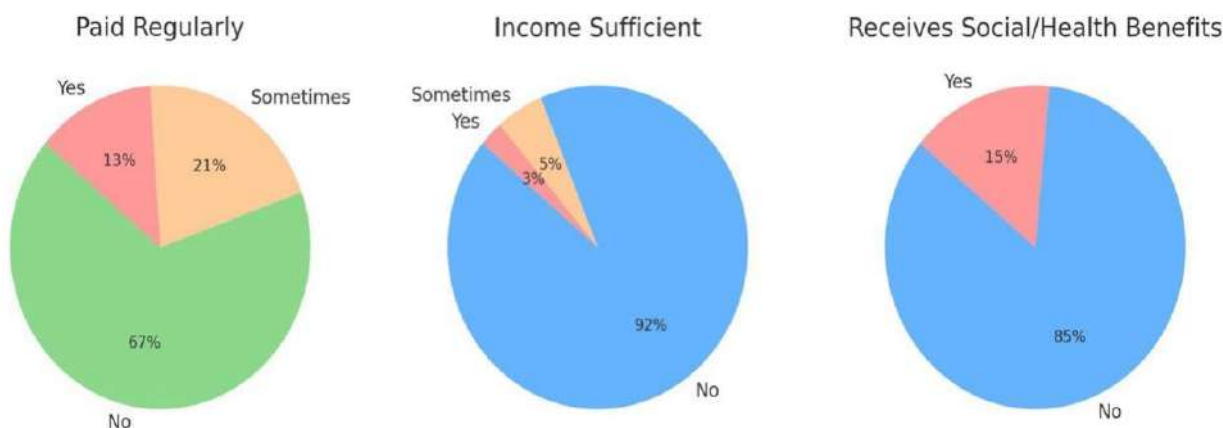


Figure 2

Key Indicators of Working Conditions for Sanitation Workers (worker survey results). Left: Regularity of wage payment; Centre: Sufficiency of Income for Family Needs; Right: Access to any Social Security/Health Benefits

In the working conditions, 67% of respondents reported not receiving regular pay, and only 13% acknowledged being paid regularly. Respondents were also asked if the income is sufficient, and 92% said the income is not sufficient, while only 3% are satisfied with their income. When asked how much they receive, respondents said they receive between TShs 100,000-150,000 (which is equivalent to USD 40-60) per month, which is not enough for urban living. Furthermore, 85% of respondents said they do not receive social and health benefits. On the other hand, 97% of workers said they are not given time to rest, and there are no holidays for them.

4.1.2 Occupational Safety, Health, and Welfare

Figure 3 illustrates key occupational safety and health indicators among sanitation workers, including their access to protective gear, perceptions of workplace safety, and receipt of relevant training.

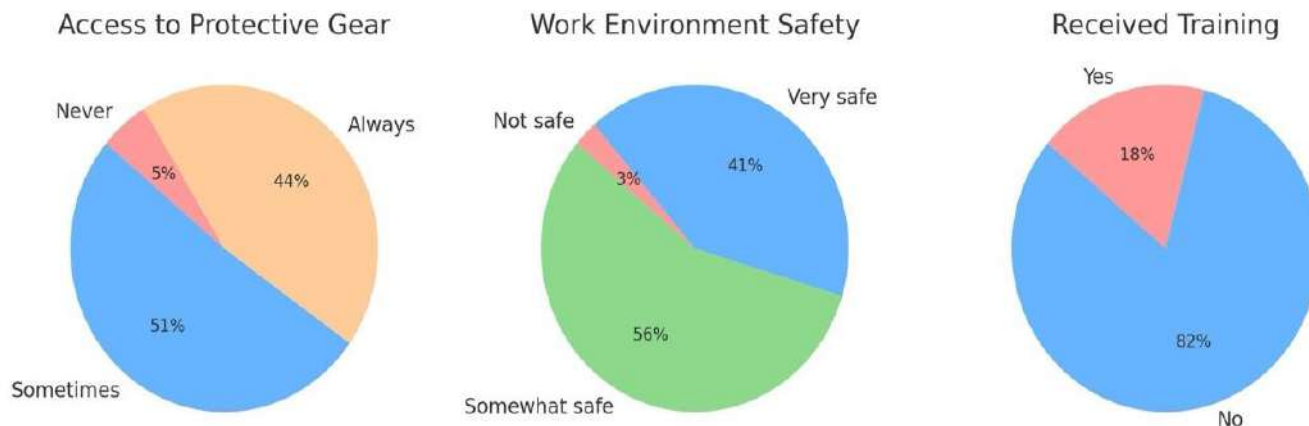


Figure 3

Occupational Safety and Health Indicators for Sanitation Workers. Left: Access to Protective Gear (PPE) like Gloves, Boots, Masks; Middle: Workers' Perception of Safety in their Work Environment; Right: Receipt of any Training Related to Cleaning or Safety Procedures.

In the occupational safety, health and welfare, 51% of respondents said they sometimes receive protective gear, 44% said they always receive, while 5% have never received protective gear. On the safety side, 56% said they are working in somewhat safe environments, 41% said they are very safe, while 3% are not working in safe environments. Lastly, participants were asked if they received training; 82% of respondents said they do not receive training, and the remaining 18% received training.

4.1.3 Technology and Innovation in Cleaning Work

Figure 4 illustrates sanitation workers' feedback concerning the technical dimensions of their employment, particularly their familiarity with novel cleaning instruments and their accessibility to mobile phones or digital devices for work-related communication.

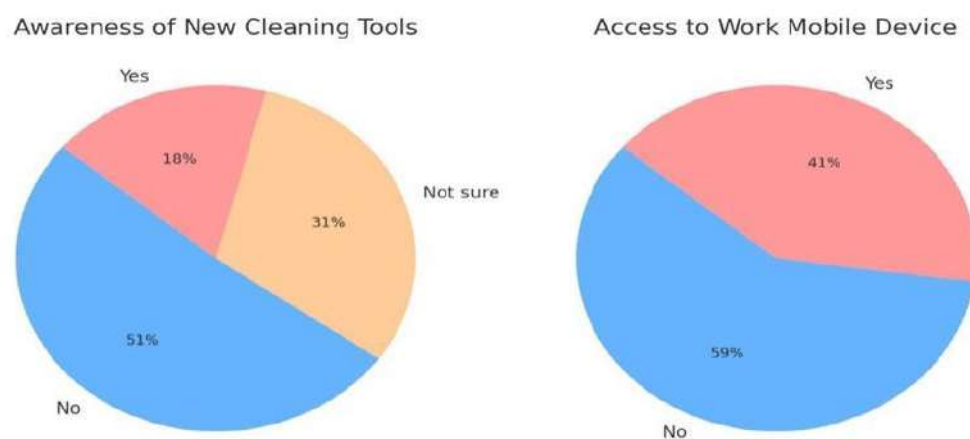


Figure 4

Worker Responses on Technological Aspects. Left: Awareness of any New/Innovative Cleaning Tools being used in their Workplace; Right: Access to a Mobile Phone or Digital Device for Work Communication

Regarding the availability and use of innovations and technological opportunities for sanitation workers, where findings indicate a limited penetration of advanced sanitation tools in HLI, where most cleaning is done manually using basic tools like mops, brushes and brooms. Respondents were asked if they are aware of new cleaning technologies, and data shows that 51% are not aware, 31% were not sure, while only 18% are aware of such technologies. Furthermore, respondents were asked if they have access to mobile devices such as mobile phones or any communication devices for work. 59% said they do not have such devices, while 41% have them.

The cleaning technologies that were expected and given as an example to the respondents included, but were not limited to, vacuum cleaners, mechanical polishers, and UV-C disinfectant and other sophisticated devices and innovations, such as robotic cleaners or IoT-based smart tools, were notably absent. It was further reported that the technologies that are currently in use are decades old and not digitally enabled. Furthermore, mobile devices that were given as an example were mobile phones, which were sometimes used for official communications or applications that are used for information sharing. Respondents said there is nothing like that, but they use their mobile phones for short messaging service (SMS) and calls that are work-related. Despite this limited exposure, workers were highly positive, with 91% of respondents agreeing that modern tools could improve their working environment and their ability to work more efficiently.

4.1.4 Constraints and Opportunities for Decent Work

Lastly, existing constraints and opportunities for the attainment of decent work for sanitation workers were examined. Data shows that 95% of workers are casually employed. 92% of workers said the wages are sometimes delayed and not sufficient for them to live in urban areas. While 85% of workers reported having no access to health insurance, pension or other work-related benefits. About 56% perceived their work as somewhat safe; there are a lot of risks attached to the job that most respondents cannot say because most of them are not provided with modern PPE and do not receive training for their work. Despite all these constraints, 95% of workers said the introduction of digital and/or automated tools would improve their work experience.

4.2 Discussion

This study aimed to explore how digitalisation and innovation in cleaning technologies could improve the work of sanitation workers in HLIs in Tanzania. Findings show that there is a significant gap in decent work for sanitation workers and point out actionable opportunities for improvement.

4.2.1 Working Conditions of Sanitation Workers

Data shows that 95% of Sanitation workers involved in this study are employed informally, with no formal contracts and work as casual labourers. As classified by the ILO, their experience is similar to what is referred to as “*vulnerable employment*”, which is witnessed through poor job security, exposure to occupational risks and low wages. Findings show that sanitation workers have a low education level and have no social protection, which compounds their vulnerability. As per assessment conducted by ILO and WHO in 2019, sanitation workers operate at the cost of their dignity, health, safety and living conditions (Philippe et al. 2022). Findings are also consistent with the Psychology of Work Theory, where people settle for work regardless of working conditions. In comparison to other regions, such as South Africa and India, sanitation workers in Tanzania face similar challenges, but they lack advocating movements like #OutsourcingMustFail, which pushed South African universities to source cleaners from within and improve working conditions (Hamilton, 2017). Because of weak union presence, Tanzania cleaners cannot negotiate or organise improvements. TUICO respondents acknowledged that union structure habitually excludes informal workers and suggested a model like workers’ cooperatives or a partnership with NGOs to be innovated to accommodate informal workers.

4.2.2 Digitalisation and Innovation

There is harmony between the manager and workers that technology could improve working conditions significantly. This goes hand in hand with Sociotechnical System Theory, where both technical and social aspects need to be aligned to achieve organisational performance and improve work-life qualities. Automated or mechanised cleaning devices, such as automated waste bins, could reduce health risks and physical trauma. Despite limited exposure, data show that 95% of sanitation workers said modern tools could improve safety and ease tasks at hand. Digitisation, when implemented with workers’ safety in mind, can reduce exposure to a hazardous environment (ILO, 2025). Due to budgetary constraints and limited procurement standards, adoption of digitalisation remains minimal. Managers suggested that the inclusion of modern cleaning technologies explicitly depends on the mandates of institutions. Which implies, including innovations and safety standards in the Public Procurement process, such as mechanised tools or provision of PPEs, could be a key policy treadle (Hinkley, 2023). Furthermore, local innovations remain untapped. Universities in Tanzania could work with tech hubs or engineers to forge affordable and context-appropriate cleaning tools (Okolo et al., 2019).

4.2.3 Constraints and Opportunities for Decent Work

Systemic constraints obstruct the path towards decent work for sanitation workers, limited enforcement of labour standards, improper outsourcing models and limited platforms for workers to air their grievances are some of these obstructions. Technology alone cannot ensure safety or fairness if not incorporated with policy reforms and on-the-job training to raise awareness (Hauk et al., 2025). Our findings support this argument, whereby workers emphasised fair pay, safety, and dignity, to mention a few. All these values align with the ILO’s Decent Work Agenda. There are opportunities where Public Institutions could lead by example, mandating decent payment and social security for sanitation workers in their tender documents and contracts (Rymarczyk, 2020). Also, institutions can enhance inclusion of sanitation workers and respect by providing them with Identification Cards (IDs), inviting them to staff meetings, providing them with respectable uniforms and more to combat stigma and social exclusion (ILO, 2025). In this study, gender was also a key dimension whereby most of the workers are women, which suggests that working strategies and conditions should address gender specific vulnerabilities, such as harassment risks and maternity protection. Findings generally suggest that current conditions fall short of decent work. Still, there is a strong will among stakeholders to improve the working conditions for sanitation workers, especially if guided by clear policy, innovations and inclusive planning (Hollis, 2020). By connecting digital tools with decent work principles, Tanzania can modernise sanitation labour while promoting dignity and equity (ILO, 2025).

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

Generally, the study concludes that the livelihood and dignity of sanitation workers in the selected institutions do not align with values stipulated in the ILO Decent Work Agenda. While the adoption of digitalisation in cleaning remains minimal, there is room for improvement by implementing multifaceted recommendations from this report. On the same footing, the study noted that adopted of digital technology alone is not sufficient to safeguard decent work. As

indicated in the findings, the working environment, social security and unionism for cleaners are highly emphasised. Therefore, the adoption of digital technologies and review of policies that safeguard the working conditions of sanitary workers, organisations can promote the achievement of Sustainable Development Goals 8 (decent work) and 12 (responsible production).

5.2 Recommendations

Since the digitalisation of sanitation works is extremely minimal in the selected HLIs, it is very clear that there should be an institutional and national willingness to adopt innovations that will amount to efficiency and safety in sanitation. To support these innovations, interventions such as training, infrastructure, and policies should all be aligned with this goal. This study pinpointed critical gaps in decent working conditions for sanitation workers in HLIs in Dar es Salaam. Furthermore, the study underscores the role of digital and technological innovations that close the gaps and contribute to decent work as stipulated in SDGs 8 and 12.

The study provides actionable recommendations to improve decent work for the sanitation worker through digitalisation. Among others, the study recommends strengthening of labour regulations and procurement policies, innovation of technologies that are safe, training and capacity building, promoting representation and voices for sanitary workers, and more research, advocacy and stakeholders' collaboration in making sure that there is decent work for sanitation workers.

All these recommendations would be fruitful if responsible government institutions work hand in hand in making sure the existing labour laws, regulations and policies are enforced, compliance with minimum wages, timely payments and enrolment in the social security scheme are observed and worked upon. On the other hand, contractors and institutions should work together in identifying opportunities and areas where the mechanisations and digitalisation will be implemented to improve cleaning working standards. Also, organisations such as OSHA, HLIS and NGOs should design and deliver training and awareness programs that upskill both technical and digital skills and later improve working conditions, and provide awareness about rights, obligations and standards of players in the working environments. Moreover, all parties, Institutions and contractors should work together in ensuring that workers are registered and have their representations in trade unions and have advocating groups that will act as platforms to air their grievances freely and privately. Finally, more research needs to be conducted on sanitation work dynamics and other related issues that are impactful to sanitation work.

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