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INDOOR AIR POLLUTION-A HEALTH THREAT TO LIFE; CHALLENGE BEFORE POPULATION GROWTH: CASE STUDY ON RAJPUR-SONARPUR MUNICIPALITY, W.B. (INDIA)

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ABSTRACT

The very fast-growing process in the fields of economy and urbanization in India in the last decades has caused a commensurate rise in atmospheric as well as indoor air pollution which has had an impact on both the environment and health. Since 2010, SO_2, CO_2 and nitrogen oxide levels have reached a level that may cause climate change and have adverse effects on the health of the local residents. Past environmental efficiency analyses have rarely examined indoor pollution, and economic developments as interacting systems; therefore, this study used a new two-stage DEA model, the Modified Undesirable EBM Two Stage DEA (Epsilon-Based Measure) to explore the environmental, economic and health efficiencies in Rajpur-Sonarpur city of India. The primary causes to improve air quality is to achieve better health condition, such as reducing instances of bronchitis, asthma, and premature mortality etc. It is also possible that improving indoor air quality may affect the economic performance of a local area, by improving the health of the workforce, contributing to overall quality of life. Indoor air pollution (IAP) caused by biomass fuel use and traditional cooking stoves is a global health threat, particularly for women and young children. The WHO World Health Report 2002 estimates that IAP is responsible for 2.7% of the loss of disability adjusted life years (DALYs) worldwide and 3.7% in high-mortality developing countries. In this research paper provide a survey report on the current literature and Rajpur-Sonarpur Municipality households on the relationship between indoor air pollution, various health issues and economic well-being.

Keywords: Economic Well-Being, Health Threat, Indoor Air Pollution, Quality of Life.

INTRODUCTION: Indoor pollution is a vital problem in present day in rural, urban and suburban area. In developing countries due to rapid growth of population, industrialisation and urbanisation the standard of life style, food habit, culture, socio-economic conditions of human being are rapidly becoming changed. People themselves are polluting their own living home environment by air, water, solid waste, noise pollution. EPA declared that indoor air pollution is 2.5 times worse than outdoor pollution level. According to WHO near about 3.8 million people a year die from exposure to indoor air pollution. Wastes from cooking, dish washing, toilets, garbage, vegetable peels, sinks, are the primary source of indoor air pollution. The household cleaners, detergent and washing soap or powder containing toxic fumes and phosphate creates allergy and also long-term diseases. Lack of proper ventilation system of home, school, office may cause of poor air quality creates breathing problem. A common class of pollutants emitted from household products VOC, include paint strippers and other solvents, wood preservation, air fresheners, dry cleaner, mosquito coil etc.

It is said that there is nothing more important than a good, safe and secure home. Home is the most secure and healthy environment for an individual because of spending the maximum time of a day in home. So, unless we won't be aware about the sources of indoor pollutants and not take necessary measures to prevent it, will not control health risks.

STUDY AREA

Rajpur-Sonarpur Municipality, the study area is the neighborhood of South Kolkata, is a city in the district of South 24 Parganas, W.B., extends from $22^0$22'56''N to $22^0$27'53''N latitude and $88^0$20'02''E to $88^0$25'48''E longitude. It is basically a part of Gangetic Delta with an average elevation of 9 meters above MSL. The area is bounded to the north by Kolkata Municipal Corporation, to the south by Baruipur Municipal area and to the east as well as to the west by the gram Panchayet Samiti. The Eastern Railways station namely Garia, Narendrapur, Sonarpur and Subhasgram are within this municipal area. It is the 7th largest municipality of West Bengal in terms of population after Kolkata Municipal Corporation, Asansol, Howrah, Siliguri, Durgapur and Maheshtala. The geographical area of Rajpur-Sonarpur Municipality is 49.26km² having 35 wards with total population 4,24,368 among which 51% is male and 49% is female as per Census of India,2011. Average literacy rate of Rajpur-Sonarpur Municipal area is 91.06% of which male and female literacy rate are 94.28% and 87.71% respectively. The sex ratio is 962 per 1000 males. The river Piyali flows on the eastern side of this area. Some small channels and creeks also are flowing through the area which are ultimately drain into river Piyali. Map No.-1 shows the location of the study area.

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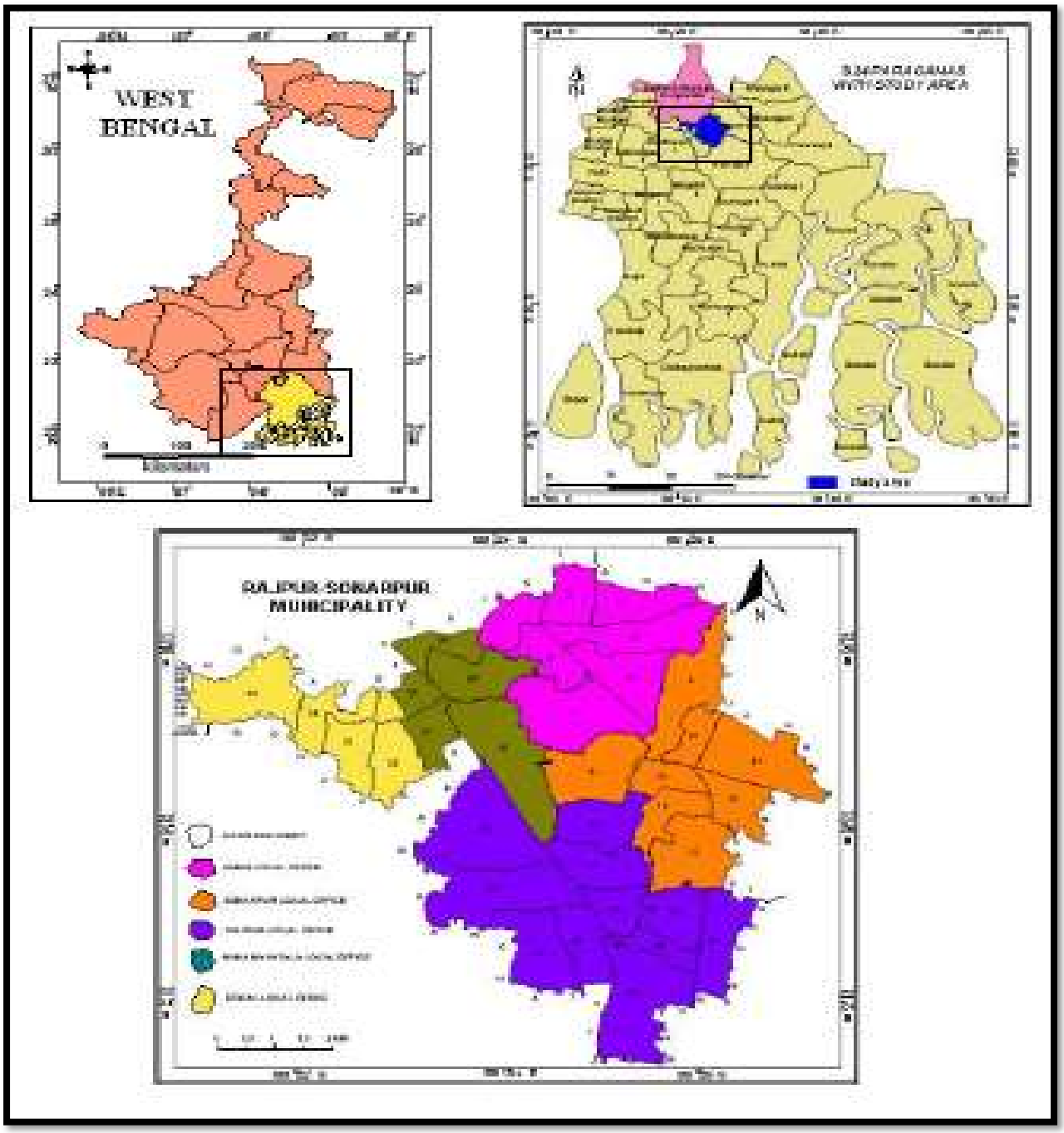
LOCATION MAP OF RAJPUR-SONARPUR MUNICIPALITY



Map No.1[Source: District Planning Map Series, NATMO, Kolkata]

OBJECTIVES: The present work is undertaken with the following deliverables-

a) To study the demographic scenario of Rajpur-Sonarpur Municipality.
b) To study the population growth rate of the study area.
c) To observe the major human activities, polluting their indoor environment in the area.
d) To identify the causes and sources of indoor air pollution evolved from standard of living of the study area.
e) To provide information on the prevalence of exposure to harmful factors in Rajpur-Sonarpur Municipality.

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f) To study the work culture and in-house amenities in the area.
g) To identify the problems evolved from household practices and sanitary system of the above-mentioned area.
h) To produce controlling measures to prevent indoor air pollution.

REVIEW OF LITERATURE:

There are several researchers who explored in the indoor air pollution as a special ground of health threat to life.

Ankita Kankaria & et.al. have published a paper dealing with the problems of indoor air pollution. They analyzed that in a large case-control study, after adjustment for demographic factors and living conditions, solid-fuel use significantly increased child deaths at age 1-4 years. More girls than boys died from exposure to solid fuels.

Frank J. Kelly & Julia C. Fussell pointed out in the article on the topic of ''Indoor air pollution and public health: emerging hazards and improved understanding of risk", published in Environmental Geochemistry and Health, Springer, that particulate matter (PM) air pollution is not only exerting a greater impact on health but also associated with a broader number of disease outcomes.

Rema Hanna & et.al have done a work concerning the relationship among indoor air pollution, respiratory health and economic well-being. They have also discussed the available evidence on the effectiveness of popular policy prescriptions to reduce IAP within the household.

Hence, to determine the impact of indoor air pollution on health in relation to population growth, the present sequel was conducted at Rajpur-Sonarpur municipality, South 24 Parganas, West Bengal. The present study relied upon health hazards of indoor air pollution and positive relationship between indoor air pollution and population growth.

METHODOLOGY

The present study is based on both primary and secondary data(mainly secondary data).After the extensive review of literatures of different aspects on occupational structure that is the base of economic well-being and relevant reports such as District Human Development Reports of South 24 Parganas, Human Development Reports of West Bengal data have been collected from sources such as District Census Handbook, Census of India, District, Disaster Management Plan, District Statistical Handbook, South 24 Parganas,2005-2013,Bereau of Applied Economics and Statistics: Government of West Bengal; different Local Urban Bodies. Various administrative and thematic maps related to the study have been gathered from National Atlas and Thematic Mapping Organization, Census of India and local urban offices etc. These collected data have been analyzed by the application of geo informatics with cartographic techniques and statistical tools.

DEMOGRAPHYICAL SCENARIO OF THE STUDY AREA

To understand the economic well-being, it is most important to study about the demographic scenario and work participation of the study area because work participation (basically main workers) is the base of economy. So extensive study has been done over the municipal area. Municipality of Rajpur Sonarpur having population of about 4.2 lakh, South 24 Parganas district's the 2nd most populous municipality, located in South 24 Parganas district of the state West Bengal in India. Total geographical area of Rajpur Sonarpur municipality is 49 km^2 and it is the biggest city by area in the district. Population density of the city is 8617 persons per km^2. There are 35 wards in the city, among them Rajpur Sonarpur Ward No.-15(Natun Pally, Chanditala) is the most populous ward with population of about 20 thousand and Rajpur Sonarpur Ward No.-20(Malancha) is the least populous ward with population of 6025.

Table-1: Decadal growth rate of Rajpur-Sonarpur Municipality

Year	Total population	Growth rate (%)
1901	10713	-
1911	11607	8.3
1921	11412	-1.7
1931	11433	0.2
1941	13614	19.1
1951	16310	19.8
1961	24812	52.1
1971	34393	38.6
1981	43985	27.9

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1991	60175	36.8
2001	336707	459.5
2011	424368	26

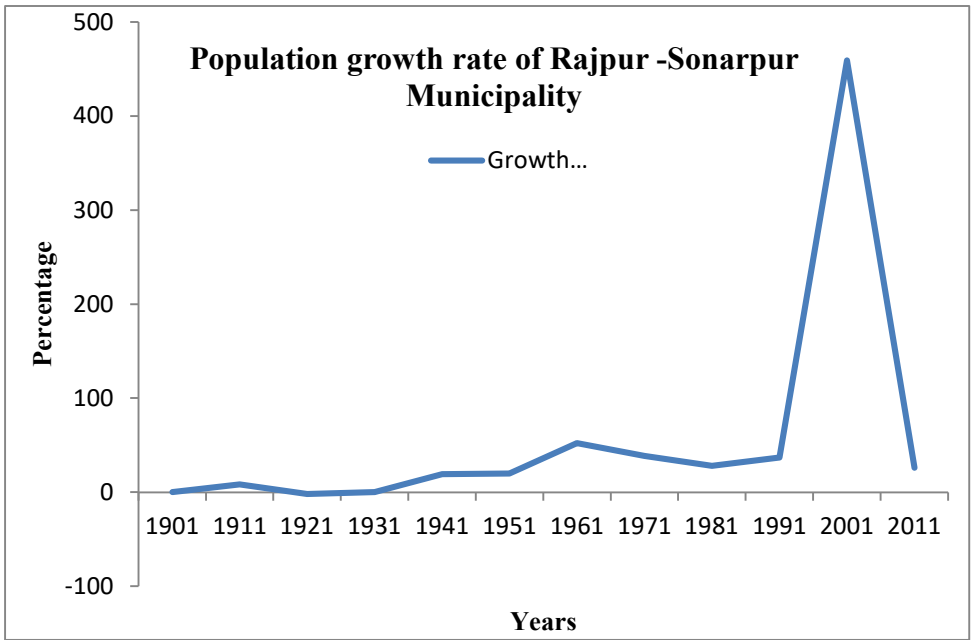

Fig:1 [Source: District Census Handbook, South 24 Parganas]

Population of the city has increased by 26% in last 10 years. In 2001 census total population here were about 3.4 lakh. Female population growth rate of the city is 28.5% which is 4.8% higher than male population growth rate of 23.7%. General caste population has increased by 33.7%; Schedule caste population has increased by 1.5%; Schedule Tribe population has decreased by -0.8% and child population has increased by 8.4% in the city since last census.

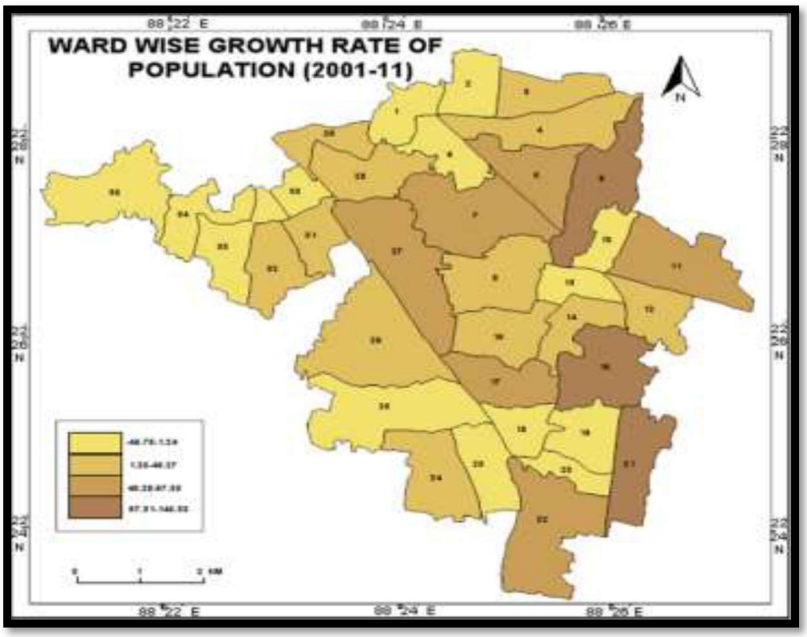

Fig:2 [Source:Census of India(2001-2011)]

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WORK PERTICIPATION RATE

According to Census of India, the people who use to work for the major part of the year are known as the main workers. On the other hand, the people who use to work at all the year but not the most part of the year are called the marginal workers.

Fig:3 shows average growth rate of workers participation as main or marginal is 6.19% per decade. Only 14.45% of the total population was employed in 1971 and it increased into 39.91% in 2011.Between the year 1991and 2001 work participation rate increased at highest rate i.e., 7.74% due to jurisdictional expansion of the study area so that major portion of people engaged different activities in the surrounding rural areas added with Rajpur-Sonarpur municipality.

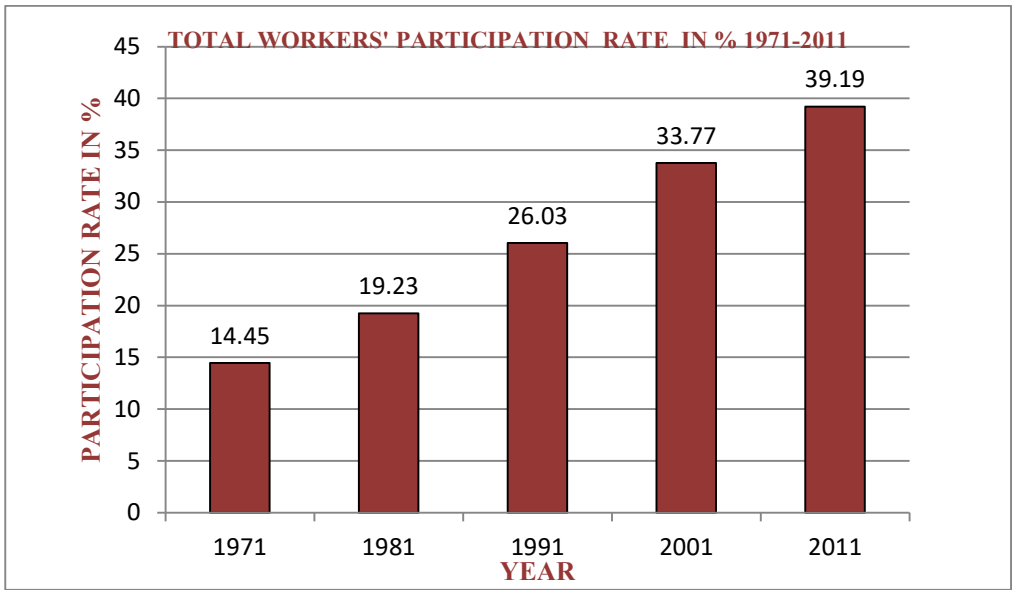

Fig:3[Source: Census of India,1971-2011]

From the decadal growth rate of total population and total workers (Fig:4) it can be observed that the growth rate of workers is more than that of the population from 1971 to 2011.It means growing population generates more workers than the earlier period. Obviously, it is very positive sign of the economic well-being of the study area. It is also observed that there is a large growth rate taken place in both the sectors of population and workers in between 1991 to 2001 due to areal expansion of the municipality from 20.98 sq.km to 49.26sq.km.

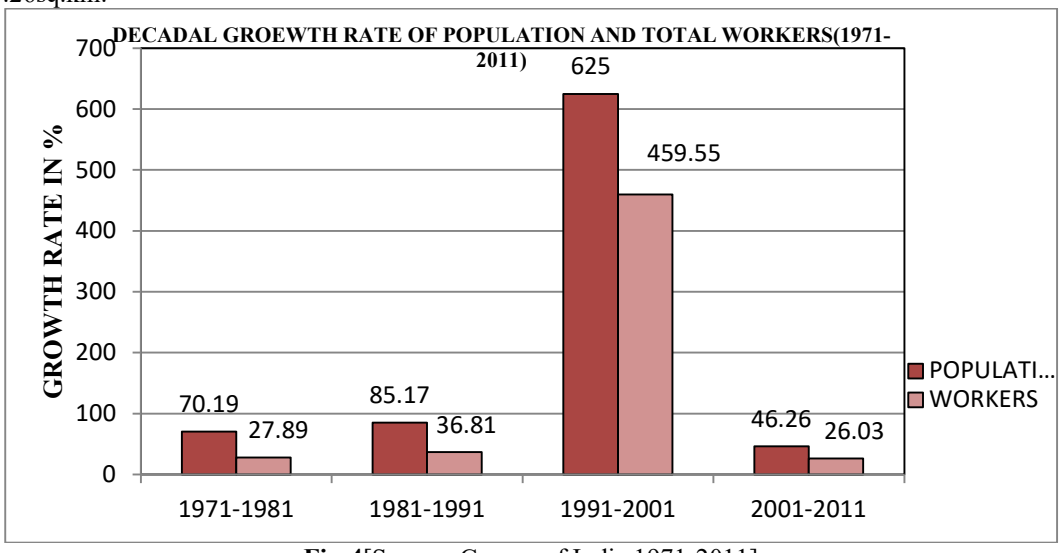

Fig:4[Source: Census of India,1971-2011]

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WARD LEVEL CHANGING PATTERN OF WORK PARTICIPATION RATE,2001-2011

In 1991 there were only 14 wards in Rajpur-Sonarpur municipality within an area of 20.98sq.km.In 1993 total area of the municipality expanded to 49.26sq.km by merging surrounded panchayat rural areas and number of wards increased to 33.So it is difficult to compare the work participation rate i.e. economic well-being of the wards with one to one correspondence from 1991 to 2001 and 2011.To solve this problem total number of wards of the year 2001 i.e. has been taken as the basis of calculated data.Fig.-5 shows the changing pattern of work participation. It shows the growth of work participation rate is not even all over the study area.

WARD LEVEL CHANGING PATTERN OF WORK PARTICIPATION RATE,2001-2011

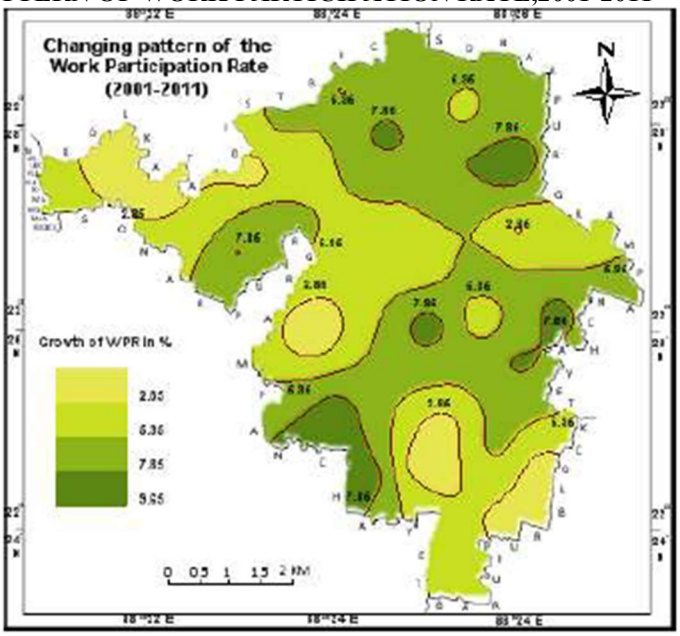

Fig:5[Source: Census of India,2001 and 2011]

INDOOR AIR POLLUTION AND HEALTH HAZARDS

Indoor air pollution refers to chemical, biological and physical contamination of indoor air. In developing countries, the main source of indoor air pollution is biomass smoke which contains suspended particulate matter(SPM),nitrogen oxide(No_2), sulphur dioxide(So_2),carbon monoxide(Co),formaldehyde and polycyclic aromatic hydroarbons (PAH_s).In industrial countries, in addition to No_2,Co and formal dehyde, radon, asbestos, mercury, human-made mineral fibers, volatile organic compounds allergens, tobacco smoke, bacteria and viruses are the main contributors to indoor air pollution.(Glosssary of environmental statistics, studies in Methods, series F,No.67,United Nations, New York,1997).Indoor air pollution may cause health hazards-A)Short-term effects and B)Long-term effects.

A. SHORT-TERM EFFECTS: Health effects associated with indoor air pollutants include irritation of eyes, nose and throat. Headaches, dizziness and fatigue have become common to more or less every person. These are generally short-term symptoms that are easy to treat. In some cases, treatment is just removing the irritation whether it would be identified. Repeated exposure to a particular pollutant may be treatable as it may be identified. But immediate reactions to indoor air pollutants depend on several factors including age and pre-existing medical conditions. It is very important to pay attention to the time and place of occurrence of symptoms.

B. LONG-TERM EFFECTS: Some people do not experience the negative effects of poor indoor air quality until they have been exposed to the pollutants for months or even years. They may end up with long-term and most harmful effects like respiratory diseases, heart disease and cancer. So, it is very important to ensure good indoor air quality.

POSSITIVE RELATION BETWEEN POPULATION GROWTH AND INDOOR AIR POLLUTION-HEALTH ISSUES

During the last two decades of rapid population growth and economic well-being, indoor air pollution has become increasingly serious and corresponding health damage has become a significant problem of Rajpur-Sonarpur municipality. The effects

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of indoor pollutants range from short-term effects are eye and throat irritation and from long term effects are respiratory disease and cancer. Exposure to high levels of some pollutants such as carnon monoxide, can even result in immediate death. Based on cancer risk alone, scientists have ranked indoor air pollution as one of the most important environmental problems. Symtoms of poor indoor air quality are very broad and depend on the contaminant. The most common symptoms are-coughing, sneezing, watery eyes, fatigue, dizziness, headache, upper respiratory congestion etc. If someone notice relief from his or her symptoms soon after leaving particular room or building, then the symptoms may be caused by indoor air contaminants. The residents of the study area have to face such problems. Figure-6 shows different sources of indoor air pollution of the study area. In this figure it can be observed that the highest percentage (75.21% in 2018) is shown in the sector 'kitchen attached with living room' from where the dangerous gases like VOC's, mould, odours are created. As such other sectors in Fig-6 shows the different sources of indoor air pollution and their percentage is comparatively low.

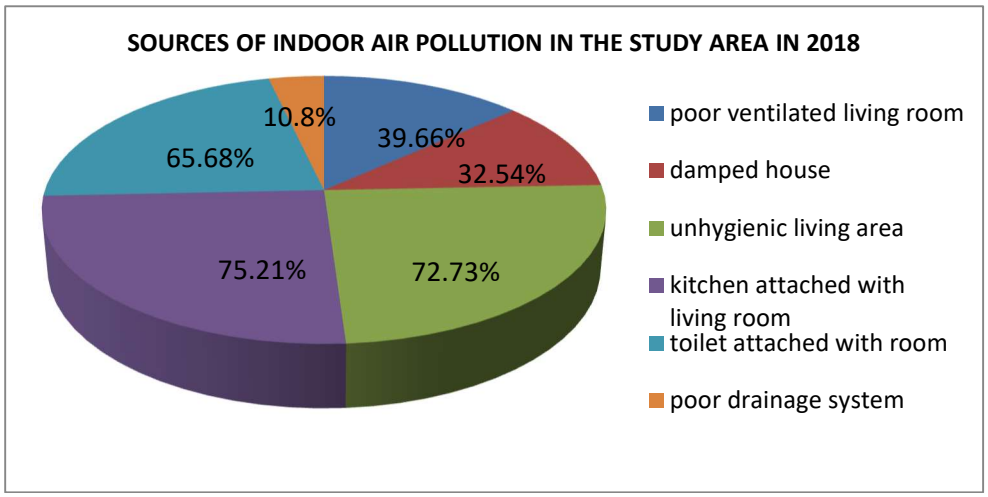

Fig:6[Source: Survey based data in 2018]

On the other hand, Fig-7 shows the common health symptoms of the study area in 2018 in relation with Fig-6. Here it is observed that the percentage of people suffering from upper respiratory congestion is highest(37.45%).The percentage of other health symptoms is lower.

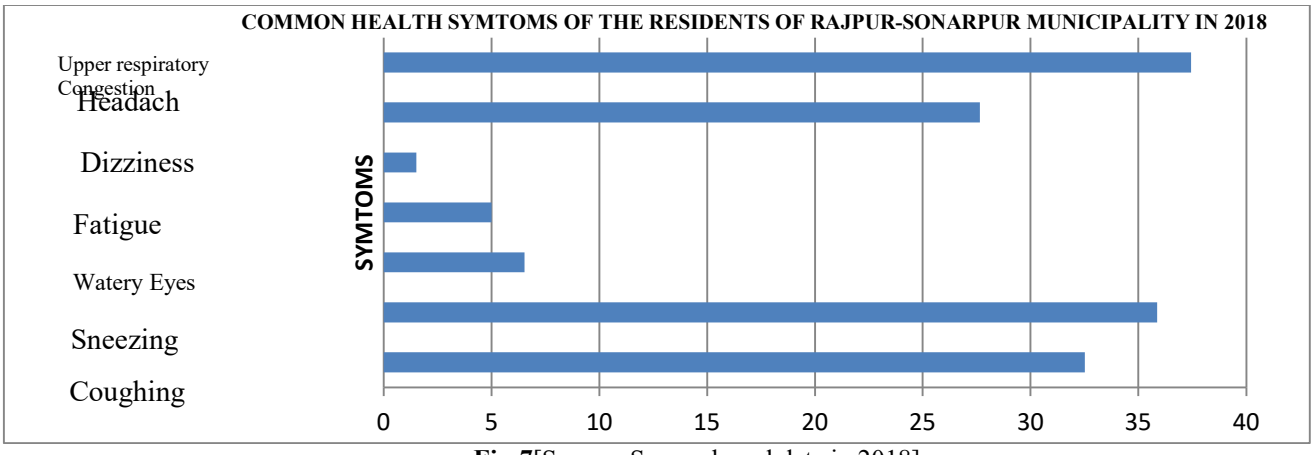

Fig:7[Source: Survey based data in 2018]

Now let observe the trend of indoor air pollution and common health symptoms of the study area in 2020.In Fig-8 it is observed that highest percentage (77.91% in 2020) is shown in the sector 'kitchen attached with living room' where as it was 75.21% in before only two years (2018).As such the percentage of unhygienic living area increases from 72.73% to 75.69%.Simulteneously it has also been observed that every sector of sources of indoor air pollution is increasing with population growth with

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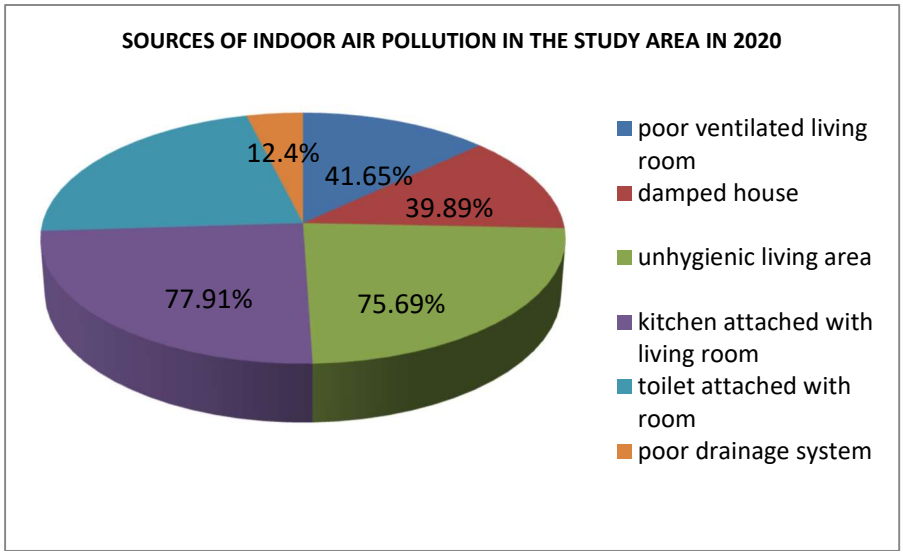


Fig:8[Source: Survey based data in 2020]

time period. Fig-9 shows the common health symptoms of Rajpur-Sonarpur municipality in 2020.It is observed that the highest percentage (40.58%) is in upper respiratory congestion where as it was 37.45 % in 2018.Simulteneously every sector of health symptoms is higher in 2020 than 2018.So it is clear that there is positive relationship

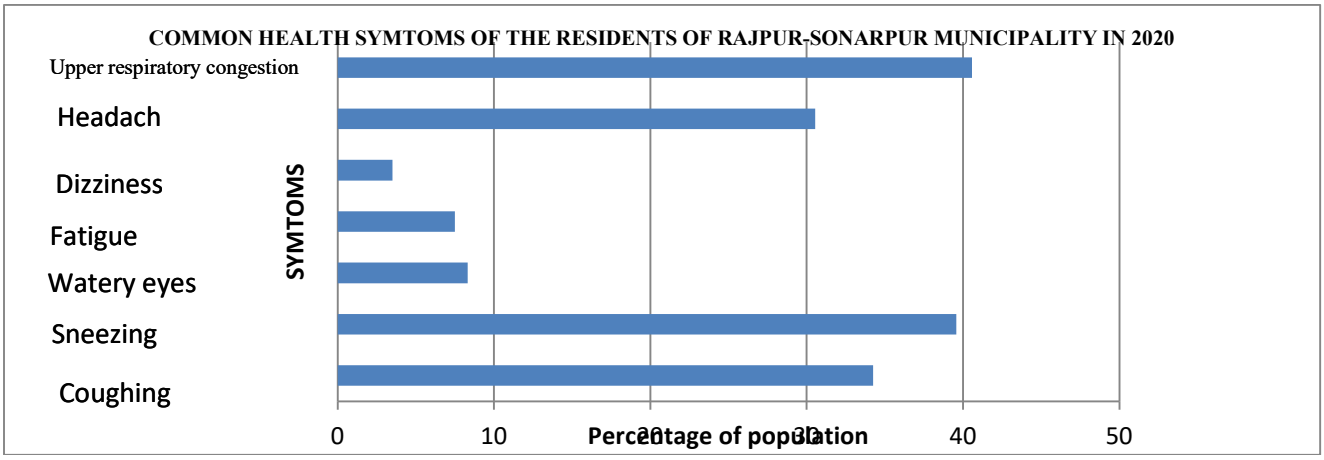
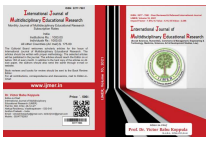


Fig:9[Source: Survey based data in 2020]

CONCLUSION

In developing countries, the main source of indoor air pollution is biomass smoke which contains suspended particulate matter (SPM), nitrogen oxide (No_2), sulphur dioxide (So_2), carbon monoxide (Co), formaldehyde and polycyclic aromatic hydrocarbons (PAHs). In industrial countries, in addition to No_2, Co, and formaldehyde, radon, asbestos, mercury, human-made mineral fibers, volatile organic compounds, allergens, tobacco smoke, bacteria and viruses are the main contributors to indoor air pollution. All the field human being i.e. population growth is the central key of indoor air pollution. Migrated people from both the overcrowded city of Kolkata and southern part of Sundarbans not only brought changes in occupational structure but also changes in settlement pattern, structure and size that subsequently rapidly changing the skyline of the outer fringe of the study area. Overall employment is increasing along the literacy rates. But the striking features is that most part of earning are used for their daily needs and savings is very meagre amount that is actually manifested in terms of production, development and sustainability of their standard of living. Increasing population has widened the gap between the demand and supply of land. Rapid and unplanned urban growth creates indoor air pollution which is a threat to life in the study area.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