

Research Article

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Waste Disposal and Sewage Related Issues, Challenges in Semi-Urban Municipal Areas Like Dubrajpur Municipality in West Bengal, India and its Mitigation: A Geographic Overview

Jayanta Gour

Assistant Professor, Department of Geography (UG & PG), Sambhu Nath College, Labpur, Birbhum, India

ABSTRACT

Waste Management now a day the most important system among all other managerial systems and is an integral part to make India Viksit Bharat by 2047. Each and every sector generates unlimited waste materials and most have not a clear idea about their individual responsibilities in making our urban environment greener annually. There is a misconception that it is the responsibility and sole duty of the municipal workers of the Urban and Semi-Urban Municipality workers to keep their municipal area neat and clean every day and local residents of different wards are supposed to generate waste daily without any precaution or future waste management for next generations. This research article has mainly aimed on finding semi-urban type municipality's severe waste management issues like Dubrajpur Municipality in West Bengal, India. The article highlighted on multi factors which contribute severe impact but are very much interrelated with each other. The results showed that only municipal workers performance enhancement cannot merely change the severity of waste disposal in semi-urban municipalities like Dubrajpur Municipality in India. Rather, systematic, collaborative and integral approach through building of self-consciousness all citizens of each household, food stalls, roadside sellers and buyers, passengers, digital shops, parks, museums, offices, educational institutes, railway stations and passenger and goods vehicle stoppages etc. of their respective wards can convert this municipality into the greenest semi-urban municipality in India.

*Corresponding author

Jayanta Gour, Assistant Professor, Department of Geography (UG & PG), Sambhu Nath College, Labpur, Birbhum, W.B. PIN- 731303, India.

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Introduction

India has targeted to make India Viksit Bharat by year 2047. More emphasis has been given to apply indigenous techniques and updated techniques to improve the quality of municipal livelihoods as well. Although, lot of fully urban municipalities has been developing rapidly in districts having high literacy rate and higher income level states in India, the semi-urban municipalities lag quite behind as projected to be developed during different budget years. Dubrajpur Municipality (geospatial extent is 87°21'E-87°24'E & 23°46'N -23°49'N and covers an area of 16.84km² as per Census 2011) in Suri subdivision of Birbhum district of West Bengal in India is the best example in this regard. The population in this municipal area rose by +16.15% from 2001-2011 [1]. In semi-urban areas like Dubrajpur Municipality of Dubrajpur C.D. Block in Suri Subdivision of Birbhum district of West Bengal, biodegradable and non-biodegradable dry and wet wastes are generated mainly from households and streetside built-ups mainly engaged in market related activities. More the increase in population more will be household density and more will be the waste generation.

Dubrajpur is historically noted for the Mama-Bhagne Pahar (and at present there are total 16 municipal wards under the Dubrajpur Municipal Area. This municipal town is well connected to industrial areas (Asansol, Durgapur etc.) and to Andal, Suri (headquarter of Birbhum district), Sainthia via Eastern Railway and is well connected by National Highway (NH-60) and State Highway (SH-14) which make it closure to surrounding districts like Bankura, Purba Bardhaman and Paschim Bardhaman.

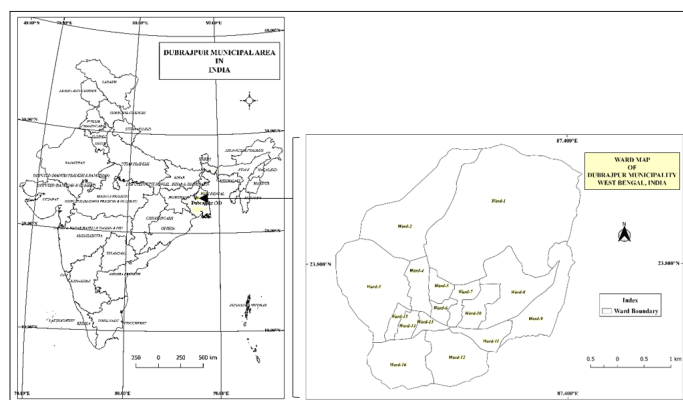


Figure 1: Location Map of the Study Area

Table 1: Dubrajpur Municipality at a Glance

Ward No.	Name of Places falling under each ward	Geospatial Area (in km ²)	Total Population (2011)
1	Bairagi Kondha, Majuria, Gobartala, Station Para	5.09	2720
2	Ranjan Bazar, Master Colony, Bank Colony, Bakreswar Road	1.90	2386
3	Ojha Para, Bagdi Para, Bauri Para, Rail Line Pass, Dubrajpur Stadium	1.73	2313
4	Rabindra Sadan, Bypass Lane, Sarada Palli, Mukherjee Para, Abhaya Mandir, Via Pakurtala, Block Office	0.38	2238
5	Lalbazar Durga Mandir, Cinema Hall, Nazirpur	0.20	3132
6	Kulu Para, Pallishree Club, UCO Bank, HDFC Bank	0.15	1924
7	Asrafi Para, Dharmaraj Mandir, Kamarshal Mor Exide	0.25	2744
8	Mehedi, Islampur Exide, Jalkali Mandir	1.06	2902
9	Satkenduri, Durga Mandir, Power House	0.91	3455
10	Majh Para, Red Rose Club	0.36	3371
11	Bakhol Para, Majh Para, Islam Sporting Club	0.32	1897
12	Ram Sita Mandir, Dakbungalow Para, Rewni Para, Dubrajpur Court, Dharmashala, Dubrajpur Poursabha	0.94	2129
13	Dubrajpur Bazar, Marwari Para, Dubrajpur Thana, Mudi Para	0.14	2092
14	Acharyya Para, Swarnakar Para, Tanti Para, Mete Para, Bagdi Para, Ujjwal Sangha Club, Prajapati Anushtan Bhavan	0.17	3040
15	Poddar Para, Napit Para, Manasa Mandir, Nayek Para, Mahaprabhu Mandir, Ananda Kanan	0.13	1698
16	Pahareswar Mama-Bhagne Pahar, Shiv Mandir, Park, Shmashan, Goshala Basti, Das Para	0.96	N/A

Source: Dubrajpur Municipality, 2026

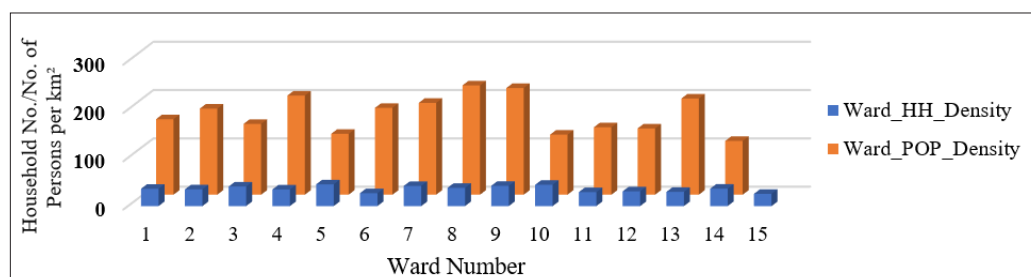


Figure 2: Ward-Wise Share (%) of Total Population of Dubrajpur Municipal Area (2011)

Objectives

The objectives of this research are

- Search of factors working behind age-old semi-urban type municipality's severe waste management issues like in Dubrajpur Municipality of West Bengal, India.
- To recommend for solving the regular and severely rising waste disposal related issues and challenges in Dubrajpur Municipality of West Bengal India.

Materials and Methods

For measuring, computing and analysing the municipal waste related data and information the materials which has been used are: Survey of India Toposheet No. 73M/5, District Census handbook and Census of Birbhum (2011), Municipality map, Landsat Satellite Imageries (LC09_L2SP_139044_20260422_20260423_02) from Bhoonidhi portal, GPS Camera (available in Google Playstore). Interviews were taken in each ward with scheduled questionnaire. For statistical data analysis, MS Excel 2024 was applied and for geospatial analysis, Arc GIS 10.8.2 (crack version) and QGIS 3.16.3 version were used to prepare targeted maps required for analysis and obtain the results.

Result and Discussion

The Wards which have higher share of urban population in Dubrajpur Municipality Area (refer the Table above) are: Ward-5 (8.23%), lying across the Dubrajpur-Bakreswar-Chandrapur main road connected to SH-14; **Ward-9** (9.08% i.e. 3455 persons out of total 38041 persons of Dubrajpur Municipal Area), **Ward-10** (8.86%), **Ward-14** (7.99%), Ward-8 (7.63%) which lies across the SH-14. The most populated ward of Dubrajpur Municipality in year 2001 was the Ward-11 with 8.27% of the total Dubrajpur Municipal Population. Considering the households (HH) and population density, it has been found that Ward-5 (Figure 1) across the Dubrajpur-

Bakreswar-Chandrapur main road connected to SH-14 has highest household density of 40.86 HH/km² area of the entire municipality and population density of 186 persons/km² respectively in Dubrajpur Municipal Area followed by **Ward-9** with 38.06 HH/ km² & 205 persons/ km², **Ward-10** with 39.96 HH/ km² & 200 persons/ km² and Ward-3 with 32.60 HH/ km² & 137 persons/ km² (even though it shares less than 0.3km of primary street access connected to the SH-14) and Ward-7 has a household and population density of 37.83 HH/ km² & 163 persons/ km². Both the Ward-7 and 9 lies across the SH-14.

Computing the correlation between the household density and population density data of Dubrajpur Municipal Area it has been bound that there is strong positive correlation between the population density and household density (Figure 3L).

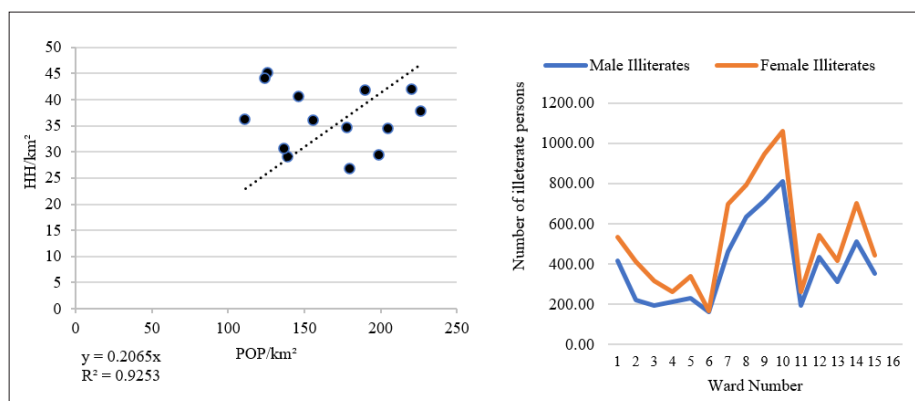


Figure 3: Left- Correlation between Household (HH) Density and Population (POP) Density in Dubrajpur Municipal Area (2011) & Right- Ward-Wise Number Illiterates

In this municipal area, increasing population indicates increase in population aging 0-6 years. More the increase in kids' number, more will be the selling of plastic and non-biodegradable toys or other games items. As illiteracy rate (36.14%) is quite high in this municipality unlike other municipal areas of West Bengal and kids' share of total municipal population is 11.89%, it can be presumed that reuse and recycling concept is quite absent in those households (Figure 3R). The correlation between ward-wise share of kids (%) between age of 0-6 years and ward-wise illiterates (%) to the dry and wet bio-degradable and non-biodegradable wastes produced (considering Kitchen Waste, Washing, Bathing and miscellaneous of 200gm, 50gm, 25gm, 10gm respectively per household per ward) shows that there is lower moderate positive relation (≤ 0.25). Ward-9 has the ward-wise highest share of population density of 205 persons/km², kids (0-6 years) of 16.79% and 38.06 HH/km² (Figure 3) but significantly one of the lowest illiteracy rates (48.13%) in this municipality area. Segregating biodegradable and non-biodegradable waste items cannot achieved as projected under these circumstances. Plastic packets and items brought from markets are also expected to be thrown here and there outside residential areas or across the highways or primary streets due to ignorance of waste management caused by lower rate of literacy in wards like this. The maximum non-biodegradable plastic-made wastes are supposed from the households of Wards like Ward-9 are supposed to be creating disposal issues if not properly disposed the households or collected properly by municipal workers. During heavy rainfall situation those wastes may choke the municipal drains and create hazardous municipal sewage system.

Natural Factors Responsible for Liquid Household Waste Drain out Issues

The hydro-morphological geospatial analysis revealed that Ward No. 1 is very much prone to inundation and the Word No. 3 is also prone to inundation and are supposed to create drainage issues in this municipal area (Figure 4) during normal rainfall condition. Reasons are:

- As average elevation of his municipal area ranges between 90m-100m above MSL and often dissected elevated areas are noticed in central parts (Wards like Ward-2, 4, 5, 6 and 13) of the municipal areas, whereas, the entire draining out of runoff or municipal waste water is diverted to relatively low lying wards like Wards 1, 3, 8 and 9 [2].
- As the municipal area share three micro-basins and flow accumulation is maximum in Ward No. 1 which is mainly drained by one of the eastward flowing distributaries of Bakreswar River to its north and northeastern part of Dubrajpur Municipal Area. The Sal River flows to the south-west of this municipal area. During heavy rainfall condition the narrow and shallow municipal drains cannot have the capacity to hold the surface runoff from the roads and irregular disposal accelerate the choking of those municipal drains.

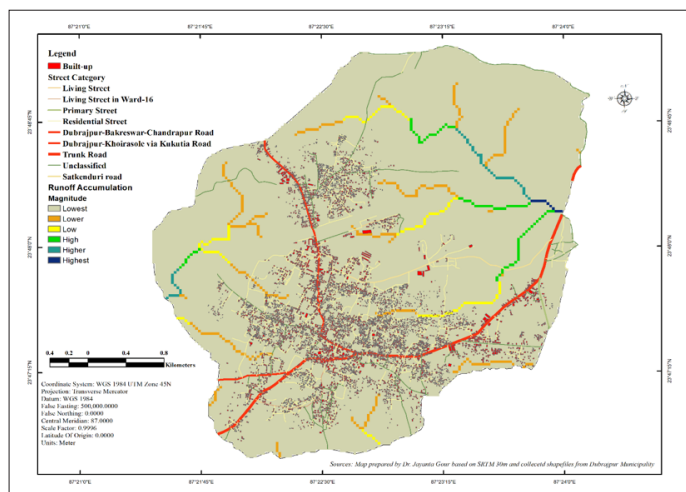
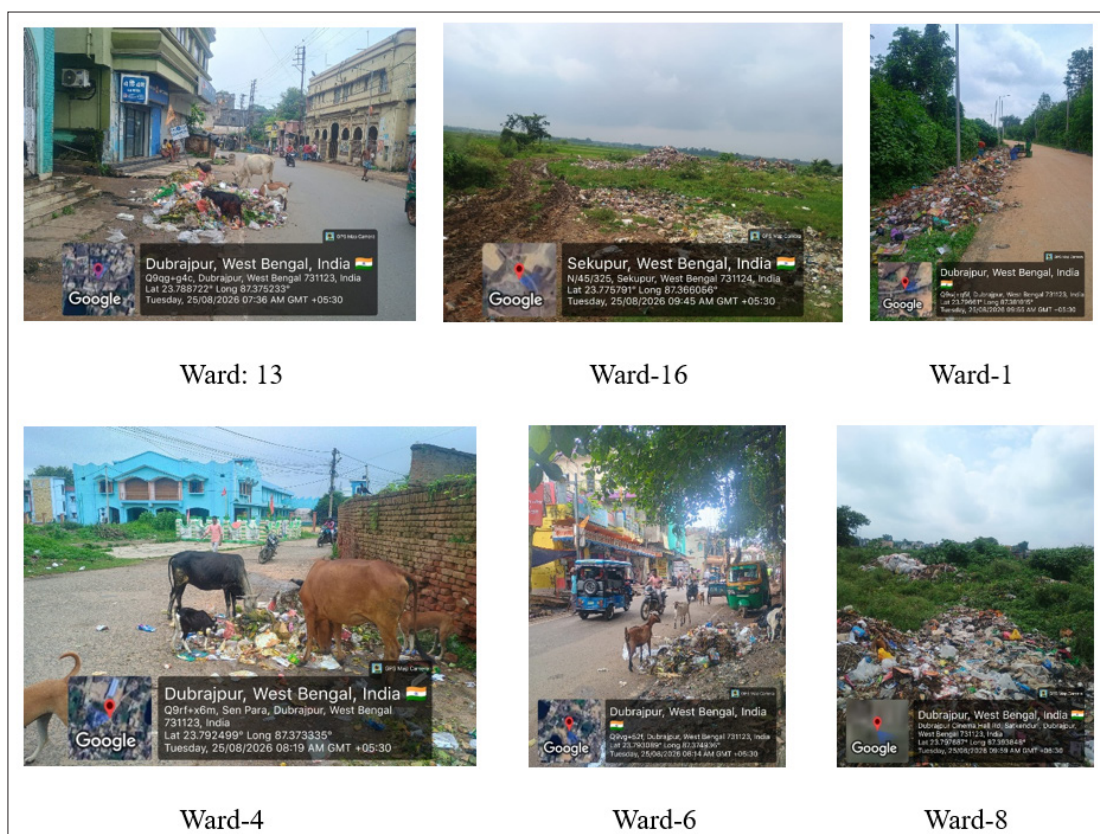


Figure 4: Drainage Flow Accumulation in Dubrajpur Municipal Area (Source: SRTM 30m, OSM shapefiles)

Rank wise, the wards which are moderately susceptible to drainage blockage during heavy rainfall or above rainfall conditions during cyclonic situations, are – Ward-8, Ward-2, Ward-9, Ward-12, Ward-10, Ward-15, Ward-16, Ward-14. Rest of the wards like Ward-4, 5, 6, 7, 11, 13 are supposed to be inundated and liquid waste drainage issues may arise if rainfall continues for a week.

Anthropogenic and Quasi-Anthropogenic Factors Behind Liquid Waste Drain Out Issues

The natural conditions related with the runoff and draining out issues in Dubrajpur Municipal Area become more hazardous or intangible when human negligence regarding their waste disposing methods. As this is a semi-urban municipality, the people are not so much quipped with modern and advanced techniques of waste disposal. As the (a) residential density is very high at the core area comprising the parts of Ward-13, Ward-6 and Ward-10, and (b) linear settlements have high density along the National Highway (SH-14) dividing the southern part of the entire municipal area into two parts, the core area has to bear a high commuters' pressure and local sellers' and buyers' regular activities (Figure 5). On the other hand, (c) the overcrowding at bus stoppages and halts by local commercial vehicles for local passengers' demand make it horribly congested during day time [3]. During this TO and FRO plying of the goods carriers, local vehicles and commuters' activities, a huge amount of non-biodegradable dry wastes (e.g. plastic packets of chips, food sachets, leathers etc.), non-plastic dry waste materials (e.g. stale products or broken glasses of wooden parts, mobiles and diesel from auto-repairing centres etc.), biodegradable wet wastes (e.g. sweets, food scraps, plant fibres etc.) are thrown intentionally and unintentionally as well. These are ultimately blown away by wind or swept away or washed away across the municipal drains along Highway and secondary roads in and around Ward No.-13, 6, 7 and 10 every day.



Photos (1-6): Waste Dumping in Some Wards of Dubrajpur Municipal Area

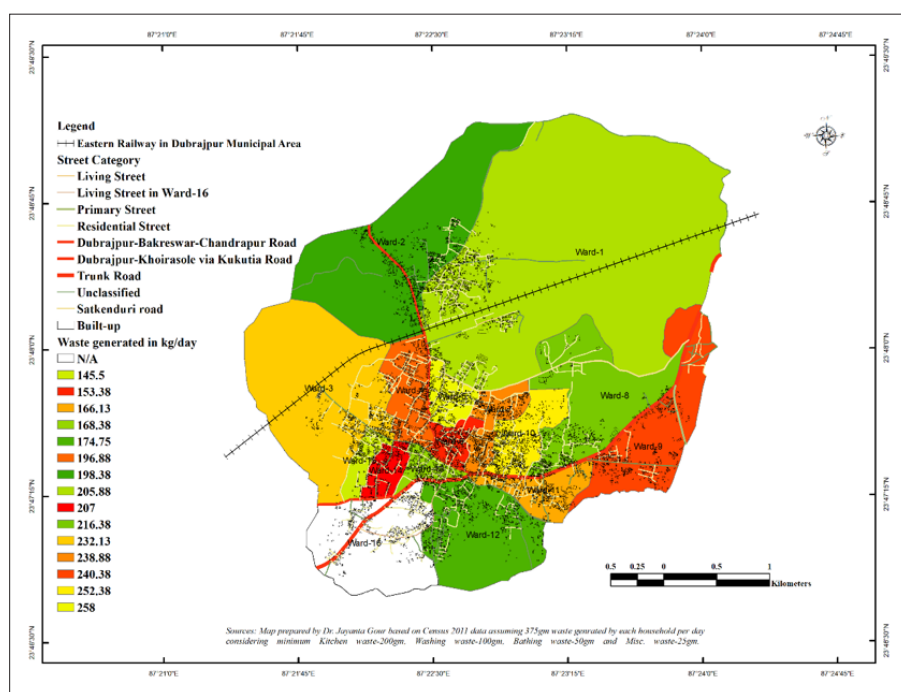


Figure 5: Hazardous Waste Non-Disposal Wards of Dubrajpur Municipal Area

Conclusion and Recommendations

Any growing sub-urban municipal crowded mainly by migrated rural people like the Dubrajpur Municipality Area, where literacy rate is lower than surrounding municipalities, and has highly congested wards having national highway with poor traffic functioning are common to face severe waste disposal issues. It cannot be mitigated merely introducing modern waste disposal techniques as proposed by government sectors for social welfare. Rather, the following steps may reduce the vulnerability of waste disposal related issues in Dubrajpur Municipality induced by natural and anthropogenic activities.

- Enhancing waste management skills of all the stakeholders through robust training as per swatch Bharat Mission guidelines.
- Using modern tools and techniques to collect, sort and segregate and finally dispose the biodegradable and non-biodegradable dry and wet wastes following the rules of 3R (Reduce, Reuse and Recycle).
- Training of proper ways of household waste management should be practiced in primary, secondary and higher education institutes as a mandatory part of their curriculum. Award system to the best practitioner at each stage of the institutions should be given annually. This will not only encourage the future generations of Dubrajpur Municipality but will reduce the waste management related fiscal of the Municipality as well.
- Open disposal should strictly be discouraged to spread vector borne diseases and contamination of water, pollution of soil and air. Bleaching or antifungal or antibacterial powders or sprays should be carried out every week to avoid unwanted environment pollution, particularly during rainy seasons. This should not be paused due to any kind of holidays or festivals. Substitutes of the absentees should be made in case of emergencies with special incentives during heavy rush.
- The municipal drains (particularly in Wards like 3, 5, 7 9 and 10) in the busy market sites should be covered by grills or metal fences so that any kind of flying plastic made materials can enter the sewage system and chock it.
- Daily commuters, workers, customers, drivers coming from

adjacent rural or urban areas or from outside states should strictly kept under CCTV surveillance (having control room at Municipality office) to control their unintentional disposal of garbage.

- Shops and Service Centres like Fast Food Delivery, Logistic centres for online delivery services, Mobile retailers and repair centres, electronic shops, Stationary product selling centres etc. (which supply plastic or non-biodegradable carry packets or plastic covers to customers) should be advised officially (can be fined if ignores repeatedly) through Municipality Ward Councillors (particularly in hazardous wards as shown in (refer Figure 2, 5 and Photos 1-6)
- Official Declaration from roadside shopkeepers and vehicle garages should be taken to take care of the passengers who carelessly throw the wastes here and there even from inside the vehicles. Not only this, the vehicles which are used for advertisements during festive seasons sometimes throw the leaflets or pamphlets which ultimately chock the narrow and shallow sewage channels and becomes one of the major problems in municipal drainage system.

Increasing literacy rate and making people aware of the civic responsibilities to live in clean and green town is the best policy is the primary step before all management system. Merely fining and forcing laws and rules cannot make Dubrajpur Municipality one of the model green municipalities in West Bengal and in India also. Mass public awareness, increasing women literacy rates, proper drone surveillance of municipal disposal sites from time to time, conscious and sincere monitoring of the commuters, passengers and visitors or tourists coming by public or private vehicles, applying AI tools and techniques like other advancing municipalities can make it Viksit Dubrajpur. Last and not the least, both state and central government allocate a justified municipal budget for the development of Dubrajpur Municipality Area as well as private entrepreneurs should invest in solving these waste and drainage related issue to promote more business oriented economic activities in increase the income level which in turn will help the illiterate population to get the opportunities to be literate [4-7].

Acknowledgement

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