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Assessment of Environmental Impact in E-commerce and Traditional Retailing: A Comparative Approach in Sylhet City

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Abstract: ***E-Commerce has revolutionized shopping in the global market and has boosted the economy of countries such as Bangladesh. However, it has also an effect on environment, for example, with CO_2 emission from logistic and packaging waste. This paper assesses the environmental effects of e-commerce in Sylhet City by looking at Daraz delivery centers and Shwapno outlets. The results reveal that the CO_2 emissions of Daraz's covered vans are 246.86 g/km which is significantly higher than motorbikes. Shwapno's localized model and environment friendly packaging make it less harmful to the environment, unlike Daraz's excessive plastic use. Furthermore, biodegradable waste management, including sophisticated decomposition of perishable waste-segregation and disposition also testify Shwapno's sustainable practices. Finally, this study highlights that the sustainable e-commerce could be achieved by utilizing the green transportation means, localized delivery systems and recyclable packaging materials. Future research should investigate the problems of integrating renewable energies and sustainable approaches.***

Keywords: ***E-commerce, CO_2 emissions, Sustainable practices, Green transportation, Localized delivery, Recyclable packaging, Waste management.***

I. INTRODUCTION

E-commerce has transformed shopping worldwide, becoming a powerful driver of economic growth and jobs. Since 2000, the number of online shoppers has increased dramatically from under 100 million to over 2 billion by 2021 [1]. This transformation, fueled by the IT revolution, is especially vital for developing countries like Bangladesh, where e-commerce is speeding up urbanization and improving access to goods and services [2]. However, its rapid rise also brings challenges, such as higher CO_2 emissions from logistics and pollution from packaging waste [3]. This brings about the need to address the environmental factors in e-commerce hence the need for this research study. Thus, it is useful to do empirical study of e-commerce in its comparison with traditional retailing, by applying the measurement of CO_2 emissions [4].

In order to explore the effects on CO_2 emissions from transportation and implications on product packaging, the distribution flow of e-commerce is considered in comparison to that of traditional retailing [4]. This comparison highlights the critical role of optimizing delivery strategies to balance efficiency with sustainability. Efficient delivery strategies, like shorter routes, can cut carbon emissions and make e-commerce more eco-friendly [5]. Additionally, as for packaging, it is evident that eco-friendly materials are an important means to minimize packaging waste as well as carbon emissions thus helping the planet [6]. In fact, sustainable packaging materials, such as paper, paperboard, glass, and metals, are gaining attention due to their advantages and potential to reduce environmental impacts [7]. Moreover, for countries like Bangladesh, shifting from waste disposal to resource management is key to protecting both the environment and public health [8].

This paper analyzes the logistics and packaging practices of Daraz and Shwapno in Sylhet City, focusing on their carbon emissions and strategies for greener e-commerce. It highlights eco-friendly transport, efficient delivery, and biodegradable packaging, offering insights for reducing CO_2 emissions in urban freight and promoting sustainable, zero-carbon solutions.

II. METHODOLOGY

This section outlines the overall approach employed to conduct the study.

Through a systematic survey method, this study analyzes the environmental effects of e-commerce platforms in Sylhet City where three major areas have been measured: carbon emissions, waste disposal and packaging methods to assess the ecological impact throughout the area.

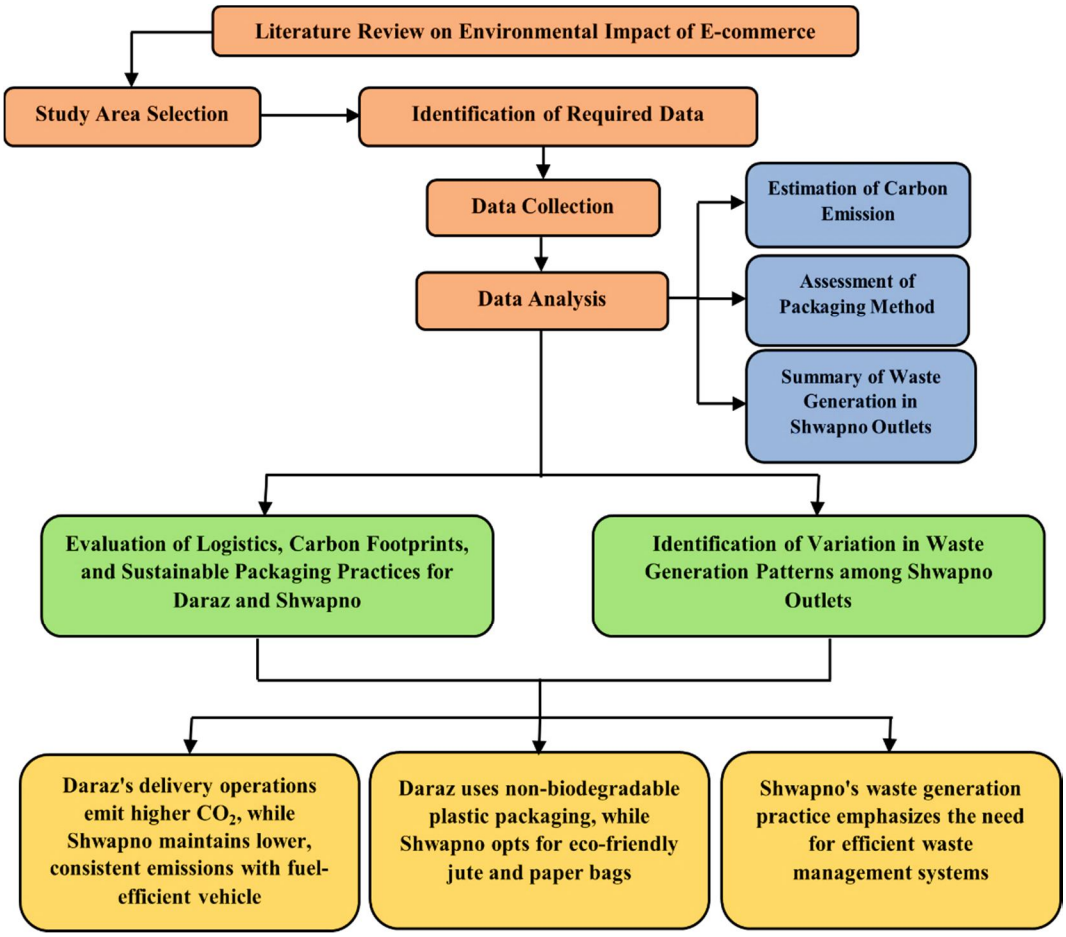

Fig 1: Overall Workflow of the study

A. Study Area

This study was conducted in Sylhet City, a rapidly growing urban area in northeastern Bangladesh. It focused on six Daraz collection points – three in Naiorpool Regional Hub and one each in Kazitula, Hawapara, and Upashahar– along with seven Shwapno outlets. These key commercial hubs handle large volumes of goods and packaging daily. By examining both e-commerce logistics and retail operations, the study provides insight into waste management challenges and opportunities in Sylhet's commercial sector.

TABLE I: Geographic Locations of Daraz Collection Points and Shwapno Outlets in Sylhet City

Study Case	No.	Location	Latitude	Longitude
Daraz	1	Naiorpool	24° 53' 40.30" N	91° 52' 39.73" E
	2	Hawapara	24° 53' 53.73" N	91° 52' 16.38" E
	3	Kazitula	24° 54' 26.48" N	91° 52' 42.40" E
	4	Upashahar	24° 52' 59.10" N	91° 53' 19.70" E
Shwapno	1	Amborkhana	24° 54' 22.16" N	91° 51' 56.50" E
	2	Kumarpara	24° 53' 59.05" N	91° 52' 45.81" E
	3	Pathantula	24° 54' 40.22" N	91° 52' 15.84" E
	4	Shah Paran	24° 54' 28.48" N	91° 55' 55.61" E
	5	Shibgonj	24° 53' 43.92" N	91° 52' 37.97" E
	6	Upashahar	24° 53' 20.33" N	91° 52' 56.57" E
	7	Zindabazar	24° 53' 44.61" N	91° 52' 17.52" E

B. Estimation of CO_2 emission

For determining CO_2 emissions, the following formula derived from a standard reference work, GUIDELINES FOR ESTIMATING GREENHOUSE GAS EMISSIONS OF ASIAN DEVELOPMENT BANK PROJECTS (2016), was used:

CO_2 emission (g/km) = Fuel Consumption rate (L/km) × Emission Factor (kg/L) × 1000…… (1.1)

Where emission factor depends on fuel types [9].

C. Study Procedure

In order to gather information for this study, structured questionnaires were used to interview logistics staffs from Daraz and Shwapno about delivery methods, vehicle types, fuel consumption, trip frequency, distances, and packaging disposal. Biodegradable and non-biodegradable waste management was evaluated with the use of waste generation data from Shwapno outlets. Ethical guidelines, including consent and confidentiality, were followed. To ensure a representative sample, one Daraz hub and seven Shwapno outlets were studied. For emissions calculation, fuel consumption was categorized by vehicle type, fuel type, and distance traveled, with specific emission factors assigned. Packaging materials were analyzed based on type and biodegradability to assess their environmental impact.

III. RESULT AND DISCUSSIONS

This study explores the environmental impact of logistics and waste management in Sylhet City through data analysis and observations. Visuals highlight key trends in carbon emissions, packaging, and waste, providing insights for sustainable improvements.

Table 2 compares delivery operations of both Daraz and Shwapno. Daraz's covered vans, due to higher fuel consumption, emit the highest CO_2 at 246.86 g/km, while Shwapno's motorbikes have the lowest at 46.4 g/km. This analysis highlights the necessity of improved vehicle performance, fuel efficiency, and environmentally friendly transportation in order to lower emissions. Regarding packaging, Daraz still uses non-biodegradable packaging, whereas Shwapno promotes sustainability with jute and paper bags, encouraging eco-friendly alternatives [10].

TABLE II: Comparison of Logistics Operations, Carbon Emissions, and Packaging Practices for Daraz and Shwapno

Variables	Daraz				Shwapno	
	Motorbike		Covered Van		Motorbike	
	Normal Days	Offer Time	Normal Days	Offer Time	Normal Days	Offer Time
No. of Vehicles	22	40	5	same as normal days	22	same as normal days
No. of Trips	22	40	10	same as normal days	22	same as normal days
Distance Covered (km/day)	662.5	1080	350	same as normal days	227.27	same as normal days
Total Fuel Used (Liters/day)	13.5	21.6	32	same as normal days	4.545	same as normal days
Fuel Consumption Rate (L/km)	0.0204	0.02	0.091	same as normal days	0.02	same as normal days
Total Carbon Emission (g/km)	47.28	46.4	246.86	same as normal days	46.4	same as normal days
Packaging Materials	Cartons, Plastic Bags, Bubble Wrap, Polythene, Sealing Tape, Paper, Foam				Jute Bag, Paper Bag, Cotton Bag	

Table 3 indicates significant differences in waste generation among seven Shwapno outlets, which escalate by around 20-30% during weekends. Monthly waste disposal costs also vary remarkably between those outlets. These findings show that specialized waste management systems need to handle higher waste output to mitigate environmental threats.

TABLE III: Summary of Waste Generation and Management Metrics Across Shwapno Outlets

Outlets	Waste Generation Metrics				
	Daily Waste in Weekdays (kg)	Daily Waste in Weekend (kg)	Packaging Materials (%)	Quantity of Expired/Unsold Products in no.s (monthly)	Monthly Disposal Cost (৳)
Amborkhana	45-50	58-60	< 20	40-42	5,120
Kumarpara	10-15	22-25	< 10	15-20	2,575
Pathantula	28-30	38-40	< 15	28-30	3,175
Shah Paran	08-10	15-18	< 10	20-25	2,575
Shibgonj	20-22	28-30	< 12	30-32	3,025
Upashahar	58-60	70-72	< 20	42-45	5,200
Zindabazar	42-45	55-56	< 20	35-40	5,000

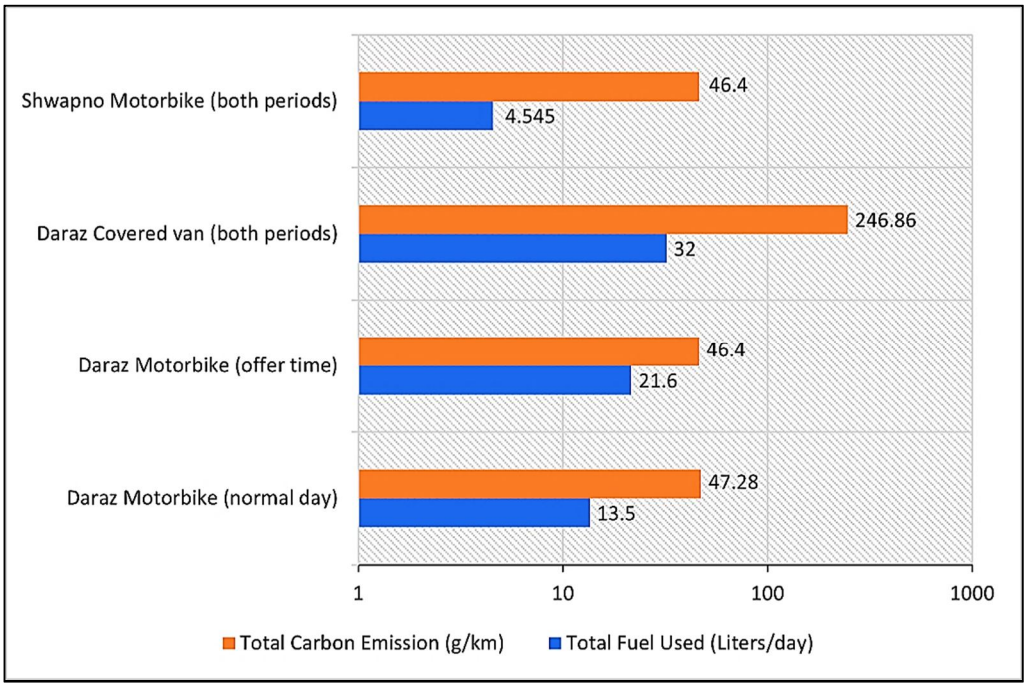

Fig. 2: Comparison of Fuel Consumption and Carbon Emission by Vehicle Type

Figure 2 displays fuel utilization (liters/day) and carbon emission (g/km) data for Daraz and Shwapno throughout their different operational schedules. During normal operational days, Daraz's motorbike requires the least amount of fuel at 13.5 liters per day but its covered van burns the most at 32 liters daily. Promotional periods drive the motorbike's daily fuel consumption to reach 21.6 liters yet the covered van maintains its regular fuel efficiency level. The delivery vehicle at Shwapno maintains stable fuel consumption rates at 4.545 liters daily throughout any operational period. In terms of carbon emissions, Daraz's covered van has the highest impact (246.86 g/km), while Shwapno's motorbike emits the least (46.4 g/km). According to this analysis Daraz's covered van demonstrates the highest environmental footprint but Shwapno's motorbike manages to balance fuel consumption with minimal emissions.

IV. CONCLUSION

This study highlights the environmental impact of e-commerce in Sylhet City. Daraz's fuel-intensive vehicles, especially during promotions, produce higher emissions than Shwapno's low-emission motorbikes. Shwapno also uses eco-friendly packaging, unlike Daraz's non-biodegradable materials. Waste analysis reveals inefficiencies across Shwapno outlets. These findings emphasize the need for greener delivery, sustainable packaging, and strategic waste management to reduce e-commerce's environmental footprint in urban areas.

V. ACKNOWLEDGEMENT

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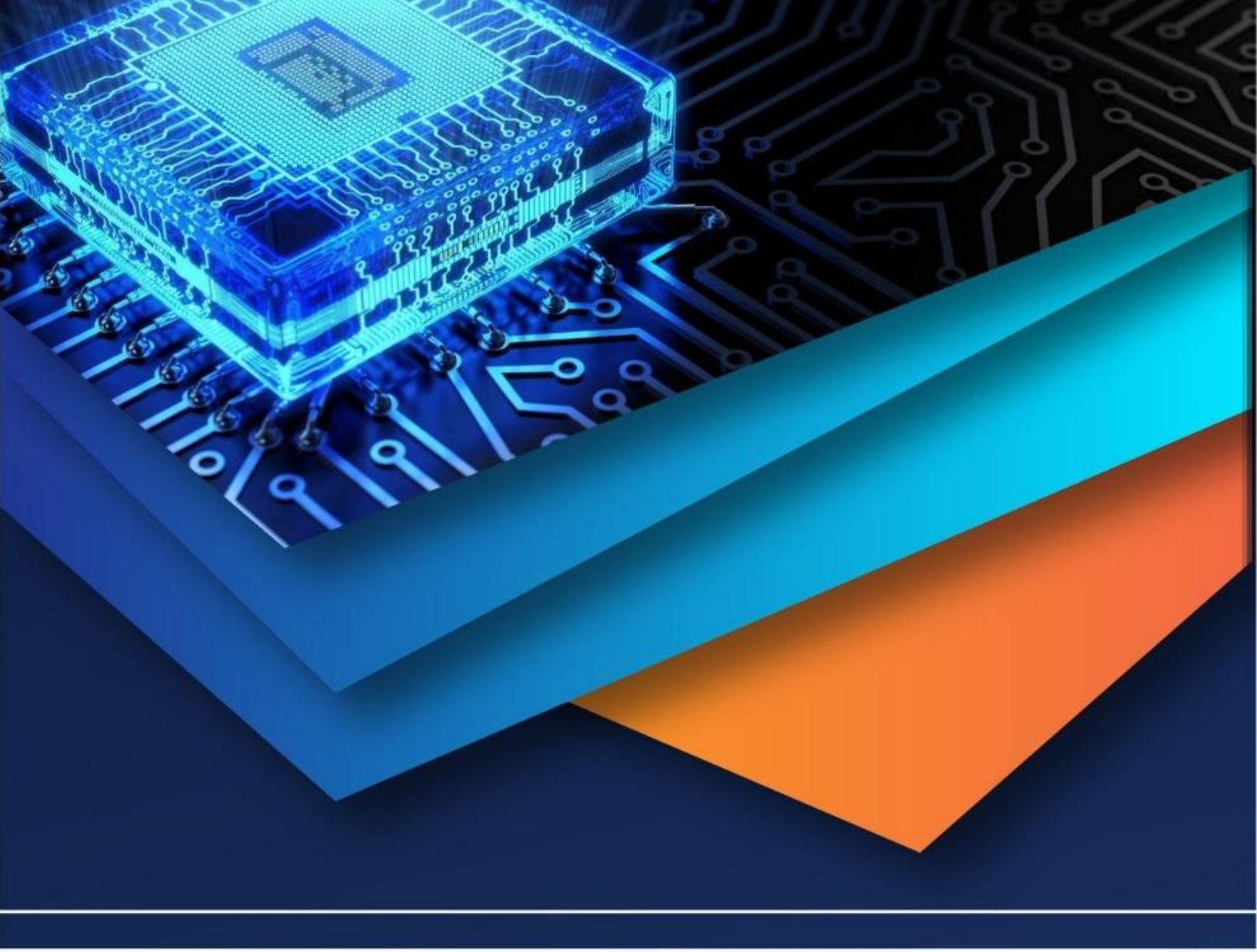

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