

Development of Patna as a Smart City

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ABSTRACT

A smart city is a developed urban area and is well equipped with technology, aspiring to replenish a qualitative sustainable environment. Cities have always been considered the engines to economic growth. Due to rapid urbanization, cities are full of problems, so there is an immediate need to converting existing cities into smart cities to find new ways and technological solutions to manage those problems. Smart cities are an endeavour to form cities more efficient, sustainable, and liveable. It's been five years of listing and Patna has only completed six projects out of eighty-three projects under the smart city. Unplanned growth and paucity of experts to guide and a limited number of smart people in the city have caused much damage to the vision of a planned Smart City. This research presents insight into the progress of the development of Patna as a smart city as well as the aspirations and priorities of the citizens of Patna towards Patna Smart City. The present study is based on sample surveys and published data and has been presented using diagrams and tables. It was found that developing Patna into a smart city has become formidable task for the authorities and the projects are also moving at a snail's pace. The success of the smart city project depends upon the implementation of technologies.

Key Words: Smart city, Development, Progress, Priorities, Patna

I INTRODUCTION

In India, the “Smart city” concept came into vogue to find better solutions for a better tomorrow by the present Modi government. The concept stands for cities that are modern in terms of facilities and opportunities (Sahay,2015). A smart city is embedded with digital technology across all city functions. A smart city provides essential infrastructure to offer a clean environment and a decent quality of life by applying some smart solutions to live in a smarter way. With 70 percent of the world's population estimated to live in urban cities by 2050, the need for inhabitable and tolerable world cities is necessary for a thriving future. India is at a point of transition where the pace of urbanization will speed up. India's economy is developing rapidly in the world with continuous and drastically changing infrastructural networks. The people are trying to change their quality of life and are thus shifting from rural areas to urban areas. Patna being an ancient city has grown contiguous to the historic town of Patliputra. Patna being the state administrative headquarters of the division and the district. Under the Companies A, 2013, Patna Smart City Limited (PSCL) is incorporated as special purpose vehicle which looks after planning, approval, fund releasing, implementation, operation, management and evaluation of the Patna Smart City Development projects. As estimated expenditure of over Rs. 2776.16 crore will be involved under the Patna Smart City Project. Of this estimated amount, Rs.930 crore will be provided by the Central and the State government on 50:50 basis. A total of 83 projects have been approved for Patna under the smart city mission. Some of the agreed visions and goals for Patna Smart city are Smart Lighting, Smart Parking, Wi-Fi Internet access, Solid Waste Management, Smart Metering, and Smart Traffic Management. According to a report by TOI in June 2022, only 6 projects have been fully completed till now in Patna. Patna's rank drastically slipped from 65th to

82nd rank in the last ranking which was declared in June 2022 by the Union Ministry of Housing and Urban Affairs which was picked up to assess the implementation of the smart city projects, based on the progress and completion rate of the projects. Patna witnessed several problems in implementing the smart city projects due to non-availability of experts to guide the officials.

(a) Hypotheses:

The working hypotheses are as follows:

- (i) Ancient city of Patna is developing as a smart city.
- (ii) Socio-economic condition of citizen of Patna is improving.
- (iii) Majority of people are not aware of the Smart City Mission.
- (iv) There is no proper garbage disposal in Patna Smart City.
- (v) Patna Smart City project is beneficial for the citizens.

II OBJECTIVES

The objectives of the present study are:

- (a) To study the concept of smart city.
- (b) To know about the socio-economic condition of citizens of Patna.
- (c) To know the aspirations of citizens for Patna as a Smart City.
- (d) To investigate progress of Patna as a Smart City.
- (e) To identify /investigate how far the plan and projects of Patna as a smart city are successful

III DATABASE

The study has been done by choosing one hundred three respondents from Patna by employing simple random sampling procedure in two circles i.e. New Capital Circle and Kankarbagh Circle of Patna Municipal Corporation Area. The study covered 103 respondents of Patna belonging to different income groups (20 belonging to low-income group, 45 to middle-income group and 38 to high-income group). Thus, it covers different groups of the society to testify the hypotheses and fulfil the objectives. The respondents of low-income group were engaged in profession such as vegetable sellers, shopkeepers, house maids, etc. while those belonging to middle-income group were engaged in profession such as teacher, banker, lawyer, receptionist, etc. and among high-income group the respondents were engaged in profession like engineer, business, professor, retired officers, etc.

IV METHODOLOGY

The research work has been done in three distinct phases. Under pre-field survey, relevant literature has been reviewed, government publications had been consulted, published data has been collected and the base map has been prepared. Under field survey stage the questionnaire has been prepared and the sample survey of one hundred one citizens has been carried out with the help of door-to-door survey. After the completion of field survey, the data

has been compiled and the relevant tables and suitable diagrams have been prepared. Chi-square test has been done to testify hypotheses. At the end, with the help of data research paper has been prepared.

V STUDY AREA

The proposed study area lies under Patna Municipal Corporation. Patna is one of the 38 districts of Bihar and is situated on the southern levee of the river Ganga backed by a curvilinear depression and incidentally is one of the ancient cities and district headquarter of Bihar as well. It is situated at a crossroad of 25°36'7.99"N latitudes and 85°7'9.7"E longitudes. The existing city can be divided into three distinct zones according to their functions and physical factors i.e. the eastern zone, the western zone and the central zone. PMC area is divided into 76 municipal wards and rearranged in 6 circles namely New Capital Circle, Bnakiipur Circle, Kankarbagh Circle, Patna City Circle, Azimabad Circle and Patliputra Circle. The study has been conducted in New Capital Circle and Kankarbagh Circle. New Capital Circle is divided into 16 wards while Kankarbagh Circle is divided in 11 wards. The main areas covered under Kankarbagh Circle is New Bypass Road area, Kankarbagh Road Area, Chiraiyatad Railway Bridge Area, Gandhi Setu Road area and Saidpur area while in the New Capital Circle Bailey Road area, Boring Road area, Khajpura area, Rajiv Nagar area, Station area, Kurji, Gandhi Maidan area, etc. wards have been covered.

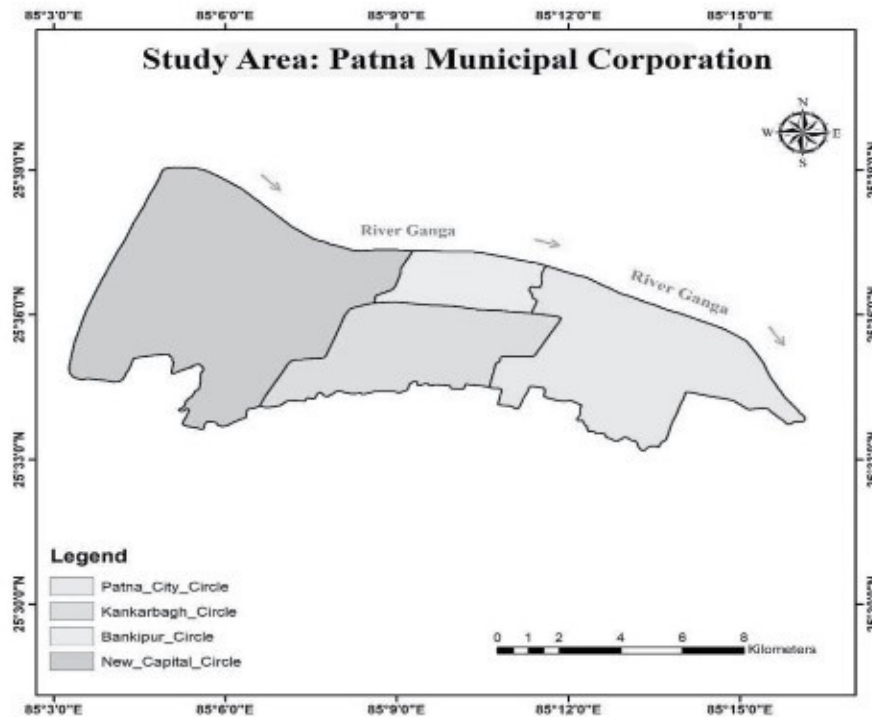


Fig. 1

(i) **Analysis:** In the present study different aspects of development of Patna as a Smart City in Patna Municipal Corporation Area has been analysed. The study has been conducted keeping in mind the objectives of the study and to prove the hypotheses of the study.

(ii) **Demographic condition of citizens of Patna:** Demography is the study of various characteristics of human population such as growth, density, size, birth rate, sex ratio, etc. Demographic analysis provides insight onto the links between these characteristics and the cultural, geographic, economic, and other attributes present in that area. Table 1 shows demographic condition of citizens of Patna.

Table 1
Demographic Composition of citizens of Patna M.C. (% of Total) *

Income Category	Type of Family			Marital Status				Reason for migration		
	N	J	E	S	M	D	Sep	M	E	Job
Low	50	42.31	7.69	23.08	76.92	-	-	57.14	14.28	28.58
Middle	82.93	12.19	4.87	36.58	56.09	4.89	2.44	42.86	28.57	28.57
High	52.95	47.05	-	26.48	70.58	2.94	-	18.19	36.36	45.45

*Based on sample survey

Table 1 shows that most of the citizens of Patna lives in nuclear families. Average number of family members in Patna varies from 5 to 6 in all income groups. Majority of citizens of Patna are married. Most of the high-income group people have migrated due to job opportunities whereas low-income group people due to marriage.

(iii) **Socio-Economic Condition of citizens of Patna:** Socio-economic condition is the combined total measure of economic and social aspect of an individual. The majority of citizens of Patna belong to middle-income group. Nowadays, people have better social facilities in Patna like better housing, good approach roads and better school. Majority of citizens of Patna are aware about the government schemes. Figure 2 clearly reveals that majority of citizens of Patna belongs to middle-income group.

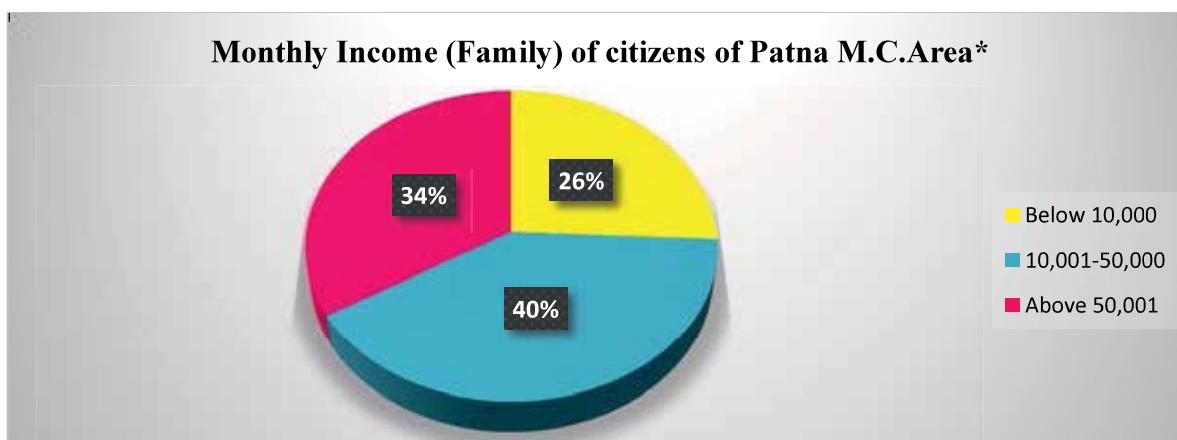
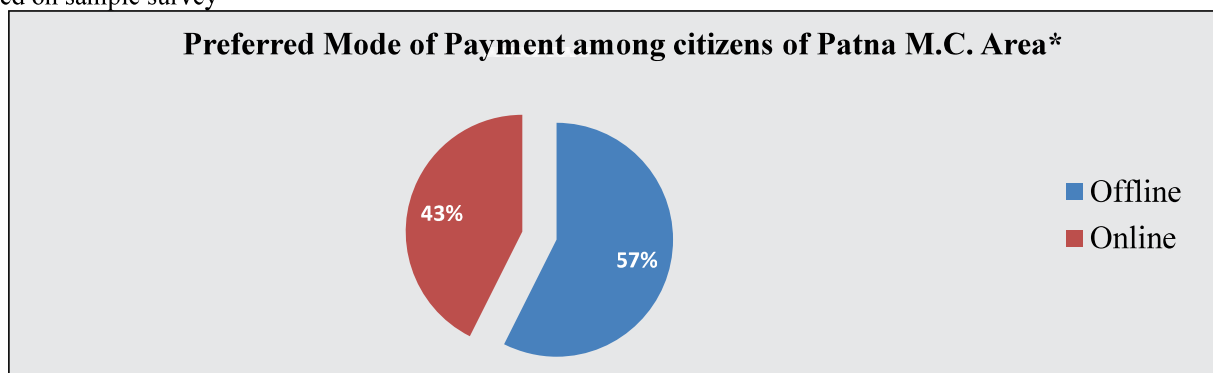


Fig. 2

Table 2
Socio-Economic Condition of citizens of Patna M.C. (% of Total) *

Income Category	Source of Drinking Water			Availability of electricity		Savings		
	Govt. supply	Own boring	Tube-well	A	NA	A	SA	NA
Low	30.78	34.61	34.61	96.15	3.85	-	23.07	76.93
Middle	21.96	75.60	2.44	100	-	31.72	56.09	12.19
High	-	100	-	100	-	70.59	20.58	8.83

*Based on sample survey



*Based on sample survey

Fig. 3

Table 2 and figure 3 indicate that 100 percent high-income group people have their boring for water supply. It was found that 26.92 percent people of the low-income group did not have water facility within their premises. Majority of citizens in Patna have accessibility to electricity. More than half of citizens prefer online payment as they found it easier and quicker.

(iv) Progress of development of Patna as a Smart City: The progress of the development of smart city can be checked through the status of projects, as well as with completion and implementation of various projects. Completed

projects of Patna under Smart city till now are- Mega screen (75X42 ft) at Gandhi Maidan, 3D paintings and Wall art, Transformation of Adalatganj Pond, Makeover of Beer Chand Patel Path, Integrated solid waste management system, Integrated control and command center (ICCC). Projects that have been partially completed and some are completed but not put into service are- Nine Jan Seva Kendras, Intermediate public transport bus stands, and e-toilets. Projects expected to complete in 2022 are- ICCC first phase, school project, Jan Seva Kendra, IPT, and e-toilets (Rumi, 2022).

Table 3
Awareness among citizens of Patna M.C. about Smart city (% of Total) *

Income Category	Awareness of Smart city		Projects completed		Patna developing as SC (People’s perception)	
	Aware	Not Aware	Aware	Not Aware	Yes	No
Low	76.93	23.07	7.69	92.31	76.93	23.07
Middle	63.42	36.58	53.66	46.34	63.42	36.58
High	100	-	58.83	41.17	82.36	17.64

*Based on sample survey

Table 3 shows that most of the people of Patna are aware that Patna is developing as a Smart city and about its plans and projects as well. 7.63 percent of low-income group people were aware of the projects completed under

the smart city in Patna whereas in the high and middle-income group more than 50 percent of people were aware. According to the citizens of Patna slowly and steadily, Patna is developing as a Smart city.

Table 4
Smart Population, Smart Education/ Online work, and CCTV Surveillance of Patna M.C. (% Of Total) *

Income Category	Smartness of Population			Smart Education/ Online work		CCTV Surveillance	
	Get smarter	Did not get smarter	Somewhere	Working well	Not working well	Yes	No
Low	23.09	19.23	57.69	88.47	11.53	50	50
Middle	58.54	34.14	7.32	51.22	48.78	75.60	24.39
High	58.83	-	41.17	79.42	20.58	85.29	14.70

*Based on sample survey

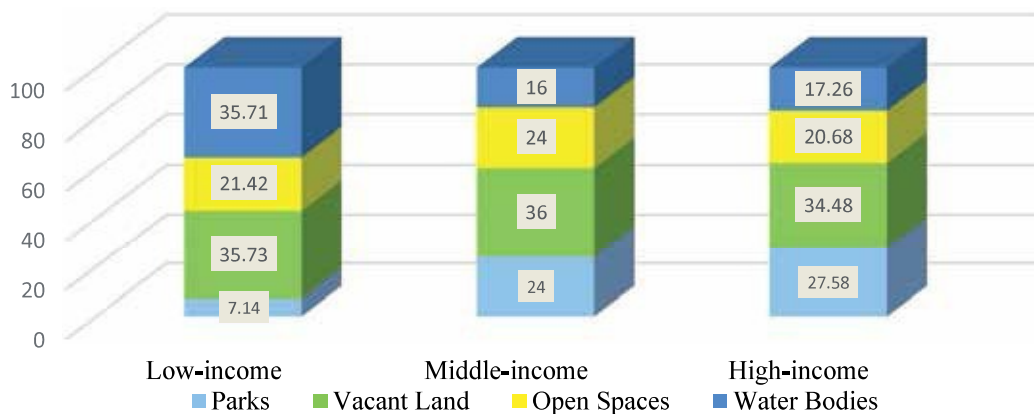
Table 4 shows the view of whether the population of Patna has become smarter or not. More than 50 percent of high and middle-income group people feel that the

population of Patna has become smarter. 50 percent of low-income and 85.29 percent high-income group people said that they have seen CCTV cameras in public places.

Table 5
Status of Vegetation in Patna M.C. (% Of Total)

Income Category	Parks / Water bodies		Status of Vegetation	
	A	NA	Decreased	Remained Same
Low	30.76	69.24	80.77	19.23
Middle	34.15	65.85	92.69	7.31
High	26.47	73.53	82.36	17.64

Type of Open Space or Greenery in Locality of the Residents of Patna M.C. Area*

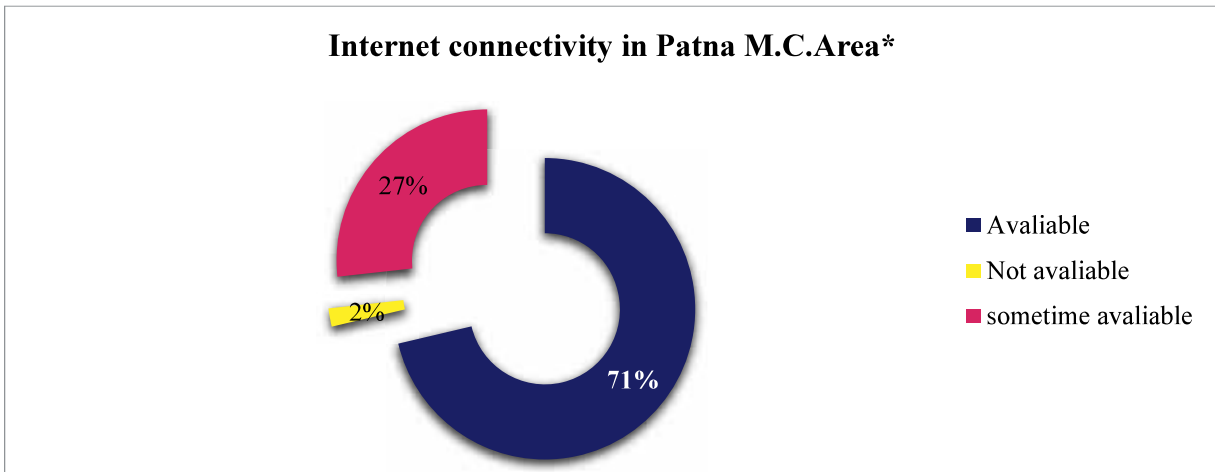


*Based on sample survey

Fig. 4

Table 5 shows as the development are taking place rapidly the green space around us is decreasing at the same pace. People are cutting down trees and building commercial and residential spaces in the vacant lands left all around. In middle and high-income group 34.15 percent and 26.47

percent of the residents have parks and/or water bodies available in their locality. 80.77 percent low-income and 92.69 percent middle-income group people said that greenery has decreased in Patna.



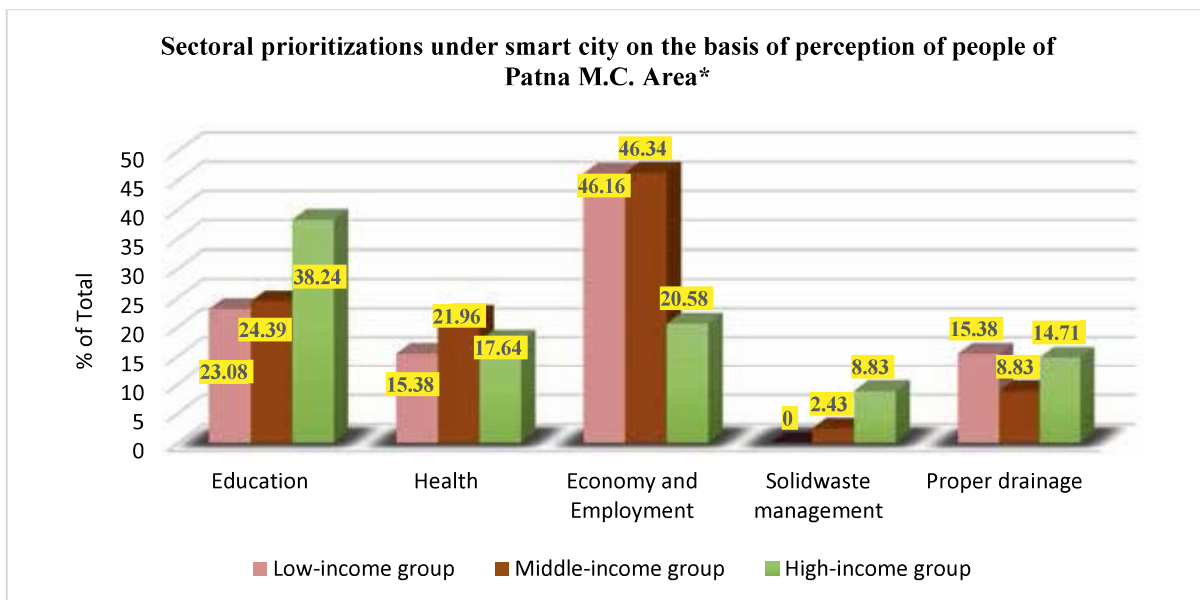
*Based on sample survey

Fig. 5

The figure 5 shows that 71 percent of people have an internet connection. 27 percent of people face the problem of low bandwidth connection while 2 percent of people are still devoid of internet connection.

varies from one place to another according to their needs and desires. The present study tried to find out some common priorities that the citizens of Patna have for Patna’s smart city.

(v) Sectoral Prioritization Under Smart City: The need and priorities of citizens for their smart city



*Based on sample survey

Fig. 6

The above figure 6 shows that citizens of Patna in all income categories prioritise employment, economy, and

education as they find it more important to have a good quality of life.

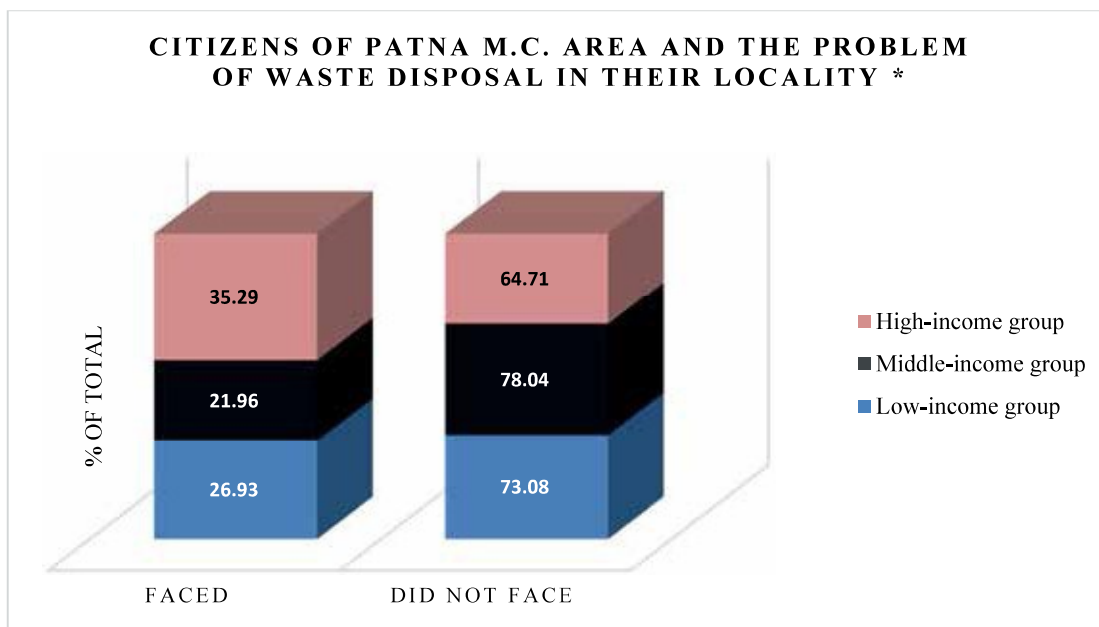
Table 6
Urban-Social problems faced by citizens of Patna M.C. (% Of Total)

Income Category	Traffic Congestion		Air Pollution		
	Faced	Did not face	Faced	Did not face	To some extent
Low	69.24	30.76	30.76	34.62	34.62
Middle	95.13	4.87	14.64	43.9	41.46
High	76.48	23.52	20.59	79.41	-

*Based on sample survey

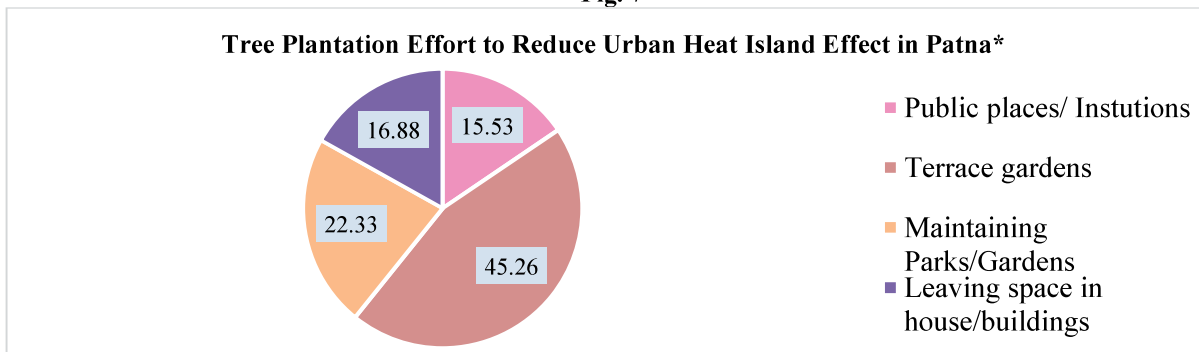
Table 6 indicates that traffic congestion is a major problem faced by citizens of Patna in all income categories. The smart city promises a healthy and clean environment but sadly 30.76 percent low-income group

people face air pollution while 79.41 percent high-income group people did not face air pollution as they do not move openly on roads.



*Based on sample survey

Fig. 7

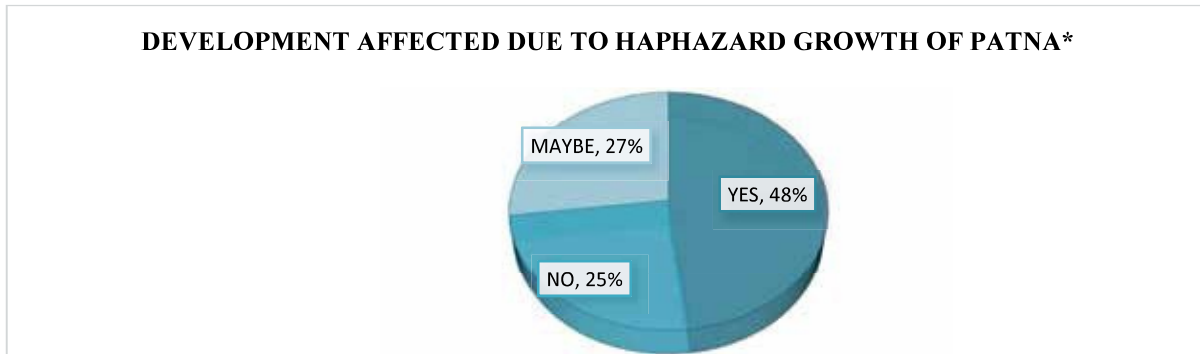


*Based on sample survey

Fig. 8

The above figure 8 shows the measures suggested by the respondents to reduce the urban heat island effect by planting trees in their locality. 45.26 percent citizens said that UHI can be reduced by planting trees and plants on terrace gardens followed by maintaining parks and gardens i.e., 22.33 percent.

(vi) Barriers to Development: Some of the barriers to smart city development in Patna are- Political instability, Haphazard development, Unclear IT management, High IT infrastructure, and intelligence deficit, Lack of cooperation, Lack of trust between governed and government, and Lack of involvement of citizens.

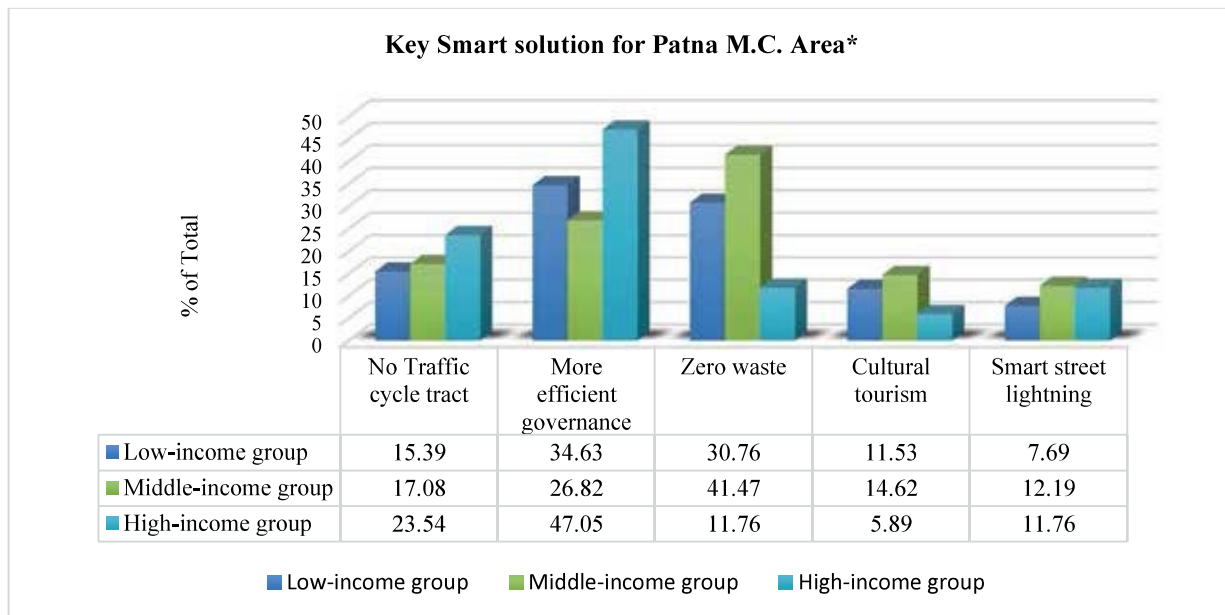


*Based on sample survey

Fig. 9

(vii) Key Smart Solutions: Every problem has a solution. There are various problems faced by the citizens of Patna in their day to life which affects their work life and mental health as well. To

solve these problems, there are some solutions that the residents want to see implemented in their locality as well as everywhere under the smart city mission of Patna.

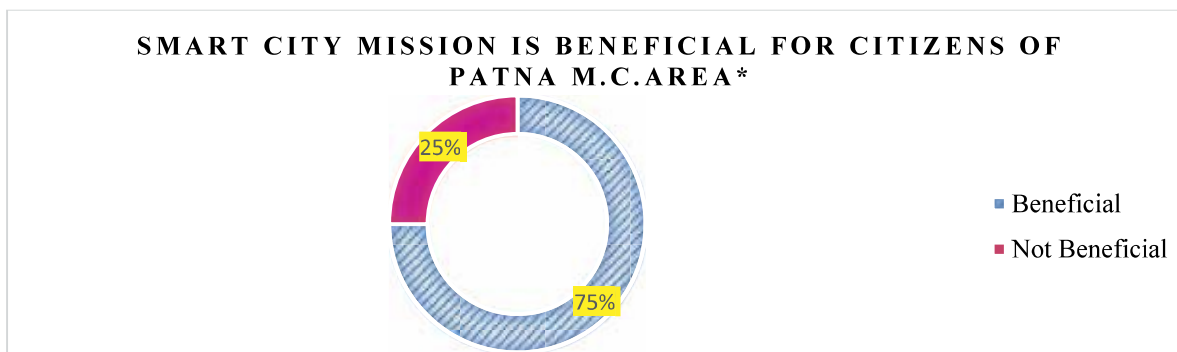


*Based on sample survey

Fig.10

(viii) Is Smart City Beneficial: Since Patna has been selected for being developed into a smart city, the views of the residents regarding the

development and its benefits have been asked by the respondents.



*Based on sample survey

Fig. 11

The figure 11 clearly reveals that about 75 percent of people agreed that the smart city project is beneficial for them while 25 percent did not agree.

VI CONCLUSION

The success of smart city mission lies to a great extent by smart citizens and allowing citizens to become active in the process of city design and priorities to solve the imminent problems in the city. For example: energy saving cannot be achieved merely with the smart meters in home. In order to reduce energy consumption and save money on bills, consumers must change their habit of energy usage behaviour. This would include shifting to energy efficient appliances, reducing TV time and switching off electrical appliances when not in use especially during peak hours. Thus, aspirations of the citizens must be accompanied with the responsibilities of the citizens. Unplanned urbanization has wiped out the greenery of the city. To make the city smart and green, plantation of the trees and its maintenance is a must. Citizens must join the mission of tree plantation along with the Government. Patna has the dubious distinction of “dirtiest capital of the country.” The title is basically due to heaps of garbage visible throughout the city. The situation can be improved by taking initiatives like banning plastic completely, using dustbins, etc.

Institutions especially schools and colleges are also responsible to make the city smart and sustainable. School students who are the future citizens of the country must be aware of the importance of a clean environment, importance of recycling and reusing the goods, community services for the poor and deprived section of the society etc. Thus, institutions must do their part of duty to make the city smart and sustainable.

To implement the Smart City Project of Patna, a special purpose vehicle company, Patna Smart City Limited (PSCL) has been formed with divisional commissioner of Patna, Anand Kishor as its chairman. As per the preliminary plan, area-based development of Patna will cover Gandhi Maidan, Exhibition Road, Patna Junction, R-Block, Beerchand Patel Path, Mandiri, Vidyapati

Marg and Fraser Road (an area of 856 acres). Several ambitious projects for the State capital have been planned. The proposals include four-lane road around Gandhi Maidan with cycle tracks, underground parking facility for four hundred vehicles, development of multi-storied shopping complexes at New Market and solar panels on Government buildings, IT centre near petrol pump at Kargil Chowk, cycle and jogging tracks, riverfront development etc. Bankipur bus terminal near Gandhi Maidan is also proposed to be redeveloped. Planning is also underway for an integrated command and control centre as well as intelligent solid waste management for the whole city. Apart from development of modern amenities, the plan proposed to form a heritage circuit, which would connect Golghar, Collectorate, Patna Museum and Patna GPO. A two –km long footpath along with the tract of motorized rickshaw is proposed to be developed along the heritage monuments in Patna junction-Gandhi Maidan area. The estimated total project cost is Rs. 2776.1 crore in which Rs. 2542 crore is for area-based development (ABD) and Rs. 243.62 crore is for Pan city. Smart road network and road construction on Mandiri Nullah will be the first project of the Smart City. Widening of the roads along with roads free from all overhead cables and electricity lines is the top priority of the smart city mission plan. A Spanish company Eptisa Servicios de Ingenieria with expertise in infrastructure and urban planning has been selected as the management consultant for the Patna Smart City mission.

The first hypothesis of the current work **Ancient city of Patna is developing as a smart city** as shown in Table 3. The hypothesis was tested with chi-square test and the tested chi-square value has come to 3.99 which is lower than the critical value (at 95% level of significance=5.99). Thus, the first hypothesis has been validated.

The second hypothesis, **Socio-economic condition of citizens of Patna is improving** can be tested based on several parameters that are taken into consideration like housing and monthly income which is shown in Figure 2. The hypothesis was tested with chi-square test and the

tested chi-square value has come 9.2 which is lower than the critical value (at 95% level of significance = 5.99). Thus, the second hypothesis has been validated.

The third hypothesis, **Majority of citizens of Patna are unaware of the Smart City mission** is shown in Table 3. The hypothesis was tested with a chi-square test, and tested hypothesis value came 7.25 which is far beyond the critical value of level of significance (5.99 at 95 % level of significance). Thus, the third hypothesis has been rejected.

The fourth hypothesis, **there is no proper garbage disposal in Patna Smart City** is shown in figure 7. The hypothesis was tested with chi-square test and the test hypothesis value came 3.14 which is lower than the critical value (at 95% level of significance= 5.99). Hence, the fourth hypothesis has been validated. Many respondents said that waste disposal was a serious issue in past but currently due to the initiative door-to-door garbage collection taken by the government, the problem got reduced but it is still there due to the irregularity of the garbage-collectors at some places.

The fifth hypothesis, **Patna Smart City project is beneficial for the citizens** is shown in Figure 11. The hypothesis was tested with chi-square test and tested hypothesis value came 1.68 which is lower than the critical value (at 95% level of significance = 5.99). Thus, the fifth hypothesis has been validated.

Summing up, smart city as a concept of urban development assumes it should include multiple spheres of growth: economy, people, urban governance, geographic mobility, natural environment, quality of life, etc. These areas should be further supported by information technology systems, provided they are a tool not a goal of development strategy. Smart strategy should also include not only multi-dimensional approach but also city's stakeholders, i.e. enterprise sector, inhabitants and local government (Parishwad and Singh, 2014). Transformation of a city to Smart does not happen instantly. Strategy Development requires understanding of the issues and challenges for the particular city. To take advantage of the IoT based smart city solution, the citizens of Patna need to carry positive mindset and understand the impact of this emerging technology. Patna needs strong awareness about IoT, a positive government attitude, up-to-date applications, better management and better information accessibility for the citizens. The success of Patna smart city depends upon the implementation of technologies furthermore on the engagement of individuals who live in them as a high percentage of the energy use remains within the hands of end users and their behaviour.

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