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Planning For Infrastructure Improvement In Slums Of Gwalior

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Abstract: Slums are the areas where lack of basic infrastructures, skills, hygiene, health, education and income sources to good living condition. Rapid urbanization and failure of governance are the key reasons of developing slums. Slum dwellers play very important role in the city development directly or indirectly. With this point of view, it is very important to study and identify the solution for slum improvement. This research is an attempt to demonstrate the issues of slums and to extent appropriate options of slum improvement.

The aim of this research is to improve infrastructure for the slum dwellers of Gwalior City. For this, firstly study the city slum profile then examine the schemes / projects through which institutions are taking initiatives in infrastructure development for the Gwalior slum dwellers. Next assessing the status of infrastructure in the selected slum areas by primary survey and secondary data collection also study the characteristics of slum dwellers and capture the community perception of selected slums. Finally, national and international case studies were done to understand the effective ways to reduce the issues, which helps in formulating the planning strategies for better living conditions by improving infrastructure in slums.

Index Terms **- Slum, infrastructure, improvement, living condition, planning.**

I. INTRODUCTION

Slum areas are the places of urban area where basic facilities are lack. Urbanization is the main reason for heavy conjunction in urban areas that forces urban poor to live in slum areas. Everyday environments are exceptionally poor in these spots because of not adequate Infrastructure. Slums are the Areas where houses are not fit for human habitation in any aspects because of overcrowding, Faulty arrangements, dilapidation and narrow streets, lack of light, air, sanitation facilities or any combination of these which are adverse to health, safety and morals (Slum Area Improvement and Clearance Act, 1956).

It is estimated that numbers of slum dwellers indicates that globally 32 percent of urban residents live in slums. Sub-Saharan Africa have more than 70 percent slum dwellers in urban population. It is highest in the world. South – Central Asia has about 60 percent slum dwellers that includes India's slum as well (UN-Habitat, 2003). In India 31 percent population lived in urban areas from which 27 percent urban population lived in extreme shelter poverty or slums. Decadal growth (2001-2011) of slum household is 37.1 percent shown in table 1(Census of India, 2011).

Table 1 Growth of Slums in India (Source - https://www.censusindia.gov.in/2011)

Indicator	Absolute		Absolute change 2001-11	Decadal Growth 2001-11
	2001	2011		
Slum				
Households	1,01,50,719	1,39,20,191	37,69,472	37.1
Household Size	5.2	4.7	-0.5	
Urban (slum reported towns)				
Households	4,35,56,155	6,27,92,741	1,92,36,586	44.2
Household Size	5.1	4.6	-0.5	
Urban (all towns)				
Households	5,58,32,570	8,08,88,766	2,50,56,196	44.9
Household Size	5.1	4.7	-0.4	

Rapid urbanization and rural to urban migration are the main reasons of Slums development in urban areas. As People are coming to urban areas is faster than the planning process that is why Governments often fail to recognize the rights of the slum dwellers and incorporate them into urban planning (UN-Habitat, 2012).

II. METHODOLOGY

The aim of this research is to improve infrastructure for the slum dwellers of Gwalior City. For this, firstly study the city slum profile and their location in the city. Next assessing the status of infrastructure in the selected slum areas by primary survey of 5 slums within Gwalior Municipal limit and secondary data collection also study the characteristics of slum dwellers and capture the community perception of selected slums.

Based on observation, residents' respond & perception as focus group discussion, face to face discussion with involving authorities and NGOs and secondary data source, infrastructure availability data and it's condition was analyse on infrastructure deficiency indicator, in which there are 8 parameters to identify the deficiency in Infrastructure in slum areas, shown in table 2. Water supply connection, sewerage disposal, pacca roads, pacca drains, waste collection, street light, healthcare facility distance and availability of education facilities are involve. Scoring criteria is set for each one to identify the level of vulnerability in slums.

Table 2 Infrastructure Deficiency Indicator (Source - Ministry of Housing and Urban Poverty Alleviation, Slum free city plan of Action.)

	INFRASTRUCTURE DEFICIENCY INDICATORS								
	Scoring Criteria	% of HHs Connected to Water Supply House Connection	% of HH with Unhygienic mode of Sewage Disposal or Defecation	% Deficiency of Pucca Roads	% Deficiency of Pucca Drains	Frequency of Waste Collection	% Deficiency of Street Lights	Distance from Heath Facilities	Availability of Primary Education Facility
Sound	1	81-100	0-20	0-20	0-20	Daily	0-20	0-1.0 Kms	Both Available
	2	61-80	21-40	21-40	21-40	2-3 Days	21-40	1.1-2.0 Kms	-
	3	41-60	41-60	41-60	41-60	7 Days	41-60	2.1-3.0 Kms	One of Primary or Pre-primary Available
	4	21-40	61-80	61-80	61-80	Not Often	61-80	3.1-4.0 Kms	-
Vulnerable	5	0-20	81-100	81-100	81-100	Never	81-100	4.1-5.5 Kms	None Available

Then finally, national and international case studies were done to understand the effective ways to reduce the issues that helps in formulating the planning strategies for better living conditions by improving.

III. RESULTS AND DISCUSSIONS

Gwalior City is the 4th higher slum household city within the Madhya Pradesh State. Gwalior have 2,09,769 slum population as per census of India, 2001 and 4,10,973 slum population as per census of India, 2011 which is 13 percent increase in a decade. In 2001, 229 slums were in city and in 2011; they are reached to 243 slums. Table 1 shows the slums selection criteria for the study and Fig. 1 showing the location of selected slums on Gwalior map (Gwalior Master Plan, 2031).

A. Analysis

Average age of the slums of Gwalior is around 72 years. There are 243 slums in the city (Slum free city plan of action, 2013). They are usually located in the old Gwalior (Lashkar and Hazira) especially nearby core area and Gwalior Fort.

Table 3 Study area Selection (Source - Author)

S. No.	Slum Name	Indra Nagar	Aadarsh Nagar	Luxmanpura	Gadde wala Muhalla	Sanjay Nagar
1	Ward	7	18	31	56	37
2	Zone	North	East	Centre	South	West
3	Population	4569	501	237	749	472
4	Households	1091	110	62	141	102
5.	Area (Sqm)	48134.84	24029.70	22400.54	21936.85	173874.88
6	Age of Slum (in Years)	52	38	150	75	62
7	Land-use	Residential	Residential	Residential	Residential	Agriculture
8	Tenability	Tenable	Tenable	Tenable	Tenable	Semi-Tenable
9	Land ownership	Private	Government	Part. Govt. & Pvt.	Government	Private

Table 3 shows the slums selection criteria for the study. Location of Slum – Selection one from each Zone, Tenability status, Land Ownership of Slums, No. of HH and Population are the criteria for section of slums. Area ranges around 22,000 Sqm to 1,74,000 Sqm. Fig. 1 shows the same spatially.

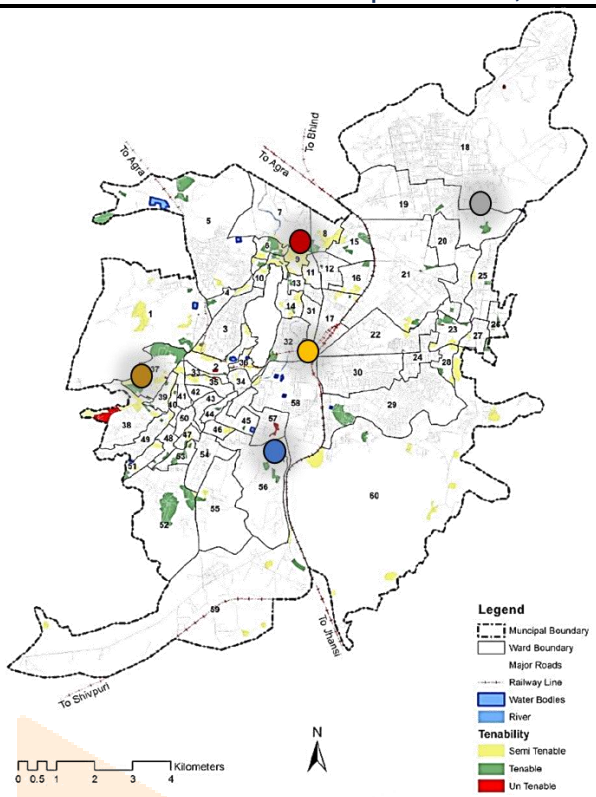

Figure 1 Location of Selected Slums on Gwalior slum map (Source - Author)

1) Study Area 1 – Indra Nagar

Slum is located in Ward no. 7, adjacent to Char Sahar ka Naka. Heritage areas - Gwalior Fort and Tansen Tomb are 2.5 – 3 Km in south from the Indra Nagar. It covers the 48134.84 sqm area (Fig. 2). Residents shifted from the Ghouspura Area to Indra Nagar around 52 year ago because of employment - Brick Factory was nearby The site had that time. Indra Nagar have 1091 households and 4569 population. There are the slum. 49 percent of residents are working age group. Majorly they are Daily wageworkers - Labour, Pottery making, Factory worker (Bidi making, Tracksuit making) etc. (HFAPoA, 2016).

Figure 2 Existing Condition of Indra Nagar (Source - Primary Survey)

35 Households were surveyed. It is found that 229 HH have to take water from their neighbours. 72 HH use open defecation method, which create unhealthy environment. Solid Waste collection done once a week only. No Street light on kachha roads. Primary school is within the slum area but no pre-primary facility is there. Study area is well connected by the roads from all directions. Traditional floor design are on the outside of the house is there (Fig. 2). Only 37 percent people satisfied with existing infrastructure. Power, Health, Education, Community Facility and Government are most unsatisfactory. (Author, 2022)

2) Study Area 2 – Aadarsh Nagar

Slum is located in Ward no. 18 in Aadarsh Nagar. Area of Slum is 24029.70 Sqm. The slum was developed with the increase of the city municipal boundary (Fig. 3). It is one of the youngest (38 Year old) slum. Majorly industry workers were setup there from urban as well as rural areas. Aadarsh Nagar have 110 households and 501 population. 26 percent of people are working. Majorly they are Daily wage workers - Labour, mess staff, Factory workers etc. (HFAPoA, 2016).

Figure 3 Existing Condition of Aadarsh Nagar (Source - Primary Survey)

20 Households were surveyed. It is found that large size of water logging area is there on the adjutant open area. Bad connectivity due to big size of water logging drain. Only 16 HH connected with piped water connection. Open defecation rate is high and no drainage system. 41 percent of roads are kuccha with no street light facility within slum area. Site is surrounded by residential area, which makes Aadarsh Nagar safe, and scope of infrastructure development is more. Availability of both Pre-primary and primary educational facility within the same colony (Fig.3). 10 percent people satisfied with existing infrastructure. Education sector is most satisfactory and rest all not satisfactory. (Author, 2022)

3) Study Area 3 – Luxmanpura

Slum is located in Ward no. 31 nearby the railway line. Luxmanpura is situated in the central Gwalior on partial government and partial private land. Area of Slum is 22400.54 Sqm. The slum was developed near the Gwalior Fort around 150 year ago (Fig. 4). Most of the people started living there, which were worked in the Gwalior fort. Luxmanpura have 62 households and 237 population. 30 percent of people are working. Majorly they are Daily wage workers, Labour, auto-riksha driver, sweepers, house cleaner etc. (HFAPoA, 2016).

Figure 1 Existing Condition of Luxmanpura (Source - Primary Survey)

15 Households were surveyed. It is found that Community toilets are not in good condition. Direct disposal of sewer by adjacent Dharamshala site next to the study area. 100 percent of house connected with piped water supply. 25 percent of slum households have to use open defecation. Around 50 percent of roads are Kuchha and have open drains. Solid waste collection done twice in a week only. Health facilities are insufficient also No Educational facility here. Increased land and property values in slums due to surroundings of commercials (Fig.4). Only 23 percent people satisfied with existing infrastructure. Waste collection, street light and Education are most unsatisfactory. (Author, 2022)

4) Study Area 4 – Gadde wala Muhalla

Gadde wala muhalla is situated in the south Gwalior on government land. Area of Slum is 21936.85 Sqm. Slum is located in Ward no. 56 nearby Gwalior-Jhansi road (Fig. 5). The slum was developed by the nearby rural people that came here for work. They started work to make mattresses (Gadde), that's why this place is known as Gadde wala muhalla. Gadde wala muhalla have 141 households and 749 population. 35 percent of people are working. Majorly they are Labour, hawkers, thela gadi etc. (HFAPoA, 2016).

25 Households were surveyed. It is found that Most of the roads are Narrow. Electricity meter are installed and people pay their bills. Open spaces can be used as community space. More than 95 percent of house connected with piped water supply. 50 percent roads are Pucca which has drainage facility.

Figure 5 Existing Condition of Gadde wala Muhalla (Source - Primary Survey)

Frequency of waste collection is 3 days. 100 percent of house connected with Electricity. Health and educational facilities are insufficient. A large recreational space is nearby the site that can help to improve social and community facilities (Fig.5). 40 percent people are not satisfied with waste collection, streetlight, drains and roads. (Author, 2022)

5) Study Area 5 – Sanjay Nagar

Sanjay Nagar is situated in the west Gwalior on private land. Area of Slum is 173874.88 Sqm. Slum is located in Ward no. 37 in Sanjay Nagar Colony nearby AH 47 (Asian Highway – Bangalore to Gwalior). It is surrounded by residential and Commercial (Bari Sabji Madi) area (Fig. 5).

Figure 6 Existing Condition of Sanjay Nagar (Source - Primary Survey)

The slum was developed during the development of AH 47. Workers came from both urban and rural areas for the construction of Asian Highway. Sanjay nagar is 62 year old slum. Sanjay Nagar have 102 households and 472 population. 31 percent of people are working. Majorly they are Labour, Hawkers, Sabji mandi workers, Sweeper etc. (HFAPoA, 2016).

22 Households were surveyed. It is found that Most of the roads are Narrow and Kuchha, where connection of water supply arranged by residents themselves. Piped water supply is insufficient. One third of slum households don't connected with sewer line. 46 percent of roads are Kuchha and 70 percent of roads have no street light. Children attending school rate is more than 50 percent due to both Primary Educational Facility is within the study area. Sabji Mandi area work as Community space in non-working time. 33 percent people satisfied with existing infrastructure (Fig.2). Health, streetlight, drains and roads are most unsatisfactory. (Author, 2022)

Table 4 represent the infrastructure wise analysis, based on infrastructure deficiency indicator for all 5 surveyed slums. It shows the comparative analysis from this it is found that Aadarsh nagar comes under vulnerable condition where rest are in average critical zones.

Table 4 Comparative Analysis of all study areas (Source - Author)

Parameter	Indra Nagar		Aadarsh Nagar		Luxmanpura		Gadde Wala Muhalla		Sanjay Nagar	
	Existing Condition	Critical Analysis	Existing Condition	Critical Analysis	Existing Condition	Critical Analysis	Existing Condition	Critical Analysis	Existing Condition	Critical Analysis
% of HHs Connected to Water Supply House Connection	86.98	1	14.55	5	100.00	1	95.74	1	55.88	3
% of HH with Unhygienic mode of Sewage Disposal or Defecation	15.49	1	81.82	5	25.81	2	20.57	2	32.35	2
% Deficiency of Pucca Roads	10	1	40.48	3	54.55	3	53.33	3	45.83	3
% Deficiency of Pucca Drains	19.17	1	100.00	5	54.55	3	53.33	3	58.33	3
Frequency of Waste Collection	7 Days	3	Not-Often	4	3 Days	2	3 Days	2	Daily	1
% deficiency of Street Lights	99.95	5	99.97	5	99.98	5	99.98	5	99.99	5
Distance from Heath Facilities (in Km)	2.2	3	2.8	3	2	3	2.5	3	2.85	3
Availability of Primary Education Facility	Primary School	3	Both	1	None	5	Primary School	3	Both	1
Overall Result	-	18	-	31	-	24	-	22	-	22

B. Findings

In research, some common issues are identified based on selected infrastructure parameters. Lack in piped water supply connection, inadequate water meter connection, lack in sewer line connection, open defecation is there, narrow and kutcha inner roads also roads are lack in maintenance, no drain / open / kutcha drains along roadside, irregular waste collection, inadequate electricity meter connection, insufficient street lighting within the slum, health facilities are insufficient, lack of educational facility.
Except common issues, slum wise issues are identified through primary survey, such as –

1) ***Indra Nagar*** **–** Some people have to choose open defecation as community toilet cannot be usable and need maintenance. Pre-Primary educational facility is not in the slum. Illegal electricity connection rate is high.

2) ***Aadarsh Nagar*** **–** Inadequate water supply in Aadarsh nagar slum. Large size of water logging area is there on the adjutant open area, which makes inaccessible slum area to open area.

3) ***Luxmanpura*** **–** Direct disposal of sewer by adjacent Dharamshala site that cause to create unhealthier environment for the slum dwellers. No Primary Education Facility within the site.

4) ***Gadde wala Muhalla*** **–** Children willingness for going to school is less. Frequency of waste collection is 3 days.

5) ***Sanjay Nagar*** **–** Insufficient water supply in the slum area. More than 50 percent or roads are kuccha and narrow due to otla development.

Based on the analysis, infrastructure requirements in the surveyed slums are mention in the table 5 parameter wise for all 5 slums.

Table 5 Parameter wise requirements of slums (Source - Author)

Infrastructure		Indra Nagar	Aadarsh Nagar	Luxman-pura	Gadde wala Muhalla	Sanjay Nagar
Water Supply	HH Connection	142	94	0	6	45
	Pipeline (KM)	120	370	0	0	1400
Sewerage & Sanitation	HH Connection	72	75	16	8	14
Road Condition	Construction Length (KM)	120	170	300	400	1100
	Repairing Length (KM)	110	95	75	70	430
Drainage	Construction Length (KM)	230	420	300	400	1400
SWM		Daily Waste Collection				
Power	HH Connection	761	99	0	0	12
	New Street Light (No.)	39978	13996	18329	24994	79988
Health Facility		Require awareness and regular health check-up (Women & Children)				
Educational Facility		Require up-gradation in facility and awareness workshop on education importance				
Community / Social Facility		Require multi-purpose space for socio-economic development				

Some potentials are also identified in the research which helps in slum improvement such as, sites mostly are surrounded by residential areas which make slums safe and scope of infrastructure development is more, recreational space is nearby / within the site which can help to improve social and community facilities, residents are willing to pay taxes if they get sufficient infrastructure facilities, traditional floor design are on the outside of the house creates aesthetics street views. **(**Author, 2022)

C. Recommendations

Development of infrastructure and services Levels of infrastructure provision should be determined by community priorities and affordability. Planning strategies are given in the same way of issues. First for parameter wise common issues then for slum specific issues.

1) Recommendations for common issues –

a) Water Supply

Individual tap connections with water supply which links to covered drains. Repair of water infrastructure in settlements. Water consumption will be metered with appropriate subsidies or shared paid connections where families with low affordability. 287 HH required piped water supply with 1890 km connection. There should be rainwater harvesting and ground water recharging systems in all settlements.

b) Sewerage and Sanitation

The toilets must be connected to sanitation infrastructure for conveying toilet discharge, such as sewer lines, shared or individual septic tanks, and other decentralized systems. Toilets were customized to home spaces - inside rooms, courtyards, terraces, etc. to minimize damage to standing structures with local materials. 'Swatch Bharat Abhiyan' will provide financial subsidies for all 185 required HHs. Direct discharge into drains must be avoided.

c) Roads

Kuccha and semi-pucca inner roads must be upgraded to pucca roads with appropriate levelling and sloping to the side drains in cement concrete or paved pathways. Relaying and reconstruction of inner streets, where necessary, shall be undertaken. 2090 Km long road needs to be pucca also 780 Km long needs to repairing.

d) Drainage

Drains in slums shall be pucca and covered to prevent solid waste from being disposed in drains and chocking. There should proper gradients with perforations to allow surface run off into the drains. Regular cleaning of drains is necessary to prevent choking. There are 2759 Km kuccha drains in the 5 slums that need to be made pucca.

e) Solid waste Management

All 5 slums shall be served by solid waste collection services. This should include door-to-door waste collection operated by the community with easily accessible garbage bins, regularly disposed of and linked with the GMC service provider. Community systems for waste management of non-biodegradable waste shall be encouraged with support of NGOs to enable communities to generate income.

f) Power and Street Light

GMC shall ensure all 5 slum households are covered with legal power supply at appropriate rates (people's earnings and ability to pay). Slums should have functioning streetlights to all access roads. Adding lights should be added where necessary as 1 streetlight every 30m distance.

g) Access to Health and Education Facilities

Health and education services shall be planned and delivered in coordination with the concerned departments. GMC shall jointly review with concerned department official, spatial distribution of municipal schools and health centres, identify gaps and plan for gap filling. One Mobile Medical Unit (should have two female staff) per slum should be available at call and inspect slums regularly which link to the nearby hospitals. (Author, 2022)

2) Recommendations for Slum specific issues

a) Indra Nagar

Not managed Community Toilet – People are too poor to invest in home toilets. Community toilet should renovate and develop with adequate facilities. Community committee shall be responsible for the O&M and user fee collection (Fig. 7).

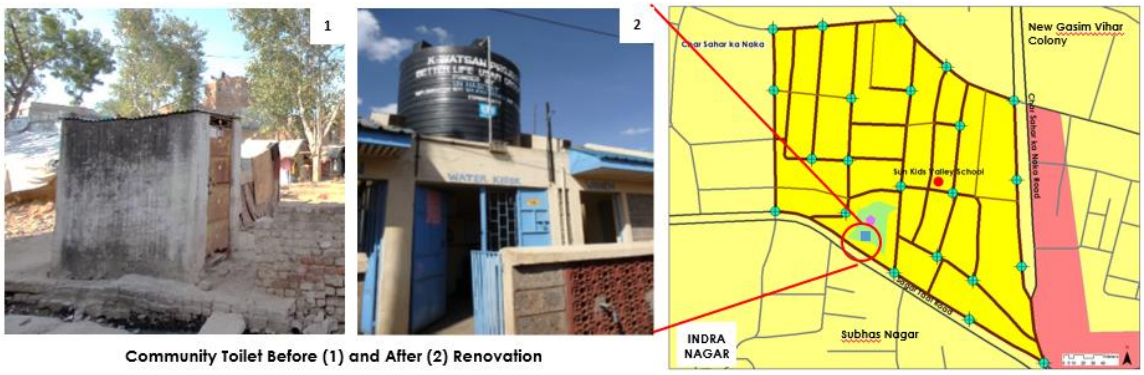

Figure 7 Indra Nagar Community Toilet (Source - Author)

No Pre-primary Facility – Education services will be upgraded either by the addition of facilities or by the upgrading of existing facilities. Primary education centres can use for Pre-primary education facility with different timings until separate facility will develop, wherever possible.

High Illegal electricity connection – Power supply should provide with smart metering which is based on Remote Detection. Government should take strict action against power thief to control the power theft.

*b) **Aadarsh Nagar***

Inadequate Water supply – Individual as well as Community level water storage. Rain water harvesting and grey water recycling at individual level. Repairing and maintaining of pipes and well points regularly.

Water Logging – Decentralized Waste Water Systems (DEWATS) can be developed in these large size water logging areas. It help to treat the grey water from toilets that passing by the settlement (Fig. 8).

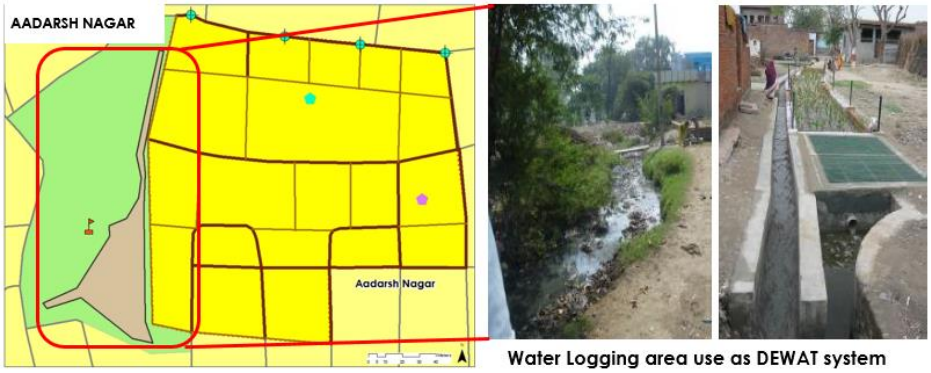

Figure 8 DEWAT system in large water logging area (Source - Author)

*c) **Luxmanpura***

Direct disposal of sewer by adjacent Dharamshala site – Direct disposal should be stop and goes to underground sewer line and vegetation on road. Road should be upgraded to pucca with side drain (Fig. 9).

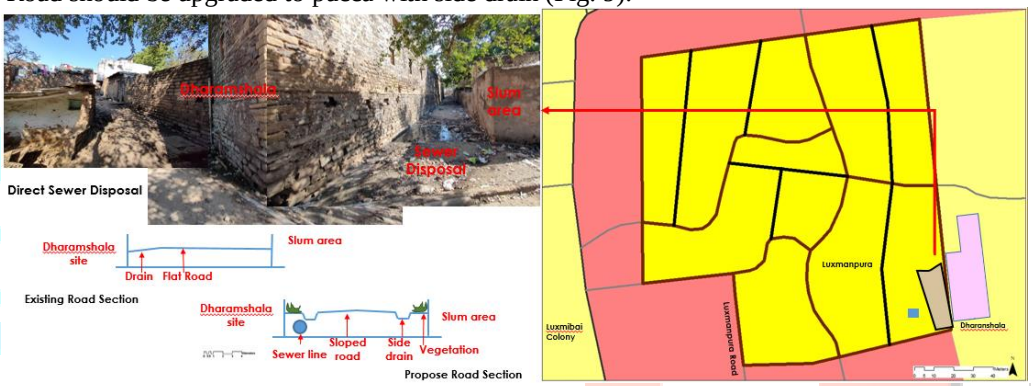

Figure 9 Proposal for removal of direct disposal in Luxmanpura (Source - Author)

No Educational Facility within the site – Proposal of an Educational centre within the Slum area (Fig. 10) – Focusing on Girl child and women education, (Mother is a child's first teacher).

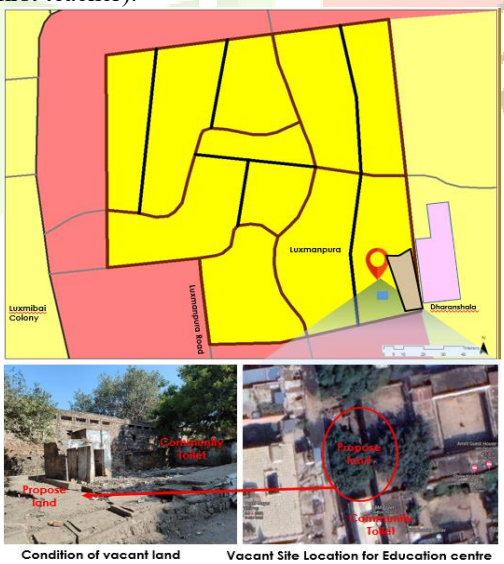

Figure 10 Propose land for educational facility (Source - Author)

Training for Employment and Empowerment. Education will be offered at minimal fee. Educational Team – Educated Teachers, 2-3 Female Teachers, Educated and Unemployed Slum dwellers if they willing to teach.

*d) **Gadde wala Muhalla***

Willingness of children going to school is less – Awareness workshop should be on regular basis for education, which encourage residents to improve education standard (Fig. 11).

Figure 11 Educational Workshop in Slum (Source - Author)

Frequency of waste collection is 3 days (specially narrow road areas) – Waste bins (11 Nos) should be place nearby narrow and wide road junction (Fig. 12). Tricycle waste collection rickshaws should operate waste collection daily.

Figure 12 Location of Propose waste bins in Gadde wala Muhalla (Source - Author)

*e) **Sanjay Nagar***

Sabji Mandi Area – Sabji Mandi Area can be used as community space (Fig. 13) for social activity program in non-working duration. It will help in increasing social living standard.

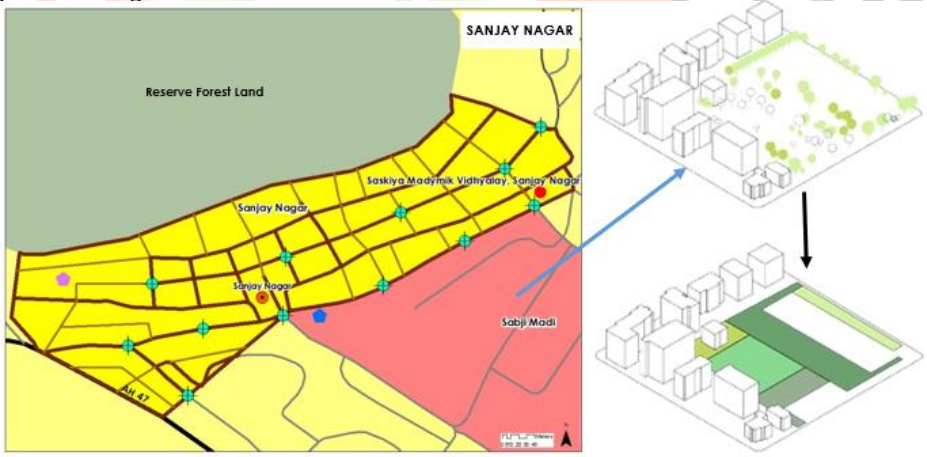

Figure 13 Multi-purpose use of Sabji Mandi (Source - Author)

Narrow Roads – Otla should remove to widen the road. First lowering and then paving the slum streets, to drain off excess rainwater during the monsoons. Concrete use as are cheaper to build and easier to clean, than asphalt.

Insufficient Water supply – Decentralized systems will install in Sabji mandi area (near OHT) in partnership with the communities that help to generate incomes for the slum Dwellers. Government shall invest capital costs (Fig. 14). (Author, 2022)

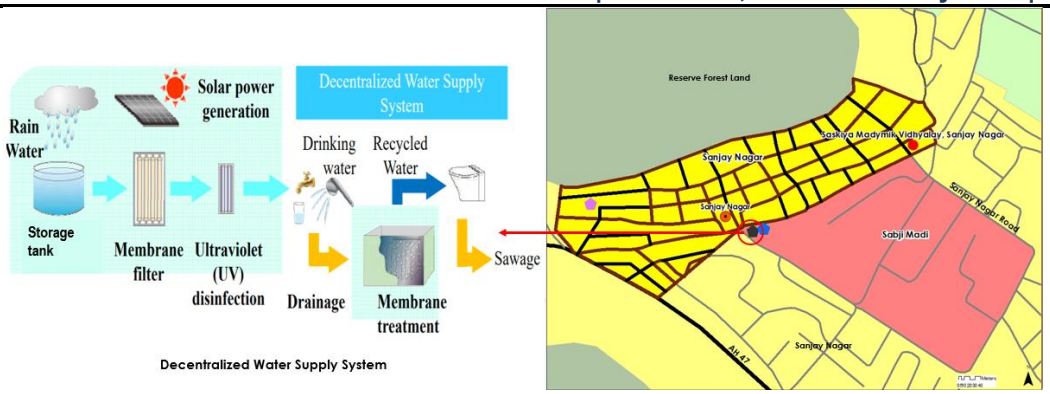

Figure 2 decentralized water supply location and process (Source - Author)

3) Propose Committees and Role of stakeholders at various stages

Community Committee (CC) – Involvement of local people in O&M. It offers opportunity for innovation, income generation and training.

Self Help Group (SHG) – Formation of SHG with the help of NGOs, which help to promote and sustain self-businesses to the slum dwellers.

Slum Improvement Board (SIB) – Under Gwalior Municipal Corporation SIB will dedicative work for improvement of Gwalior slums. It will provide training to community and handle maintenance focused on slum wise services and infrastructure.

There are requirements of various stakeholders for involving at different stages to improve the infrastructure status in Gwalior slums. Propose role of stakeholders are mention in the table 6.

Table 6 Role and Responsibility of Stakeholders for Gwalior slum improvement (Source - Author)

ROLE AND RESPONSIBILITY OF STAKEHOLDERS AT VARIOUS STAGES					
Stakeholder	**Preparatory Phase**	**Planning**	**Implementation**	**Reforms**	**Post Implementation**
State Government	Legal, Policy and Funding				
Madhya Pradesh Urban Services for Poor		Provide Funds for Planning	Provide Funds	If / whether required	Provide Funds
Gwalior Development Authority		Provide training to community	Funding and management	If / whether required	Operation & Maintenance - Monthly
Slum Improvement Board (Gwalior Municipal Corporation)	Legal, Policy and Funding at city level	Project Planning and Design	Supervisor of work	If / whether required	Operation & Maintenance
NGOs		Co-ordinate with Govt. and Slum dwellers	Formation of SHG		Conducting Workshops
Slum Community / CBOs		Suggestions	Engage in civil works		Community Committee

IV. CONCLUSION

According to the study, urban settlements that are unhealthy, polluted, structurally unsound, hazardous, and providing only limited economic support constitute slum pockets. The resulting complications affect health, education, security, and social well-being. Based on the findings of this research, institutional platforms and slum requirements planning approaches have the most potential to impact and implement infrastructure improvement programs in slums.

Infrastructure provision should be based on community priorities and affordability. Urban infrastructure and services will be intended to take into consideration steady updating as unfortunate networks work on their wages and their ability to pay for administrations increments. The research is attempt to recommendation for the improvement of slum as their social development of educational, health, and poverty alleviation programs help to improve the social living pattern of slum residents. Improve quality of life on incremental basis as poor communities increase their incomes. Create healthy environment and increase economic safety.

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