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# Gender Dimensions of Solid and Liquid Waste Management for Reuse in Agriculture in Asia and Africa

Avinandan Taron, Pay Drechsel and Solomie Gebrezgabher



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**Resource Recovery and Reuse (RRR)** is a subprogram of the **CGIAR Research Program on Water, Land and Ecosystems (WLE)** dedicated to applied research on the safe recovery of water, nutrients and energy from domestic and agro-industrial waste streams. This subprogram aims to create impact through different lines of action research, including (i) developing and testing scalable RRR business models, (ii) assessing and mitigating risks from RRR for public health and the environment, (iii) supporting public and private entities with innovative approaches for the safe reuse of wastewater and organic waste, and (iv) improving rural-urban linkages and resource allocations while minimizing the negative urban footprint on the peri-urban environment. This subprogram works closely with the World Health Organization (WHO), Food and Agriculture Organization of the United Nations (FAO), United Nations Environment Programme (UNEP), United Nations University (UNU) and many national and international partners across the globe. The RRR series of documents presents summaries and reviews of the subprogram's research and resulting application guidelines, targeting development experts and others in the research for development continuum.



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RESOURCE RECOVERY & REUSE SERIES 21

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Avinandan Taron, Pay Drechsel and Solomie Gebrezgabher

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# ACRONYMS AND ABBREVIATIONS

AIW	Alliance of Indian Wastepickers
FSM	Fecal Sludge Management
GLAAS	Global Analysis and Assessment of Sanitation and Drinking-Water
GRID	Global Resource Information Database
KKPKP	Kagad Kach Patra Kashtakari Panchayat (waste pickers' union in India)
MCC	Micro-composting Center
MSWM	Municipal Solid Waste Management
NGO	Nongovernmental Organization
PMC	Pune Municipal Corporation
PPP	Public-private Partnership
RRR	Resource Recovery and Reuse
SDG	Sustainable Development Goal
SEWA	Self Employed Women's Association
SHG	Self-help Group
SWaCH	Solid Waste Collection and Handling (cooperative of waste pickers in Pune)
UD(D)T	Urine-diverting (Dry) Toilet
UN	United Nations
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization
WLE	CGIAR Research Program on Water, Land and Ecosystems





# SUMMARY

Resource Recovery and Reuse (RRR) is at the core of the circular economy and particularly important in an urbanizing world where cities as consumption hubs become vast sinks of usually wasted resources. To recover the value which wastewater and organic (food) waste, in particular, can offer agriculture, there are many entry and scaling barriers for entrepreneurs to realize the required potential of the circular economy, and these are even higher for women. Different challenges apply to efforts increasing safe reuse where resource recovery is already happening at scale, for example in the informal wastewater irrigation sector.

Through a gender lens, this report examines social equality aspects in RRR via implementation of the circular economy in low-income countries. The focus is on solid waste management and composting as well as wastewater management for reuse in agriculture. The report complements a previous one in the same series on energy recovery from waste and is based on research supported by the CGIAR Research Program on Water, Land and Ecosystems (WLE) and a literature review.

The report shows that women are represented in greatest numbers at the base of the recycling chain, most often as informal waste pickers and as sorters of recyclables with limited upward mobility. They have less access to equipment, vehicles and waste than men; thus, women are less able to access, collect and transport larger volumes and higher value recyclables. Analyzing the gender dimension is important for understanding household responses to RRR programs, differences between the formal and informal sectors as well as along the waste-to-resource value chain from collection to treatment and reuse. The report maintains focus on the current situation and does not discuss the wider benefits and gender-related impacts of improved Water, Sanitation and Hygiene (WASH) or waste management which have been described elsewhere in sufficient detail.

The report shows that despite the wide gender gap in the waste sector, projects targeting municipal waste reduction or recycling, including the recovery of soil nutrients and organic matter via composting, cannot bypass women who are usually the focal point for waste management in households, including waste segregation, and in many regions constitute the most powerful waste collection and recycling workforce where the informal sector complements the formal one.

The report also shows that despite the wide gender gap in the sanitation sector, projects aiming at food safety where wastewater is used for irrigation must work with women along the food chain who in many regions have the safety of irrigated vegetables 'in their hands'.

Key findings are:

- In solid waste management and recycling as well as wastewater irrigation, gender equality and equity are missing and often undermined by strong gender stereotypes given the nature of the work.
- However, regionally, women can play an important and gender-specific role in informal waste collection and recycling activities as well as the sale of wastewater-irrigated crops which makes them the main target group for reforms and safety innovations.
- As the success of composting at municipal scale depends on household waste segregation, a gender-sensitive approach is needed for educational programs to identify the right target group(s) within households, who are often women, but can also be children or household staff.
- Safe greywater reuse and composting at household or community levels offer women in water-stressed regions opportunities for food production and income while saving time and resources.
- Most RRR business models do not show (technical) gender equality barriers preventing a higher share of women than commonly observed in the waste and sanitation sectors (10% to 20%). However, there is no gender neutrality and common barriers, like access to finance, as well as cultural stereotypes make it difficult for women to find work in the formal waste and sanitation sectors.
- The formalization of usually women-dominated waste pickers into associations or cooperatives can significantly improve the status of women and urban waste management services including decentralized energy recovery and compost production from organic waste.
- A key requirement for any sustainable RRR from waste products is 'safety'. Gender-sensitive risk reduction measures are needed in line with the World Health Organization's (WHO) multibarrier approach where clear gender differences can be found along the food value chain, such as irrigated vegetables, to make this 30-million hectare (ha) farming system a safe pillar of the global circular economy.

Given the cultural diversity across the reported cases and general absence of gender-disaggregated data in waste management, and RRR in particular, further gender studies are highly recommended.



# 1. INTRODUCTION

With rapid population growth and increase in per capita consumption, generation of waste is expected to increase at a higher rate than population growth. The estimates forecast that waste generation will increase by 70% and reach 3.4 billion tonnes by 2050 (World Bank 2019a). This will challenge many administrations where currently waste management consumes a major part of the budget<sup>1</sup>. Given the increasing scarcity of freshwater and phosphorus, a paradigm shift towards a circular economy is required. This is particularly important in view of urbanization where hungry cities become regional consumption hubs importing vast amounts of soil nutrients through food, while farmers in the food production areas struggle with depleted soils (Drechsel and Hanjra 2016). Cities are also extremely thirsty, extracting every available freshwater source from their vicinities contributing to negative urban footprints (Kookana et al. 2020). Strategies in support of a more circular economy target the potential of waste as an undervalued resource which allows the recovery of raw materials and water for reintroduction into the agricultural production–consumption cycle. In particular, this concerns the largest waste category, i.e. organic waste, such as food waste and fecal sludge, which is rich in crop nutrients, energy and organic compounds but a major environmental and health hazard if poorly managed (Ellen MacArthur Foundation 2019).

The circular economy concept offers multiple benefits, which have been recognized in ecological economics, green growth and sustainable development paradigms, e.g. the Sustainable Development Goals (SDGs). The core of the circular economy, i.e. Resource Recovery and Reuse (RRR), can be instrumental in achieving several SDG targets such as food security and sustainable agriculture (SDG 2), recycling and safe water reuse, and water for ecosystems (SDG 6), increasing the share of renewable energy (SDG 7), reducing waste generation through reduction, recycling

and reuse (SDG 12), and restoration of degraded soils (SDG 15) that acknowledge the concept of the circular economy directly or indirectly.

In this context, the RRR sector is still nascent which is also reflected in the scarcity of gender-related data and publications. Many RRR initiatives continue to depend on subsidies/funding from donors and often have difficulty in surviving their pilot phases. However, hopeful signs of viable approaches to RRR as a business are emerging around the globe including low- and middle-income countries. These enterprises or initiatives are building on an entrepreneurial mindset, where public–private partnerships (PPP), for example, help to realize commercial or social value. In many cases, RRR will allow some degrees of cost recovery, which within the waste and sanitation sectors are still an exception, while other RRR models manage operational and even capital cost recovery (Otoo and Drechsel 2018).

Along with the realization and recognition of the importance of RRR, it is imperative to understand gender roles, constraints and opportunities within the waste and sanitation sector to be able to incorporate a gender lens in the circular design (OECD 2020). According to UNEP-IETC and GRID-Arendal (2019a), bringing gender equality into the waste sector will catalyze gender equality in other economic and social sectors and accelerate the ability of governments to meet their broader global and national equality commitments (Figure 1), particularly for SDG 4 (quality education), SDG 5 (gender equality), SDG 11 (sustainable cities and communities) and SDG 12 (responsible consumption and production). A particular gender target under SDG 5 which is highly relevant to the waste sector, is to “ensure women’s full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life.”

<sup>1</sup> Effective waste management is expensive, often comprising 20 to 50% of municipal budgets (World Bank 2019a).

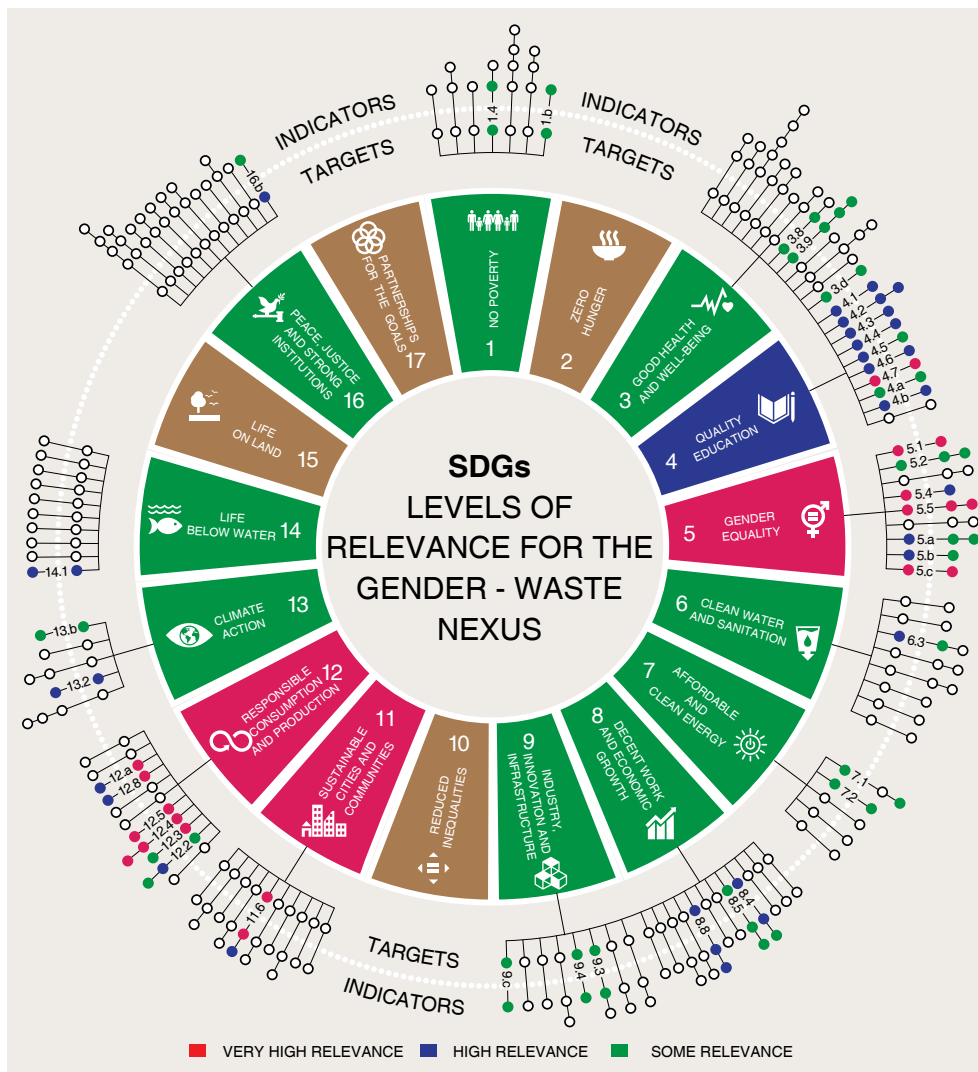


FIGURE 1. RELEVANCE OF SDG TARGETS AND INDICATORS FOR THE GENDER-WASTE NEXUS (SOURCE: MODIFIED FROM UNEP-IETC AND GRID-ARENDAAL 2019B).

## 2. FRAMEWORK OF THE STUDY

The study is based on a review of literature<sup>2</sup> with a focus on gender aspects in the circular economy and resource recovery within the waste and sanitation sectors for reuse, particularly in agriculture. The main emphasis is thus on organic waste and wastewater management and the recovery of plant nutrients, organic matter and reclaimed water, complementing a previous report in the same series on energy recovery (Njenga and Mendum 2018).

The emphasis is on urban waste for closing the rural-urban resource loop at scale. This can be food waste, agro-industrial waste or fecal sludge from on-

site sanitation systems or wastewater (sewage) and greywater from kitchens. With an emphasis on scaling, the report will only touch on household-based recycling efforts, such as backyard composting.

The study tries to apply a gender lens and address gender patterns in the formal and informal, private and public sectors. The common scarcity of gender-disaggregated data in the waste and recycling sector does not allow general statements across countries, as even the larger surveys or reviews (e.g. IWA 2014) on gender and sanitation only refer to a subset of countries or cases with large cultural diversity.

<sup>2</sup> The review builds in several sections on research supported by the CGIAR Research Program on Water, Land and Ecosystems (WLE) and/or its partners, like the RUAF Global Partnership, International Water Management Institute (IWMI), International Center for Agricultural Research in the Dry Areas (ICARDA) and World Agroforestry (ICRAF). Asterisks (\*) in the reference list indicate these sources.

The study gives due attention to the reality of reuse, e.g. untreated wastewater irrigation, with particular emphasis on gender differences that are important for the promotion of safety interventions.

Although RRR can leverage private capital and support cost recovery within the sanitation service chain, with the ultimate benefit of more functional service delivery (Rao et al. 2017), the report will remain as far as possible focused on RRR and **will not** explore the wider nexus between gender and Water, Sanitation and Hygiene (WASH), such as the benefits of investments in toilets, which have been extensively described (Dankelman et al. 2009; Geertz and Iyer 2018; MacArthur et al. 2020).

The report is structured into two main parts covering solid and liquid waste management and resource recovery. It starts with an analysis of gender roles and issues in solid waste management and recycling looking at the critical roles of households as well as the formal and informal sectors. The second part applies a gender lens to wastewater treatment, the social acceptance of reclaimed wastewater as well as agricultural reuse and gender roles along the value chain of wastewater-irrigated vegetables in terms of food safety.

Based on this analysis, the conclusions point at particular barriers for gender equality which require priority attention to operationalize the full potential of RRR from solid and liquid waste within a circular economy.

### 3. GENDER ASPECTS IN WASTE MANAGEMENT AND RESOURCE RECOVERY

The following sections differentiate between municipal solid waste management (MSWM) and sanitation (wastewater and fecal sludge management); in each, the gender lens is applied to the formal and informal sectors. For MSWM, the focus moves from households to the city with special attention on waste collection and recycling activities, including composting, and for wastewater management from its treatment to its reuse, including stakeholder perceptions. Within the wastewater sector, informal reuse of untreated wastewater is a common reality over nearly 30 million ha (Thebo et al. 2017) so special attention is given to the gender roles for securing food safety along the wastewater-irrigated food chain. Processes which link the sanitation and MSWM sectors, at the household level, or through the co-composting of fecal sludge and organic (food) waste at the city level, are only mentioned if they have particular gender perspectives.

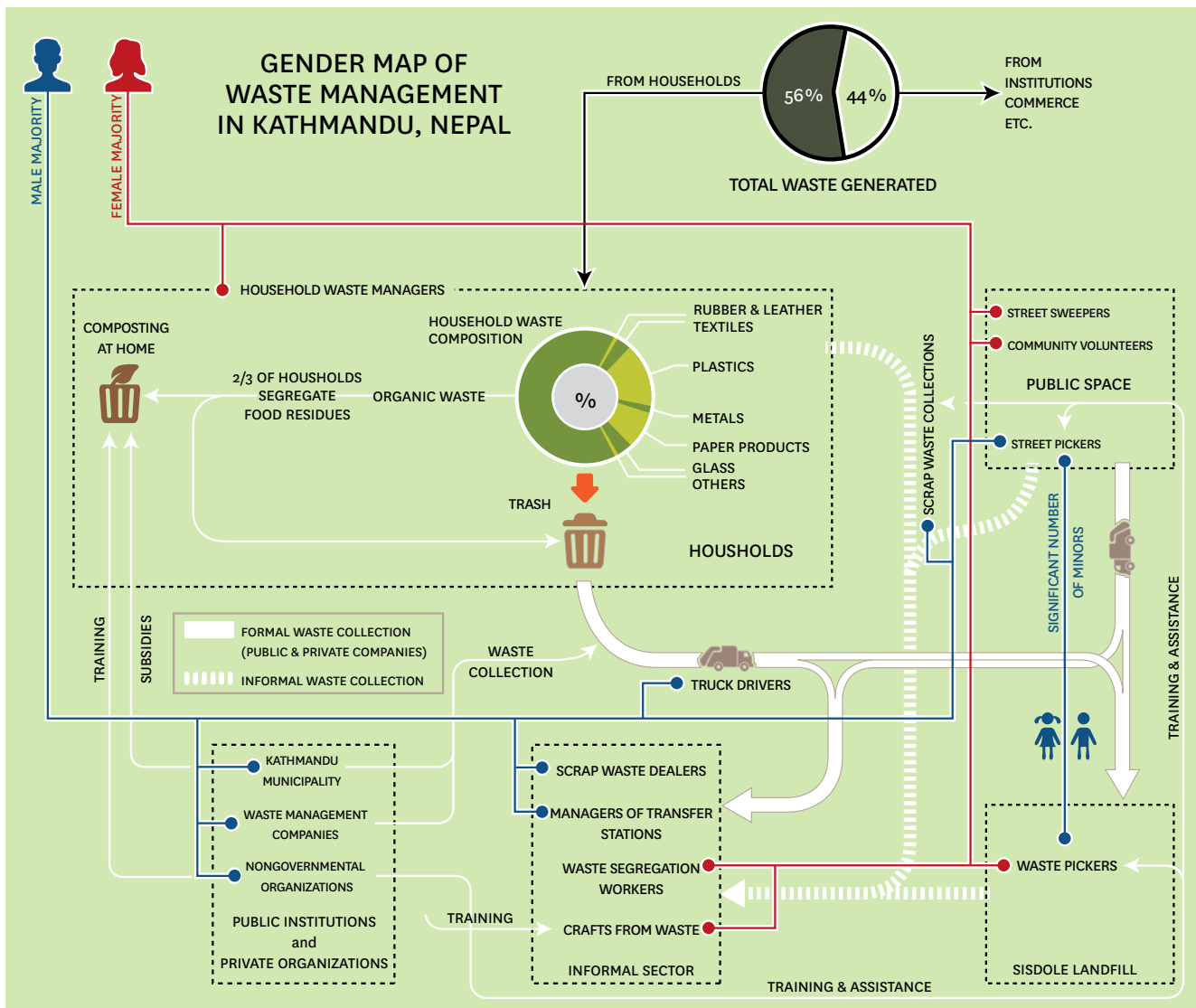
#### 3.1. Municipal Solid Waste Management and Resource Recovery

Gender roles and dynamics can have great influence on access and control over resources that in turn impact the production and recycling process. This refers in the RRR context first of all to the waste resource itself, apart from the common challenges of start-ups to access such as finance (Box 1), information, technology and so forth, which can all be challenging, in particular for women entrepreneurs (Hovorka et al. 2009; Muspratt 2016a, 2016b; Di Mario et al. 2018). In a city, different waste-related processes and streams are significantly interlinked with the usually complementary roles of the informal and formal sectors, each with a particular gender dimension as illustrated for MSWM in Kathmandu, Nepal (Figure 2). In an ideal circular economy, the processes in support of RRR are interlinked across scales, from the household level to the municipal level.

**BOX 1. INVESTMENT CLIMATE FOR COMPOSTING ENTERPRISES – INSIGHTS FROM WOMEN ENTREPRENEURS IN KENYA.**

In an assessment of the investment climate for private companies engaged in nutrient recovery in Kenya, access to finance was flagged by both male and female entrepreneurs as the most severe constraint to their businesses. Female entrepreneurs were particularly intimidated by the collateral requirements for debt, which in general discouraged both male and female entrepreneurs from submitting an application. In the compost sector, where only a small percentage of firms is run by women, the female-owned firms rely exclusively on internal funds to finance initial investment. However, male-owned firms finance 22% of their initial investment with grants from national or international donors. Women entrepreneurs identified loan interest rate, rigidity regarding loan-related analysis and collateral, and knowledge about access to loans as the key impediments towards access to finance. As a result, women have to rely on less formal sources such as friends and relatives to provide them with limited funds for investment and hence their businesses remain informal and small scale. Access to different forms of finances are key reform priorities that need to be put in place to address the gender disparities in accessing resources for businesses.

Source: Authors' unpublished data.



**FIGURE 2. GENDER MAP OF WASTE MANAGEMENT IN KATHMANDU, NEPAL (SOURCE: MODIFIED FROM UNEP-IETC AND GRID-ARENDA 2019A).**

### 3.1.1 Household-based Waste Management

It is noteworthy that many waste-transforming business models operating at an urban scale significantly depend on household-based processes and behavior as this is where most of the waste is usually generated. But households also have a tremendous collective capacity to reduce the flow of waste into the system, both through consumption practices and waste management as well as in-situ recycling strategies. Household needs and structures must therefore be included in all waste management plans. Women play a key role in this context from waste generation (such as grey water and food waste in kitchens, and grey water from washing laundry and bathing children) and waste management which is often the responsibility of women and makes them an important target for efforts supporting waste reduction, segregation, composting and recycling (UNEP-IETC and GRID-Arendal 2019a).

In a four-country comparison, presented by Ocean Conservancy (2019), the women of the households in India, Indonesia, the Philippines and Vietnam were primarily, if not solely responsible for managing household waste, whether this was mixed or segregated.

Indonesia and India had the highest percentage of respondents reporting that women are solely responsible for household waste followed by the Philippines. Vietnam had a smaller percentage of respondents who identified disposal as a 'women only' task reflecting the higher instances of shared responsibility among men and women in Vietnam. As waste composting works best based on decentralized household waste segregation<sup>3</sup> into at least organic and inorganic components, women – and not men – in these countries have to be the primary target group for any household training on waste segregation. Projects that do not understand who is in charge of waste at the household level are likely to fail as experiences from Kumasi in Ghana show, where children have a key role in household waste disposal (Danso et al. 2004). Other RRR-related roles commonly associated with women at the household level are:

- The cultivation of backyard gardens using household waste resources as inputs (food waste compost, grey water for irrigation) unless the compost gets confiscated by men (Quansah et al. 2001).
- Where waste is externally treated or recycled, women are the key customers for dry energy or biogas (Njenga and Mendum 2018) while compost marketing might bypass women (Nkedi-Kizza et al. 2014).
- Women are more likely to experience the negative side-effects of unsustainable waste management,

given their responsibility for collecting water, changing diapers (excreta contact) and gathering biofuel and food, which makes them more exposed to human and environmental health hazards and a key target group for capacity development in safe waste handling and reuse.

Given that women are more exposed to household waste than men and are often the household members in charge of waste management, any RRR campaign which starts at the household (waste segregation, safety measures) has to target women whether they are the head of the household or not.

Households, which currently have the least formal engagement with the waste sector's power and policy structures, may be the pivotal sites for reform. Households have tremendous collective capacity to reduce the flow of waste into the system, both through consumption practices and waste management and recycling strategies. Household needs and structures must be included in all waste management plans. Methodologies should be developed to assess the value of sustainable eco-services that are currently provided on an unpaid basis by women managing waste in households and communities. This will enable policies to be based on a more accurate view of the waste value chain (UNEP-IETC and GRID-Arendal 2019a).

Women can also play a significant role in community-based recycling activities such as waste composting (Gathuru et al. 2009). In India, for example, women organized in self-help groups or waste picker associations are increasingly engaged in local composting activities (see below)

### 3.1.2 Waste Collection and Recycling Businesses in the Formal Sector

Once the household waste is collected, waste ownership shifts to the municipality. The last three decades have seen many cities partnering with larger firms to manage their solid waste, including organic waste collection and composting, while small and micro-enterprises support the collection of fecal sludge from households. These arrangements can move the ownership of the waste to the private sector based on the operational contract, with potentially negative consequences for informal waste collectors and recyclers who will have to compete with larger companies who can legally claim the materials that provide individuals, waste picker associations or small enterprises with a livelihood (Samson 2009; UNEP-IETC and GRID-Arendal 2019a). When the Pune Municipal Corporation (PMC) considered handing the entire waste collection process over to a private company, the

<sup>3</sup> Separation of different wastes (*inter alia* organic, glass, metal, plastic materials) before it is collected.

waste picker association Kagad Kach Patra Kashtakari Panchayat (KKPKP) intervened to prevent its members from being completely displaced (Tangri 2012). Such associations are however missing in many locations. Otoo and Drechsel (2018) analyzed equal employment opportunities and possible gender-specific barriers across 24 RRR business models. The most common advantage for men was related to gender-specific labor roles or cultural stereotypes, like truck driving. In general, there was no model which supported inequity per se, however, like for other start-up businesses, access to land, water or capital can be significantly more challenging for women than men, but not the RRR engagement itself. Thus, the waste sector is certainly not gender neutral and gender inequalities are embedded in almost all aspects of waste management. Overcoming the presumption of gender neutrality is the first step to mainstreaming gender in the waste sector.

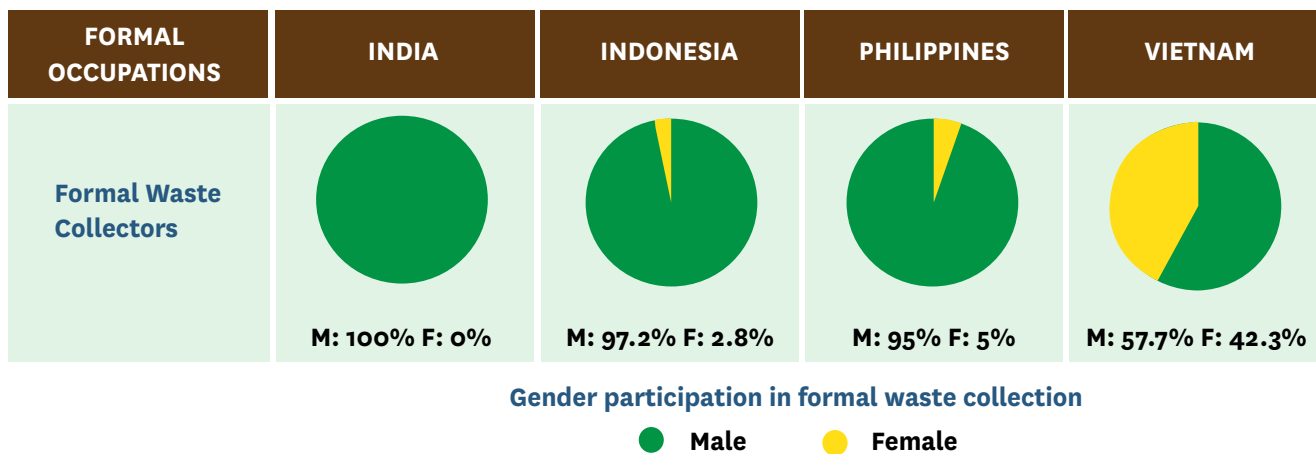
As in many sectors of the economy, but especially in engineering, few women own and operate businesses at the end of the waste or sanitation service value chain. While women participate in components of the value chain, they are noticeably absent from the ownership or management of later-stage businesses such as being aggregators, material processing company owners, landfill operators and so forth. At the very most, women are employed by the processing companies to perform repetitive and time-intensive tasks such as sweeping, waste cleaning, sorting, segregating or accounting and recording, while men are generally considered more suitable for collection, loading and packing of recyclable materials (Ocean Conservancy 2019; UNEP-IETC and GRID-Arendal 2019a). On the other hand, women might take up a wider spectrum of roles in community-based initiatives, like composting, from senior management to waste collection (Gathuru et al. 2009; Agathos 2011).

According to Muller and Scheinberg (2003) waste organizations led by women are in a different position compared to waste agencies led by men when dealing with households and government officers. The authors pointed out that the bargaining power of a single women entrepreneur is lower. Moreover, women with a lower social status feel uncomfortable in visiting offices headed by men and discussing inadequate contracts or difficulties in getting payment. To boost self-confidence, women prefer groups, including other family members, to negotiate with municipal personnel. This might be one of the reasons why women-led community-based management is often made operational through institutional interventions (like government agencies, Nongovernmental Organizations (NGOs) and donors). The situation is similar in composting activities where – except for women-led community-based organizations – the involvement of women as owners is mostly absent.

A comparison of the situation in four countries in Asia (India, Vietnam, the Philippines and Indonesia) by Ocean Conservancy (2019) reconfirmed the disadvantages women face in the solid waste and recycling sector, but also differences among the countries. In the three Southeast Asian countries of the study, it was observed that formal waste collectors were primarily men. In Indonesia and the Philippines this is because the collectors must travel quite a long way from home on trucks and carry heavy loads, and for similar reasons are preferred by employers. In Indonesia, fewer women participate in the waste collection chain in general and this is reflected in the lower participation rates. In Vietnam, where like the other countries, waste collection is still not fully mechanized but gender participation across formal occupations is more equitable, a higher participation rate is noted with either no gender preference (waste collection) or a preference for women (waste processing). In the Philippines, however, it was noted that women were frequently employed as street sweepers as the task allowed them to operate and work closer to their homes and also did not require heavy lifting. While in India formal waste work is in general dominated by men, the situation can differ by state, especially in the southern part of the country, which is not captured in Figure 3. Generally, the salaries in this sector whether paid by the government or by private employers do not vary much, primarily because of the relatively low pay levels and little variations in the nature of work (Ocean Conservancy 2019). A more detailed analysis from Nepal showed a similar male dominance in Kathmandu with 24% of staff being women in public waste management and 28% in private companies, with a large majority of women in both cases being street sweepers (UNEP-IETC and GRID-Arendal 2019a). In an analysis of 14 compost/recycling centers in Sri Lanka, 18% of the worker were women with a higher percentage among permanent than non-permanent staff (Butty 2018). Activities of women included mostly sorting and cleaning of recyclables, or compost packing, but seldom waste unloading, compost piling or pile turning, and never driving; except at the composting facility of Puttalam which had only women employed. As employees of the Government, the data did not show any income disparities between men and women. Aside the regular income, health benefits/checks, pension and positive social acceptance were mentioned as benefits, questioning the more negative anecdotal evidence presented by Sinnathamby et al. (2017). Before their current job, the majority of the female workers were unemployed (55.6%) compare to only 12.5% among their male colleagues, stressing the opportunity for gender-sensitive job creation in this sector (Butty 2018).

While the reasons for the gender gap differ between countries (cultural stereotypes, political support among





**FIGURE 3.** GENDER PARTICIPATION IN FORMAL WASTE COLLECTION AND RELATED VARIATIONS IN PERCEIVED EMPLOYABILITY AND SALARY IN INDIA, VIETNAM, INDONESIA AND THE PHILIPPINES (SOURCE: OCEAN CONSERVANCY 2019).

others) the absence of women also reflects their still low percentages among global engineering graduates. In fact, in many countries, engineering has lost ground to other sciences, including agriculture. However, there are regional exceptions: the share of women graduating as engineers has, for example, risen in sub-Saharan Africa, the Arab States and parts of Asia. Of the 13 sub-Saharan countries reporting data, seven observed substantial increases (more than 5%) in women engineers since 2000. However, on average less than 20% of women still graduate in engineering, with the notable exceptions of Liberia and Mozambique. Several Asian countries show much higher rates: 31% in Vietnam, 39% in Malaysia and 42% in Brunei. In India, the substantial increase in women undergraduates in engineering may be indicative of a change in the ‘masculine’ perception of engineering in the country. It is also a product of interest on the part of parents, since their daughters will be assured of employment as the field expands, as well as an advantageous marriage. Other factors include the ‘friendly’ image of engineering in India, compared to computer sciences, and the easy access to engineering education resulting from the increase in the number of women’s engineering colleges over the last two decades (UNESCO 2015).

### 3.1.3 Waste Collection and Recycling Activities in the Informal Sector

Cities in low- and middle-income countries often have a large informal sector that makes a living from recyclable solid waste recovery. The work of these recyclers is generally not recognized by local authorities although it constitutes an integral part of the solid waste management systems as they collect waste from homes, streets, commercial and industrial establishments as well as final disposal sites. A comparison of recyclable materials collected by the formal versus the informal

sector in Lima, Lusaka, Pune, Quezon City and Cairo showed on average a 1:3 distribution of shares, respectively (Gunsilius et al. 2011).

In the informal waste sector, workers collect materials for recycling either directly from households that segregate, from already collected but mixed waste, from public bins, litter in the street or landfills. India’s recycling collectors for example, can be roughly categorized into two groups. In the lowest income range are the free-roaming bag-on-shoulder pickers collecting from streets and dump sites. This group has large female representation. Earning slightly better incomes are the cycle or cart-carried recycling collectors, often employed by private recyclables collectors or scrap dealers. This category is dominated by men (Figure 4). In general, data on gender roles are patchy and vary between countries and cases. They are compounded by many factors, such as ethnicity, religion and the social stigma of the job (Dias and Ogando 2015; IADB 2013; Florisbela and de Pauli 2006).

Although waste picking for recycling and reuse might be perceived as a degrading job, women in India stated that they preferred waste picking to construction or domestic work, the only other principal occupations open to them, because it afforded greater independence, flexibility and relative freedom from the feudal and often sexually exploitative relationships prevalent in those other fields (Tangri 2012). Flexibility is important as it allows women to have the autonomy to determine how to structure their working day around their domestic chores or to bring young children along (IADB 2013). The creation of associations and unions of waste pickers and recyclers has significantly helped to improve the working conditions of the predominantly female workforce in this sector (Box 2).

### BOX 2. FORMALIZING THE INFORMAL WASTE SECTOR THROUGH ASSOCIATIONS IN INDIA.

Under the Alliance of Indian Wastepickers (AIW) 35 organizations in 22 cities support street cleaners with the large majority being women. Examples of these organizations are Hasiru Dala in Bengaluru and KKKPKP or Solid Waste Collection and Handling (SWaCH) in Pune, which have formed union-like organizations and cooperatives for waste sector workers, bringing together waste pickers, itinerant waste buyers, waste collectors and other informal recyclers. The unions work with the municipalities to provide waste collectors with uniforms, protective gear, city-approved ID cards and health insurance premiums. In the Pimpri Chinchwad Municipal Corporation, this has not only made their occupation safer (e.g. against police abuse) but also contributed to the reduction of social stigma of female waste pickers in the society, allowing them to formally offer door-to-door waste collection which has continued even under the Covid-19 lockdowns. While most of these organizations are mainly composed of women (>70%), some are also dedicated wholly to women like the Self Employed Women's Association (SEWA) with over 70,000 members. The transition from waste picker to service provider has not been easy as reported from Pune. It has required new attitudes and behaviors from both waste pickers and residents; but these changes have been mutually reinforcing. The waste pickers have had to learn to be punctual, regular and cordial in their work, and to professionalize their appearance (with the help of uniforms). The residents have learned to treat them as workers and human beings. This change in the waste pickers' social status and self-perception has been described as one of the most dramatic results of their organization (Tangri 2012; Ocean Conservancy 2019).

The ownership and operation of junk shops by women is quite common, e.g. in the Philippines (approximately 37%) and representative of the general trend of this form of employment, i.e. the operation of small businesses in the country (Box 3). An even higher percentage can be

found in Vietnam (Figure 4), although men dominate higher paying positions not only in the informal waste economy, such as dealers and owners of recycling businesses, but also in the formal waste economy, such as truck drivers and managers (Ocean Conservancy 2019).

### BOX 3. GLOBAL GENDER GAP REPORT 2018.

Of the four countries Ocean Conservancy (2019) compared in its study, **India** has the lowest score on the Gender Gap Index (World Economic Forum 2018) ranking 108 out of the 149 countries evaluated. According to the United Nations (UN) India Business Forum (<http://in.one.un.org/unibf/gender-equality/>), more than 50% of the work done by women in India is unpaid, and almost all of it is informal. Many Indian women are also excluded from the formal financial system. Nearly half of India's women do not have banking access or savings accounts and 60% have no valuable assets.

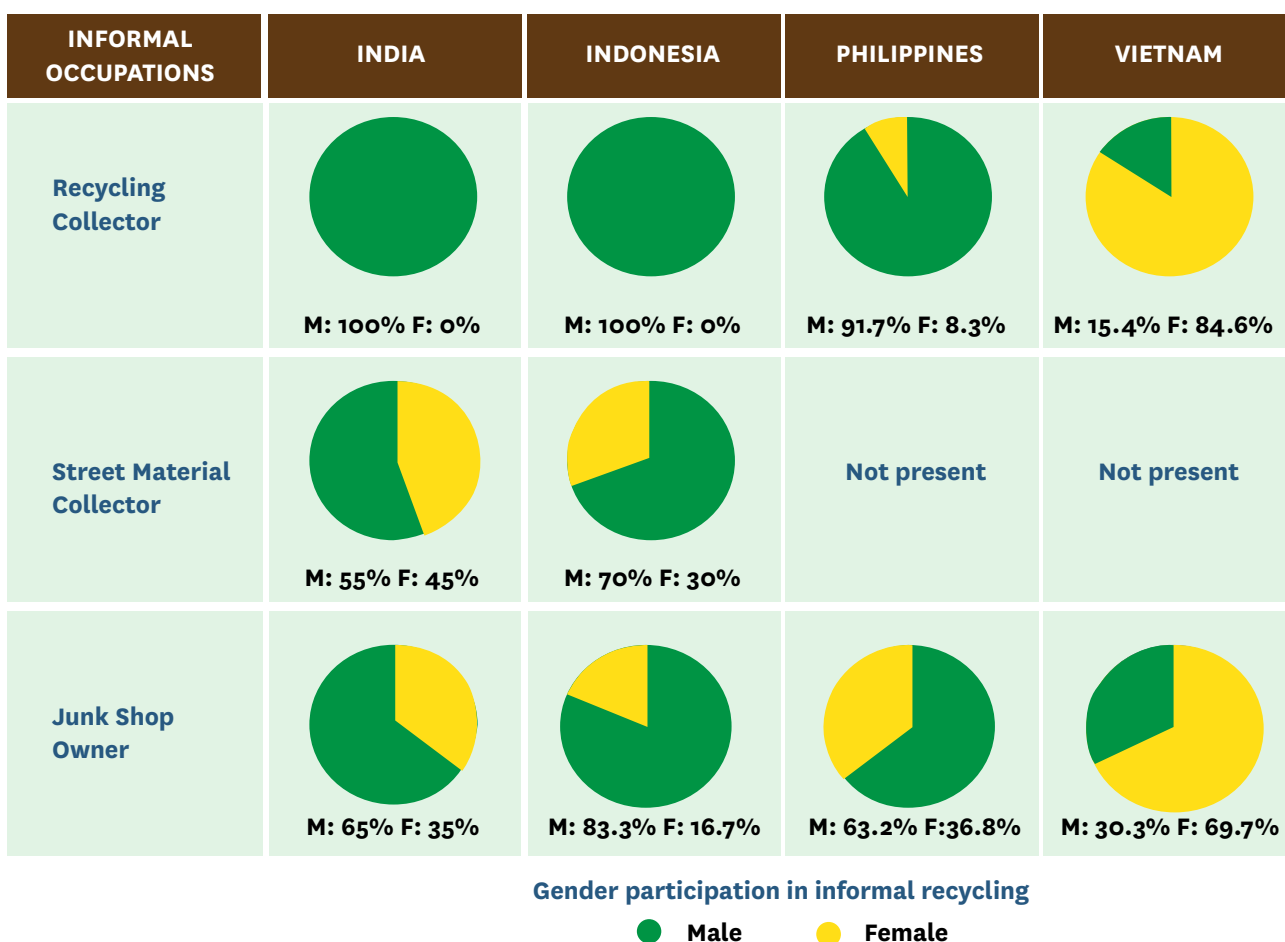
**Indonesia** ranks 84 out of 149 countries in the Gender Gap Index due to low economic participation, limited political empowerment and lack of education for women.

The **Philippines** is one of the higher-ranked Asian nations with respect to closing the gender gap, boasting a global ranking of 6 out of 149. Contributing factors are high rates of health and survival, education, and economic participation. Women, however, primarily constitute a large portion of the informal sector and are typically found in small home businesses and other underdeveloped sectors of the economy including waste segregation and recycling.

In **Vietnam**, women are actively engaged in owning and operating businesses as well as participating in the workforce, compared to other countries in the region. However, due to lack of political empowerment, the country ranks only 77 out of 149 countries.

Recurring themes in all of the four countries are those of low or limited economic participation, often not allowing for growth or scaling up from small, localized businesses.

*Source:* Ocean Conservancy 2019.



**FIGURE 4. GENDER PARTICIPATION IN INFORMAL WASTE COLLECTION AND RECYCLING SHOP OWNERSHIPS AS OBSERVED IN INDIA, VIETNAM, INDONESIA AND THE PHILIPPINES (SOURCE: OCEAN CONSERVANCY 2019).**

Traditionally, waste pickers have not been interested in organics (i.e. 'wet' waste), as they have no perceived commercial value compared to cardboards, metal, plastics and so on. However, in Pune, India, the local waste picker cooperative SWaCH included organics in its portfolio. SWaCH is providing door-to-door collection for more than 330,000 households, or 47% of the city, in both institutional campuses and in ordinary neighborhoods, on a contract basis (Tangri 2012). Residents are supposed to separate their waste at home, but compliance is modest: about 30% do rigorous wet/dry separation and another 60% sort some recyclables. The organics are used in support of one of several biogas plants (which only accept very clean organic waste) while other organics that SWaCH collects from households go to a larger centralized composting plant (100 tonnes/day) operated by a local NGO, or to about 40 decentralized smaller compost stations. These stations are operated by SWaCH members who are 92% women and almost all from the lowest (Dalit) caste. Since residents can see where their organics are being composted, and see SWaCH members cleaning the organics, they are far more

rigorous in their source separation – which results in better quality compost (Tangri 2012).

In other Indian cities, like Madurai, Bhubaneswar or Shillong<sup>4</sup>, the municipality reached out to women self-help groups (SHGs) to engage them in the operation of their decentralized micro-composting centers (MCCs). Each MCC can handle up to 5 tonnes of organic waste per day and is operated by four to five employees. While the MCCs, such as in Madurai, help to reduce the cost of shifting waste to a centralized dump yard, the advantages for the SHGs are that the running cost for the first year has been provided, the SHGs can sell the compost in their areas and are also allowed to utilize available land to grow vegetables. The SHGs are run by women for (mostly) women. Functioning as microfinance providers, the SHGs also work towards empowerment of women through training and social capital development (Kandpal and Saizen 2021).

Similarly, in the Nilgiris, SHGs run a co-composting unit utilizing fecal sludge and organic waste, incentivizing female farmers to use the co-compost for growing exotic vegetables (Gupta, 2019).

<sup>4</sup> [http://timesofindia.indiatimes.com/articleshow/78354489.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](http://timesofindia.indiatimes.com/articleshow/78354489.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)  
<https://www.orissapost.com/shgs-to-manage-composting-centres/>; <https://citizenmatters.in/shillong-womens-self-help-group-boosts-waste-recycling-14566>

## 3.2 Gender in Wastewater Management and Reuse

In **wastewater management and reuse**, the formal treatment sector and the predominantly informal reuse sector need to be distinguished. While in the formal sector, women play a marginal role, as in solid waste management, they can play a major role in the informal reuse sector, although not necessarily on farm. Understanding these roles is critical for safeguarding consumers.

### 3.2.1 Wastewater Treatment

In the formal wastewater treatment sector, employment disparities are similar to those in solid waste management. In the 2011 UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS), half of the countries surveyed reported that women comprised less than 10% of the total professional water and sanitation workforce (WHO and UN-Water 2012). The same picture applies to the gender distribution among staff in water and wastewater treatment facilities. Based on studies in 15 developing countries in Asia and Africa, IWA (2014) found that women accounted for an average of just 17% of all staff engaged in the water and sanitation sector, while NGOs seemed to have more women employed than the public and private sectors (IWA 2014). While Willetts et al. (2016) verified the male dominance of the sanitation sector in a study in Indonesia (13% women), Timor-Leste (0% women) and Vietnam (40% women), the authors also showed the relatively large variability among countries

and perceptions of opportunities and constraints for women engaging in the sanitation sector.

The picture is equally gender-biased for **fecal sludge management** (FSM) which is serving on-site sanitation systems, and can be an important input for resource recovery, e.g. through co-composting with other organic waste sources (Cofie et al. 2016). In contrast to the vast literature on gender and toilet access or WASH in general, there is scant information on gender within public or private FSM business operations. Given the investment needs for a septic truck, and cultural perceptions of women as truck drivers or fecal sludge managers, it is not surprising that the sector has a negligible share of women (Willetts et al. 2016; Mulandano 2020). However, there can be exceptions (Box 4), and a much higher participation of women in public, private and community-based composting and co-composting facilities.

At the household level, the understanding of gender perceptions is important for introducing alternative sanitation systems, like urine-diverting (dry) toilets (UD(D)T) which are mobile and do not use much space. Women would like to have such toilets in their houses to reduce walking to outside latrines or public toilets especially at night or during bad weather conditions. On the other hand, these toilets can be an extra burden if women have to clean and empty them (Dankelman et al. 2009). More than half of the families in a large South African case study felt 'very bad' about emptying the chambers (Stenström et al. 2011). This is the reason why some UD(D)T providers (usually NGOs) offer collection and replacement services of full chambers with the option to treat the fecal sludge for reuse.

#### BOX 4. BREAKING GENDER BARRIERS IN FECAL SLUDGE EMPTYING.

Venkatalakshmi, a resident of Narsapur, India, is a shining example of a successful female entrepreneur fighting the odds to implement sustainable sanitation in her hometown. Recognizing a business opportunity, she secured money to own two desludging trucks, hired drivers, painted the trucks to make them appealing and advertised them. She has financed the operation herself and empowered her family to work with her. Although she has met resistance and violence, she continues to work and grow. She also started to collaborate with her main (male) competitor to save costs and jointly dominate the market. Today, she is being supported by the town of Narsapur which is empowering desludging operators, introducing tools and safety training to implement regular desludging, and building a state-of-the-art treatment plant to prevent wild dumping. Venkatalakshmi's story is an inspirational one of the power of involving citizens, especially women, in providing a roadmap to enter sanitation businesses across India (Dasra India 2017). Related encouraging examples of women-led de-sludging services are also found in Tamil Nadu<sup>5</sup>. Presently, at least five women-led enterprises are operating in Trichy while Mulandano (2020) describes a similar story from Zambia in Africa.

Women's relative high enrollment in engineering and the sciences, as in the Middle East and North Africa, is not yet reflected in a higher female labor force or employment (World Bank 2009). This challenge requires much more targeted policy support, actively backstopped by funding

agencies and their gender policies (Box 5). However, fewer than half of the 109 reporting countries in the 2021 SDG 6 update have laws or policies that specifically mention women's participation in sanitation or water resources management (UN-Water 2021).

<sup>5</sup> Watch <https://www.youtube.com/watch?v=XcXiXDCAHZw>

### BOX 5. EFFORTS TO ENHANCE WOMEN'S EMPLOYABILITY IN WASTEWATER TREATMENT PLANTS AND SEWERAGE PROJECTS.

For expansion of the As Samra wastewater treatment plant in Jordan, particular emphasis was placed by the funding agency (Millennium Challenge Corporation) on increasing the small share (3%) of female employees. Women's associations were contacted to encourage the participation of women in public consultations about job opportunities in the construction and operation phases, and to help in analyzing, via a predesigned questionnaire in Arabic and English, possible barriers to women's employment. As most participants had already left the consultation before reaching the gender discussion, soft copies of the questionnaire were sent via e-mail to the participants who had left earlier, and follow up by phone was done. Nevertheless, the feedback remained limited. In general, many participants noted that they were not interested in jobs, particularly in construction. However, 69% of the (mostly male) respondents thought that hindrances preventing women from applying for work opportunities could be resolved and social and cultural constraints could be overcome by conducting more awareness campaigns and workshops. Television, newspapers, the Internet and official channels of municipalities and associations could be used for such purposes. About 77% of the respondents thought that women would be interested in pursuing a non-construction job, like management (including accounting), supervision, engineering, catering, laboratory analysis and general plant safety. The respondents recommended very transparent terms of reference and indication of all benefits in the job advertisement, such as clear working hours, provision of transport, good salary, health insurance, vacations and so forth. Examples of possible hindrances to be mentioned were particular physical requirements, cultural and traditional constraints, long working hours or the unavailability of transport or daycare for babies. It was concluded that to motivate women and overcome cultural constraints special efforts were needed (Consolidated Consultants 2012).

### 3.2.2 Acceptance of Wastewater Reuse

Across gender, the acceptance of using reclaimed water has been studied in many countries and is usually increasing along a trajectory (Figure 5) from direct to indirect physical contact with the least

preferred option being its use in drinking water reservoirs or to replenish groundwater (Drechsel et al. 2015). Variations between gender are location-specific and can point at a higher rate of acceptance by men, as shown for example by Daghighi et al. (2020) (Figure 6).

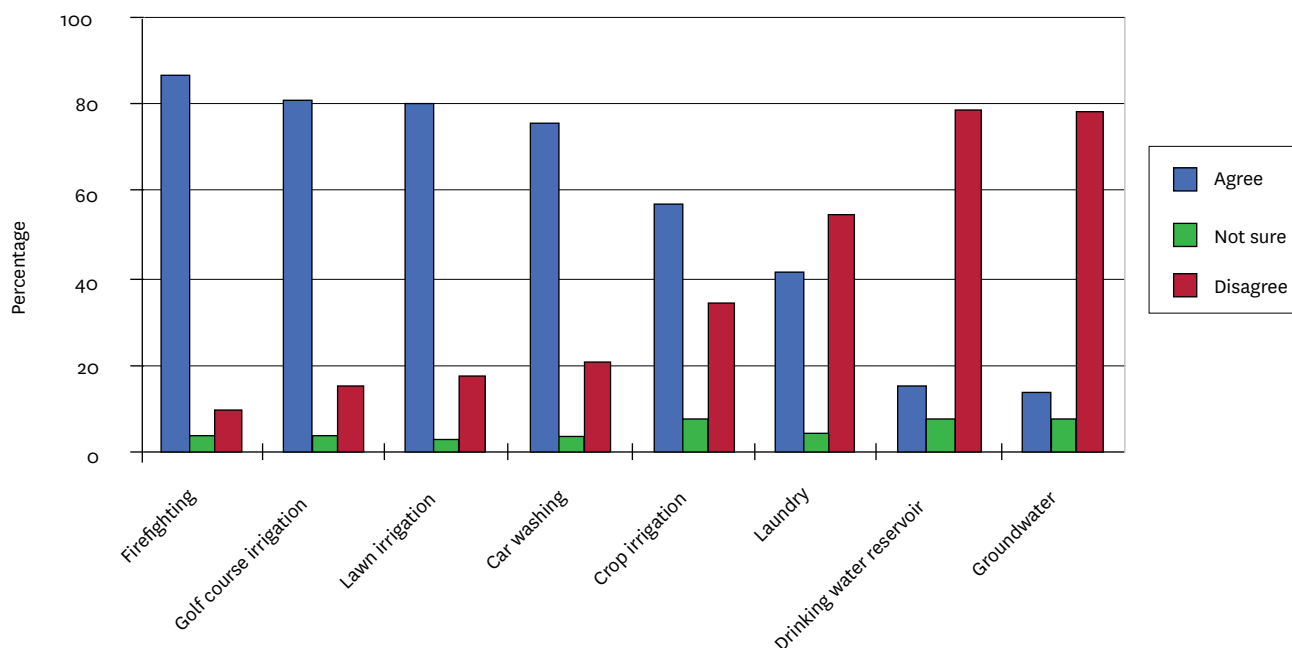
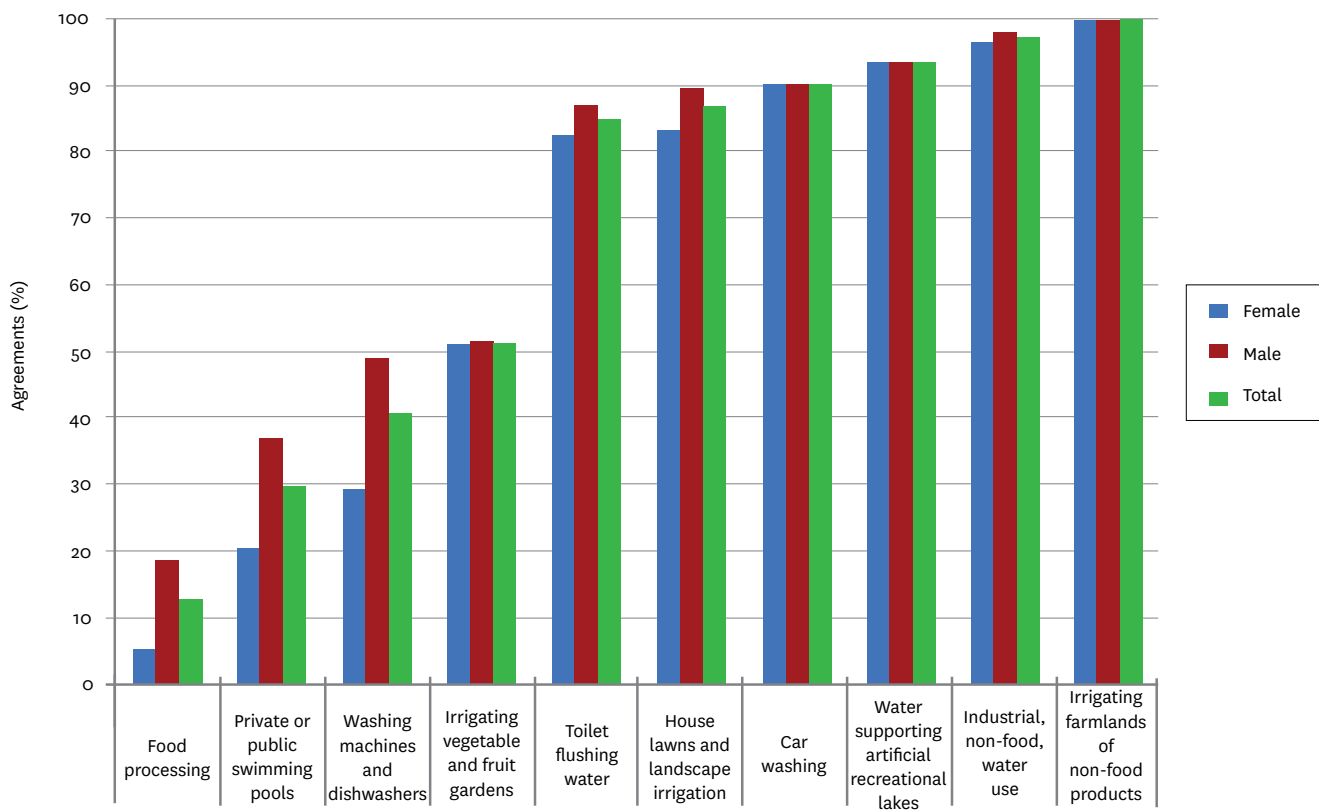


FIGURE 5. ATTITUDES TOWARDS WASTEWATER-USE OPTIONS FROM A SURVEY IN SOUTHEAST UNITED STATES (SOURCE: MODIFIED FROM ROBINSON ET AL. 2005).



**FIGURE 6. EFFECTS OF GENDER ON THE ACCEPTANCE OF RECLAIMED WATER USE IN TEHRAN, IRAN**  
(SOURCE: MODIFIED FROM DAGHIGHI ET AL. 2020).

### 3.2.3 Wastewater Reuse in Agriculture

In view of agricultural reuse, three scenarios can be differentiated:

a) The treated wastewater released from larger treatment plants into waterbodies might be used downstream by farmers for irrigation or aquaculture. This sector has been estimated to cover less than 1 million ha (Kookana et al. 2020). Smaller treatment plants might also support irrigation schemes or fish farming in direct proximity, especially where water is scarce. In more elaborate situations, the reclaimed water is offered to farmers in exchange against freshwater for urban needs (Otoo and Drechsel 2018). The gender dimensions in all these situations will depend on local factors starting from the stakeholder acceptance of the reclaimed water (see above) to the ability of women to join an irrigation scheme and engage in irrigated farming, which is often linked to land rights, credit access and participatory irrigation management, factors which are not commonly to the advantage of women (FAO 2011; Njie and Tacko 2013).

b) Given that 80% to 90% of the wastewater generated in low-income countries is untreated, and most surface water sources in and downstream of urban areas carry wastewater to different degrees,<sup>6</sup> urban and peri-urban farmers constitute a 30-million ha farming sector already practicing resource recovery, albeit not without putting their own and consumers' health at risk (Thebo et al. 2014, 2017). This risk factor requires significant attention (see below) as a key requirement for any sustainable resource recovery from waste is not to inflict harm on human and environmental health.

c) A third scenario in between the previous two is the reuse of greywater in home gardens, ideally with adequate on-site treatment (Box 6) (Haddad El-Hajj 2010).

Wastewater irrigation also allows the production of cash crops in the dry season. The most profitable cash crops are easily perishable vegetables, such as lettuce, which cannot be transported without significant loss from more rural areas to the urban market. As lettuce is usually

<sup>6</sup> In this report, the term 'wastewater irrigation' covers the use of diluted as well as raw wastewater, with the first being the significantly more common situation (Thebo et al. 2017).

consumed raw as ‘salad’ it poses significant health concerns to the public where the wastewater is not well treated (WHO 2006). The recommended and World Health Organization (WHO)-adopted risk mitigation measures

between farm and fork (Amoah et al. 2011) require a high level of gender sensitivity to account for traditional gender roles of farmers, wholesalers and retailers which can vary between crops and cultures (Obuobie and Hope 2014).

#### BOX 6. GREYWATER USE AT HOUSEHOLD AND COMMUNITY LEVELS.

Women can play a significant role in household and community-based water recycling activities. Greywater, i.e. the water from kitchens, laundry and bathing (without toilet water), constitutes an important water source for farming near the homestead where freshwater is scarce and/or expensive. Low-cost treatment options (Keraita et al. 2014; Boufaroua et al. 2013) can be installed for one or more households. Examples from Jordan, Palestine and Lebanon showed that stakeholder participation in the design of local treatment and reuse systems has been appreciated by local residents, especially women, since they are in charge of water management in the household. The women reported that the reclaimed water helped to improve food security, and most importantly saved them trips for hauling water, e.g. from the polluted town spring (Haddad El-Hajj 2010; Ghanem 2016). The support of household- or community-based greywater recovery systems for gardening allowed the community to offset some food purchases and generate income by selling surplus production, instead of spending more on the water bill (Faruqui and Al-Jayyousi 2002). Bader (2013) concluded from Palestine that the empowerment of women has an effective and active role in woman’s acceptance of the reuse of treated wastewater if their practical and strategic needs have been connected and if there has been an attempt to meet these needs simultaneously. An intervention by WASTE and the Rural Development Organization in the Nilgiris, India, supported women farmers to grow vegetables utilizing recycled greywater from nearby households even during the dry season which reduced water transport costs, adding up to their income (Gupta, 2019).

### 3.2.4 Gender Roles Along the Wastewater-Irrigated Vegetable Value Chain

In many cities in sub-Saharan Africa, women dominate vegetable marketing where they can earn more than in open-space irrigated urban farming (Bellwood-Howard et al. 2021) which is in many West African countries dominated by men (Table 1). Compared with rural farming, urban proximity and water access for farming both in the hot and dry seasons allow urban farmers and traders to pass the poverty line (Danso et al. 2002). Where wastewater is the only or seasonally main water source, resource recovery is therefore not only securing livelihoods but offering women who might lack access to land or formal employment a job opportunity. Given that in many cities up to 90% of all perishable vegetables, like lettuce, is produced with wastewater, water reuse supports a significant share of the urban market supply with salad greens (Drechsel et al. 2007).

The gender split is of course more complex than Table 1 might imply: There can be further gender differences between urban and peri-urban areas, particularities in view of crops (exotic versus indigenous), type of irrigation, type of employment and so forth (Drechsel et al. 2006).

In the well-studied case of gender in urban open-space farming in Ghana (Hope et al. 2009; Obuobie and Hope 2014), women and men’s roles are complementary and have been attributed to societal norms and economic factors. On most open spaces, which are usually near streams, manual irrigation with watering cans is common. Especially exotic, leafy vegetables (like lettuce) which are not adapted to the hot climate in the region require frequent watering, even in the rainy season. Irrigation with cans is very energy consuming and done at sunrise and sunset to avoid unnecessary water loss through evaporation. There are, however, times when women have important duties at home (getting children ready for school; preparing food for the family). Women farmers are thus challenged in multiple ways and resort to planting indigenous vegetables (e.g. amaranths) which require less water but sell at lower prices than lettuce, for example (Bellwood-Howard et al. 2021). Particularly irrigation, if done manually, can take between 40% and 70% of farmers’ time with a common distance of 50 meters (m) to 100 m between field and water source. It is therefore noteworthy that on farms where streams can be blocked and gravity irrigation using furrows is possible,<sup>7</sup> water supply can be initiated by a member of the farmers’ association for the whole group, and equal

<sup>7</sup> <https://www.youtube.com/watch?v=oVBDYge868k>

**TABLE 1. GENDER RATIO IN OPEN-SPACE<sup>8</sup> FARMING IN VARIOUS CITIES OF WEST AFRICA.**

COUNTRY	CITY	FEMALE (%)	MALE (%)
Benin	Cotonou	25	75
Burkina Faso	Ouagadougou	38	62
Cameroon	Yaoundé	16	84
Côte d'Ivoire	Abidjan, Bouaké	5-40	60-95
Gambia	Banjul	90	10
Ghana	Accra, Kumasi, Takoradi, Tamale	10-20	80-90
Guinea	Conakry, Timbi-Madina	70	30
Mali	Bamako	24	76
Mauritania	Nouakchott	15	85
Nigeria	Lagos, Ibadan	5-25	75-95
Senegal	Dakar	5-30	70-95
Sierra Leone	Freetown	80-90	10-20
Togo	Tsévié, Lomé	20-30	70-80

Source: Drechsel et al. 2006.

numbers of women and men are farming (Obuobie and Hope 2014). Therefore, improving irrigation technologies could facilitate a better gender balance on farms.

Interestingly, the ability to access land (in proximity to a water source) which is a common factor disadvantaging women in agriculture, and can be a major role in rural and peri-urban settings, has a lesser role in many urban settings where spaces male or female farmers occupy are owned by third parties (like unused private plots, institutional or governmental land). Access therefore depends less on inheritance, customary rules or one's gender but rather on the individual's ability to lobby among those who are farming already or with the caretaker of the plot. However, soil quality can be a challenge. Labor-demanding marginal quality soils can result in women quitting urban agriculture more often than men (Karg et al. 2020).

Male farmers feel significantly oppressed by their dependency on credit provided by market women who regularly visit the farms and reach agreement with farmers before they plant the crops in demand. However, the exact price to be paid later will remain open (depending on the development of supply and demand), which the traders will use to their advantage. Efforts by men to break these stereotypes exist (Danso and Drechsel 2003) but are usually short-lived due to social pressure within markets (Obuobie and Hope 2014), allowing women to 'secure' their job domain. Strict gender mainstreaming (i.e. opening up vegetable retail markets to men) could thus disenfranchise women if it provides men an opportunity for entering and possibly taking over the more profitable retail sector (Drechsel et al. 2013).

Delving deeper into the different gender dimensions along the vegetable value chain, it can be added that in general cash crop farming is considered in most Ghanaian communities to be the domain of men. Women, particularly in northern cities (like Tamale), have in many cases less access to resources to conduct market-oriented farming (Zibrilla and Salifu 2004; Bellwood-Howard et al. 2021). Customary laws do not permit women the right to hold land except through male relatives or as widows. However, they can have user rights unless land is in short supply. Sometimes they are pushed towards more marginal plots. The crops selected are more likely to be subsistence crops, partly for the household, partly for sale, which require low initial capital investment for seeds and less maintenance which could clash time-wise with household chores.

Women's general dominance in marketing was constructed through the intergenerational reproduction of gendered roles and skills, but can also be attributed to the lower investment costs compared to farming (Bellwood-Howard et al. 2021), though there are crops, which are traditionally handled by men, while others are 'women's crops'. Among vegetables, cabbage, sweet pepper and cucumber are normally associated in Ghana with men, while lettuce, carrots, spinach, okro, garden eggs and others are associated with women (Obuobie and Hope 2014). However, this gender differentiation is less binding on urban farms where farmers grow whatever gives profit, but more obvious in wholesale and retail. For example, while large onions from Niger are sold by young men in Accra's streets, and there are many male cabbage wholesalers, lettuce wholesale and retail is managed

<sup>8</sup> Open-space farming refers to larger unbuilt areas in cities where between 10 and more than 100 farmers cultivate crops. The other common urban agricultural system is on-site backyard farming at the house.



by women. The time and means needed to access and transport the heavier crops also play a role. While the easily perishable lettuce is grown within the urban area, it requires transport to buy cabbage from villages in urban proximity. Access to capital to buy minivans or trucks for crop transport and the ability to stay long days away from home have been cited as some of the barriers women wholesalers face (Obuobie and Hope 2014).

In summary, it is important to understand the relationships between women and men along the value chain, in particular where traditional or designated roles depend on access to resources including time. Focusing support only on one gender's activities can equally lead to failure to achieve project objectives if the complementary or conflicting roles and relations between women and men are not considered (Box 7).

### BOX 7. MISGUIDED GENDER SUPPORT IN AQUACULTURE.

In Guinea, West Africa, women play an important role in the processing and marketing of fish, which are generally caught by men. In a traditional arrangement, women either pay fishers directly for their catch or repay a share of the profits after processing. They may also supply fuel for the fishing trip. A project initiated by a UN agency aimed to increase the productivity, income and working conditions of these women. To do this, women were organized into groups and trained in improved technologies. The project also aimed to empower women through increased solidarity but failed to meet its objectives. The supply of fish broke down for some women and many of the groups failed to function. At the root of the problem were various inappropriate assumptions. First, the project assumed a sharply dualistic division of labor. Because women undertake all fish smoking, it was assumed that men have nothing to do with this. In fact, all production involves interdependent activities between men and women. In targeting women alone, the project undermined this interdependence. Some men raised their prices because they perceived the women as part of an externally funded project. As a result, many women were more concerned about protecting their traditional arrangements than being involved in the project. The project also assumed that all women have the same interests. However, diversity in age, conjugal rank, class and religion influenced the ability of the women to work together. The idea of female solidarity did not prove sufficiently strong to hold the groups together. A further assumption, that women's time is elastic, also proved to be wrong. The project imposed regular hours for attendance and work that conflicted with the many other claims on women's time.

Source: Goetz 1997 cited in Kusakabe 2003.

### 3.2.5 Gender Dimensions of Health Risk Perceptions

Given farmers' daily exposure to multiple health hazards at home (like poor sanitation) and on farm, which can all cause pathogenic infections, but probably also increased long-term immunity as well as limited knowledge about transmission pathways, the (usually male) farmers in urban Ghana show very limited knowledge of possible food safety issues arising from contact and use of their highly polluted irrigation water (Obuobie et al. 2014). It is noteworthy that despite negative media reports about 'wastewater irrigation' and a range of projects addressing the wastewater challenge (including from IWMI), recent perception studies continue to show that most farmers interviewed in Accra and Kumasi disagree<sup>9</sup> that the use of their irrigation water can contaminate vegetables or make consumers sick (Quansah et al. 2020; Arimiyaw et al. 2020) similar to reports from surveys conducted 20 years earlier

(Obuobie et al. 2014). The usually female vegetable traders, on the other hand, demonstrate basic risk awareness and are at least in Accra more concerned about food quality than their male counterparts on farm. Compared to farmers, they are also closer to the final consumers or street food kitchens and possible negative feedback.

### 3.2.6 Gender Dimensions of Health Risk Mitigation Measures

Karg and Drechsel (2011) outlined a bundled innovation combining awareness creation (training), incentives, social marketing and better enforced regulations as a requirement to catalyze a lasting change of behavior along the wastewater-irrigated crop value chain. Recommended and tested risk mitigation measures with high cost effectiveness have to go beyond occupational exposure risks for farmers (Box 8) and target the much larger risk group of consumers<sup>10</sup> of uncooked salad greens (Drechsel

<sup>9</sup> The data do not show if the answers are 'protective' as the question could jeopardize farmers' businesses, which then would imply a high risk awareness. However, from an observational perspective, most farmers (80%) do not show any special care when handling the water.

<sup>10</sup> In Accra, about 1,000 farmers produce exotic vegetables that are consumed daily as salad side dishes in street restaurants by about 200,000 urban dwellers. Raw salads are not part of the traditional diet at home (Keraita and Drechsel 2015).

and Seidu 2011). The different roles of women and men along the wastewater irrigation food value chain require a gender-sensitive approach for the implementation of risk mitigation measures following WHO's multibarrier approach which calls for interventions from farm to fork where wastewater treatment is absent or insufficient (Amoah et al. 2011; WHO 2006).

**Interventions on farm:** Health risk awareness creation, training in risk mitigation practices and 'road shows' for example can be important components but are eventually insufficient to trigger any lasting behavior change among the usually male vegetable farmers as past efforts have shown (Amoah et al. 2009). To catalyze the adoption of risk reduction options for the benefit of consumers, a more tangible incentive could be to increase tenure security as farmers live with a constant fear of eviction from the farm plots they are informally (often illegally) using. Increased tenure security could be linked to compliance with safety measures. Another incentive attractive to male farmers could be the prestigious annual 'Best Urban Farmer Award' with prizes such as a pickup truck. The Government of Ghana presents awards annually to the best farmers across the country, within the region and in different farming categories (Obuobie et al. 2014).

In view of occupational exposure and risk for the farmers, protective clothing and hygiene are the common recommendations. However, observations made in various tropical countries showed that the use of protective clothing was usually perceived as a burden limiting farmers' mobility and discomfort in view of the usually hot weather. Observed gender differences in the use of protective gear, as seen in Hanoi, were mainly attributed to differences in farming activities, not risk awareness (Knudsen et al. 2008). In fact, both genders felt that protective clothing constrained their work as also reported from Ghana where a survey in Accra showed that only one out of five farmers used boots or gloves (Obuobie et al. 2014). In the case of Hanoi, farmers

who wore protective clothing often did so to protect themselves from physical injuries rather than pathogens (Knudsen et al. 2008). Such observations provide entry points for indirect marketing strategies for protective gear where the awareness for 'invisible' (pathogenic) threats is too low to catalyze adoption.

**Intervention along the food chain:** In West Africa, women dominate the marketing of salad greens which makes them the main target group for risk reduction between farm and consumer. Once harvested, the vegetables are kept moist before selling them the next day. Lettuce in particular quickly loses its fresh appearance in the hot climate of the region. Also in markets, traders moisten their vegetables on display to maintain their fresh look because produce appearance is the key criterion consumers are looking for (Keraita and Drechsel 2015). Access to clean water for market women is therefore a key measure to prevent postharvest contamination. However, the main contamination can occur just after harvest while on farm. Hope et al. (2008) reported that many traders clean vegetables, like lettuce, on farm in local irrigation water to remove soil particles, dust or insects that are attached to leaves and roots. The resulting contamination just after harvest can jeopardize any risk mitigation measure farmers might have used and makes awareness creation and the provision of alternative options for the traders important.

**Interventions for street restaurants and households:** Buyers of vegetables are concerned about their appearance and price, not their origin or invisible 'defects' (Keraita and Drechsel 2015). This situation requires awareness creation as well as indirect strategies to catalyze behavior change like social marketing. Social marketing can help to identify and promote valuable risk-related benefits, including indirect business advantages (safety labelling, branding), improved self-esteem (awards) or feelings the target group will try hard to avoid ('yuck factor', Box 9).

#### BOX 8. OCCUPATIONAL EXPOSURE RISKS OF FARMERS FROM A GENDER PERSPECTIVE.

Farmers who irrigate their fields, and their relatives, are more exposed to health risks from parasitic worms and other pathogens than farmers who can access safe water (van der Hoek et al. 2002). The common practice of relying on women as low-cost agricultural labor (e.g. for weeding) also puts women at elevated health risks from pathogen exposure (Moriarty et al. 2004). As women usually cook meals and cater for children, their pathogen exposure and possible transmission to other family members is of particular concern if good hygiene is not sustained (Saad et al. 2017). In general, exposure is closely linked to the acceptance of the waste product, and acceptance can vary between gender, cultures, education, castes and many other factors (Burt et al. 2021), including the lack of alternatives and/or conscious risk acceptance given the high cash benefits.

Studies must look for such core values that trigger the adoption of options which have the side effect of risk mitigation. For example, if a feeling of being ‘advanced’ can be associated with using chlorine tablets rather than salt for vegetable washing, or drip kits compared to watering cans, then the social marketing messages and communication strategies should reinforce these existing positive associations (Karg and Drechsel 2011) as successfully demonstrated in handwashing and end-open-defecation campaigns. The trigger in these cases was not ‘health’ per se, but feeling of ‘comfort’, ‘status’ or the wish to avoid ‘disgust’. As in handwashing campaigns, women in charge of child health and food preparation should be the key target group for ‘healthy vegetables’.

An example for a negative incentive would be fear of exposure and business closure: Where safety regulations cannot be monitored by authorities, media exposure (‘naming and shaming’) can be a powerful alternative to steer compliance. Urban farmers and food restaurants in Ghana fear media exposure as it can trigger ad hoc policy responses like eviction from the land or business closure (Keraita and Drechsel 2015). An important long-term strategy should be to increase risk awareness to catalyze demand for safe produce. Promising results were achieved through the involvement of strong private sector partners, compared to public sector training programs (Amoah et al. 2009). Communication channels that provide consumer feedback (via traders, media extension staff) to the farmers are also useful.

#### BOX 9. SOCIAL MARKETING EXAMPLE FROM WEST AFRICA TARGETING WOMEN.

In general, women are more exposed to waste-related health risks than men, where they have a (cultural) responsibility for household waste management and take care of small children (diaper changing) (IETC 2017). To improve hygiene, a social marketing approach was applied in a nationwide hand-washing campaign in Ghana (‘Health in Your Hands’). The campaign involved the use of professional marketing techniques facilitated through a private–public partnership to promote ‘socially useful products’ (in this case, hand washing with soap) through generation of demand. The underlying research revealed two main drivers for hand washing with soap: disgust of dirt (yuck factor) and caring for a child, whereas health (protection from disease) was a weak motivator. The communication campaign was thus designed for women to evoke the feeling of disgust without mentioning health or sickness (Scott et al. 2007). The campaign utilized mass media and community events. The unifying message across all communication channels was that hands were not ‘truly’ clean unless washed with soap. The campaign reached 82% of the study population; 62% of women knew the campaign song, 44% were exposed to one channel and 36% to two or more. Overall, TV and radio had greater reach and impact on reported handwashing than community events, while exposure to both a mass media channel and an event yielded the greatest effect, resulting in a 30% increase in reported hand washing with soap after visiting the toilet or cleaning a child’s bottom (Scott et al. 2008).



Photo source: Desire JP Lompo

## 4. CONCLUSIONS

This study attempted to explore gendered perspectives in the RRR sector with examples from the business as well as reuse standpoints. The RRR sector is still nascent but with potential to support several SDG targets (especially SDGs 2, 6, 7, 12 and 15). Identification, understanding and targeting gendered perspectives in the transition from linear to circular economic approaches will add a focus on SDG 4 (quality education), SDG 5 (gender equality) and SDG 11 (sustainable cities and communities). The gender lens is necessary as men and women have different opportunities and constraints and contribute differently towards production and consumption processes and the realization of resource recovery. The report reviewed different examples, in particular from Asia and Africa, related to municipal solid waste management and wastewater reuse, with a special focus on agricultural reuse.

The current gendered profile of the waste sector in many countries is largely the product of people's attitudes about men and women and the associated stereotypes directly linked to everyday life. Gender inequalities and norms are embedded in almost every sector and this includes waste management and sanitation, mirroring existing socioeconomic structures and gender gaps (UNEP-IETC and GRID-Arendal 2019a; World Economic Forum 2018). The development of evidence-based, gender-sensitive policies requires information and data. Gender-disaggregated statistics and information related to the waste sector are currently not collected in any systematic way except for parts of the WASH sector. Measuring impacts and results by developing and extending gender-disaggregated data collection across all indicators relevant to the circular economy will provide important benchmarks against which changes in the sector can be assessed (UNEP-IETC and GRID-Arendal 2019a). This absence of data also severely undermines the visibility and contributions of women in the sector (Aidis and Khaled 2019).

So far, work on the circular economy has largely focused on the environmental and business aspects of circularity, while there has been little analysis of the social implications, in particular the role of women in leading or contributing to the necessary transformations in the circular economy, the skills set needed, and the impact on women's job opportunities (OECD 2020). As Murray et al. (2017) pointed out, key social equality aspects such as gender, racial and financial equality, inter- and intragenerational equity and equality of social opportunities remain absent in the existing conceptualizations of the circular economy.

The reported examples and reviews clearly show that the waste, sanitation and recycling sectors are male-

dominated like other engineering-based sectors of society. Women have significantly lower technology participation rates compared to men; a result of entrenched sociocultural attitudes about the role of women in society as found in other sectors, described by Antonio and Tuffley (2014) as typical for developing countries. Women often find it more difficult than men to formalize their businesses due to low levels of education and business skills as well as sociocultural factors which may restrict the female domain to low-level economic activity and the domestic environment (Simavi et al. 2010). Also in the waste, sanitation and recycling sectors, large proportions of women remain concentrated in low value-added, lower-skilled retail and service functions, particularly at the micro level of society. Women's access to resource-efficient and cleaner production methods is limited and they are under-represented in the public and private waste and sanitation sector's workforce. Studies have noted the importance of including women in the design, operation and maintenance of water and sanitation facilities which results in positive outcomes at different levels (GWA 2011; Thompson et al. 2017; Geertz and Iyer 2018; World Bank 2019b).

However, despite the wide gender gap in the waste and sanitation sectors, projects targeting municipal waste reduction or recycling, including the recovery of soil nutrients and organic matter via composting, or safe wastewater reuse, cannot bypass women who are (i) usually within households the focal point for waste management, including waste segregation; (ii) form in many regions the most powerful waste collection and recycling associations where the informal sector complements the formal one; and (iii) are regionally the key target group for risk reduction strategies where RRR threatens public health as in the vast informal wastewater irrigation sector.

The following section points at four challenges identified for women entrepreneurs at different scales in the private and informal sectors which remain work in progress and should receive priority attention. They are as important for an inclusive circular economy as for many other business sectors, and in part not only challenging for women. The selection is by no means complete as there are many challenges for women which cut across society, like missing policy support, lower wages for women, challenges to access latest technologies and expertise, and so forth (UNESCAP 2018):

### **(a) Access to finance**

A common bottleneck in most developing countries, not only for starting RRR businesses, is the lack of local capital markets that provide long-term financing for small- and middle-scale infrastructure projects (Lazurko

et al. 2018). There is a particular lack of options for project needs valued at USD 10,000 to USD 100,000, which are often too small for the corporate sector and too large for micro loans (Winpenny 2003). Access to diverse public and private funding sources for capital and operational costs is particularly critical for financing RRR as RRR solutions have unique characteristics that introduce challenges to financiers, including high up-front costs, a range of project scales, long payback periods, lack of track record, limited technology diffusion and challenges related to valuing non-economic benefits (Lazurko et al. 2018). For larger projects, these returns on investment would come in the form of socioeconomic benefits from improved sanitation and health, which are fully internalized by governments and citizens, but very difficult for a private company to monetize (Muspratt 2016a). Moreover, while large government contractors and international construction firms can smooth cash flow over intermittent sanitation projects and a slow government pace, young firms do not have the reserves for this time frame (Muspratt 2016b). These countries could learn from others, like Singapore, which supports local enterprises and business start-ups with various green financial instruments (Di Mario et al. 2018). As women usually have fewer assets than men, like land, which could be used as collateral, they struggle more with access to formal finance and have to rely on informal sources. These will continue to be important for women entrepreneurs, although the onus is with the banks and microfinance institutions to improve their services, e.g. in view of group lending schemes (Aliber 2015).

### **(b) Development of unions**

In many parts of the world, the informal recycling sector is struggling with the increasing privatization of the waste sector and related regulations which put them out of business. The national recycler movements in Latin America, for example, were the result of a process that began with specific struggles when waste pickers were excluded from disposal sites, denying them access to recyclable material and thus affecting their only source of income. As a result, groups, organized in associations, cooperatives and other organizational structures, started to form local and later national movements that oriented their actions towards changes in public policy (IADB 2013). Similar examples are reported from many countries, as in India or the Philippines, where cooperatives organized themselves to strengthen their position in negotiations with government authorities, aimed at consolidating their participation in the solid waste management system. While the added value and immense workforce of the informal sector has been acknowledged, direct support remains a struggle. In Africa, well-known groups are found in South Africa and Egypt. When recyclers are organized, female members reported benefits from greater social protection, less harassment, more support from colleagues and pride

in being a member of a cooperative (Alvez-Feitosa 2005; Samson 2009; Dias and Ogando 2015; Aidis and Khaled 2019; Ocean Conservancy 2019).

### **(c) Improving social acceptance**

Social acceptance is a key limiting factor for (i) reuse projects as much as (ii) waste sector workers and women in particular (Willets et al. 2016). Improving the image of the waste management worker by developing awareness of the relevance and benefit of such work is one way to alleviate the social stigma that it is generally associated with solid or liquid waste. Also, dignifying the work by supporting segregated collection, visualizing the workers' formal role via association (see above) and creating cleaner work environments will remove the perceptions that people working in waste material management are 'unclean' or 'unhygienic' as the materials handled would not be part of a waste stream but of a 'material stream' (Ocean Conservancy 2019). Operating recycling shops and engaging in community compost projects can increase workers' ability to network and gain self-confidence within society apart from the direct livelihood support from their services.

The same acceptance challenge applies to new reuse projects. Even when these projects are technically well-planned, appear financially viable and have incorporated appropriate health protection measures, reuse can fail if planners do not adequately account for the dynamics of social acceptance. While water scarcity, for example, supports a discussion about alternatives, the ultimate acceptance of reclaimed water is – as shown above – influenced by the level of direct exposure, availability of alternative (even if more expensive) sources, educational levels and gender-specific perceptions of health risks. Overall, acceptance of waste-derived resources appears to grow with the development stage of society, but probably not in a strict linear way as limited risk awareness can also facilitate reuse while a strong public opinion can result in oversensitivity that undermines the market acceptance of waste-derived resources. This variability makes social feasibility studies, close participation of target groups and trust building essential components of successful reuse programs (Drechsel et al. 2015).

### **(d) Reducing bias in education and employment**

Identification and understanding of gender-specific barriers in education and employment are pillars for a more diverse and inclusive circular economy. World Bank (2019b) summarizes key recommendations to address common barriers women are facing in water utilities which are as dominated by men as the waste and sanitation sectors.

- Attraction: Student exposure to (commonly male-dominated) jobs in engineering and related female role models can be important to remove stereotypes and

encourage schoolgirls to explore career avenues that they may not have been considered originally. Utilities can offer information sessions, guest lectures and offer open days for undergraduates, targeting in particular female students. An advanced incentive is the offer of college scholarships or loans specifically for women pursuing studies in engineering which can help the sponsor to build a more diverse workforce.

- **Recruitment:** Positive directions to reduce bias should include gender neutral advertisements, use of language that speaks more to women, gender-blind shortlisting and diverse and inclusive interview panels. Other initiatives include apprenticeships, internships and placement programs with quotas for female interns and the possibility of transitioning into employment based on diversity targets.
- **Retention:** Fair wages remain a key recommendation, as in developed countries. Another is family-friendly policies, supporting maternity, paternity and parental leave, as well as a return-to-work guarantee. Equally important is a work environment that considers female requirements which may be as basic as bathroom facilities and nursing rooms for mothers with toddlers, and ideally include low-cost access to childcare facilities, given that their husbands will be working. A respectful work environment

includes sexual harassment prevention training, monitoring and a serious follow up on any form of harassment.

- **Advancement:** Female leadership programs are a common approach for many institutions, as well as targets for gender composition in leadership positions. Given that female mentors in senior management are still an exception, younger female employees could at least be paired with older female employees as mentors. Any formal training has to be delivered at times and in locations accessible to both men and women.

Finally, to provide sound policy recommendations the data gap must be closed to better understand the challenge. Targets and indicators on gender equality, so far only common in the WASH sector, can be powerful tools for informing decision-making. Gender-disaggregated data on RRR, ideally across scales, would help to establish gender-based monitoring, evaluation and reporting on RRR allowing governments and donors to invest more in gender equality (Tilley et al. 2013; Fletcher and Schonewille 2015). Given the vast data gap and cultural diversity across the reported cases, caution should be applied before generalizing the findings presented here, while further studies to verify them are highly recommended.

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## ANNEX: DEFINITIONS

### **Gender**

The term gender refers to the behavioural characteristics and roles that society has assigned to women and men within a historical, cultural and social economic context, beyond the biological differences, that have helped to shape responsibilities, opportunities and barriers faced by women and men.

### **Gender Equality**

Gender Equality requires equal enjoyment by women and men of socially-valued goods, opportunities, resources and rewards. Where gender inequality exists, it is generally women who are excluded or disadvantaged in relation to decision-making and access to economic and social resources. Therefore, a critical aspect of promoting gender equality is the empowerment of women with a focus on identifying and redressing power imbalances and giving women more autonomy to manage their own lives. The objective is to reach a situation in which men and women have the same opportunities in life.

### **Gender Equity**

Gender Equity is the process of being fair to men and women. Women and men should not only be given equal access to resources and opportunities but they should also be given the means of benefitting from this equality. Gender equity implies fairness in the way men and women are treated. The different life experiences and needs of men and women are taken into consideration and compensation is made for women's historical and social disadvantages. The lower status of women in society often constitutes a handicap and provisions should be made to redress this situation before they can take advantage of the opportunities provided. Gender equity serves to level the playing field and empower women. Therefore, we can say that equity is essential to achieve true equality. From this perspective, the different starting conditions of women and men should be considered and options developed so that both can develop equally with the same opportunities.

### **Gender Mainstreaming**

Gender mainstreaming is the process through which gender equity is sought with the objective that the needs of both women and men are acknowledged and taken into account during project design, implementation, monitoring and evaluation.

All definitions by IADB 2013.

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