AUGUST 2023

QUANTIFYING THE CIRCULAR ECONOMY
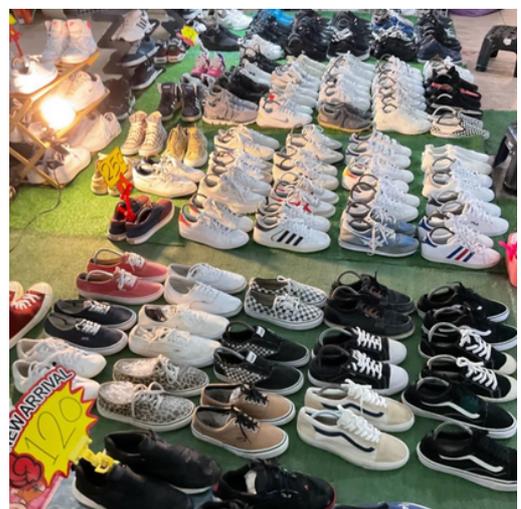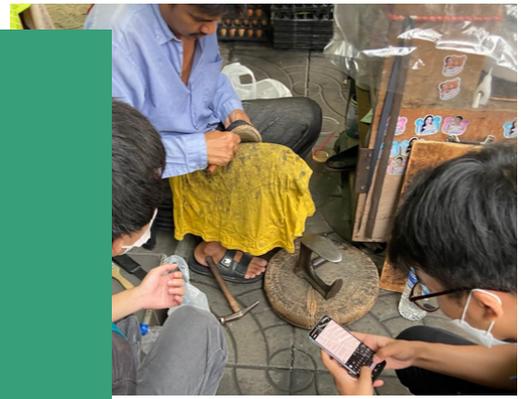
A comparative analysis of reuse and repair in Yangon and Bangkok

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1. ABSTRACT

The circular economy (CE) describes a systemic shift in production and consumption patterns from a linear make-use and -dispose to a multi loop system in which ideally nothing becomes waste. In the global north this systematic shift is driven by a consciousness of climate change, finite resources and material pollution. This paper shows, in a case study comparison between Bangkok and Yangon, that lower income environments with actual material resource limitations practice a circular economy scaling with resource scarcity.

For this research, an analysis was conducted of 856 Small and Medium Enterprises (SMEs) in Yangon constituting 17% of all CE SMEs in the city and 304 SMEs in Bangkok constituting 15% of all CE SMEs in the city, all of which are active in the reuse and repair economy. The circularity in the dimension of items, material and value was quantitatively displayed in a flow chart referred to as the "butterfly diagram"[1].

The analysis indicates that Yangon has a more vibrant circular economy than Bangkok, with higher rates of reuse and repair (2.1 and 2.7 items per capita per year in Yangon versus 1.2 and 0.4 items per capita per year in Bangkok). In terms of value generated for society a Yangon citizen saves on average 192 USD per year through relying on the circular economy, while in Bangkok this is less than half of that. The comparison of the two cities strongly supports the assumption that actual resource scarcity is the driving force in economies lacking sustainable production and consumption policies.

Picture: An electronics repair and resell shop in Yangon

1 Ellen McArthur Foundation

2. SITUATIONAL BACKGROUND

Yangon and Bangkok, the economic hubs of Myanmar and Thailand, respectively, have been centers of urbanisation and trade for their respective countries. Both cities underwent rapid urban growth after World War II. However, since the 1960s, Yangon took a different path due to the country's isolation from foreign investment and trade, with only short periods of opening between 2010 and 2020. In contrast, Bangkok continued its modernisation process with less political turmoil.

While countries in the global north are commonly driven[2] by political motives such as climate change, global agendas, and economic changes, to transform their economy to become more circular, these drivers have yet to play a significant role in Yangon and Bangkok. The main drivers for Yangon and Bangkok CE therefore are assumed to be "natural," such as resource scarcity, limited purchasing power, and a strong low-income labor market. Given the different socio economic situation of the both cities Yangon is expected to have a more thriving CE, even more so since the economy contracted by 18% in 2021 and does not show any sign of recovery.

Picture: A key and watch repair shop in Bangkok

2 Towards a circular economy: Key drivers OECD 2020

3. RESEARCH FRAMEWORK

	Yangon	Bangkok
Aim	Quantifying and comparing the reduce and reuse loops of the circular economy as shown in the "butterfly diagram" of the cities Yangon and Bangkok.	
Scope	The sectoral selection and categorization is based on the CE structure in Yangon and only these sectors were compared with Bangkok. They refer to the following CE sectors: • Textiles and Fashion (clothing, bags, shoes, umbrella) • Electronics (IT, electronic appliances, cooling &heating, pump and fan, watch) • Transport (only bicycles and motorbikes)	
Sample size	Interviews with 856 SMEs constituting 17% of all CE SMEs in the city	Interviews with 304 SMEs constituting 15% of all CE SMEs in the city
Method	• Systematically check all CE activities in the target area as well as item specific hubs. • Mapping sectoral markets for the city	• Interviews with SMEs in selected neighborhoods • Mapping sectoral markets for the city • Data comparison with Google map entries
Surveyed Area	Area with the population of 166,000 citizens divided into center, peri urban and outskirts as well as dedicated markets for bicycles, clothing, IT and furniture;[3] For Yangon a customer survey with 642 people was added to countercheck data;	Area with a population of 153,000 citizens divided into center, peri urban and outskirts as well as dedicated markets for clothing and IT;[4]
Data Extrapolation	The results were generalized based on the targeted area's population, and the data was then extrapolated to represent the entire Yangon.	Generalization was done by comparing the surveyed shops with data from Google Maps, and then extrapolating the results from surveyed shops to match the shop numbers as recorded on Google Maps.

3 Survey map Yangon
4 Survey map Bangkok

RESEARCH FRAMEWORK CONT'D

|	
CE sectors not included	• The automotive and real estate sectors, although major contributors to the economy, have been neglected due to their perceived similarity with those in other countries. • Books, vinyl records, CDs, cassettes, and antiques have had negligible contributions to the economy. • The material contribution of the fast-moving consumer goods (FMCG) sector is significant, but its value contribution is markedly different from that of other sectors. Refill from the FMCG sector is important, but the value it brings to the economy cannot be measured in the same way as other sectors. • The FMCG sector's recycling efforts hold value, but they are not given due consideration when compared to other sectors. One reason for this is the difference in units of measurement. While other sectors measure their contribution in terms of items, the FMCG sector measures it in terms of mass.
Limitation	• Sample quality: The accuracy of the responses relied on the CE-SMEs' inputs, and the inclusion of revenue information may have introduced inaccuracies. False information was identified and removed during the data cleaning process. • Coverage: Estimating the population of the sector-specific markets in both cities was challenging. In Yangon, a random passenger interview approach was used to overcome this challenge, while in Bangkok, the contribution of specified centers was assumed to be accessible to all citizens. Shops selling only online were neglected in this research, resulting in an extrapolated sector size that may be underestimated due to the exclusion of such shops. • Analysis: The main method used to summarize the data was average functions to address gaps in information from CE-SMEs that were either unreliable or missing.

Picture: *Display of clothes at a second hand clothing shop in Bangkok*

4. EVALUATION METHOD

This research uses a common display method known as the the "butterfly diagram"[5] to illustrate circularity, following an understanding of the CE as described by the Ellen McArthur Foundation. The diagram qualitatively depicts the flow of material through the various loops of circularity. This research aims to quantify the different loops for specific CE sectors as mentioned in the research framework. The flow is displayed in a Sankey-style flow chart format where the thickness of the lines indicates the quantity.

Since this research focuses on materials in the technical cycle of the butterfly diagram, all evaluation charts will display the "stock management"/technical cycle of Bangkok on the right side and Yangon on the left side. The evaluation is presented in the flow diagrams of the technical cycles for the three dimensions: mass, items, value.
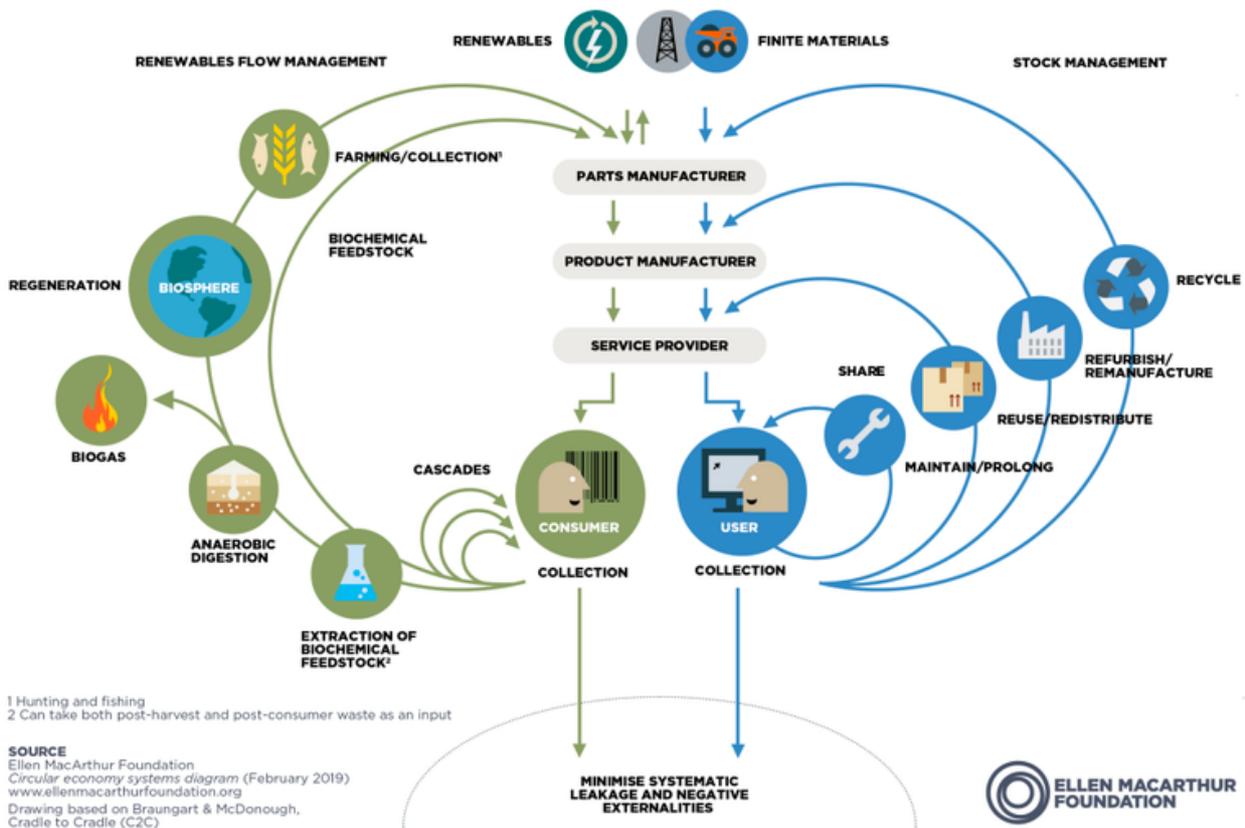
Figure 1: Qualitative flow diagram of the circular economy system referred to as the butterfly diagram

5 Ellen McArthur Foundation

This research compares mostly only two loops of circularity as shown in the "butterfly diagram"

- **Reuse/redistribute (reuse)[6]:** Here we look at items which are left in its original form but change the owner. This redistribution of goods is mainly facilitated by secondhand shops and their dependent supply chains.
- *refurbish/remanufacture (repair)*: This loop stands for all goods which are repaired against a fee and where the item is returned to the same person.

Loops not included:

- **Maintain/prolong:** Quantifying this loop is challenging and would require a citizen survey on item maintenance and was not included in the research.
- Recycle: this loop was only included for the material flow diagram as in the item dimension defining an item is not valid and in regard to the value analysis the amount would be negligible in comparison to Reuse and Repair.
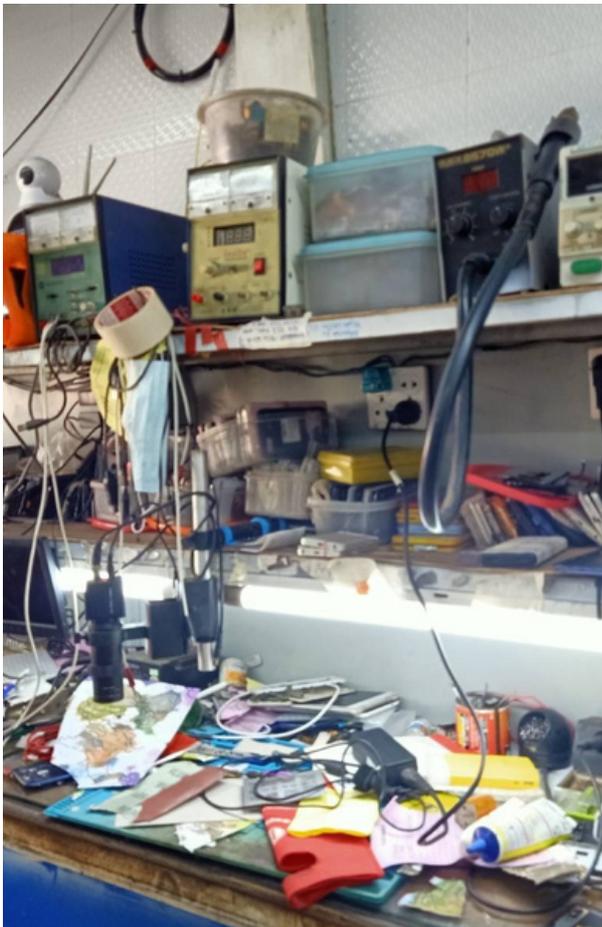
Picture (left): A second repair and resell electronics shop in Yangon

Picture (right): Mobile phones repair and resell shops in Bangkok

6 Often this is not a continuous closed lop as items are mainly often imported from countries like Japan, Taiwan, Korea, etc.. Therefore, this loop would be actually an extension of those countries' circularity.

5. EVALUATION

In this research 13 different sectors (see figure 2) contributing to the CE were analyzed. Each SME gave answers to a list of questions (see ANNEX 2) which were analyzed mostly quantitatively. The following analysis compares the CE of the two cities by looking at the state of the sectors and its contribution to material and item reduction as well as the economic value generated for the society.

5.1 State of the sectors contributing to the CE in Yangon and Bangkok

Comparing CE in Yangon and Bangkok reveals significant differences and a few similarities: Both cities exhibit high job satisfaction levels, with 88% of CE-SMEs in Yangon and 94% in Bangkok reporting satisfaction. Additionally, 30% of SMEs in Bangkok did not face significant operational challenges, while in Yangon, only 9% did not face such challenges. This signifies that majority of the SMEs face significant operational challenges. Regarding the size of the sector, Yangon employs approximately 44,000 people in Reuse and Repair (with an estimated additional 5,000 working in recycling) of workforce 3.2 million[7] while Bangkok employs only 6,700 people in Reuse and Repair with a workforce of 5.7 million[8].

Another important factor to consider is the level of informality of the CE SMEs. This is believed to be high especially in Yangon where already 14% of all businesses operate out of roadside stalls. No further detailed data on formality was collected as it was believed that SMEs would not necessarily answer this truthfully.

Picture: Survey at a second hand clothing shop in Yangon

7 Yangon Region Census Report 2015. https://myanmar.unfpa.org/en/publications/union-report-volume-3l-yangon-region-report
8 National Statistical Office 2023

A detailed analysis of the sectors within the CE is presented below, examining three economic dimensions: Revenue, Age, and Proximity to the customer.
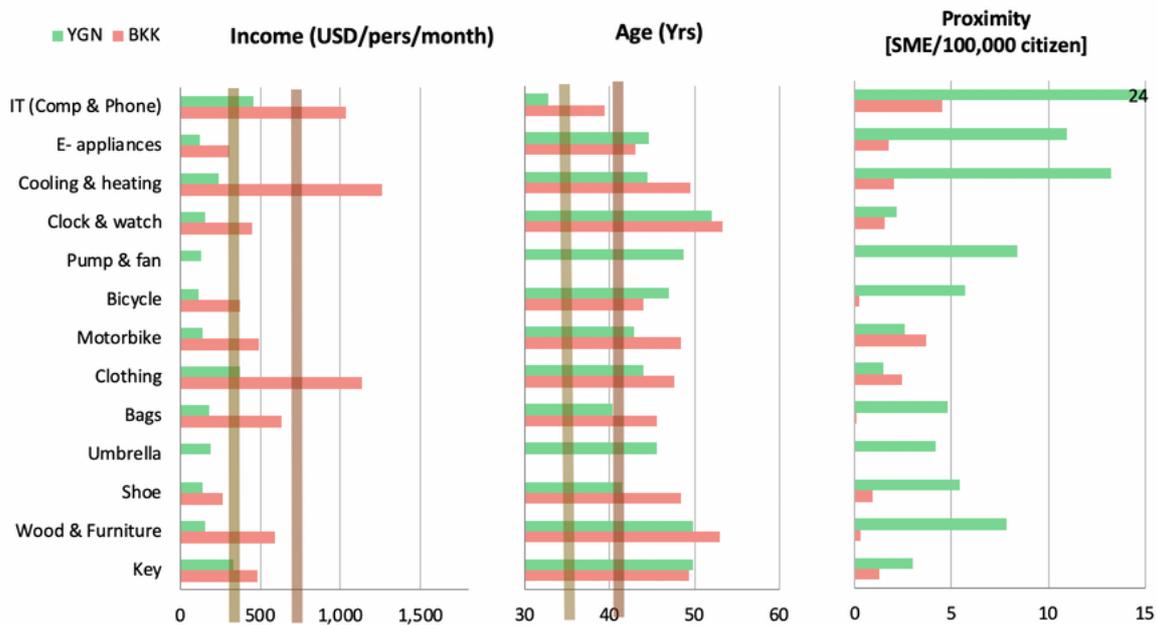
Figure 2: Three dimensions are extracted to show the state of the sectors part of the CE:

Revenue generated by one worker in each sector (in USD). The vertical colored line show the average income in the respected cities (Green for Yangon, Red for Bangkok): The revenue generated is much higher in Bangkok compared to Yangon however when comparing with the mean city salary (vertical bars: YGN: 274 USD/month and BKK 680 USD/month) both cities show that people in the CE are generally at the lower income levels. This is extreme for "shoe", "umbrella" and "bicycle" sectors which are often operated at roadside stalls doing minor repairs.

Age of the owner: People working in the sector are generally older than the average working age except for the IT sector which is dominated by young people. The general trend between Yangon and Bangkok derives from the much older population in Thailand in comparison to Yangon. Both cities suffer from an aging human resource regarding CE which eventually could lead to a decline of the sector when knowledge disappears.

Proximity: Number of CE-SMEs accessible by 100,000 citizens. Yangon has clearly a more vibrant CE than Bangkok with relevant shops often in walking distance inside residential areas. Bangkok on the other hand has its CE sector located at local markets or has special markets only for the specific sector and is therefore easier to find although maybe much further away. Online "proximity" was not included, although even in Yangon citizens reported buying 25% of their second-hand items online. In Bangkok this percentage is believed to be much higher.

5.1.1 Comparison of circular systems[9]

The following table gives a few examples of how circularity is approached in the global north in comparison to the two analysed cities.

LOOPS	SYSTEM APPROACHES IN THE GLOBAL NORTH	SYSTEM APPROACHES AS OBSERVED IN YANGON AND BANGKOK
REUSE AND REDISTRIBUTE	EU: "has voted to support a directive aimed at improving product durability by banning planned obsolescence, addressing misleading or greenwashing claims on consumer labels, and requiring that a product should still function well with spare parts and consumables from a different manufacturer."[10]	Import items from countries where these are considered partly waste or are available with low cost on the secondhand market and resell them in countries where a product scarcity exists.
	Heightened consumer awareness regarding the environment and pollution is driving a growing demand for more sustainable and circular products and services.	Reduced purchasing power heightens interest among citizens in affordable items that are relatively high quality.
REPAIR	Maintenance responsibility is kept with the producer, increasing product lifespan and repairability in design.	Skilled low paid technicians making repair the economical more attractive alternative to replace.
	Austria implements right to repair: "Designed to tackle electronic waste, the government program covers half the cost of repairs. It applies to defective devices such as smartphones, laptops, coffee makers and dishwashers."[11]	

9 https://www.mckinsey.com/capabilities/sustainability/our-insights/growth-within-a-circular-economy-vision-for-a-competitive-europe
10 EU law will ensure product durability, by Environmentanalyst, 2023
11 Euro.news: 2023

5.2 Item Circularity

This section analyzes consumer item usage in various sectors. Each sector serves the consumer by either taking in unwanted items, redistributing them, or refurbishing broken items to make them available again for the consumer. The analysis of the sectors is done from the perspective of the consumer, using the unit [Item/pers/year] which represents the number of items each citizen either purchases secondhand or has repaired within a one-year period.

Figure 3 illustrates the number of items an average consumer receives through each CE sector. The data reflects the consumption patterns of items, with clothing being a frequently consumed category. In YGN, an average consumer purchases 1.7 clothing items per year and 0.5 items are repaired. In BKK, the average consumer purchases 1 clothing item per year and repairs 0.1 items.

For other items like IT, there is a more balanced distribution between reuse and repair in YGN. However, in BKK, repair rates are notably higher, indicating that people in BKK tend to buy IT material mostly new but actively engage in repairing them. In contrast, in YGN, the secondhand market for IT items is substantial, with 42% of citizens opting to purchase IT items second hand, according to the consumer survey conducted in this research.

In contrast, certain sectors emphasize repair over reuse, especially those involving items that are less commonly found in the secondhand market, such as Pump & Fan, Cooling & Heating, and others. These items are more utilitarian and are not subject to frequent replacement due to changing trends or consumer preferences for new items. Instead, consumers tend to prioritize repairing these functional items to extend their lifespan and reduce waste.
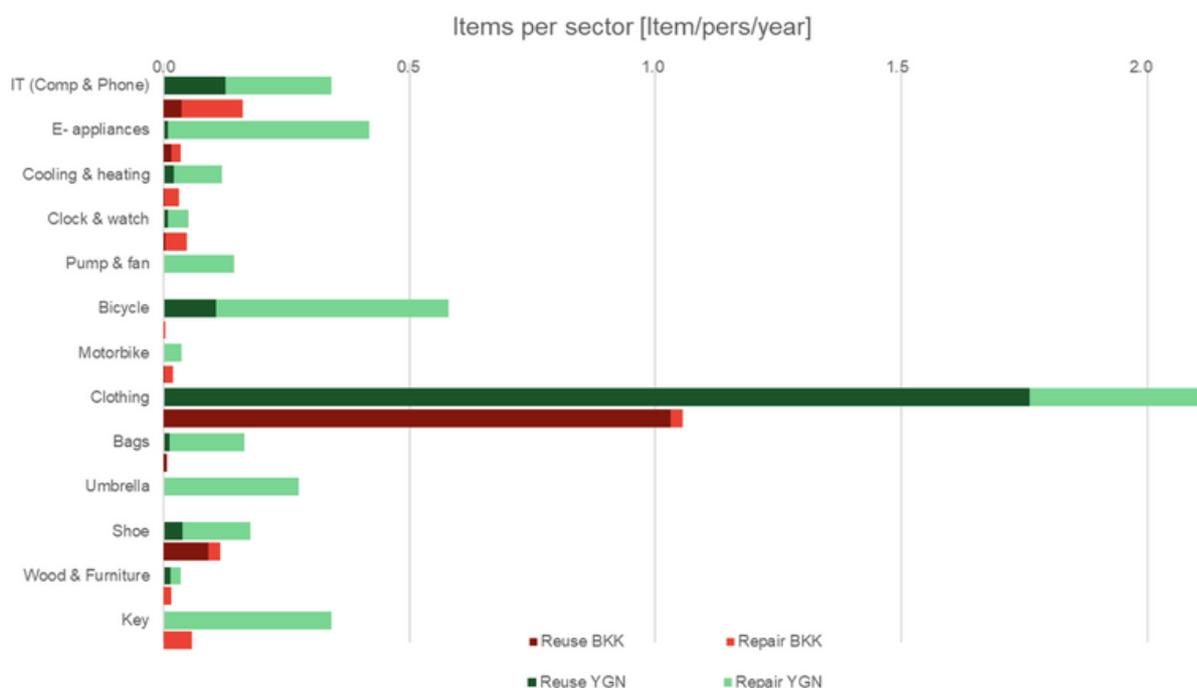
Figure 3 shows the number of items each citizen is utilizing through the two loops (reuse and repair) for the different CE-sectors. YGN (green) shows to be more utilized throughout all sectors and for both loops than BKK (red).

6 The butterfly diagram: visualising the circular economy by Ellen MacArthur Foundation
7 Often this is not a continuous closed lop as items are mainly often imported from countries like Japan, Taiwan, Korea, etc. Therefore this loop would be actually an extension of those countries circularity.

5.2.1 Comparing item (reuse, repair) circularity

Summarizing the data from Figure 3 into two item flow loops (reuse, repair) for the two cities provides a general status analysis of CE for consumer items. The flow chart uses the "butterfly diagram" structure while looking only at the technical cycle/user side as described in chapter 5.
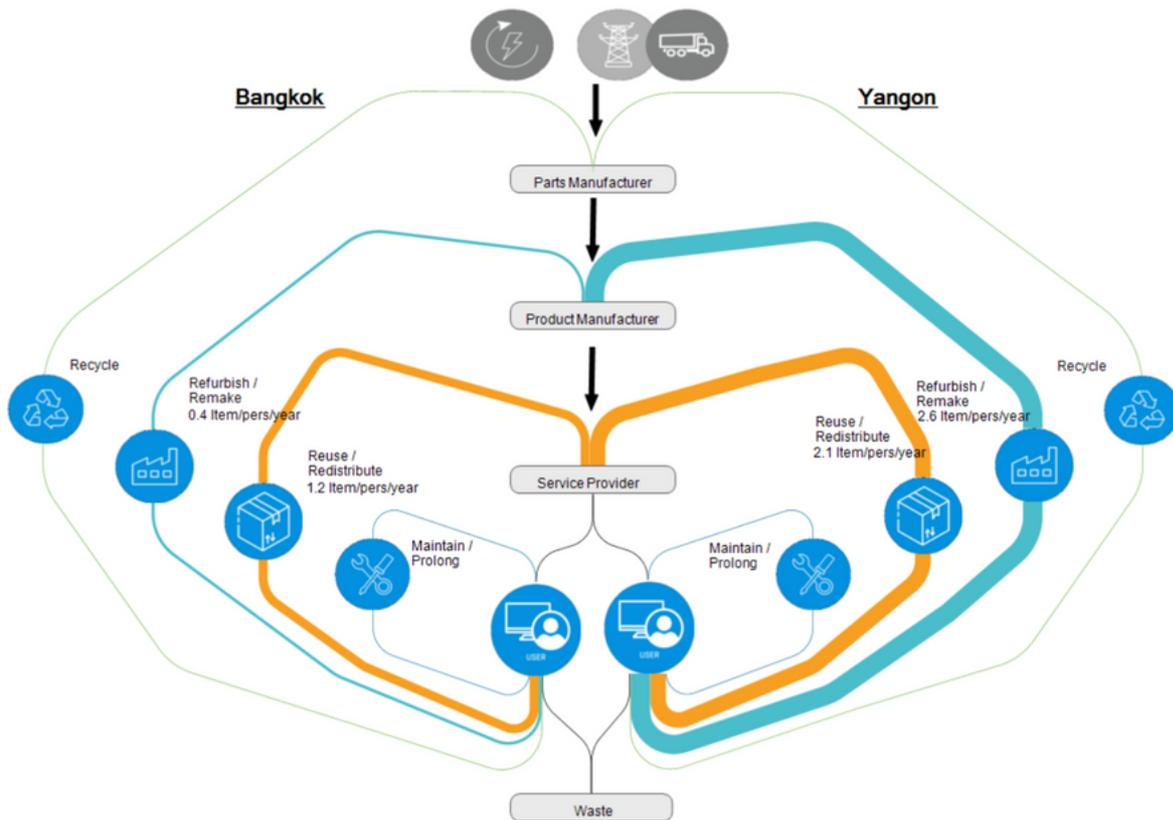
Figure 4: Illustration of cross-sectional view of the 'Technical Cycle' of the butterfly diagram with BKK on the left and YGN on the right in the unit Item/pers/year. Only the loops "Reuse/Redistribute" and "Refurbish/Remake"/repair can be measured quantitatively[12] with Yangon having a combined item circularity of 4.8 items for each citizen per year, while BKK CE is only keeping 1.6 items per year inside the two loops.

The most notable disparity between the two cities can be observed in terms of repair, with Yangon exhibiting repair rates over five times higher than those in Bangkok. This difference is particularly evident in the repair of IT equipment, electronic appliances, and bicycles. Conversely, items such as shoes and umbrellas are gradually transitioning from being frequently repaired to being discarded when broken. In Bangkok, the repair sector primarily focuses on IT equipment, cooling and heating systems, and motorbikes.

In the Reuse loop, clothing (including shoes in Thailand) represents the most common secondhand item. In Yangon, IT equipment and bicycles are prominent secondhand goods utilized by the population.

12 The loops "maintain/prolong" and "recycle" can not be quantified in the dimension of "items" (see section Evaluation Method)

5.3 Material circularity in mass

In contrast to the "item" dimension, the "material" dimension gives insight into the CE from an environmental or waste management perspective as it analyzes how much material is not ending up in the linear waste stream.

In this analysis the loop "recycling" as well as the linear flow from "user" to waste (inorganic waste) can be included. It is important to note again that for the inner loops only the specified sectors are included.

Heavy mass items like cars or the reuse of glass bottles by FMCG are not included into these two loops while all consumer streams are included in the "recycle" loop and in the "waste" destination. This leads to a sizable underrepresentation of the inner loops. Still, from the perspective of comparison between YGN and BKK it can provide valuable insights.

Table 2: Material flow through different user loops and disposal. The contribution of all loops in ratio to material generation is only 23% (Yangon) and 18% (Bangkok) showing that linear economics driven mainly by FMCG is dominating.

| Item	Unit	Reuse	Repair	Recycle	Treated organic waste	Inorganic Waste	Organic Waste	Ratio: Recovered/Generated
Material YGN[13]	kTPY	13	113	151	69	500	667	
Material BKK[14]	kTPY	6	76	700	97	1,455	2,598	
Material YGN	Kg/cap/year	2.4	21.4	29	13	94	126	23%
Material BKK	Kg/cap/year	0.6	7.1	65	9	136	243	18%

Comparing the two cities from the perspective of mass there are some key points to note (see Table 2 and Figure 5):

- BKK generates more inorganic waste per person then YGN which follows the general understanding that an increase in GDP results in the increase of waste generation.[15]
- BKK generates over twice as much recyclable material per person than YGN suggesting a stronger use of higher quality products in higher quality packaging (HDPE bottles instead of sachets, aluminum cans instead of PET, etc.). This loop is dominated by FMCG packages and scales in general with waste generation.
- The reuse loop plays a minor role in this dimension since heavy items in general would be kept for a longer period of time by the same person (motorbike, bicycle, e- appliances) but require maintenance and so predominantly adding to the repair loop.

13 2022 Waste Audit Brief, Thant Myanmar
14 Solid Waste Management City Profile (Bangkok 2015)
15 What a Waste 2.0, World Bank 2016
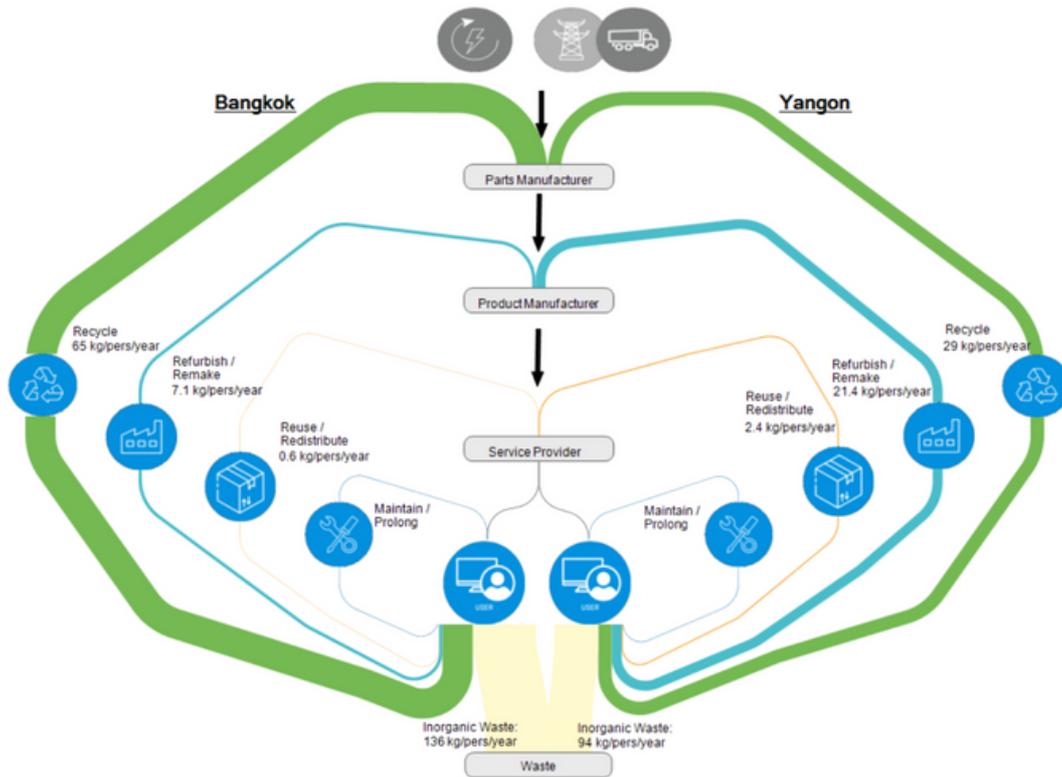
Figure 5 shows the butterfly flow diagram in the dimension of mass (Unit: kg/pers/year). For both cities flows are dominating (Linear flow from user to waste and the "recycle" loop). For BKK only 18% of mass is part of the circular economy, while for YGN it is 23% (see Table 2).

Box 1: Challenge of interpreting the Mass flow diagram

The mass flow diagram for CE highlights the challenges of CE rather than its solutions. The inner loops may seem insignificant, leading policymakers to believe they are negligible and that the private sector maintaining the flow in these loops does not require attention.
This is specifically true in countries like Myanmar or Thailand where the structure and size of the inner loops are poorly understood and discussed. Despite mentioning the waste hierarchy principles as key in most policies related to pollution control, sustainable development, or waste management, action plans to support these crucial sectors are often lacking.
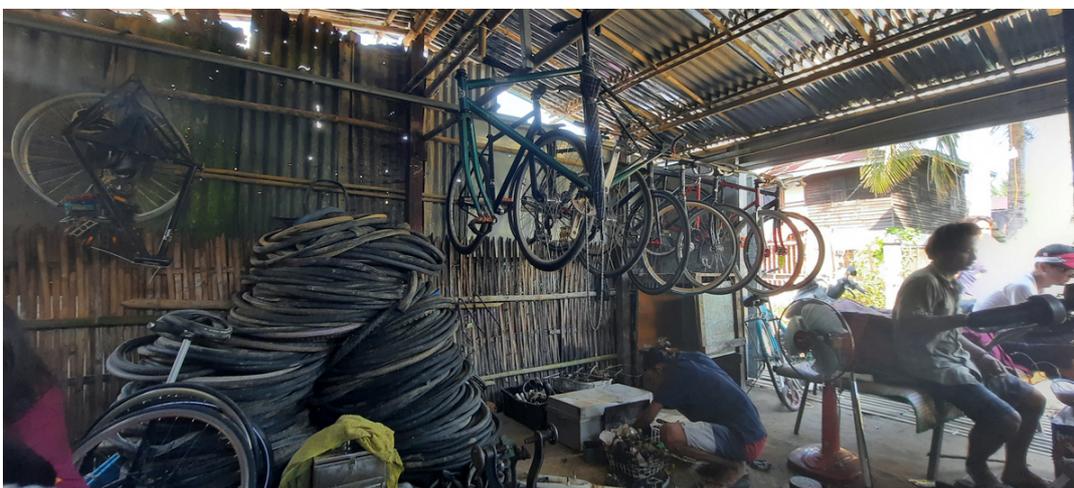
Picture: Bicycle repair shop in Yangon

5.4 Value generated by the Circular Economy

This section highlights the importance of understanding the value associated with different loops to address the challenge of misinterpreting a mass flow diagram (see Box 1). However, determining the "value" dimension is not simple, as it encompasses various factors such as economic, environmental, health etc.. In this analysis, we concentrate solely on the economic value, as other values may be less apparent to consumers and, therefore, have a lesser impact on their decision-making when utilizing these loops.

5.4.1 Definition of value

The value generated by the circular economy for society cannot be accurately measured using the conventional economic assumption that the value is determined by price of the product or the service. Applying this model would underestimate the economic benefits of the sector, as secondhand and repair services are relatively inexpensive.

Here we define the value that CE is contributing to society as the financial gain from the consumer's perspective of having an item reused, repaired or recycled. The financial gain is the difference between the price of a new item and the price of a reused item or its repair cost. In the case of recycled material, the value corresponds to the price the consumer would receive upon selling the material. However, since recycling is mostly part of the waste collection without or negligible incentive[16] for the consumer it is neglected in this analysis.

As an example, we will look at a bicycle: The value contribution comes from the difference of buying a secondhand bicycle instead of a new one. The price difference is the gain provided by the circular economy to the consumer while providing the same functionality. When a bicycle is broken its function is lost but is reinstated through repair so the gain for the consumer is the difference between the price of a new bicycle and the cost of repairing the existing one. After the bicycle cannot be repaired anymore, its value for the consumer is the price of the material the consumer will receive by selling the metal to a scrap dealer. This value is so low that it is neglected for the evaluation. In both cities the annual return per person for household waste is hardly reaching 1 USD, even in structures like in Yangon where waste pickers are buying recyclables from households.

It should be noted that this value definition does not account for additional positive effects, such as reductions in waste management and pollution costs incurred throughout the product life cycle. Furthermore, it is important to acknowledge that this is a conservative estimate of value, as many secondhand items originate from countries with stringent product standards and greater purchasing power. In Yangon, this is often referred to as the "Japan use" brand (see Box 2).

16 In YGN and sometimes also in BKK there are scrap buyers/waste pickers who buy recyclables from households, creating an economical value for the consumer. However this hardly sums up to a few USD per year.

Box 2: "Japan Use" - guaranteed quality from Japan or similar locations

Historically, high quality and affordable used items were imported to Myanmar mainly from Japan through the second hand market. Presently, this mechanism remains intact, with Taiwan and Korea also contributing as source markets. Contrary to the quality items branded "Japan Use", new items originating from China, referred to as "Made in China" are considered cheap but easily breakable. This branding distinction still holds sway among consumers purchasing secondhand items and has experienced a resurgence following the military coup d'etat in 2021.

5.4.2 Method of data gathering

During the survey of the CE SMEs, each SMEs provided the revenue they received by repairing/reselling a certain number of items. Therefore, an average resell/repair price could be calculated per item per sector, which was then compared with an average new item value (see Table 3).

Table 3: The table lists the average price to be paid for an item in a specific sector divided into: NEW, RESELL, REPAIR. The gained value for the consumer is the difference between NEW and either RESELL or REPAIR. Knowing the number of reused or repaired items per citizen (see Figure 3) in a year allows us to calculate the VALUE generated per citizen per sector as well as the total sum generated by the sectors combined which adds up to 197 USD in YGN and 82 USD in BKK.

ITEMS	YGN NEW PRICE [USD/ITEM]	BKK NEW PRICE [USD/ITEM]	YGN RESELL PRICE [USD/ITEM]	BKK RESELL PRICE [USD/ITEM]	YGN REPAIR PRICE [USD/ITEM]	BKK REPAIR PRICE [USD/ITEM]	YGN, VALUE GENERATED [USD/PERS/YEAR]	BKK, VALUE GENERATED [USD/PERS/YEAR]
SUM							197	82
IT (COMP & PHONE)	143	234	39	81	27	25	38.0	31.9
E- APPLIANCES	20	40	7	27	6	27	6.0	0.2
COOLING & HEATING	300	515	110	392	26	41	30.6	14.4
CLOCK & WATCH	30	30	6	20	4	10	1.3	0.9
PUMP & FAN	30		34	-	3	-	3.9	0.0
BICYCLE	133	245	36	-	2	21	72.4	0.7
MOTORBIKE	429	1,471	112	368	3	44	16.0	26.3
CLOTHING	10	10	1	5	3	9	18.4	4.7
BAGS	20	30	2	10	1	-	3.1	0.1
UMBRELLA	4	-	1	-	0	-	1.0	
SHOE	4	13	2	10	0	7	0.6	0.4
WOOD & FURNITURE	200	200	51	-	77	56	4.8	2.0
KEY	4	4	-	-	1	9	1.2	

17 GDP of Thai Provinces, Wikipedia
18 The World Bank Data 2021

5.4.3 Comparing value circularity

The value flow diagram shows the economic value received by each citizen through the CE (see Figure 6). It is dominated by the repair sector for both cities while YGN CE sector creates more than double the value for each consumer in comparison to BKK.
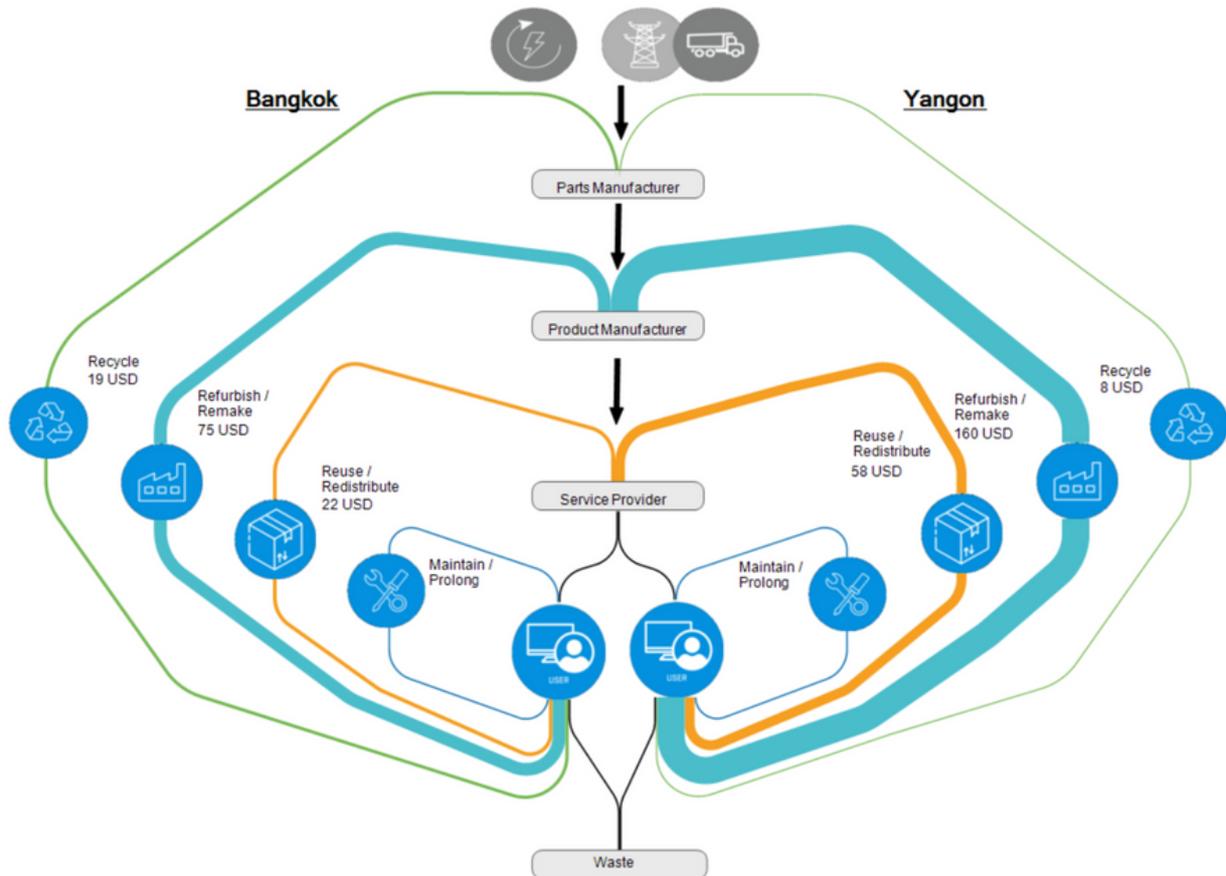
Figure 6: The value flow diagram illustrates the value contribution of each loop to the CE. Combined Yangon generates a value of 197USD/person/year while Bangkok generates less than half at 82 USD/per/year. Comparing these values to the per capita GDP (Bangkok:19,749 USD/pers/year[17] and Yangon: 3006 USD/pers/year[18]) of each city reveals that the CE contributes 0,4% to Bangkok's GDP and 6.6% to Yangon's GDP.

The repair loop is the primary contributor to the CE's value in both cities. The reuse loop represents approximately only one-third of the value generated by the repair loop in both cases. This can be attributed to lower income levels, where limited purchasing power encourages individuals to maintain and repair items to preserve their value.

6. CONCLUSION

Yangon's circular economy (CE) outperforms Bangkok's in all three dimensions: items, material, and value. This can be attributed to influential factors such as resource scarcity, low purchasing power, and a large labor market with low incomes.

The repair loop emerges as the more significant contributor in terms of quantity. However, successful operation within this loop necessitates technical capabilities and an environment that allows for minimal investment and income. This is particularly true for inexpensive products like electrical appliances, shoes, umbrellas, and to some extent, bicycles. On the other hand, both countries demonstrate highest repair rates for IT products.

In the reuse loop, both cities benefit from the global market, which makes high-quality brands available as a result of overconsumption in countries like Japan, Korea, or Taiwan. This accessibility allows low-income individuals to obtain valuable items that would typically be affordable only to the higher-income segment of society within their respective countries. For example, in the bicycle sector, a new branded racing bicycle valued at 2000 USD can be obtained in Yangon for only 10% of the price as a second hand item.

7. ANNEX

7.1 Annex 1: Questionnaire

No.	Question to SME
1	Name of business?
2	Address and Contact?
3	Years of business running?
4	Type of business (Repair or Reuse)?
5	Main Business sector?
6	Business size (Number of staff)?
7	Business place?
8	Owners Age?
9	Owner's Gender?
10	Is that main business or side business?
11	Do you like your job?
12	Would you change your job if you still get the same amount of income from other job?
13	How many items do you sell per week?
14	How many items do you repair per week?
15	How many items do you fail to resell/repair per week?
16	Sources to buy spare parts?
17	What do you do things which can't be repaired or resold?
18	Business Revenue per month?
19	Value of the business
20	What capacity development do you need?
21	How do you do marketing?
22	Do you have any difficulties in running business currently?

7.1 ANNEX 2: Comparison of Actions under CE principles

Principles of CE	EU actions	Myanmar
Regenerate	Shifting to renewable energy	Myanmar's grid system is currently running 54% from hydropower energy sources and 45% from natural gas energy sources. [19]
Share	- Peer to peer sharing - Public sharing or pooling - Secondhand products - Maintenance - Repair - Design for durability and upgradability	**Peer to peer sharing -** Sharing and exchanging clothes and personal materials with friends and siblings. Donation to IDP camps and poor communities. Thrift clothing is entering the countries from sources of different countries ranging from Japan to the EU and America. **Public sharing & pooling -** 50% of the trips in Yangon are using public transport (Buses).[20] Companies such as Grab or Oway are operating in Yangon. Delivery services such as FoodPanda are using bicycles for delivery. Residents are using bicycles for short distances moving around the local area. **Second hand products -** Local and second products imported from different countries are utilized in daily life of the Yangon citizens. **Maintenance -** Maintenance is not currently running smoothly in Myanmar due to lack of access to producing sources. **Repair –** Repair ranging from small low price electrical appliances such as rice cookers to expensive smart phones and laptops are being conducted in Myanmar. **Design for durability -** Myanmar due to lack of production capacity has no authority for designing for durability.
Optimize	- Increase performance/efficiency of the product - Remove waste in production and supply change - Leverage big data - Remote sensing - Steering	
Loop	- Remanufacturing products - Recycling - Anaerobic digestion - Extracting biochemical from organic waste	**Remanufacturing products –** Products such as bicycles and laptops are imported in good shape or in broken form to Myanmar. Agents and repairers are repairing and assembling new products and selling. **Recycling –** Recycling from waste was happening on a large scale informally. **Anaerobic digestion –** No large- or small-scale AD is practicing in Yangon.
		Extracting biochemical from organic waste – Composting of organic waste intentionally or unintentionally.
Virtualize	Book or music Online shopping Virtual office	**Book or music –** Due to lack of strong copyright rules or regulations, movies, music and books are circulating on different online platforms. **Online shopping –** Online sales of different materials are accelerating starting from covid period on a large scale in Yangon. **Virtual office -**
Exchange	Replace old with advanced non-renewable materials Apply new technology (e.g., 3D printing) Choose new product/service (e.g., multimodal transport)	**Replace old with advanced non-renewable materials –** Fast pacing technology is cross-cutting Myanmar especially Yangon and residents are jumping from conventional to modern methods such as from landline phone to smart phones. **Apply new technology –** No operation or action in Yangon. **Choose new product/service –** New products are coming into the country while a whole conventional obsolete material is skipping in Yangon due to the digital platforms mainly Facebook.

19 https://www.trade.gov/country-commercial-guides/burma-energy
20 Myanmar Transport Sector Policy Note. 2016. Asia Development Bank. https://www.adb.org/sites/default/files/publication/189083/mya-urban-transport.pdf

SURVEY PICS

A look at the CE shops in Yangon and Bangkok