Smart redevelopment of slums prevent epidemics

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Abstract

Objective: Novel corona virus pandemic has placed the slum dwellers at high risk. This necessitates re-development of slums. This paper discusses the priority for slum re-development under Smart City Program, and the way forward in India.

Prior Work: A study was carried out on early lessons from public administration measures to address the corona pandemic in India. This paper is based on a research following the earlier study.

Approach: The process involved – (a) Study and analyze health survey reports of various municipalities; (b) Sample field surveys; (c) Discussions with limited number of municipal officials; and (d) Comparative analysis of other similar studies.

Results: Slums are characterized by congested space, lack of adequate water supply, unhygienic sanitation conditions. Almost 8 to 10 persons live in a cramped space. Majority of the slum dwellers are daily wage earners and poor. Congested space and insufficient water do not allow social distancing and hand wash, which are essential to fight novel corona virus infection. Further, exposure outside home for daily earning makes the slum dwellers vulnerable to corona infection. Dharavi slum of Mumbai metropolitan in India, and some of the informal settlements of New York are unique examples. To address the present pandemic and improve the quality of life of the slum residents, re-development of slums and local economic development assume significance. It calls for re-oriented approach in urban planning, infrastructure development and creation of local employment opportunities under Smart City program.

Implications: (a) Urban planners need to research for effective redevelopment of slums, and (b) Practitioners require to be familiarized with the urgent need to improve slums and are provided with options to re-orient area-based development as part of Smart City.

Value: The study findings are relevant for most developing countries. It provides a way forward in redefine the priorities of "Smart Cities".

Keywords: pandemic, slum, social distancing, hand-wash, smart city program.

1. Introduction

1.1 Paper objective

COVID 19 is a type of corona virus that struck the world in late 2019 and was subsequently declared as pandemic by the World Health Organization (WHO). The virus is transmitted through droplets created from sneezing and coughing from those infected. In a situation where there is overcrowding in a place and lack of hygiene sense, the risk of spreading the infection is high.

In this regard, novel corona virus pandemic has placed the slum dwellers at high risk as slums are usually overcrowded, lacks basic civic facilities, and there is absence of hygienic practices. This necessitates re-development of slums.

It is in this background, this paper is developed focusing on India with the objectives to:

- Examine the relation between urban population growth and slum population;
- Study the conditions of the city slums;
- Assess the impact on health of the slum dwellers; and

- Determine a way forward for re-development and improvement of slums.

1.2 Prior work

This study is a sequel to an earlier research on lessons from public administration measures to address the novel corona virus pandemic in India.

When COVID 19 spread across the world, preparedness to cope with this pandemic was inadequate in India. To prepare the nation to combat the challenges ahead, the national government laid down several policy guidelines, coordinated with different ministries, other agencies, and the provincial governments, and monitored implementation of the protective measures initiated. In implementation of the policies and strategies, local governments were involved and civil societies were engaged, with support from the national government.

Especially the cities with large population and slums were most vulnerable to the novel corona virus. This was mainly due to high population density in the cities and particularly in the slum areas, which impeded maintaining social distance that is a vital measure to combat spreading of the infection. Besides, slum dwellers who largely constitute of daily wage earners and are poor could not keep themselves confined to their homes for search of their earnings. It was a towering challenge before the government to choose between protection of life and safeguarding of livelihood.

Following from the findings of the earlier study and considering the growing slum population in India [1], the focus of this study is on city slums, which, as stated earlier, due to cramped space, poor civic facilities, high density of population, and low awareness of hygienic practices is vulnerable to novel corona virus pandemic and other similar health hazards.

1.3 Approach

On account of constraints for undertaking extensive field level study in the present novel corona virus pandemic situation, the present study is mainly based on data collected from the secondary sources. Limited field survey has been conducted.

Data is gathered from the Census of India (Census) from 2001 and 2011 [2]. Reports on slum development by the government agencies have been studied. Besides, urban heath reports of the Ministry of Health & Family Welfare, Government of India, and different urban local bodies have been reviewed and analyzed.

In addition, sample survey in limited number of cities has been carried out to co-relate the findings from the secondary sources and assess the ground reality. Discussions were held through virtual mode with a few officials of different municipalities to understand the factors responsible for the current situation and steps taken or being considered to address the challenges of cities in general and slum settlements in particular.

The observations and findings emanating from this exercise were reviewed through comparative analysis of past similar studies to understand the similarities and examine the

differences. This finally paved the way to draw conclusions for possible way forward in resolving the research question - how slum re-development can prevent spread of epidemics.

2. Urbanization in India

2.1 The urban growth

In India, out of 1.3 billion population, 8 million people live in rural areas and 5 million are urban residents, which is slightly over 33 per cent of the country's total population. It is projected that India's urban population will grow from 33 per cent in 2011 to an estimated 39 per cent by 2036. Urban population growth would account for approximately three-fourth of the total population by 2036. The UN Report "World Urbanization Prospects" projects that between 2014 and 2050 India will add 404 million urban dwellers. With speedy progress of economic development in India and cities becoming "engines of growth", it is likely that in the coming decades India will witness unprecedented rapid urbanization.

Hitherto, urban growth in the country has been largely unplanned and haphazard. With growing population, Indian cities are under severe stress, and quality of life has been adversely affected. Dearth of safe drinking water, poor sanitation, shortage of housing, and lack of transport infrastructure are the main challenges before urban administration in India. In addition, there are concerns for adequate and affordable health service, environmental degradation, unemployment, and poverty in urban areas.

2.2 Urban slum population

In India growing industrialization, poor employment opportunities in rural areas, and ineffective land reforms forced a large number of rural people to migrate to urban centers. With policies for economic liberalization and reforms, cities turned into growth centers and drew more people from rural and per-urban areas. For example, in Jharkhand [3], a province in eastern part of the country, the primary reason for rural to urban migration is the economic strength of large urban centers like Ranchi, Bokaro and Jamshedpur in its contribution to employment opportunities and better means of livelihood. In Jharkhand, similar to other provinces of India, migration too played an important role in accelerating urban growth.

According to the Census of 2001, about 52 million people out of a total population of 1.02 billion moved from rural to urban areas. The Census of 2011 showed rural to urban movement of about 78 million people out of a total population of 1.3 billion. The decadal increase of migration from rural to urban areas in India was nearly 50 per cent, which is fairly significant.

This rural to urban migration increased the population of cities and imposed further burden on the urban infrastructure, which, in any case, was already in poor condition. The migrant population along with the cities' existing poor populace lived in shanties that exponentially increased slum settlements. Estimates indicate that about one-third of the population in the large cities live in slums or slum-like conditions and the proportion could be higher in metro

and mega cities. According to the estimates of UNESCAP, 29.4% of India's urban population live in slums, which are expected to grow rapidly as India urbanizes.

The Statistical Compendium of Slums in India prepared and published in 2015 by the Ministry of Housing & Urban Poverty Alleviation, Government of India reports-

"Slums in the 189 towns of Maharashtra accounts for 11.85 million population, which is 18.1 percent of the total slum population of the country. This is followed by Andhra Pradesh (10.2 million), West Bengal (6.4 million), Uttar Pradesh (6.2 million) and Tamil Nadu (5.8 million). In fact, these 5 provinces namely Maharashtra, Andhra Pradesh, Uttar Pradesh, West Bengal, Tamil Nadu account for about two-thirds (61.9 per cent) of the total slum population of the country. Other 10 provinces and Union Territories namely Punjab, Haryana, Delhi, Rajasthan, Gujarat, Karnataka, Chhattisgarh, Odisha, Madhya Pradesh and Bihar have reported each more than 1 million slum dwellers in its cities/towns in 2011. Besides Jammu and Kashmir, all North-Eastern states including hilly states reported less than half a million slum population."

The proliferation of slums in cities is abated by the weakness of the urban system to respond adequately to meet the shelter requirements of the economically weaker sections, which migrate to the city primarily for economic reasons. In the absence of adequate access to shelter, the economically weak migrant population lives in abysmal environmental quality compounded by the inability and awareness among the slum dwellers to take up self help initiatives for improvement.

2.3 Urban slum condition

Slums are characterized by overcrowding, unhygienic conditions, grossly inadequate basic amenities, unplanned layouts and poor accessibility. On an average, 6 to 8 people live in cramped rooms. At many times, it is when a room inmate is out on work or otherwise that the other inmate stays inside room as the space is too small to accommodate all the inmates simultaneously. In cities of Meerut, Delhi, Kolkata, and Mumbai, residential crowding among poor households is extremely high with more than one in five poor households in these cities have at least seven persons per sleeping room. The disparity in residential crowding between slum and non-slum areas is particularly prominent in Delhi and Kolkata [4]. Besides, light and ventilation is so poor that staying indoor can cause a feeling of suffocation. It is horrifying when community toilets used by the slum dwellers are not only in limited numbers but also in deplorable condition. Some toilets are without doors, and those toilets which have doors are without latches. Water supply being grossly inadequate and at times disrupted, these toilets are full of filth and human excreta. Quite often it is seen in many slum settlements of Kolkata, men and children taking bath in open on the skirt of the pavements. As garbage disposal service is irregular in slums, there are dumps of garbage emanating foul order and working as breeding ground for flies and mosquitoes. The lanes in the slums are narrow and often the sewage water stagnates in open surface drains, which emit bad smell. There is almost no open space within a slum settlement that could provide scope for freshness to the residents. Even if there is an open space such as a public park, it usually used as dump yard as for example is the case in Lal Bagh Slum of Azadpur area in North-Eastern part of Delhi.

Evaluation on various basic parameters of living conditions in slums in India indicate a rather gloomy picture as would be evident from **Table 1**.

Table 1: Living Conditions in Slums in India by Different Factors

Factor	Indicator	Data Source	Remarks
Durability of Housing	Roof Type	Household Survey	Mainly tin and tarpaulin with some having brick and concrete roofing
Sufficient Living Space	Square feet per person	Household Survey	Ranging primarily between 1.25 to 1.87 square feet
	Building Height	Household Survey	Largely single-storied with few cases of double and triple sotoried buildings
Access to Safe Water	Water Source	Neighbourhood Survey	Mainly hand pumps and water tankers
Access to Adequate Sanitation	Toilet Source	Household Survey	Mainly common or community toilets, with exceptional instances of private toilets
	Drainage Type	Neighbourhood Survey	Mostly open, except in some cities where it is closed

Source: Adapted from International Growth Centre Working Paper titled "Urbanization and India's Slum Continuum: Evidence on the Range of Policy Needs & Scope of Mobility" (Reference No. C 35309-INC-1)[5]

2.4 Health of slum communities

Characterized by housing of poor structural integrity, overcrowding, poor access to water, sanitation and other facilities, and overall challenging living conditions, slums impact their inhabitants directly and indirectly. All these factors work in concert that compromises the health of slum communities. This is corroborated by the fact that urban slum communities often have poorer health outcomes than those in neighboring urban areas, and even rural areas. The complexity of this situation is exacerbated by the diversity and fluidity of urban slum settings, and given the interplay between the physical and environmental features of slum systems and local socio-cultural contexts. The slum communities tend to be particularly vulnerable to a range of health issues, many of which are largely preventable. However, slum-based patients have relatively poor access to care, and only tend to come into contact with formal health care services relatively late into their illnesses [4].

2.5 Measures to address the challenges of slums **[6]**

To mitigate the sufferings of the slum dwellers and address the challenges, number of initiatives has been taken as listed below:

- During 1970s - Basti Improvement Programme (Kolkata); Urban Community Development Programmes (Hyderabad, Visakhapatnam); and Environmental Improvement in Slums.
- During 1980s - Urban Basic Services and Integrated Low-Cost Sanitation scheme.
- During 1990s - National Slum Development Programme (1996) aimed at upgrading urban slums, whereas the Swarna Jayanti Shahari Rozgar Yojana

(1997) sought to provide gainful employment to urban unemployed or underemployed.

- Valmiki Ambedkar Awas Yojana (VAMBAY) in 2001 facilitated construction of dwelling units in slums and environment improvement by constructing community toilets under Nirmal Bharat Abhiyan.
- In 2005 Jawaharlal Nehru National Urban Renewal Mission (JnNURM) was launched for strengthening urban infrastructure provision and service delivery including development of basic services to the urban poor.
- Rajiv Awas Yojana (RAY), now modified and renamed Pradhan Mantri Awas Yojana (PMAY) was launched in 2009 to make India "slum-free" and to tackle the problem of slums.
- With the vision of the National Urban Sanitation Program and to make India clean, litter free and Open Defecation Free, the Swachh Bharat Mission was launched in October 2014.

These programs have helped to improve living conditions to some extent. The effect of implementation of the programs varied from city to city and resulted in differing status of slum improvement. A study [5] revealed that there are significant gaps between the poorest slums in Jaipur and Bengaluru and the rest of the slums in those cities. In Patna, however, the range of difference is narrower; service provision levels are lower than in the other two cities. However, due to the dense population in the slums and variations in extent of implementation of improvement measures, vulnerabilities persisted.

3. Challenge to slums in COVID 19 pandemic

The overcrowded, highly dense slum settlements of Indian cities and usually inhabited by people on the lower rungs of the economic ladder poses a serious the challenge to control over the novel corona virus pandemic. While living within congested, over-crowded housing and shared basic amenities in such areas of the cities, it is near impossible for slum dwellers to practice the WHO guidelines of social distancing, frequent hand-washing with soap and water and other hygiene to combat the novel corona virus. And, the spread of the corona infection in Dharavi, in Mumbai, which is said to be the largest slum settlement in Asia raised a question on the preparedness of the country in dealing with an epidemic like novel corona virus.

Analysis of the slum conditions as described in the preceding paragraphs and on relating with the ground situation, it would be observed that –

- The ratio of a room to person in urban slum settlements is 1:1.41, which means more than one individual shares one room. This figure, however, varies in different provinces. For example, in West Bengal, one room is shared by more than two individuals. In Maharashtra, Uttar Pradesh, Delhi, Gujarat and Assam, the ratio is higher than in other parts of India. This underlines the fact that it is near impossible to follow social distancing and quarantine in urban slums of the country.

- Use of common sanitation facilities and collection of water from common public source for drinking and other purposes lead to greater exposure to outside, which puts especially aged people and children to high risk of getting infected.
- Shortage of water supply and lack of hygienic behavior impede washing of hands at regular intervals as advised by WHO. Usually, only 53 per cent of slum dwellers wash their hands with water before having their meals and almost 17 per cent use only water to wash hands after defecation. Further, a study states that about 27 per cent of the slum households reported availability of water, but not soap or detergent in and around the toilet (Nijara Deka & Gautam Kumar Das, Down to Earth, May 2020).

Therefore the slums are largely prone to diseases and severe vulnerabilities during pandemic times as at present. The situation was similar in 2014 to 2016 in the slum settlements of Liberia, Guinea and Sierra Leone when Ebola epidemic broke out.

On the other side, poor stream of income or no income with meagre savings in hand; several of the slum dwellers were compelled to come outdoor for employment and earnings. Livelihood became a major issue and no heed was paid to advice on health safeguards for protection of life.

In sum, the challenge to combat novel corona virus pandemic in slums emanated from poor infrastructure and lack of access to economic resources by the slum residents.

4. Root-cause analysis

It is important to examine that despite the problems of slums persisting since long and measures taken to address, the situation remains largely unaltered. Sample field surveys and limited interactions with the slum dwellers and city officials provide an interesting insight.

City planning is at times inappropriate that results in cropping up of slums. An instance in point is that of development of Vasant Vihar area in South-West part of Delhi. It is a usual practice in Indian cities where middle class, upper middle class and rich families keep domestic helps. Besides, vendors for daily necessities such as milk, bread, vegetables, newspapers, etc. are supplied by daily income earners falling in the low income category. There is therefore a need to provide space for these categories of people in the locality that they serve. There has been no identified space planned in Vasant Vihar for accommodation of these people. As a result, shanties have grown up wherever there is vacant space and not troubled by law-enforcing authorities. This demonstrates how urban planning has ignored the practical aspects and requirements leading to proliferation of slums in the city.

Also, many slums which are existing since long and their residents living therein for generation are not provided legal authorization documents. The residents of these slums do not have proper ownership or tenancy rights. Hence, utility companies such as electricity and power are unwilling to build the infrastructure and provide services to such slum settlements. This has led to tapping illegal connections and poor basic services. This again is an example of lackadaisical urban planning and city management.

Besides, to prevent continuous and huge migration to major cities, setting up a ring of satellite townships with easy connectivity to the nearby major city, as part of regional planning, has been virtually absent. If due attention would have been given to such regional planning, overcrowding in cities, especially large and metro cities, could have been substantially prevented. For example, Lucknow, the provincial capital of Uttar Pradesh could adopt a state capital region concept planning in the lines of the National Capital Region to minimize squatter settlements. Other provinces could also consider such approach.

To crown it all, urban planning in India has seldom followed a participatory approach. It has mainly been top-down approach in planning imposed on the residents of slums. This has alienated the slum dwellers from city development and is an impediment in creating a feeling of ownership with the city's growth.

In nutshell, lack of vision in urban planning and not involving the slum residents or their representatives in the planning process has contributed to the slum situation in the country as today, and despite the initiatives taken by the government considerable achievements could not be attained.

5. Way forward

5.1 Planning & infrastructure development

To address the malaise of slum settlements that has further came into open during the novel corona virus pandemic, the first and foremost requirement is proper housing for the slum residents and access to shelter. For this, work under PMAY program is in progress. However, availability of adequate land in suitable locations in the city is a constraint, as well as, rehabilitation of affected persons during the slum reconstruction period. A phase-wise approach in construction and engagement of the slum residents in planning and development activities could largely resolve the issues surrounding location of housing and allocation of space.

It may be underlined that housing itself is not sufficient for human habitation until the basic civic facilities are arranged. Adequate supply of safe water, proper toilet and sanitation facilities, open space for refreshment, health and education facilities, amenities such as community halls, recreation canters are equally necessary. This requires coordinated work among various agencies such as utility companies; real estate developers, municipal bodies and other agencies. Generally, it is found coordination is easy to say but difficult to implement. At times, due to lack of coordination, the whole reconstruction or redevelopment project gets delayed with cost overrun and even some times is improperly executed or remain incomplete. To avoid such a situation two-tier coordination task force with representatives from the relevant organizations could be formed that should regularly meet and resolve issues that may crop up. One task force would be at the policy and strategic decision-making level and the other at the operational level to facilitate seamless coordination among the agencies at both policy and decision making and execution level.

In this context the program for smart cities is of vital importance. Depending on the size of the city and extent of slums, priorities could be re-laid on slum re-development on either

specific areas of the city under Area Based Development component; or on Pan-City basis. It is important to mention that a city can be smart only if it has adequate and appropriate civic infrastructure and facilities that enable the citizens to live healthy and decent life. Therefore, emphasis on application of information technology and different digital applications ranks second, which perhaps is now getting priority attention in most cities covered under Smart City Program. This prioritization needs to be reconsidered.

5.2 Economic environment

Work from Home (WfH) has become a common feature during the novel corona virus pandemic. It may become the new normal system in the post pandemic period. However, with space constraint and inadequate shelter, WfH for slum residents is a distant dream. The dream could be realized if the shelter has space to accommodate working from home and proper internet connectivity at affordable rates. Many slum women and even men could work from home if such facilities are made accessible to them.

It is here where Smart City Program could integrate physical infrastructure and information technology to facilitate local economic development, and reduce the need for slum dwellers to go outside of their homes and be exposed to risk of infection. Possibly, this is an aspect that smart city managers could seriously consider and incorporate in the city development program.

5.3 Public health

Along with housing, water supply, sewerage, sanitation and other basic amenities the other significant element is public health facilities. The National Urban Health Mission (NUHM) aims to provide health care needs of the urban population with focus on urban poor, by making available to them essential primary health care services and reducing their out of pocket expenses for treatment. This is intended to be achieved through strengthening the present health care service delivery system, targeting the people living in slums and converging with various schemes relating to wider determinants of health like drinking water, sanitation, and school education.

Under NUHM, Mahila Arogya Samiti, which is local women collective group, forms an important component. These bodies are mandated to take collective action on issues related to health, nutrition, water, sanitation and its social determinants at slum level. These units play a leadership platforms for woman's and focal community group in each slum area for improving awareness and access of community for health services, support the frontline health workers, to develop health plans specific to the local needs and serves as a mechanism to promote community action for health. Mahila Arogya Samiti aims to generate demand, ensure optimal utilization of services, establish referral linkages, increase community ownership & sustainability, and establish community-based monitoring system. Also, building awareness of hygienic practices and health safeguards is of immense significance to change the mindset of the slum residents. Here too Mahila Arogya Samiti have an important role. To carry out its activities Mahila Arogya Samiti is given a sum of INR 5000-/- (equivalent to USD 68 at current exchange rate) annually. This amount is too meagre and not adequate to encourage women in the slum neighbourhood as they could earn much more by spending time in selling vegetables in the local markets or working as

domestic helps. Thus, though the concept of Mahila Arogya Samiti is a workable mechanism but the annual funds allotted is a serious constraint in implementation of the concept, especially in metro and large cities such as Mumbai, Delhi, Bengaluru, Kolkata and others the slum women have better options to engage themselves in vegetable vending or as domestic help from the economic perspective. Hence, the quantum of annual fund allotment to Mahila Arogya Samiti needs reconsideration.

As stated earlier, along with focus on development of infrastructure, Smart City Program requires providing thrust on health facilities, especially in slum areas under Area-Based Development component. Water, sanitation, sewerage that are part of infrastructure and related with health, convergence between the two aspects under Smart City Program could be effectively ensured. Hence, to make the city smart habitation, the priorities of Smart City need to be re-prioritized.

5.4 Required change in slum re-development

One-size-fits-all preventive measures against COVID-19 will not work, particularly for slums, which represent unique characteristics in terms of the socio-economic status of residents and their residential environment. Given high density and inadequate services, hand washing and social distancing are luxuries that slum-dwellers in India cannot afford. The existing conditions in slums only exacerbate the vulnerabilities of already marginalized population. It is time to re-think public health measures that work in slum context and ultimately prevent spread of the disease without costing lives and livelihoods of slum-dwellers. In addition, cities need to improve living conditions for urban poor that reside in slums to make these habitats livable.

In this context how the city of Surat completely transformed after the 1994 plague could be a good example to follow for Smart City Program to focus on slums and cities amid novel corona virus pandemic. This would inspire long-term solutions that would reduce the vulnerability of marginalized population and make the cities in the country resilient.

Example of Surat

Within 18 months of Surat being hit by a deadly plague in 1994, the city managed to transform itself from a dirty, garbage-strewn mess into one of the cleanest and most orderly cities in the country. Surat Municipal Corporation (SMC) played a key role in fast-tracking the decision making process and ensuring that rapid action was taken. SMC undertook series of structural and financial reforms such as decentralization of civic functions, creation of city civic centers, rationalization of cadres, introduction of unit area method of tax assessment, levy of user charges, earmarking of the budget for urban poor and others. E-governance was adopted to promote transparency and interaction with citizens as well as for functional efficiency. Further action was taken in identification of cases and giving antibiotics, fumigating cargo, clearing garbage to prevent spread of insecticides over vast areas.

6. Conclusion

6.1 Study results

Slums are characterized by congested space, lack of adequate water supply, unhygienic sanitation conditions. Almost 8 to 10 persons live in a cramped space. Majority of the slum dwellers are daily wage earners and poor. Congested space and insufficient water do not allow social distancing and hand wash, which are essential to fight novel corona virus infection. Further, exposure outside home for daily earning makes the slum dwellers vulnerable to corona infection. Dharavi slum of Mumbai metropolitan in India is an unique example.

The epidemics are supposed to hit harder the urban areas with denser population and poor socio-economic conditions, i.e., in slums. The same pattern is being observed globally for the ongoing epidemic of novel corona virus. Uniquely, a rare exception of this has been in Dharavi in Mumbai the capital of Maharashtra in India. Although Mumbai is the financial capital of India and many parts of the city are genuinely prosperous, Dharavi has gained a dubious honor of Asia's largest slum. Dharavi has an area of 2.1 square kilometers and a population of about 1,000,000 (a population density of over 277,136/km) which makes it one of the most densely populated regions in the world

Owing to optimum conditions for the epidemic outbreak and impossible to implement social distancing norms in Dharavi, when the first case of COVID-19 was reported on 1st. April 2020, there was fear that the epidemic will spread like fire in the bush. Fortunately, the provincial government and the city administrators took proactive, swift, and coordinated measures to prevent the epidemic outbreak. The city municipality, Brihanmumbai Municipal Corporation (BMC), played a central role in that. The first fever clinic was set up just three days after the first case. Dharavi was given a priority over other city parts, and 2,450 government health workers were engaged for it alone. Additionally, private medical practitioners, social activists, community leaders, and non-governmental organizations (NGOs) were roped to battle the epidemic at war footing. Basic epidemic control training to grass-root level health workers was given, and personal protective equipments (PPEs) were availed to all engaged personnel. Regular sanitization of all community places, including community toilets, was done. Large community quarantine centers were established. A vigorous approach of tracing, tracking, testing, and treatment was applied to limit the spread of the epidemic. Initially, door to door screening was done, and later community clinics were set up where residents could approach for screening and testing. Senior citizens were given special attention. Most of the symptomatic cases were treated at the community centres alone, and only critical patients were referred to the city hospitals. The investment was made in trust-building efforts to harness public support for ruthless containment measures. Strict lockdown was implemented, and at the same time, delivery of essential commodities was maintained.

No later, the concerted efforts made for the epidemic containment started paying. Although COVID-19 has severely affected the city and healthcare facilities have kept exhausted, a drastic improvement has been seen in Dharavi. The growth rate of positive cases, which was 12% in April 2020, reduced to 4.3% in May 2020 and to 1.02% in June 2020.

Recently WHO has applauded the success of Dharavi, Effective containment of the epidemic in Dharavi has set an example and has raised hope that with proactive and multi-pronged approaches, COVID-19 spread can be contained in even the areas with the poorest socio-economic conditions and with negligible health infrastructure. Some of the other examples are those in Italy, Spain and South-Korea,

To address the present pandemic and improve the quality of life of the slum residents, re-development of slums and local economic development assume significance. It calls for re-oriented approach in urban planning, infrastructure development and creation of local employment opportunities under Smart City program. Simultaneously, proactive and urgent action in addressing the immediate deficiencies, engaging the people and roping in NGOs and the private sector are equally important.

6.2 Implication and value

This paper provides a base for urban planners to further research on effective re-development of slums. The practitioners can assess and identify the urgent need to improve slums and examine the options to re-orient Area Based Development as part of Smart City. The study findings are especially relevant for most developing countries.

6.3 In sum

In nutshell, it is shelter, basic civic infrastructure, environmental safeguard, public health facilities and hygiene awareness that need to constitute the focused parameters for Smart City as evident from the impact on city slums caused by the novel corona virus pandemic. Thus, city planners and managers of smart cities would require to relook at the approach for city development, especially slum improvement, to make a city truly smart in the real sense.

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