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Regenerative Post COVID-19 Recovery Measures: The Case of Rwanda

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Abstract

Governments worldwide are scrambling to combat both the biological and economic effects of the global COVID-19 pandemic. Given urban unemployment and poverty induced by the global pandemic, this paper asks if developing countries could use regenerative agriculture as a form of poverty alleviation. By using Rwanda as a case study, this paper analyzes two of the existent home-grown poverty alleviation initiatives for rural food security: *Girinka* (Have a cow) and *Akarima k'igikoni* (Kitchen Gardens). We investigate if the rural *Akarima k'igikoni* initiative could be implemented in urban areas. Using descriptive statistical data gathered during the pandemic in Rwanda's capital, Kigali, we found rainwater collection practices already well established. We find that many households already separate waste, but that only some households practice composting and home-gardening. We conclude with several recommendations on how the Rwandan government's commitment to sustainable development and urban agglomeration in the Vision 2050 strategy can be achieved. Using already well-established policy mechanisms like the "*Umudugudu*" (=Village) network and the *Akarima k'igikoni* initiative, Rwanda can better weather the economic effects of the global pandemic. These mechanisms present a valuable opportunity for Rwandan businesses to invest in composting activities and regenerative practices in their buildings and waste management systems. Other developing countries can also learn valuable lessons from an environmentally sustainable and home-grown poverty alleviation policy.

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1. Introduction

The effects of the global Coronavirus pandemic are yet to be fully quantified, but undeniably had a detrimental effect on the economy and its people (Nicola et al., 2020). As many economies failed the people they are supposed to serve - from health systems and education to sustenance and job security - the pandemic has taught us that there is no option of going back to normal; sustainable practices are not just a nice-to-have but a must-have. The destructive scale of climate change is projected to far exceed the damages caused by the Coronavirus since it endangers our own existence on earth. Climate change-induced temperature increase is "predicted to reach up to 3.25°C by the end of the century" (Bendito and Twomlow, 2015), which is 1.25°C above the degree limit to control climate change repercussions (2°C) (Koch, 2014). Because of their heavy reliance on rain-fed crop production, developing countries and more specifically African countries will disproportionately experience the disastrous effects of climate change such as the frequent droughts and floods and increasing wind speeds that affect, sometimes irreversibly, the crops as well as the initial poverty of the population and limits the capacity to adapt (Mikova et al., 2015). Ironically, while humanity struggled with the economic, social, and biological effects of the virus, the biosphere seemed to recover (NASA, 2020). It is disappointing that it had to take a global pandemic for us to pause our environmentally destructive economic activities. This pause gives us all a valuable moment to reconsider our actions and policies.

In this paper, we will show the key role that sustainability can play in the recovery process after COVID19 for developing countries. By using Rwanda as an example, we will show in the literature review the historical efficacy of regenerative initiatives such as the *Girinka* project. In sections four and five we will use data from a field research study conducted in the midst of the lockdown to show that Kigali may be ready for expanding the *Akarima k'igikoni* project (a more recent regenerative agriculture project launched in 2019) as part of a post-COVID19 recovery process in peri-urban centres. Finally, we present policy recommendations in section six and summarise our findings based on obstacles identified in our field research in section seven.

There are various important solutions that Rwanda has implemented to recover from economic and social hardship after the 1994 genocide against the Tutsi in Rwanda. One such solution was to implement a form of home-grown universal basic income called the *Girinka* project - a system by which all families

received a milk cow as a food source. After the food security brought about by the *Girinka* project, and in order to further diversify vitamin intake, the *Akarima k'igikoni* initiative was implemented - a kitchen garden based on circular food system principles. Both these initiatives were supported by the *Umudugudu*[1] network and *umuganda* - an innovative and uniquely Rwandan community service event that proved a very effective way of enacting national policies locally.

Our research builds upon these and other measures. However, our recommendations only represent one piece of the sustainability puzzle - more research into the circular economy, biomimicry, green businesses and renewable energies needs to still be done to help develop a sustainable macroeconomy. We build upon the research done on circular food systems by the Ellen Macarthur Foundation (2019). A more comprehensive review of terms such as regenerative agriculture, circular food systems and composting can be obtained from their comprehensive Cities and Food for Circular Economy report (see Ellen Macarthur Foundation, 2019 and Nijman, 2020).

Our solutions offer guidance around circular food systems that are home-grown, regenerative, and supportive of the urban agglomeration agenda of Rwanda's Vision 2050 development strategy. It is important to realise, as Kolinjivadi put it (Kolinjivadi, in Selby and Kagawa, 2020:3); "[both COVID-19 and climate change] are rooted in the same abusive economic behaviour, and both have proven to be deadly for humans". It is therefore imperative that our economic recovery measures after the pandemic also address (and not further exacerbate) our environmental impact.

2. Context of the COVID-19 pandemic

Rwanda responded to international concerns around the novel SARS strain by installing handwashing stations in and around public transportation hubs, restaurants, commercial centres and banks in its major cities by 11 March 2020. The government tested all incoming air travellers and confirmed the first case on 14 March 2020 - a foreign national travelling to Rwanda. On 16 March, the government declared all large gatherings, education and religious institutions to be closed in the country to limit the spread, and introduced social distancing, mask-wearing and hand-washing rules. These were strictly adhered to with

[1] The closest translation for *Umudugudu* is "village", and is the smallest administrative division in Rwanda. An *umudugudu* normally consists of around 200 - 1000 people, and come together on the last Saturday of every month for *Umuganda*, a collective community service event. Some *Umuganda* days are used for neighbourhood cleanup, repairing of houses or public infrastructure, or the planting of vegetable gardens (*akarima k'igikoni*). For more on the *umudugudu* and *umuganda*, see Uwimbabazi and Lawrence (2013)

penalties like spending a night in the local stadium while being recited the dangers of the virus, among others (Asala, 2020). On 20 March, a full lock-down was implemented with all international flights suspended, non-cargo travel between provinces prohibited, all non-essential travel banned and all incoming travellers were subject to 14-day mandatory quarantine. Only essential services businesses were allowed to operate and movement was strictly enforced with a daily curfew of 9pm-5am. Our own data (Figure 1 below) shows that income levels in our sample dropped by an average of 76 per cent in the sample taken for Kigali during this time of lockdown - mostly because of how hard-hit the informal economy was. Gradually, the Rwandan government relaxed certain restrictions and opened up segments of the economy - most notably the tourism and hospitality industry - which is Rwanda's largest source of foreign reserves (AOEC, 2020). By 1 July 2020, most domestic business activities had been allowed to resume (people were asked to work from home if possible and strict social distancing and mask-wearing policies were in place for those who could not). By 1 August 2020, international flights and tourism had been allowed to resume, subject to strict quarantine and social distancing policies. For the purpose of this study, when we refer to 'lockdown restrictions', we generally refer to the period between March 2020 and July 2020. The data used in this study was collected in the first week of July 2020. As such, it shows the behaviour of households within the peri-urban areas of Kigali after the worst lockdown restrictions have started to lift, as well as their responses during lockdown.

Our study shows that the right conditions are in place in Kigali's peri-urban areas to make use of decentralised regenerative agriculture as a way of poverty alleviation. Most respondents have the right abilities and practices in place to use productive home gardens for sustenance. This is a particularly relevant insight following the depths with which the global pandemic has exposed the thin margin on which much of the informal economy survives. As a developing capital with large peri-urban areas and a large informal economy (Ackerman, 2020), Kigali is a good model for other developing capitals in sub-Saharan Africa. It is also among the fastest growing economies, and the government has a strong focus on industrialising within environmental limits. Our study therefore opens up an avenue for further investigation for developing countries who may also seek to establish regenerative agricultural practices. But it is only the start - more research needs to be done to establish if this is an effective tool for poverty alleviation, and if it can be sustainably scaled in urban centres. Our study merely shows that the potential for implementation exists.

3. Literature Review

3.1. Regenerative Agriculture Overview

The agricultural industry is immensely diverse and has been one of the most defining activities of humankind's development and our impact on the biosphere (Kinahan, 2009). The most common form of commercial agriculture is what can be called 'monoculture', where a single crop is planted at a large scale; fauna and soil minerals are artificially controlled. The monocrop, once harvested, often leaves the fields completely barren, and artificial fertiliser is then needed to plant the next crop. This is contrary to natural regenerative systems where no external inputs are needed to ensure growth (Anderson, 2019). By mimicking natural systems in agriculture, a regenerative circular food system does not need external inputs in the longer run. This may mean planting a diversity of crops that give and take different minerals from the soil, and integrating livestock in agricultural practices more efficiently to mimic natural fauna fertilisation.

Regenerative agriculture has emerged as a compelling field of research and an environmentally fit approach "to adjust our sight to the needs of the new ecology" (Anderson, 2019:2). As such, 'disrupting linear agricultural production' has been a large focus within the research on the circular economy, which evolved into investigating the efficiency of circular food systems. A 2018 study done by Lundgren and LaCanne (2018:1) on corn production found that "regenerative fields had 29 per cent lower grain production but 78 per cent higher profits over traditional corn production systems", which implies that "regenerative farming systems provided greater ecosystem services and profitability for farmers than an input-intensive model of corn production" (LaCanne and Lundgren, 2018:1). The Ellen MacArthur Foundation report on Cities and Circular Economy for Food estimates that for a metropolitan city like São Paulo in Brazil to relocate its farming systems into regenerative practices will yield "USD 67 million cost saving in health due to reduced pesticide exposure and lower air pollution", and "USD 25 million worth of soil saved from degradation in conventional farming practices" (Ellen Macarthur Foundation, 2019:49), and help avoid 92,000 tonnes of greenhouse gas yearly among many other benefits on the individual and communal level (Ellen Macarthur Foundation, 2019). This study hopes to contribute towards the efforts at expanding regenerative agriculture in cities.

What then constitutes a circular food system, and how could we test its viability? Nijman (2020) and the Ellen MacArthur Foundation (2019) suggests implementing a circular system rests on three principles; 1) design out waste, 2) keep products and materials in use and 3) regenerate natural systems. Nijman (2020) applied these principles to regenerative agriculture and considered three variables in a study on East African agricultural practices; 1) the propensity to use organic waste as compost, 2) the propensity to reuse agricultural materials (such as jerry cans and paper bags) and 3) the prevalence of regenerating natural systems (through practices like aquaponics or agroforestry). Because our study is considering households, and not farmers, our study looked at slightly different variables to consider the same three principles. We looked 1) at the the propensity to separate waste (which is an essential step in designing out waste that ends up in a landfill), 2) what most households then do with the waste they separate (is it reused or does it end up in a landfill), and 3) we asked if households capture rainwater (which is a prerequisite for implementing a regenerative urban agricultural system and mimics natural water catchment systems). In addition to these three main areas of investigation, we also considered if alternative water sources are available to test the assumption that rainwater collection is a prerequisite in urban agriculture.

3.2. Recovering from previous challenges; the Girinka Programme

Girinka, which translates to "have a cow," is a Rwandan government initiative launched in 2006 that consists of giving one dairy cow to every low-income family as part of a poverty alleviation strategy. By June 2016, 248,566 cows had been distributed to poor households (Mudingu, 2017). "One Cow brings nutrition, sustenance, and employment, providing a stable income for a family and is a source of soil nutrients via manure to assist small scale cropping activity" (Nyabinwa, 2018:1).

The programme is also in line with the Rwanda Government's priorities for the Transformation of Agriculture (PSTA). On the one hand, as income generated from milk production increases, farmers' abilities to invest in crop production have been on the rise as well as their ability to take loans and participate in development (Unicef, 2012). On the other hand, new cattle breeds have been developed for higher milk yields, and manure was used for crop fertilization and biogas (Unicef, 2012). *Girinka* can be perceived as a form of a universal basic income (UBI). However, since it was non-monetary and culturally

appropriate (developed in Rwanda, for Rwanda), it is an interesting and regenerative approach to UBI for a country with limited fiscal ability.

This program was not only created to serve economic purposes but also as a social project to reconstruct Rwanda and reconcile communities after the tragic genocide against the Tutsi in 1994. "If a cow is given from one person to another, it establishes trust and respect between the giver and beneficiary" (Mudingu, 2017:2). *Girinka*'s social dimension has a profound impact on Rwandans' perception of each other because it utilises the cultural significance around the act of giving cows in Rwandan culture - giving cows is traditionally reserved for marriage, where families are ceremonially linked together in the future. In addition, the programme also encourages the use of communal cow sheds as another aspect of fostering connection and knowledge transfer for beneficiaries who are not knowledgeable about cow breeding.

The programme has also contributed to changing the mainstream Rwandan mindset from "looking at cattle as a status symbol (the more cows one had, the better) - to a source of income and livelihood" (Mudingu, 2017:2). By changing this social perception, the negative effects of conspicuous consumption decried by Veblen are avoided (Veblen and Banta, 2007) - most notably that of conspicuous waste. This is an important point, as governments attempt to redefine consumption and consumerism in an effort to achieve decent living standards. Rwanda has shown that by looking inward - at its own cultural roots - the negative consumption patterns that the developed world is now trying to redress, can be avoided. However, as Rwanda gradually urbanises, it is becoming increasingly important to adapt this rural-suited initiative to a more urban setting. With limited land in urban areas, a more appropriate alternative for the future needs to be applied.

3. 3. The Akarima k'igikoni Programme

In an effort to reduce malnutrition, Rwanda's government launched the Akarima k'igikoni initiative as part of a model village planning program in the whole Southern Province in 2019. Child malnutrition is a prominent health issue in Rwanda, with "only 18 per cent of children aged 6-23 months are fed in accordance with the recommendations for infant and young child feeding practices" (Ahishakiye et al., 2019:1). Akarima k'igikoni which translates to "Kitchen Gardens" hopes to provide food diversity especially to young children in order to address poor diets (Kanamugire, 2019).

Not much has been written on this initiative because of its recent implementation. However, it forms part of a series of bigger grassroots strategies for poverty alleviation (such as the *Girinka* programme,

among others). For Akarima k'igikoni, the government provides staff, materials, and seeds to build kitchen gardens in each house of the village. There are 338 households sheltering a population of 1525 people who benefited from this program to-date in Gishyushye Village (Kanamugire, 2019). The Akarima k'igikoni program also invests in training people on gardening skills and general knowledge of seeding plants.

Since Akarima k'igikoni uses a participatory approach to build communities, it is seen as building trust between civil society and government - as both work together for the betterment of living conditions and self-sustained living. The government collaborates with the citizens to build the kitchen gardens in all the households of the model village by training them on gardening practices, so they can also help their neighbours in the process. It even involves the community in organising campaigns to collect seeding plants and gardening materials or funds to buy them. "The Executive Secretary of the Rukoma Sector, Nkurunziza Jean de Dieu, urged the people that no one else should make the model a model village except for the people themselves" (Kanamugire, 2019:1). The Akarima k'igikoni is a practical biophilic solution to malnutrition that brings Rwandans together and connects them to their agricultural roots.

4. Research Method

We conducted a series of questionnaire-based interviews in the Bibare, Masoro and Kinyaga cells, which fall under the Gasabo District within Kigali City province. These areas are all located around the newly developed Special Economic Zone / Innovation City, and as such, could be typified as peri-urban.

All data is derived from completing these questionnaires through a verbal interview conducted in Kinyarwanda or English by native speaking fieldworkers, who documented responses (for the full questionnaire, see Appendix 1). A sample size of 151 was used, making the data statistically significant. Where respondents declined to give information, the data point was excluded (see Appendix 1 for the sample size of each question). In general, our sample reflects key similarities with the 2019 census data for Kigali, making the data representative with three major exceptions. Our data has an over-representation of people with secondary school education and above. It also has an over-representation of those working in wholesale and retail trade, repair of motor vehicles and motorcycles. Those working in agriculture are underrepresented - most likely because few farm holdings and many commercial centres were located in the areas where data was collected. In addition, Gasabo has the 2nd highest labour participation rate of all districts in the country, explaining why we have a slight over-representation of labour force respondents

in our sample compared to the national average. (NISR, 2020:8). The data collection was funded by the African Leadership University and remains the property of the university.

Table 1. Sample comparison with Kigali population, where available, from NISR data in 2019

Indicator	**Sample Result** *Source: own data*	**Kigali / *National Population** *Source: NISR 2020*
Unemployment*	12.6%	15.2%
Informal Sector* (as percentage of total active labour force)	70.5%	75.8%
Sectors	Agriculture[2] 0.8% Industry 11.4% Services 87.9%	Agriculture 7.3% Industry 19.29% Services 73.4%
Industries	Agriculture (1.1 %) Wholesale and retail trade, repair of motor vehicles and motorcycles (49.5 %) Construction (8.6 %) Manufacturing (3.2 %) Transport and storage (14.0 %)	Agriculture (7.3 %) Wholesale and retail trade, repair of motor vehicles and motorcycles (20.2 %) Construction (10.8 %) Manufacturing (1.0 %) Transport and storage (8.0 %)
Education of Labour Force*	None 22.0% Primary 31.1% Secondary 34.1% Tertiary 12.9%	None 47.2% Primary 29.5% Secondary 16.2% Tertiary 7.2%

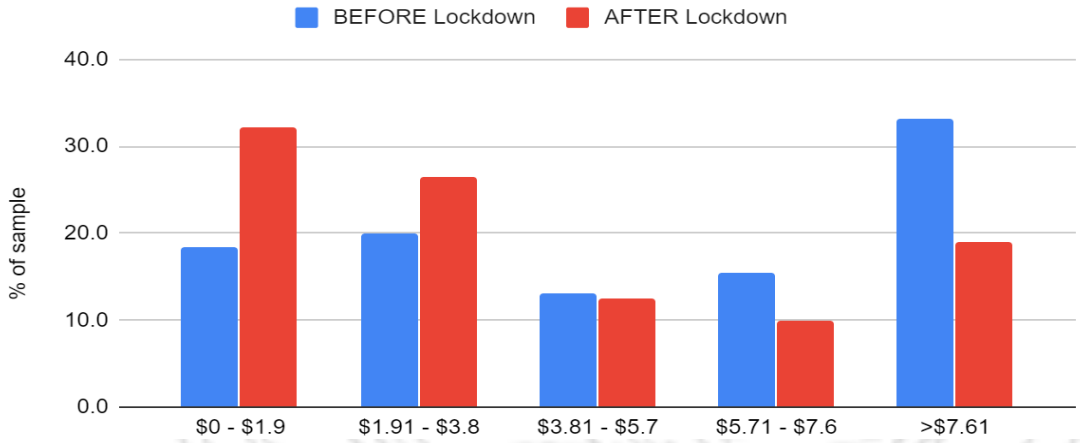
Source: NISR (2019) and Own data (2019)

We analysed the data using descriptive statistics only, mainly because that was sufficient to answer the research questions. More can certainly be done to better understand the full picture of the lockdown on Kigali (*see* Ackerman, 2020)

[2] Note that agriculture here refers to market-oriented agriculture only - subsistence agriculture was excluded from the labour force entirely by both the NISR and this study in line with ILO practice.
*Kigali data not available; figure here is for Rwanda nationally.

Figure 1 shows the average self-reported daily income levels of our sample, adjusted for Purchasing Power Parity to US Dollars. Our data shows that there is a clear negative impact on income levels for our sample because of the Coronavirus pandemic, which supports international literature around the negative effect of the pandemic on the economy. However, respondents self-reported income, and not expenditure, as is best practice for poverty research. As such, the data may not be useful in the literature on absolute poverty prevalence in Rwanda - which was not the purpose of this study. For a more comprehensive review of the poverty prevalence, debates and measurement challenges in Rwanda, see Fatima and Yoshida (2018). For our study, we can only conclude that there is a negative effect on the income levels of our sample. More research should be done, using best-practice consumption-based surveys, to determine the full effect of the lockdowns on income levels during.

Figure 1. Composition of average self-reported daily income levels of sample (adjusted for Purchasing Power Parity)



Source: Own data (n=121)

5. Results & Discussion

5.1 Akarima k'igikoni

Our first area of investigation is to determine the prevalence of these kitchen garden practices among the households in our sample. As an initiative only recently started primarily in the Southern Province, we did not expect to see many households make use of this regenerative agricultural practice in Kigali. Our findings confirmed this expectation - only 5 per cent of respondents reported using their vegetable garden as a way to get food during the lockdown time. Since only 1 per cent of respondents reported working in agriculture, it shows that more people have vegetable gardens at home than work in agriculture - but only

by a very small margin. This finding highlights two points; firstly, that vegetable gardens and decentralised food systems are an underutilised form of subsistence in Kigali, even in times of crisis. Secondly, it shows the opportunity for expanding the *Akarima k'igikoni* initiative in urban areas, since very few people currently make use of it.

5.2 Waste categories after separation

Our second area of investigation was around the underlying social practices needed to make a success of decentralised, regenerative food systems. As outlined by the Ellen Macarthur Foundation (2019), having a well-established waste separation culture is a key ingredient for successful implementation of regenerative agriculture. The second step after waste separation is the effective use of composting. Thirdly, access to water is important for vegetable gardening, and finally access to skills and knowledge. In our study, we tested these practices[3].

Considering the first step of waste separation, our data shows that around 21 per cent of the respondents separate their household's waste from their general waste. This can be broken down into the categories shown in Table 2. This means that the practice of separating household waste is already somewhat established (comparatively, only 7 per cent of households in Copenhagen, Denmark demonstrated a high waste separation potential (Pedersen and Manhice, 2019), while 8.13 per cent of South Africans reported separating waste with a slightly higher involvement for urban households at 11.18 per cent (Oyekale, 2017). In addition, respondents were also asked which common packaging items they frequently do not throw away but instead reuse for another purpose. Respondents were given a list of options, and 55.4 per cent of respondents reported reusing packaging frequently for another purpose (Table 4). This also points to a strong culture of reusing items, which is a part of waste separation as well. It shows that Rwandan culture already includes aspects of reusing and recycling, which is only now starting to take root in Europe and the developed world (see Ellen Macarthur Foundation, 2019; Broerse et al., 2014).

Table 2. Percentage of respondents who separate their waste before disposal

Does not separate waste	**78.81%**
Separates waste	**21.19%**

[3] We did not test for skills and knowledge in our study because of the complexity around reliably ascertaining the level of knowledge/skill. As a proxy for this, we consider simply the number of respondents who reported using their vegetable garden as a form of subsistence and support - indicating that enough knowledge and skills exist in order to provide sufficient produce for subsistence.

Categories into which waste is separated[4], as a % of total respondents	Glass	0.66%
	Organic Waste	17.22%
	Paper	1.32%
	Plastic	3.31%

Source: Own data (n=151)

Respondents were also asked *how* they dispose of their waste (Table 3). Only 3.3 per cent of total respondents reported composting their waste[5]. However, the vast majority of people (72 per cent) depend on the government's waste collection, where most of the waste goes through municipal channels and end up in landfills. We can therefore conclude that very few people in our sample made effective use of composting, and there is, therefore, a big opportunity for the *Akarima k'igikoni* to expand this knowledge in urban areas in order to create more circular waste systems. Since around 17.22 per cent of respondents separated organic waste, yet only 3.3 per cent used it for composting, it also represents an important business opportunity for waste management and compost creation businesses in Kigali. The consumer behaviour already seems to separate out waste, but no value is currently being created from this practice.

Table 3. Waste disposal methods used, as percentage of total

Selling waste	1.34%
Burning waste	2.68%
Composting	3.36%
Own landfill	19.46%
Waste Collection	75.17%

Source: Own data (n=149)

[4] Note that the categories do not add up to the total, because some respondents separate into more than one category, and were therefore counted in both categories. As such, this table can be understood to mean that 17.22 per cent of respondents separated organic waste from their general waste, while 1.32 per cent separated paper from their general waste. Some of those who separate organic waste also separate paper, and so on.

[5] This may under represent the total composting practices in our sample. The 3.31 per cent shown here refer to respondents who reported using their organic landfills as compost. However, of those who reported separating organic waste from their general waste 30.77 per cent reported making their own landfill with the organic waste, which is essentially an ineffective form of composting without using the compost itself. Therefore, those who make organic landfills and those who compost make up 8.68 per cent of total respondents.

Table 4. Percentage of respondents who reported reusing the below material for another purpose before disposing of it

Does not reuse packaging frequently		**44.6%**
Reuses packaging frequently		**55.4%**
Products frequently reused, as percentage of those who reported reusing products	Paper Bags	50.36%
	Cardboard Boxes	12.23%
	Plastic Bottles	11.51%
	Plastic Containers	10.79%
	Glass bottles	7.91%
	Plastic Bags	6.47%
	Glass Jars	4.32%
	Paper Cups	3.60%
	Plastic Cups	1.44%
	Metal Tins	0.72%

Source: Own data (n=139)

5.3 Water access and rainwater collection

Finally, we also tested the reliability of access to water. On a macroeconomic level, access to clean water is a prominent issue in Rwanda despite the government's efforts to date. 5.1 million people still lack clean water (WaterAid, 2020), and approximately 60 per cent of rural households drink untreated water (World Bank Group, 2020:92). Although Rwanda has done much to remedy this in the face of the global pandemic by installing simple handwashing stations at most public spaces, these numbers are still concerning.

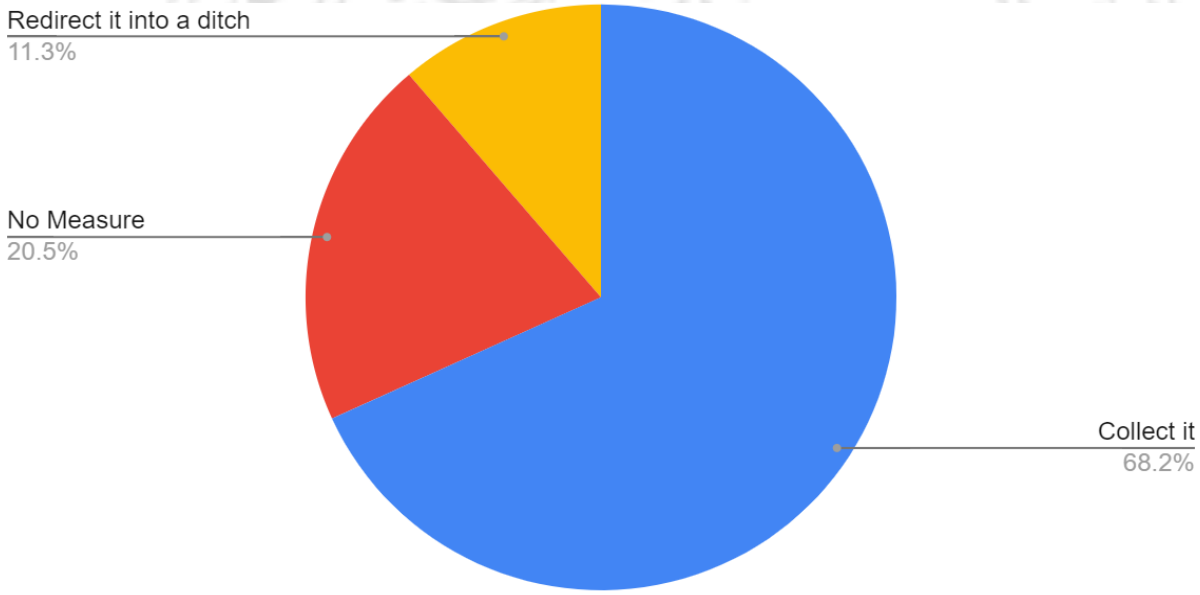
The water problem was clearly observed in the respondents' answers as well; 78.6 per cent reported that they experienced some water cuts for 4 of the days in the week or more[6]. It is possible that this high reported loss of access to water is as a result of the ongoing construction at the nearby Special Economic Zone, but it still points to an underlying problem of consistent water access even in peri-urban areas of

[6] Respondents were simply asked how often they experienced water cuts in an average week. They were not asked about their source of water, but the phrasing implied the source being that of piped water from the Rwandan Water and Sanitation Corporation (WASAC). It is common in the area for people to walk to a WASAC well nearby to collect water in containers that is then used in homes. Our study did not differentiate between respondents who had water piped into their homes, and people who collected water outside of their home from a WASAC tap.

Kigali. It, therefore, suggests that expanding an *Akarima k'igikoni* initiative in the urban centres necessitates fully addressing the water access issues.

Another alternative to the centralised water supply is decentralised water entrapment, primarily using rainwater. Rwanda has a relatively high annual rainfall[7], making this is a viable option for many households. Our data reveals that most households (Figure 2) already entrap rainwater in some way, making rainwater harvesting during COVID19 a vital source of survival. As the government's efforts to expand access to clean drinking water materialise, it is essential that the practices of rainwater harvesting remain - rainwater plays a critical part in the support of a further expansion of Akarima k'igikoni. Hence, it is a good time to introduce the practice of *Akarima k'igikoni* while people still collect rainwater and as government efforts increasingly provide access to grid network drinking water.

Figure 2. Rainwater management at the household level



Source: Own data (n=151)

6. Policy Recommendation: Expanding the *Akarima k'igikoni* Programme

The very successful home-grown *Girinka* project is unsuited for the growing urban agglomeration agenda of Rwanda's Vision 2050. Urban spaces host many malnourished children, with stunting in urban

[7] See https://climateknowledgeportal.worldbank.org/country/rwanda/climate-data-historical

areas in Rwanda documented at 27 per cent (Bosteels and McDonough, 2016). This paper recommends that the government boost the outreach of the home-grown Akarima k'igikoni program after COVID 19 as both a recovery measure and a way to address the malnutrition problem in urban areas. It is also a key ingredient for making the Vision 2050 sustainable and equitable - with further agglomeration and urbanisation of Kigali and other cities, it is important for a circular food system to be well embedded in order to avoid the crippling environmental destruction experienced by the developed world (World Bank Group, 2020). Other developing countries experiencing rapid urbanisation may do well to learn from the Rwandan case - balancing environmental concerns with development is an important global priority.

As our data shows, there is a somewhat well established waste sorting culture, but not yet a well established composting culture in Kigali. Training should be done to teach people composting habits and ways to use organic waste. Similar interventions have been done using Umuganda, and we propose using this as a channel for large-scale education and changing of cultural practices. Phasing out waste from these households and diverting it away from landfills is a valuable step towards circular agriculture. This aligns with the Vision 2050 priority of investing in human capital. According to the strategy, human capital is a very "safe" investment, since "human capital is a portable asset that can have powerful effects on people's welfare and mobility" (World Bank Group, 2020:70).

Apart from changing composting behaviour, it is also essential that the requisite spaces for gardens be incorporated into new developments. Rwandans should be able to also integrate these kitchen gardens in corporate workplaces. The so-called 'living buildings' created by Google and other larger corporations (GER, 2019) are an important trend to follow. Google's efforts to make their campus more waste efficient have "prevent[ed] more than 1 million kilograms (2.25 million pounds) of pre-consumer food waste in its cafés around the world, totalling over 3 million kilograms (6.6 million pounds) of food waste prevented since 2014" (GER, 2019:41). Google keeps producing more innovative solutions towards sustainable business office spaces. Translating the living buildings to a Rwandan context could similarly enable Rwanda to be a front-runner in green urbanisation. The newly built African Leadership University campus in Kigali's Innovation City has adopted measures to encourage reusable water containers instead of single-use bottles, with plans to expand green spaces with food-producing plants for circular campus food production, among others. Similar development should be done in other parts of Kigali, and the government should take a more active lead in ensuring that the new developments in Kigali Innovation

City are representative of global best practice. The *Akarima k'igikoni* should not only be limited to households but can be woven into the fabric of Rwanda's urban scene. Rooftop gardens and green spaces is a great step towards building a Rwanda at the forefront of green innovation. We propose that businesses pilot these green buildings for further analyses of their effect as part of a decentralised food system for urban centres in developing countries. Incorporating these food systems into the industrial symbiosis of the eco-industrial parks proposed by Caycedo (2019) in Rwanda would be a great place to start. In a rising COVID-induced business competition, green practices, sustainable buildings, and regenerative circular urban planning all reflect different models for Corporate Social Responsibility; an excellent competitive advantage to businesses (Urmanaviciene and Arachchi, 2020). CSR does not have to be limited by charity or philanthropy, the need for more innovative and strategic models is evidently urgent and pivotal (Urmanaviciene and Arachchi, 2020) to sustain the economic interests as well as the social and environmental commitment of Rwandan businesses.

In order to support this expansion of the Akarima k'igikoni, the issue of water access needs to be addressed. Several initiatives are currently being implemented to solve the water problem in Rwanda like the WaterAid Rwanda initiatives or the DelAgua Rwanda Project, but their timeline is relatively long. The DelAgua Rwanda Project, for instance, aims to distribute 600,000 advanced water filters to the poorest 30 per cent of households over 20 years (DelAgua, 2020). WaterAid Rwanda has also resorted to training programmes in collaboration with the Centre for Science and Environment (CSE) for state and non-state practitioners (engineers, consultants, planners, academicians, and researchers) on sustainable and affordable rainwater harvesting (RWH) in Rwanda. The purpose of this training overlaps with the vision of managing rainwater in a decentralized way for every household to become self-sustainable with consistent access to water.

This paper supports the governmental push for a holistic decentralized approach to water access in Rwanda through rainwater harvesting and treatment. The government should invest in equipping areas, where there is an existent culture of water collection, with domestic water filters and water collection tanks over the first phase and expand the project with training programs over the second phase. Rainwater

harvesting practices have been implemented in some public institutions in Rwanda and have proven to be very efficient in driving sustainability and water-sufficiency[8].

A note on the *Girinka* Programme

As outlined before, the *Girinka* project was a widely successful project for what was a very rural Rwanda post-1994. All our recommendations support the UNICEF recommendation that the project should be upscaled with more donors and partners involved (Unicef, 2012). The *Girinka* program should be reintroduced in Rwanda after the pandemic with a significant focus on government training and skilling activities on cow breeding, composting, and self-managing waste for more sustainable households. Educating the population and developing its human capital is a key driver of economic growth (Zeynalli, 2020); it establishes communication and ensures the alignment between the government's vision and the people's needs. Although our study did not investigate the project or its application in rural Rwanda, it is still part of regenerative agriculture, which is aligned with our recommendations. The production and use of cow manure also have considerable spillovers into the rest of the agricultural value chain. However, considering the grazing and land required to rear cows, it remains a rural solution. Our recommendations aim to address the growing urban areas.

The implementation of proper measurement systems diminishes the high risks of wasted time and resources (Urmanaviciene, 2020). Therefore, we advise that the implementation of these and the previous recommendations be coupled by social impact assessment measures that inform sustainable future governmental planning and policymaking.

7. Summary and Conclusions

In this paper, we discussed the potential expansion of the *Akarima k'igikoni* initiative into urban and peri-urban areas in Rwanda. We investigated the past application of initiatives like the *Girinka* project and the *Akarima k'igikoni* initiative. We considered current cultural practices in the peri-urban area of Kigali's Gasabo District. We found that although most people reuse packaging material frequently, only some portions of the population separate waste. We can conclude that more education should still be done to

[8] For the full report on the potential of rainwater harvesting in the whole of Rwanda, see Matto and Jainer (2019).

support a successful expansion of the *Akarima k'igikoni* programme, starting with education around organic waste disposal and composting. Very few people seem to use vegetable gardens for sustenance, and it, therefore, represents a vastly untapped opportunity for urban food security and circular, regenerative agriculture. We also recommend expanding the *Akarima k'igikoni* in corporate spaces and office parks by adapting the 'living building' concept to a Rwandan context. We found surprisingly prevalent rainwater entrapment practices that could support the expansion of *Akarima k'igikoni* in peri-urban areas. Sustainability can no longer be treated as an externality - it should be a primary driver for policymaking. Our recommendations contribute towards linking the various threads of food security, sustainable decentralised and regenerative agricultural systems, and urban agglomeration.

Limitations of the study

It is important to note that our research was focused in the peri-urban areas of Kigali's Bumbogo, Masoro, Kinyaga and Bibare areas within the Gasabo District. These areas are located in and around the new Special Economic Zone and Kigali Innovation City developments. It, therefore, does not fully represent the more urban, affluent and densely populated areas of Kigali City, nor rural Rwanda at all. Considering the literature on the Akarima k'igikoni, the practice of kitchen gardening seems to be more widespread in the rural Southern Province. This study considers its application in peri-urban Kigali in order to add to the discourse around sustainable agglomeration of urban centres, as outlined in Rwanda's Vision 2050 document.

Finally, this study's data was collected in the first week of July 2020. It is therefore located in the midst of an ongoing pandemic and as such, subject to change during this time. Although questions concerning the topic of this study were phrased to elicit general responses and behaviours notwithstanding the pandemic, it is entirely possible that the time of collection may have skewed the results. We cannot yet know if respondents were more, or less likely, to practice regenerative agriculture during the pandemic time.

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Appendix 1. Questionnaire

NOTE: The full questionnaire included questions relevant to the impact of the ALU campus in that area, as well as questions related to environmental practices. Since those questions were not used in this specific study, they are not listed below. For a full list of all questions asked, contact the authors directly.

Demographic Questions

1. Gender (n=151)
   - ❑ Female
   - ❑ Male
   - ❑ Other……..

- ❑ Prefer not to say

2. Age (n=141)
   - ❑ ……
   - ❑ Prefer not to say

3. Nationality (n=151)
   - ❑ Rwandan
   - ❑ Other……...

4. If not Rwandan, what are they doing in Rwanda? (n=2)
   - ❑ Working
   - ❑ Visiting
   - ❑ Studying
   - ❑ Other……...

5. Where do you stay/live (Cell and sector)? (n=149)

……

6. Highest level of education attained? (n=147)
   - ❑ Primary
   - ❑ Ordinary level
   - ❑ high school or equivalent
   - ❑ Tvet, Polytechnic institute
   - ❑ Associate degree/ Diploma
   - ❑ Bachelor's degree
   - ❑ Post-graduate degree
   - ❑ Did not attend school

7. What languages do you speak? (n=151)
   - ❑ Kinyarwanda
   - ❑ English
   - ❑ French
   - ❑ Kiswahili
   - ❑ Others……...

8. Employment status (n=151)
   - ❑ Self-employed
   - ❑ Employed
   - ❑ Retired
   - ❑ Unemployed
   - ❑ Other……..

9. If employed, what is the nature of your employment? (n=42)
   - ❑ Permanent employment contracts (formal)
   - ❑ Fixed-term employment contract (formal)
   - ❑ Casual employment (informal)
   - ❑ Seasonal employment (informal)
   - ❑ Daily employment (informal)

10. What sector have you been working in for the past six months? (n=137)

……...

11. How many people live in your household? (n=150)

……...

12. How many people depend on you? (n=150)

……

13. What are the sources of your household's income? (n=140)

    ……....

14. What was the last monthly income **before** Covid-19 lockdowns (Feb 2020) for each source mentioned above? **RWF** (n=142)

    ……....

15. What is the average monthly income **during** the Covid-19 lockdown (Mar-May 2020) for each source mentioned above? **RWF**? (n=133)

    ……....

16. What is the average monthly income **now** after Covid-19 lockdown(Jun 2020) for each source mentioned above? **RWF**? (n=124)

    ……....

17. Did your business shut down due to the COVID pandemic? (n=95)
    - ❑ Yes
    - ❑ No
    - ❑ Partially

18. Did you lose your job due to the COVID pandemic? (n=84)
    - ❑ Yes
    - ❑ No
    - ❑ My pay was cut, but still employed

19. How did you manage to get income for survival during the time of lockdown restrictions? (n=151)

……
……... ……

20. How do you dispose of your garbage/trash? (n=149)
    - ❑ Waste Collection
    - ❑ Burn
    - ❑ Own landfill
    - ❑ Composting
    - ❑ Other…….

21. Do you separate your waste before putting it away? (n=151)
    - ❑ No
    - ❑ Organic Waste
    - ❑ Plastic
    - ❑ Paper
    - ❑ Glass
    - ❑ Dangerous Waste
    - ❑ General

22. How much does it cost to dispose of your waste? **RWF**? (n=126)

……

23. Which of these things do you not throw away? (n=139)
    - ❑ Paper Bags
    - ❑ Cardboard Boxes
    - ❑ Paper Cups
    - ❑ Plastic Containers
    - ❑ Plastic Bags
    - ❑ Plastic Bottles
    - ❑ Plastic Cups
    - ❑ Glass Jars
    - ❑ Glass Bottles
    - ❑ Aluminium Cans
    - ❑ Metal Tins
    - ❑ Other……..

24. Are you negatively affected by the industrial zone? (n=146)
    - ❑ No
    - ❑ Air/Smoke
    - ❑ Noise
    - ❑ Water
    - ❑ Garbage/Smell

- ❑ Visual
- ❑ Other……..

25. How many days in a week do you not have water? (n=146)

……
……

26. How does your Household manage the rainwater? (n=151)
    - ❑ No Measure
    - ❑ Collect it
    - ❑ Redirect it into a ditch
    - ❑ Other…….