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Industrialisation and Accompanied Urban Fabric: Case Studies of Asian Cities

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Abstract

Industrialisation has been identified as the mechanism by which the necessary increase in capital accumulation and investment rates takes place, enabling the shift to self-sustaining development. This broadly accepted theory of the function of industrialisation focuses on the national framework and the expanding economic sectors. On the other hand, it is also measured in ways other than through national economic indicators. It is both a cause and a result of urbanisation. This paper begins by examining the inception of industrialisation and its subsequent expansion throughout the continent, ultimately proliferating globally. This study strives to provide appropriate information about how the development of industrial sectors affects the urban fabric and, as a result, influences the planning road maps of the authorities, driven by certain significant case studies from various countries.

Keywords

Industrialisation, Self-sustaining development, Economic Sectors, Urbanisation, Urban Fabric.

Introduction

Industrialisation, primarily an expansion of the manufacturing sector, is credited with boosting overall urban and economic growth (Szirmai, 2012) and is considered to present prospects for capital accumulation and scale economies (Szirmai & Verspagen, 2015). Manufacturing businesses in many developing nations produce job prospects attributing to lowering the unemployment rate (Nazem et al., 2014). The manufacturing sector has essential connections and spillover effects (Guerrieri and Meliciani, 2005; Szirmai & Verspagen, 2015). Urban industrialisation, particularly manufacturing, is a significant factor in the booming urban economy and population.

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There is a growing concern over industrialisation-induced urban development in developing countries (Henderson, 2002). However, in city strategies, economic growth frequently takes precedence over its negative effects. In order to compete in the global market, most essential industries in developing nations are export-oriented and produce low-value-added jobs with low pay (Checkland, 1981; Myint et al., 2015). As a result, apart from creating jobs, the industrialisation and the economic progress have little positive impact on workers' living standards, the quality of life in cities, or on the circumstances of the poor people. Environmental degradation and the loss of natural habitat are the two main side effects of the industrialisation process (Seto et al., 2012) and (Wu, 2014). Additionally, the infrastructure and utility services in suburban areas are strained by the urbanisation process.

The most likely sector affected by the industrial growth is the housing market. Due to their limited affordability, industry workers need affordable accommodation preferably near their employment location (Sultana & Nazem, 2020). To meet this requirement, substandard housing, such as slums, has been expanding in suburban regions. These settlements are typically untidy, unhygienic, and overcrowded (Islam et al., 2006). According to the bid-rent theory, consumers make various trade-offs to localise their resource usage more effectively. For instance, businesses that are adversely affected by limitations in the inner city may try to relocate outside the city to mitigate the effects, and affected households may move to other areas. Forcing growth onto nearby areas with lax regulation will negatively affect the original community's growth (Helsley and Strange, 1995). The land owners and the property developers can simply avoid the growth control restrictions imposed by the authorities by relocating their industrial units to the outskirts of the cities. Local government decisions regarding land supply and land use may further worsen the sprawling problem (Glaeser & Kahn, 2004; Kearsley, 1983; Pacione, 2009). This paper focuses on the specific context in which these events occur.

The Advent and Spread of Industrialisation

The beginning of industrialisation in Great Britain throughout the late 18th and early 19th centuries (1760–1840) was the key turning point in the history of human settlements. Europe's social, political, and cultural fabric underwent changes during the Industrial Revolution. The ordinary people of England were impoverished before the industrial revolution and deprived of basic amenities. (Mohajan, 2019). Mass movement from rural to urban areas was facilitated by the growth of varied industries, replacing the customary intimacy of rural life with impersonal coexistence. By the 1850s, Great Britain was the wealthiest country in the world following the outcomes of the Industrial Revolution (Deane, P. M., & Cole, W. A., 1962). An important historical phenomenon in the global context, the industrial revolution brought about the economic transition from an agrarian to an industrial economy, first in Europe and North America and subsequently spreading to the rest of the world. In Great Britain, several factors

coalesced to create the country's first industrial revolution. Initially, there was the agricultural revolution and a sharp increase in the urban population. Second, it had convenient access to finance and potential manpower from cottage industries. Thirdly, it possessed an abundance of natural resources, including iron ore for building tools, buildings, and machinery, waterpower, and coal for fuel. Fourth, Great Britain had shorter distances for transporting goods and services than other countries. Fifth, the People of England were well fascinated by wealth and commerce (Clark G, 2007; Deane and Cole, 1962).

However, the city growth remained unplanned, especially in the early decades of the industrial revolution. Massive manpower and infrastructure demand from industrial units resulted in the untamed rise of cities. People from rural areas flocked to industrial cities for the opportunity to work and gradually shifted from agricultural activities to manufacturing activities (Berlanstein, L. R., 1992). During that period, the cities were packed, and the workers faced homelessness, poor housing and sanitary conditions and sickness. They were forced to reside in dense slum zones close to the industrial plants to reach at their work places on time (Crafts, 1985). The cities grew without any development plans or building regulation codes. The testimony of the first industrial revolution is the indiscriminately growing population of the expanding cities of that time. Both the standard of living and population growth have altered significantly. The population of Europe upsurged from 100 million in 1700 to 400 million in 1900 (Murmman, J. P, 2003).

Throughout the 19th century, industrialisation moved at varying speeds and timeframes from Great Britain to continental Europe and America. Belgium, France, the German States, and North America were the first ones to industrialise and move up the value chain. The German States, Belgium, and France in 1815 were generally agrarian countries. British skilled labourers were crucial to Belgium's industrialisation. In order to create industries, Germany imported British engineers and machinery around 1835 (Veblen, T., 1915). Urban populations on the continent grew at a slower pace compared to Paris. Paris had 547,000 inhabitants in 1800, while the only other cities with a population of 100,000 were Lyons and Marseilles. In German and Austrian countries in 1800, there were only three cities with more than 100,000 people (Vienna had 247,000); fifty years later, there were only five, but Vienna had grown to 440,000.

Urbanisation and Industrialisation in Asian Countries

In 2018, the world's population was 7,632.8 million. Of which the majority lived in Asia, with 59.55 per cent (4,45.1 million), 16.87 per cent (1,287.9 million), and 9.73 per cent (742.6 million) living in each of Africa and Europe (UNDESA, 2018a & UNDESA, 2018b). However, despite having a low degree of urbanisation, Asia has the highest absolute number of people living in urban settlements due to its vast population (4,545.1 million) (See Table 1).

Table 1: Urbanisation Level of Asia in 2018

Sl. No.	Continent / Sub-Continent	Total Population		Urban Population		Urbanisation Level (in %)
		(in million)	(in %)	(in million)	(in %)	
	ASIA	4,545.1	59.55	2,266.1	53.70	49.86
1.1	Eastern Asia	1,653.9	21.67	1,039.8	24.64	62.87
1.2	South-Central Asia	1,963.3	25.72	710.9	16.85	36.21
1.3	Central Asia	71.9	0.94	34.6	0.82	48.18
1.4	Southern Asia	1,891.5	24.78	676.3	16.03	35.75
1.5	South-Eastern Asia	655.6	8.59	320.4	7.59	48.87
1.6	Western Asia	272.3	3.57	195.0	4.62	71.63

Source: Authors' Calculation. Data from UNDESA, 2018b.

The world's South Asian area is rapidly becoming more urbanised. A 2016 World Bank research states that South Asia, particularly Pakistan, India, and Bangladesh, have the highest proportion of rapidly urbanising areas. Undoubtedly, the world's population growth is becoming more problematic, particularly in Asia. However, there is also a belief that people are migrating from rural to urban areas in quest of better employment possibilities due to fast industrialisation. The South Asian area is the geographic centre for a group of emerging nations whose economies rely heavily on urbanisation. Asia's share of global industrial production increased ten-fold from a tiny four per cent to over 40 per cent indicating that the region's higher economic development resulted from a significant structural shift (Nayyar, 2019a).

Southeast Asia is in the centre, with South Asia often lagging in every way. South Asia's industrialisation also lagged. Manufacturing value added as a percentage of GDP more than quadrupled, growing at a moderate clip in Southeast Asia, quickly in East Asia, and sporadically in South Asia. The prosperous East Asian nations—Japan, the Republic of Korea, Taiwan, Singapore, Thailand, Malaysia, and China—underwent structural change in accordance with the traditional path, which led from agriculture to manufacturing or industry. On the other hand, South Asian economies, particularly those of India, Pakistan, Sri Lanka, Bangladesh, and a few other Southeast Asian nations, have shifted from being centred on agriculture to being dominated by services, eschewing the industrial sector.

Case Studies of Asian Cities

After industrialisation became the norm in Europe, it spread to other nations. It had a significant impact on both American and Asian countries. There are nations in Asia

where it had a detrimental effect on the urban fabric. In this paper, a study of some such Asian nations has been conducted. In these nations, as the industries thrived, the urban fabric around them also expanded, albeit haphazardly. Either some initiatives were taken to improve the accompanied urban fabric in these countries' industrial cities, or development was disregarded. Both such situations have been covered in the present paper. Osaka Industrial City of Japan, Jakarta Industrial City of Indonesia, Dhaka Industrial Development of Bangladesh, and Kanpur industrial city of India are the industrial cities and their surrounding territories that are further addressed here.

Osaka, Japan

Since Japan is the most prosperous nation outside the historical circle of Western culture to undergo modernisation, it has drawn particular attention from modernisation theorists. For a long time, the central questions in this field of study were whether Japan would modernise along similar paths to those of Europe and North America and if the social upheavals accompanying this process in the West would also occur there. Japan completed its modernisation during the last 25 years with fast, intense urbanisation and industry. When the Japanese decided to industrialise during the Meiji period, they did so with an emphasis on output first. Regarding how we define the process, Japan's industrialisation followed a similar general path to that of almost every other country that started its industrialisation in the 19th century. As has been the case worldwide, the Japanese chose to progress towards the modern industrial state through an early surge in population growth, which reversed a protracted period of informal demographic control that had been implemented during the latter half of the Tokugawa feudal period.

Even in 1920, with a population of roughly 56 million, Japan still possessed many of the demographic traits of a semi-industrialised, agrarian, and partly urbanised society: the majority of people lived in small towns and villages or the country, high-density urban areas were limited to the areas around Tokyo and Osaka. By 1970, the situation had drastically changed. In terms of square kilometres, the population density increased quickly, reaching 280 in 1970 from 191 in 1950. However, from 1970 onwards, there was a sharp increase as people moved from smaller towns and rural regions to larger centres. Out of the 103 cities, 44 had a population above 200,000, and 8 had a population exceeding 1,000,000; Tokyo's metropolitan area had a population over 11,400,000. Only two prefectures—Tokyo and Osaka—had more than half of their people living in cities in 1920; by 1940, five prefectures had reached this threshold; by 1960, thirteen had done so; and by 1970, fourteen.

Urbanisation in Japan increased sharply throughout the second part of the 20th century. Second, industrialisation has been a significant factor in Japan's urbanisation. Japan began to urbanise prior to World War II and picked up speed in the years that followed. From 37.3 per cent in 1950 to 76.2 per cent in 1980, its pace of urbanisation

more than doubled before slowing down in the 1980s and 1990s. The industrialisation level climbed by 43.5 percentage points while its urbanisation level increased by 41.4 percentage points between 1950–2000 (See Table 2).

Table 2: Urbanisation and Industrialisation in Japan

	1950	1960	1970	1980	1990	2000
Industrialisation	51.5	67.3	80.7	89.1	92.9	95.0
Urbanisation	37.3	65.2	72.1	76.6	77.4	78.7

Source: Japan Census 2000.

The Pacific Belt area, which generated 71–78 per cent of the country’s manufacturing output between 1909 and 1980, is greatly favoured by economic concentration in Japan (Sorensen, 2002). Even in the post-industrial era, the area continues to be dominant. In Japan, 61.5 per cent of the country’s population lived on 24.2 per cent of its land in 2000; in 2005, this area produced 67 per cent of the country’s GDP; and in 2006, it produced over 60 per cent of all job possibilities (Refer Table 3). Japan’s three most significant metropolitan areas (MAs)—Tokyo, Osaka, and Nagoya—are likewise located in this region. It is important to note that the economic concentration in the three main Metropolitan Areas has been further reinforced by two industrial transitions that occurred in Japan. The first movement in industrial restructuring occurred from the agriculture to the heavy and chemical sectors between the 1950s and the mid-1970s. Eleven million people had relocated into the three MAs at this time. The second shift, from heavy industry to high-tech and service sectors, began in the middle of the 1970s and lasted into the 1980s. Consequently, Tokyo transitioned swiftly from massive heavy industry to flexible, small-scale, high-tech businesses, establishing itself as a major hub for contemporary service, finance, and business sectors worldwide. The city even managed to draw headquarters from Osaka, Massachusetts (Takahashi & Sugiura, 1996).

Japan’s modern major cities possess many characteristics of an industrial town. Following the Meiji period’s modernisation, the combined forces of industrialisation and urbanisation propelled Japan’s major cities’ explosive growth. Economic activity has been centred in Osaka long before modernisation. Full-scale industrialisation began in Osaka during the Meiji period in the 1880s. Osaka gained a moniker called “the Manchester of the East” in the early 20th century due to its surpassing Tokyo-level industrial output, primarily from the textile industry. Osaka was a thriving industrial and commercial hub, boasting the greatest industrial production in Japan. The centre of this economic and industrial zone, the City of Osaka, underwent a merger process in 1897 that included other towns and cities that were part of the previous metropolitan region. As the number of enterprises using coal as a fuel rose quickly, soot damage spread, and Osaka’s air pollution was already a typical occurrence. “The City of Smoke” was the

moniker given to the city. Near the industries, workers' housing was constructed near, and land areas with a mix of industrial and residential uses were created. Nevertheless, because the neighbourhoods were densely populated and the homes were small, the living conditions were appalling.

Table 3: Economic and Population Concentration of Pacific Belt and Three Metropolitan Areas in Japan (*in per cent*)

	Area	Popula- tion	GDP	Number of Establish- ments	Employ- ment	Annual Sales
Year	2000	2000	2005	2006	2006	2003
Pacific Belt	24.2	61.5	67.0	59.6	59.3	61.2
Tokyo MA	3.6	26.3	31.8	24.2	22.4	22.5
Osaka MA	5.7	14.5	13.8	14.3	14.3	13.7
Nagoya MA	4.9	8.7	9.8	9.0	11.0	12.5
Sum of three MAs	14.2	49.5	55.4	47.5	47.7	48.7

Source: Japan Census 2000; Portal Site of Official Statistics of Japan (PSOSJ) 2009.

At the same time, private railway firms started developing the land for houses in the suburbs (near Osaka City), and upper-class individuals who loathed the pollution wanted to relocate there. Regions annexed to Osaka City all became industrially developed zones. Developed residential sectors near industrial sites were initially abandoned due to air pollution and environmental damage. Most of the industrial labour shifted to industrial areas of small and medium units producing less pollution. As a result of the implications, authorities shifted large-scale industrial sectors along with housing provisions to the outskirts. In addition, houses and apartments were constructed on the vacant land left by factories that had been closed or moved overseas. The second time cities, towns, and villages had been amalgamated, was in 1925 when Osaka absorbed the western and northern rural districts. A city having two million people called "Greater Osaka" emerged when the Osaka City region grew. Every single region that Osaka City absorbed, developed as an industrial zone. Workers flocked into these areas from different locations in western Japan, boosting Osaka's economy.

Dhaka, Bangladesh

Bangladesh has sharply increased its urban population in recent decades, similar to other developing nations. From 22.5 million in 1991 to 31.1 million in 2001 and then again to 56.8 million in 2011, the country's urban population has expanded (BBS, 2011). Over 50 per cent of the nation's urban population lives in the two major cities, Chittagong

and Dhaka, the capital. Thus, the degree of urbanisation varies greatly throughout these locations. Bangladesh's economy is significantly impacted by urbanisation, with over 60 per cent of the country's GDP coming from industries located in urban regions. Over the previous 20 years, there has been a noticeable increase in the urban population in Dhaka and Chittagong. In addition, plenty of unskilled labour jobs are available in the unorganised sector, accelerating the trend of urbanisation. Although Bangladesh's economy is mainly based on agriculture, other industries have also seen tremendous growth during the last 20 years. The nation's industrial backbone, encompassing several broad industries, including textile, manufacturing, construction, transportation, and communication, is still quite strong, and the service sector has proliferated.

While labourers in agriculture or cultivation are becoming fewer in number, industry is the primary driver of urbanisation in Dhaka. Consequently, the reasons for urbanisation have changed throughout the past few decades. Modern urbanisation has been sparked by industrialisation, which significantly increased urban production. It acts as a draw for individuals to relocate from rural to urban regions. Urbanisation levels correlate positively with industrial production (Xiaofei et al., 2014). The situation of the world economy has a significant impact on how any region's urban structure is altered (Islam, 1996). For instance, Dhaka continues to be a significant hub for labour-intensive businesses in Bangladesh as a result of the world market for textile goods. While the overall population expanded by 35 per cent above 1991 levels, urbanisation increased by 18 per cent between 1991 and 2011 (See Table 4).

Table 4: Urbanisation Levels in Bangladesh

Year	Total National Population (in million)	Urbanisation Level
1991	106.31	21.11%
2001	124.35	25.01%
2011	142.31	39.91%

Source: BBS (Bangladesh Bureau of Statistics), 1991, 2001 and 2011.

The level of urbanisation of all the main cities expanded from 1991 to 2011, notably in Dhaka, Khulna, and Chittagong (Refer to Table 5). In all these three cities, the share of the population living in urban areas is significantly more than 50 per cent. But of the three, Chittagong has benefitted the most. Dhaka has been experiencing a similar set of development and city expansion during the past few years. For the case study locations, Konabari-Kashimpur suburban area of Greater Dhaka Region (GDR) was selected as it is the most recent and the only one to have grown from a wholly rural region to a suburban centre. It fulfils the ensuing requirements: (a) being in the rural-urban fringe area and (b) experiencing rapid population and industrial employment growth. In the Konabari-Kashimpur region, there were 83 thousand residents in 1991; this number rose to 143 thousand in 2001; and 408 thousand in 2011. Between 1991

and 2001, the population grew at a 5.59 per cent per year pace, rising to 11.03 per cent between 2001 and 2011.

Table 5: Urbanisation Levels of Major Cities Compared to the Surrounding Region

City	1991	2001	2011
Dhaka	88.16	91.53	93.18
Chittagong	22.45	51.13	63.23
Rajshahi	27.94	37.01	38.26
Khulna	50.09	53.98	70.73
Barisal	14.99	16.75	18.44
Sylhet	15.44	16.96	17.56

Source: BBS (Bangladesh Bureau of Statistics), 1991, 2001 and 2011.

In comparison to the average regional (GDR) growth rate (4.1% annually), the growth rate in the case site was extremely high (Nazem et al., 2014). Population densities increase with rapid expansion, as evidenced by the rise in population density per square kilometre from 1,587 in 2001 and 4,518 in 2011. The research indicates that because there are more negative externalities in the inner metropolitan area, labour-intensive and specialised companies have been migrating to the surrounding suburban areas or the periphery of cities to take advantage of large land parcels and minimal laws. However, without controls and oversight, the relocation of such massive corporations has negative social and environmental repercussions in suburban and rural areas. The research outlines how the industrialisation has resulted in rapidly growing suburban areas that need low-class, affordable housing.

Jakarta, Indonesia

With the fourth largest population globally and the largest economy in Southeast Asia, Indonesia has had an unusual industrial and economic past. Its contemporary industrialisation process began in the mid-1960s. Since 2000, most of Indonesia's industrial activity has been concentrated geographically on the islands of Sumatra and Jawa. Jawa's superiority is primarily due to the manufacturing sector. Most of Indonesia's contemporary industrial facilities (approximately 81–83%) are still concentrated on the Jawa and Sumatra islands to a much lesser extent (Kuncoro, 2007). Even if we divide all of Indonesia's provinces into the country's five major islands—Java and Sumatra, Kalimantan, Sulawesi, and the Eastern Islands—more than 90 per cent of the country's manufacturing jobs (and value-added) during that time came from these two islands (Kuncoro, 2012). From 179.4 million in 1990 to 255.5 million in 2015 (See Table 6), the population of Indonesia has grown (BPS, 2012; 2016). However, there was no corresponding increase in the population's geographic spread.

Table 6: Population Growth of Indonesia

S.No.	Year	Population (in million)
1	1990	179.4
2	1995	194.8
3	2000	206.2
4	2010	237.6
5	2015	255.5

Source: BPS, 2012.

After Indonesia's fast development in the 1970s, the country saw a massive surge in urbanisation. Since then, rural-urban migration has been the leading cause of Indonesia's high pace of urbanisation. 15 per cent of Indonesians were urban dwellers in 1950. Industrialisation has emerged as the primary cause of Indonesia's increasing urbanisation between 1960 and 2014. Indonesia's rate of urbanisation rose from 15 per cent in 1960 to 53 per cent in 2014. Urbanisation and industrialisation are trending positively, as seen by the positive association between the two. In other words, urbanisation and industrialisation have a positive correlation, and vice versa. Central Jawa, East Jawa, DKI Jakarta, and Bali are highly industrialised and densely inhabited provinces.

The expansion of Jakarta's central business district has also led to a migration of low-income residents and industries to the city's outskirts. The author investigated how globalisation affected physical land usage, resulting in a fast suburbanisation of residential and industrial areas. Jakarta's dilemma is typified by the typical suburbanisation spread along development corridors that go beyond the Master Plan's boundaries. The development initiatives that have resulted in the construction of numerous new towns and industrial estates have involved both the public and private sectors. As a result, more profitable and intensive land usage took their place, potentially displacing the conventional urban communities. Initially, weak private housing development in Indonesia was triggered by oil sector industries. People started investing and playing in the property markets in suburban areas (Charles Goldblum & Tai-Chee Wong, 2000). Its preferred development area extends beyond the administrative boundaries of the Jakarta Special Region to include the neighbouring districts of Botabek, Bogor, and Tangerang. The scale of development varies, ranging from the sale of residential lots covering hundreds of hectares to the construction of new towns covering thousands of hectares. In the Bekasi District alone, there were 235 private home development projects between 1991 and mid-1992. In addition, the neighbouring districts surrounding Jakarta were overrun by the migratory influx of middle-class and upper-class residents living in urban villages like Kampung and core regions. Property values have increased because of the movement caused by industrial dispersal from the city centre to the new towns in the suburban areas.

Kanpur, India

The Industrial Commission, which examined India's industrial development and released its findings about 25 years ago, concluded that its industrial growth was required to meet its needs and resources. In the following years, Indian industries like cotton textiles, iron and steel, paper, and so on saw enormous growth. The cotton textile sector holds the top spot in India's industrial life. Three hundred ninety mills were operating in 1941, with an average of around 4.5 lakh people employed. Before the invention of machine industries, India's cotton and silk products dominated the global textile industry. In India, the British started bringing tea from China to England and selling opium to China. Numerous Indians entered commerce as minor participants, lending money, acquiring goods, and transporting shipments. Having profited from trading, several of these businessmen had the ambition of creating industrial firms in India. Large industries comprised a modest portion of the economy, even if they expanded after the World War I. There were 584,000 employees in Indian factories in 1901. By 1946, the total was above 2,436,000. Workers in most industrial areas were residing within the residential areas.

Kanpur has grown from a small town to a significant industrial hub in less than a century, making it a relatively new city. It is a superb illustration of an urban agglomeration founded on India's contemporary industrial boom. The East India Company chose Kanpur as a military post along the boundary between the British and Oudh territories because it was drawn to the steep, slightly concave high bank of the Ganga and its permanently navigable canal. Numerous industrial companies were established in Kanpur during the first period (1857–1900). The Elgin Cotton Spinning and Weaving Company Ltd., the first cotton mill in Kanpur was established in 1860 (S.N. Singh, 1990). The earlier-established industry was consolidated during the second phase (1901–1947). The industrial belt that had previously occupied the riverfront zone in the north gradually moved to the south. During the third phase (1948–present), under strict government control, a planned, balanced, and swift industrialisation process was initiated in the state to meet the national purpose and goal. Non-traditional industries were supported at this time. Between 1940 and 1965, there were 827 new units registered with the Industries Office Directorate; only 192 of them were for manufacturing traditional products, with the remaining 635 being for manufacturing non-traditional items. There were 273 officially recognised factories in the city in 1953, employing 68,832 people (Singh, 1990). This area was home to almost every kind of factory, with textile, ammunition, leather, iron and steel, chemical, metal and mineral, engineering, food, and tobacco being the primary industries. The government's industrial policies caused the pace of industry growth to remain relatively modest throughout the third phase, and the structure of industrial development also saw substantial changes. Small and medium-sized units rose in number and significance while replacing large-scale units.

Accompanied Urban fabric- Developed Labour Colonies

The need for housing industrial labourers was felt acutely in Kanpur due to the growth of the city's industries and labour force, and efforts were made to house the majority of workers in labour quarters constructed by the companies or other organisations. Historically, there have been three stages in creating these work quarters: the early labour colonies built before 1919, the Improvement Trust and Employers' labour colonies built after 1919, and the government-built labour colonies around 1950. The village had 805 quarters spread across 26.1 acres. By 1912, the Sisamau and Ghusaramau region, which was bounded by the G.T. Road, Benajhabar Road, Hamirpur Road, and Ganga Canal, had grown to include several more colonies, and the area was largely occupied by workers' quarters. A committee to expand the town was established in 1913, and after the end of World War I, it produced a report detailing the living circumstances of workers and their dwellings. The Municipal Board Annual Reports for 1908–09 and 1910–11 show that the city's hygienic standards declined due to the growing industrial boom and labour force.

Government and Improvement Trust and Employers' Labour Colonies

In 1919, the Kanpur Improvement Trust was established to facilitate the city's planned growth. The Improvement Trust introduced several new plans for the city's planned development. In 1923, the plans were altered to include the development of 1,000 acres for public construction uses along Kalpi Road, also known as the manufacturing area—private companies constructed residential quarters for workers in the plant region, housing a sizable labour force. In early 1933, the Improvement Trust built four blocks of labourers' cottages in Khalasiline, which it later turned over to the Elgin Mills. Similarly, more industries were given land to build labour quarters. Six sizable labour colonies came up, each housing around 8,365 people in 2,672 quarters of varying sizes and grades and often consisting of one or two rooms. A significant portion of the city's population, primarily industrial workers, sought refuge in Ahatas, which eventually converted into slums. The Improvement Trust adopted a plan to clear some of these areas and provide new quarters for the slum dwellers in a portion of those areas. The Improvement Trust was succeeded in September 1945 by the Development Board, which established water and sewer facilities in new labour colonies and connected these to floating buses to increase income.

The State government took significant and quick action to ameliorate the housing facilities for industrial workers. Numerous large colonies were built, including those at Babupurwa, Juhi, Benajhabar, and ancient Kanpur. By offering loans and other financial assistance to the needy poor labourers to build dwellings in the labour colonies at Kanpur, the state government actively contributed to solving the housing crisis. During 1949, 104 quarters in the waterworks and 258 quarters in Gutaiya were built for labourers. The largest of these colonies is Armapur Estate, which has 26 per cent of the quarters and houses roughly 25,000 people in double-story quarters.

Babupurwa comes in second place with 3,390 quarters, housing around 15,000 people; the most prosperous colony is Jajmau Labour Colony, sometimes called Jay Kay Puri Colony, with 1,224 double-story quarters housing about 7,500 people. In addition to these colonies, over 18,000 people have been placed in Kidwai Nagar, which has 3,000 quarters, Nawabganj, a labour colony with 1000 quarters, and Civil Lines, a work colony with 300 quarters (Majumdar, et al., 1960).

Conclusion

This paper has demonstrated that manufacturing industrialisation has quickly expanded suburban areas that demand low-class and affordable housing, motivating private landowners or individuals to create communities akin to slums. Workers are moving to these suburban areas because of low living expenditures, the proximity of the workplace to the place of residence, and the high labour demands brought on by the continuous expansion of industry. Companies and individual private housing developers are subject to the bare minimum of regulatory regulations because they are outside the planned area. Therefore, they take advantage of the environment and workers for financial gain. Without any doubt, government action is required, and it should always take the lead in procedures involving planned urban growth. In order to prevent unwanted growth, the government must make sure that a regional strategic plan permits future industrial growth.

References

- Bangladesh Bureau of Statistics. (1991). Bangladesh Population Census. BBS, Dhaka: Ministry of Planning.
- Bangladesh Bureau of Statistics. (2001). Bangladesh Population Census. BBS, Dhaka: Ministry of Planning.
- Bangladesh Bureau of Statistics. (2011). Bangladesh Population Census. BBS, Dhaka: Ministry of Planning.
- Berlanstein, L. R. (Ed.). (1992). *The Industrial Revolution and Work in Nineteenth Century Europe*. London and New York: Routledge.
- Birla, G. D. (1944). Industrialization in India. *The ANNALS of the American Academy of Political and Social Science*, 233(1), 121–126. doi:10.1177/000271624423300118
- BPS. (2012). Penduduk Indonesia menurut Provinsi 1971, 1980, 1990, 1995, 2000 dan 2010 [Indonesia Population based by Provinces 1971, 1980, 1990, 1995, 2000 and 2010]. Retrieved from http://www.bps.go.id/tab_sub/view.php?kat=1&tabel=1&daftar=1&id_subyek=12¬ab=1.
- BPS. (2016). Berita resmi statistik [Official statistic news]. No. 101/11/Th.XIX, 7 November 2016, Jakarta: BPS.
- Checkland, S. G. (1981). The new international division of labour: Structural unemployment in industrialised countries and industrialisation in developing countries. *Journal of Economic Literature*, 19(3), 1091–1093.

- Clark, G. (2007). *A Farewell to Alms: A Brief Economic History of the World*. Princeton University Press.
- Crafts, N. F. R. (1985). *British Economic Growth during the Industrial Revolution*, New York: Oxford University Press.
- Deane, P. M., & Cole, W. A. (1962). *British Economic Growth, 1688–1959*. Cambridge University Press, England.
- Glaeser, E. L., & Kahn, M. E. (2004). Sprawl and urban growth. *In Handbook of Regional and Urban Economics* 4, 2481–2527 Elsevier.
- Guerrieri, P., & Meliciani, V. (2005). Technology and international competitiveness: The interdependence between manufacturing and producer services. *Structural Change and Economic Dynamics*, 16(4), 489–502.
- Helsley, R. W., & Strange, W. C. (1995). Strategic growth controls. *Regional Science and Urban Economics*, 25(4), 435–460.
- Henderson, J. V. (2002). Urbanisation in developing countries. *The World Bank Research Observer*, 17(1), 89–112.
- Islam, N. (1996). Dhaka: From City to Megacity, Perspectives on People, Places, Planning and Development Issues. Urban Studies Program. Department of Geography, University of Dhaka.
- Islam, N., Angeles, G., Mahbub, A., Lance, P., & Nazem, N. I. (2006). Slums of urban Bangladesh: Mapping and census 2005. Centre for Urban Studies, National Institute of Population Research and Training, and MEASURE Evaluation.
- Japan Census. (2000). Final Report of the 2000 Population Census, Statistical tables presented in the report. <http://www.estat.go.jp/SG1/estat/ListE.do?bid=000000030587&cycode=0>.
- Kearsley, G. W. (1983). Teaching urban geography: The Burgess model. *New Zealand Journal of Geography*, 75(1), 10–13.
- Kuncoro, M. (2007). *Ekonomika industri Indonesia: menuju negara industrial baru 2030?* [Industrial economics of Indonesia: towards a new industrial nation 2030?], Yogyakarta: ANDI Offset.
- Kuncoro, M. (2012). *Perencanaan daerah: bagaimana membangun ekonomi lokal, kota, dan kawasan* [Regional planning: how to develop local economy, cities and zones], Jakarta: Salemba Empat.
- Mohajan Haradhan Kumar. (2019). The First Industrial Revolution: Creation of a New Global Human Era; *Journal of Social Sciences and Humanities*. 5(4), 377–387.
- Majumdar D.N. (1960). assisted by N.S. Reddy, S. Bahadur and a field team: *Social Contours of an Industrial City*. Social survey of Kanpur, 1954–56.
- Murmann, J. P. (2003). Knowledge and Competitive Advantage: The Coevolution of Firms, Technology, and National Institutions. *Journal of International Business Studies*, 35, 560–563.
- Myint, M. M., Rasiah, R., & Singaravelloo, K. (2015). Globalization of industrialization and its impact on clothing workers in Myanmar. *Journal of the Asia Pacific Economy*, 20(1), 100–110.
- Nayyar, Deepak. (2019a). *Resurgent Asia: Diversity in Development*, Oxford, and New Delhi: Oxford University Press for UNU/WIDER.
- Nayyar, Deepak (2019b) *Asian Transformations: An Inquiry into the Development of Nations*, Oxford: Oxford University Press for UNU/WIDER.

- Nazem, N. I., Chowdhury, A. I., & Hossain, M. A. (2014). Cities in Asia Pacific and Latin America: Case study on Dhaka, Bangladesh.
- Pacione, M. (2009). Urban geography: A global perspective. Routledge.
- Portal Site of Official Statistics of Japan (PSOSJ). Regional Statistics Database. <http://www.e-stat.go.jp/SG1/chiiki/CommunityProfileTopDispatchAction.do?code=2>
- Singh S.N. (1990). Planning and Development of An Industrial Town: *A Study of Kanpur*, ISBN 81-7099-241-9
- Seto, K. C., Güneralp, B., & Hutyra, L. R. (2012). Global forecasts of urban expansion to 2030 and direct impacts on biodiversity and carbon pools. *Proceedings of the National Academy of Sciences*, 109(40), 16083–16088.
- Sorensen, Andre. (2002). The Making of Urban Japan: Cities and Planning from Edo to the Twenty-First Century. London: Routledge.
- Sultana, S., & Nazem, N. I. (2020). Housing affordability of readymade garment workers in the Dhaka metropolitan area. *Environment and Urbanization ASIA*. <https://doi.org/10.1177/0975425320938581>
- Szirmai, A. (2012). Industrialisation as an engine of growth in developing countries, 1950–2005. *Structural Change and Economic Dynamics*, 23(4), 406–420.
- Szirmai, A., & Verspagen, B. (2015). Manufacturing and economic growth in developing countries, 1950–2005. *Structural Change and Economic Dynamics*, 34, 46–59.
- Takahashi, Junjiro, and Noriyuku Sugiura. (1996). “The Japanese Urban System and the Growing Centrality of Tokyo in the Global Economy.” In *Emerging World Cities in Pacific Asia*, ed. Fu-chen Lo and Yue-man Yeung, 101–143. Tokyo: United Nations University Press.
- United Nations Department of Economic and Social Affairs [UNDESA]. (2018a). *World Urbanization Prospects: The 2018 Revision (ST/ESA/SER.A/420)*. United Nations. <https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf>.
- United Nations Department of Economic and Social Affairs [UNDESA]. (2018b). *World Urbanization Prospects 2018*. <https://population.un.org/wup/Download/> [accessed on 15.04.2021]
- Veblen, T. (1915). *Imperial Germany and the Industrial Revolution*. Kitchener, Ontario: Batoche Books.
- Wu, J. (2014). Urban ecology and sustainability: The state-of-the-science and future directions. *Landscape and Urban Planning*, 125, 209–221.
- Xiaofei Li., Raymond J., G.M. Florax., Brigitte S. & Waldorf. (2014). Agricultural Productivity and Urbanization: A Smooth Coefficient Regression Analysis. Selected Poster prepared for presentation at the Agricultural & Applied Economics Association’s 2014 AAEA Annual Meeting. Minneapolis, MN.

Fiscal Consolidation of Local Urban Bodies in India: Review and Reforms for Institutional Resilience

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Abstract

As an essential pillar of the urban institutional infrastructure, municipal corporations are indispensable in providing local public service delivery and organisation. Their efficient functioning is imperative in an era of rapid urbanisation and large scale rural to urban migration which pressurises the institutional capabilities of metropolitan cities. This paper is an attempt at investigating the fiscal challenges that plague the functioning of municipal corporations in India and estimates their performance through reports of the 15th Finance Commission and national level indexes such as the Municipal Performance Index 2020. Existing challenges in the domain of municipal finance, operational efficiency and service delivery are identified along with the fiscal reforms undertaken by municipal corporations in India to overcome them. The study emphasises the urgent need for financial self-sufficiency and economic resilience¹ of municipal corporations to achieve the United Nations Sustainable Development Goals and overcome modern challenges.

Keywords

Urban Local Bodies, Municipal Corporations, Public Finance, Urban Economics, Local Self-Governance.

Introduction

Local self-governance institutions play a pivotal role in effectuating the welfare functions of the state and are an essential pillar of modern governance. The 73rd and 74th Constitutional Amendment Acts of 1992 established local self-governance institutions on the recommendations of several advisory committees. Even before India's Independence from the United Kingdom, these institutions were in operation in decentralised forms and represented the modernising elements in the Indian urban life

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(Aijaz, 2007). The Madras Municipal Corporation was the oldest municipal corporation under the British in 1688, and its duties became defined by 1856 to include delivery of public services, maintenance of law and order and simplification of tax revenue administration.²

In the modern context, urban local bodies are units of self-governance and counterparts of the rural Panchayati Raj system. Their functioning represents the collective needs of the urban population and indicates the extent of urbanisation and efficacy of the institutional infrastructure (Bandyopadhyay & Sharma, 2020). As Class 1 cities/urban agglomerations in India (with a population of 1,00,000 and more) expand to 298 cities and 170 towns, with 53 metropolitan cities having a million plus population³, their fiscal management assumes utmost importance as the backbone of their developmental endeavours. Despite their powers and functions under the Constitution of India, they lag behind in their operations due to a dearth of commensurate revenue resources and inefficient fiscal management (Mohanty et al., 2007; Aijaz, 2007; Abraham, 2013; NIUA, 2015; Ahluwalia et al., 2019; MoHUA, 2021; Verma et al., 2022). While socio-economic development has expanded their responsibilities and stretched their existing capabilities, the requisite accommodation in the form of rapid capacity enhancement and upgradation of the fiscal apparatus has not been forthcoming in most urban bodies (Aijaz, 2007; Mohanty et al., 2007; NIUA, 2015; Ahluwalia et al., 2019; MoHUA, 2021; Jha, 2022). This can decelerate the pace of developmental outcomes of government schemes and result in institutional lethargy. Longstanding shortcomings were further exaggerated post the introduction of the Central Goods and Services Tax Act in 2017 which inadvertently affected the revenue generation capabilities of municipal bodies due to deep structural changes that initially curtailed their revenue sources without adequate alternate compensation (Ahluwalia et al., 2019; Chakraborty, 2021; MoF, 2021). Rapid urbanisation coupled with rural to urban migration is causing great stress to cities. Mega-cities such as Delhi, Mumbai and Kolkata experience acute problems including traffic congestion, housing scarcity and inadequate provision of public goods as new infrastructure development is outstripped by demand, while pollution and environmental degradation are other negative externalities of such mobility and growth (UN DESA, 2018). According to the Global Metro Monitor 2018 report by the Brookings Institution, the 300 largest cities in the world were responsible for half of the global production despite accounting for only a quarter of the labour force in 2016. As engines of economic growth and output generation, these cities offer several pull factors which amplify their infrastructural concerns (UN DESA, 2018; MoHUA, 2021).

With grants of Rs. 4,36,361 crores being recommended for local governments by the 15th Finance Commission for 2021-2026, existing drawbacks and sources of drain due to financial mismanagement need to be quickly rectified to fully utilise the resources (MoF, 2021). Financial resilience of urban bodies is further necessitated in light of the possibility of unanticipated shocks like the 2019 coronavirus outbreak in the future and the potential fallout on urban infrastructure. This paper is an attempt to consolidate the concerns in the fiscal management of urban local bodies with an emphasis on municipal

corporations, so that the 206 Municipal Corporations and 1683 municipalities⁴ in India may fully deliver on their mandate under the Constitution of India.

Problem Statement

The performance of municipal corporations is dependent on key financial aspects such as devolution of resources and grants from the Central government and states, capacity to raise own revenue through taxation and fees, use of debt, etc., as well as on institutional organization and efficiency to utilise the available funds (Aijaz, 2007; Mohanty et al., 2007; Bahl et al., 2013; Abraham, 2013; NIUA, 2015; MoHUA, 2021). Most municipal corporations in India are facing constraints in their working, and a concise assessment of their problems is imperative for urban economic development. The paper utilises the 15th Finance Commission report and the National Institute of Public Finance and Policy's working paper titled '*COVID 19 Context and the Fifteenth Finance Commission: Balancing Fiscal Need and Macroeconomic Stability*' to study these limitations. The Reserve Bank of India's report '*Municipal Finance in India: An Assessment*' is a deep source of knowledge on municipal finance. An analysis of the publication '*Finances of Municipal Corporations in Metropolitan Cities of India*' by the Indian Council of Research on International Economic Relations (ICRIER) has provided rich insights on the existing challenges and trends. '*The Municipal Performance Index (MPI) 2020*' report by the Ministry of Housing and Urban Affairs and the Institute for Competitiveness measures the performance of 111 municipal corporations in India across five verticals including services, finance, policy, technology and governance. It is a valuable source that quantifies the parameters and enables comparisons.

Research Methodology

The paper utilises secondary qualitative research conducted by government departments, international bodies and independent organisations. The 15th Finance Commission recommendations have been keenly studied to understand the possible course of actions that government departments may take in the future.

Results and Discussion

Municipal Corporations and their Existing Challenges

As per the advance estimates, the India's GDP is projected to expand at a rate of seven per cent in 2025.⁵ Apart from the contribution of agriculture, much of this growth will take place in urban agglomerations. According to the UN, an urban agglomeration is "a contiguous territory inhabited at urban density levels without regard to administrative boundaries."⁶ Metropolitan areas, on the other hand, do have rigid boundaries in terms of their legal and administrative jurisdiction (Mohanty et al., 2007). In India, the principal local urban bodies are the municipal corporations, municipal councils and nagar panchayats.

Municipal corporations are established in cities with a population of more than one million, and are responsible for their efficient governance. Although the Constitution envisaged Metropolitan Planning Committees for these bodies, most state governments did not develop the legislation for their creation and the development planning is undertaken by bureaucrat-led development authorities created by the state governments (Mohanty et al., 2007). The friction between the development authorities, the elected urban government and parastatal bodies that are the extension of the state government for specific provisions (e.g., the District Rural Development Agency) leads to lack of responsibility and coordination.

The fiscal resources available with them are insufficient and their ability to raise own revenue is limited. According to ICRIER's report "*Finances of Municipal Corporations in Metropolitan Cities of India*", own-source revenue of 37 municipal corporations in India declined from 0.33 per cent of the gross domestic product in 2012-13 to 0.23 per cent in 2017-18. As a share of their total revenue, it declined from 67.3 per cent in 2012-13 to 51.6 per cent in 2017-18 (see Figure 1). Introduction of the Central Goods and Services Tax abolished local taxes such as octroi, entry tax and advertisement tax, and local bodies could not adequately compensate through other means. The share of "local taxes other than property tax" has sharply declined from 22 per cent of the municipal revenue in 2012-13 to 8.5 per cent in 2017-18, and property tax has assumed renewed significance as the single largest source of own municipal revenue in most municipal corporations. Abolition of octroi, which is a tax on goods entering the city for sale, use and consumption, has affected the revenues of the municipal corporations that depended on it. In Mumbai, the total "other tax revenue" declined by 20 per cent in 2017-18 in comparison to 2016-17 due to the abolition of octroi. Entertainment tax is still levied but grossly under utilised, and constitutes only around one per cent of the revenue of municipal corporations. Professions tax is not adequately utilised either by most cities including Mumbai and Bengaluru.

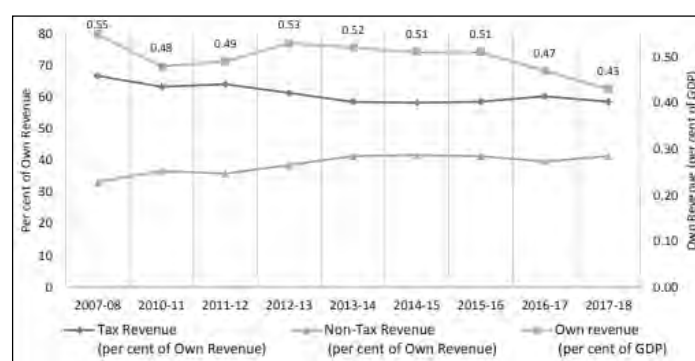


Fig. 1: Municipal Tax Revenue, Non-Tax Revenue and Own Revenue.

Source: Indian Council of Research on International Economic Relations (ICRIER).

Note: Vertical axis plots the own revenue as percentage of GDP. The horizontal axis plots the tax and non-tax revenue as percentage of own revenue and own revenue as a per cent of GDP. Tax revenue as a per cent of own revenue has shown a marginal decline, while non-tax revenue (consisting majorly of state transfers) has steadily risen over the years. Own revenue as a per cent of the GDP has steeply declined.

The ability of municipal corporations to manage their own finances is crucial for their administrative autonomy and accountability, but they are highly dependent on fund transfers from state governments and the Central government to meet their expenses (Aijaz, 2007; Mohanty et al., 2007; Bahl et al., 2013; Abraham, 2013; NIUA, 2015; Ahluwalia et al., 2019; MoHUA, 2021). This impacts their independent functioning and subjects them to political influence from other tiers of the government. Most state governments have unfavourable fiscal management with high deficits and liabilities and are unable to devolve resources to urban local bodies as per the recommendations of the State Finance Commissions (SFCs), which are not constituted regularly (Aijaz, 2007; Mohanty et al., 2007; Abraham, 2013; Ahluwalia et al., 2019; Verma et al., 2022). Ironically, some states have in place ceilings on property tax rates in urban areas which defeats the purpose of decentralisation by limiting growth of own source municipal revenues. Delays in revaluation of property according to market rates and updating tax rolls adversely affect property tax collection (Mohanty et al., 2007; NIUA, 2015; Ahluwalia et al., 2019). The numerous exemptions accorded to religious bodies, charitable institutions and public properties further impose a high administrative burden on municipal corporations. Realisation of user charges and fees for public services is extremely poor despite the ability to pay due to a lack of willingness, political populism and poor quality of services (Ahluwalia et al., 2019). These factors severely restrain the ability of Municipal Corporations to increase own-source municipal revenue requiring urgent correction.

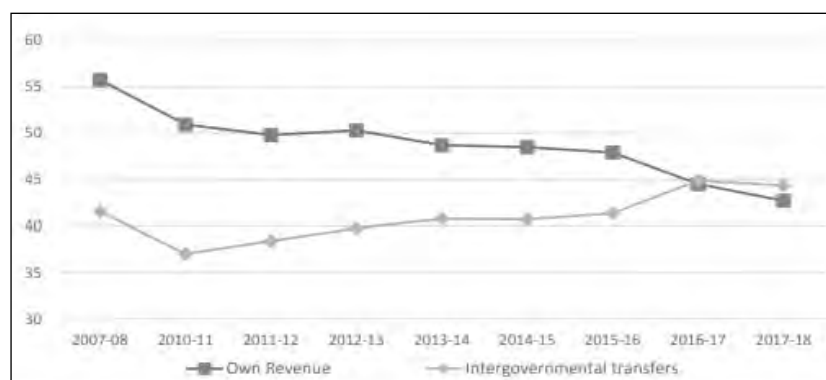


Fig. 2: Municipal Own Revenue and Intergovernmental Transfers.
(As a percentage of the Total Municipal Revenue)

Source: Indian Council of Research on International Economic Relations (ICRIER).

Note: Own Revenue as a per cent of Total Revenue has continuously declined while revenue from governmental transfers has risen to surpass it in 2016-17.

Most municipal corporations have low borrowings from market sources and under-utilisation of debt instruments, with ample scope of raising resources through the debt market by issuing municipal bonds like the developed countries of Europe and America (Mohanty et al., 2007; Bahl et al., 2013; Ahluwalia et al., 2019; MoHUA, 2021).

However, almost all municipal Acts in India impose restrictions on urban bodies taking on debt. Borrowing also requires the previous sanction of state governments and only 13 municipalities having a million plus population in India can borrow and invest funds without state approval.⁷ Certain cities such as Amritsar, Patna, Guwahati and Rajkot have low credit ratings which impact their ability to borrow. Revenue expenditure of municipal corporations is 63 per cent of their total expenditure (Ahluwalia et al., 2019), and such a high share implies that fiscal resources are being further expended on establishment and administrative requirements instead of productive expenditure towards capital formation. Few municipal bodies have revenue surpluses that can be utilised for capital formation (MoHUA, 2021; Verma et al., 2022). There also exists a persistent regional bias in terms of the overall performance of municipal corporations in India (Aijaz, 2007; Mohanty et al., 2007; Ahluwalia et al., 2019; MoHUA, 2021). According to the Municipal Performance Index 2020, municipal bodies of southern states outperform those of northern states, with all their million plus Municipal Corporations ranking in the top 30 while no city in the North of India features among the top 10 Municipal Corporations. The north eastern states have the fewest municipal corporations and the lowest rankings across all verticals in the index, while central India consists of both the highest and lowest performing bodies. The Indore Municipal Corporation is the top performing corporation under the “Finance” vertical of the MPI 2020 in the million plus cities category while Guwahati is at the bottom of the ranking.⁷

The top performing states under the “Finance” vertical of the report have performed well in their overall scores as well. Finance also has a positive correlation with the general governance of cities and availability of health and education services. For many million plus municipalities such as Greater Mumbai, Hyderabad and Bengaluru, capital expenditure is low and municipal activities are labour intensive. Hence there is considerable scope for improving the quality of expenditure by these bodies and rationalisation of the number of personnel. There is a need to improve financial accountability, as less than half of the municipalities participating in the index conducted internal and external audited accounts for financial years 2017, 2018 and 2019. Fiscal resources available with urban local bodies need to be raised to match with the resources available in other countries such as United States, Canada, Brazil, etc. (Mohanty et al., 2007; Aijaz, 2007; Bahl et al., 2013; Ahluwalia et al., 2019). Use of public-private partnerships for infrastructural development that transfer risk from the government to the private entities can be further promoted, and while many urban bodies levy education cess, development cess and drainage cess as well as minor taxes, the revenue yielded through such measures is insufficient and can be expanded (Mohanty et al., 2007; Abraham, 2013; Ahluwalia et al., 2019).

Best Practices and Financial Reform Measures

The shift of most municipal bodies in India to the Double Entry Accrual Accounting System (DEAS) has led to improved transparency and resilience in their financial matters (Abraham, 2013). The double entry accounting system involves a debit entry

and a credit entry for every transaction, and enables financial statements to be presented through an income and expenditure account, a balance sheet and a statement of cash flows. It has ensured the adoption of modern accounting principles and more fiscal discipline. In Karnataka, a Municipal Reform Cell (MRC) centrally monitors all 213 urban local bodies in the state, and all their accounts are stored on the MRC server. According to Abraham (2013), the arrangement ensures a unified system of accounting across the state through the same accounting guidelines, enabled by the software and information technology infrastructure.

The Municipal Corporations of Mumbai, Hyderabad and Bengaluru have tried to deal with the resource constraint by attempting to expand their property tax base through comprehensive mapping by GIS and other techniques such as periodic self-assessment, easier modes of tax payment, stricter enforcement and modern property valuation techniques that represent the market value (Bahl et al., 2013; NIUA, 2015; Ahluwalia et al., 2019). Mumbai also has the highest per capita property tax, user charges and fees collection. The loss of revenue to the Brihanmumbai Municipal Corporation due to the subsumption of octroi under the GST has been adequately compensated by the Maharashtra state government in the form of generous state transfers (Ahluwalia et al., 2019). In Bengaluru, widespread tax reforms were initiated in 2000 and property tax registers were updated using GIS (NIUA, 2015; Ahluwalia et al., 2019). Formula driven self-assessment schemes were introduced and taxpayers were encouraged to file returns through the media, resident welfare associations and payment clinics which led to a 33 per cent increase in property tax collection in 2001 (Ahluwalia et al., 2019). Use of drones and Laser Imaging Detection and Ranging Survey (LIDAR) by Chennai and Mumbai respectively are currently enhancing their tax revenue administration.⁸

All the six largest municipal corporations have carried digitisation of tax rolls (Ahluwalia et al., 2019; MoHUA, 2021). Raipur utilises GIS mapping along with door-to-door property survey through a special mobile application to improve the database.⁹ In Pune, property tax collections have grown from Rs. 245 crore in 2010-11 to Rs. 1158 crore in 2016-17 due to shifting to capital value-based system that reflects the market rates of properties and GIS mapping. Bengaluru effectively utilises miscellaneous fees such as road cutting fees for laying optical fibres and building license fees for raising revenue.¹⁰ The Surat Municipal Corporation has implemented reforms to achieve 100 per cent cost recovery of services by formulating the Water Meter Policy on user charges and integrating the latest technologies in water mapping, installation of water meters, etc. It surpassed its target and achieved 126 per cent recovery of operations and maintenance costs in 2013-14 (Ray & Tewari, 2018; NIUA, 2015). Similar reforms were undertaken in Mumbai as well (Bahl et al., 2013).

The 15th Finance Commission has imposed several criteria for urban local bodies to receive central grants. These include setting up regular state finance commissions and following their regulations on or before March 2024, publishing the provisional and

audited accounts of municipal bodies in the public domain and fixing minimum floor prices by the state authorities for property tax rates.¹¹

Merger of Municipal Corporations in Delhi

In 2011, the Municipal Corporation of Delhi was divided into three bodies, i.e., the North, South and East Delhi Municipal Corporations to improve the availability of civic services in the city. In April 2022, they were again merged into a single body by the Central government to improve finances and governance. According to the Central government, Delhi's division into the three bodies was uneven in terms of territory and revenue generating potential and led to a gap in the resources available to them and their dues. The gap widened to such an extent that timely disbursement of salaries to employees became difficult. The unification aims to improve transparency, governance and planning and eliminate administrative duplication by streamlining the workforce. Some benefits of municipal mergers are:

- Larger municipal bodies achieve economies of scale as duplication of jobs is avoided and total costs are reduced.
- They ensure consolidation of tax bases, and command greater financial resources.
- Their ability to raise debt and attract financial institutions is increased.
- Larger municipalities offer better service delivery, by adopting the best prevailing standards.

However, smaller municipalities achieve greater decentralisation, are less likely to suffer from bureaucratic hassles and are more competitive.

Source: Jha, R. (2022). *Assessing the Merger of Delhi's Municipal Corporations*. ORF Occasional Paper No. 362, Observer Research Foundation.

Conclusion

The success of major Central government schemes such as the Smart Cities Mission depends upon the institutional and financial efficiency of urban local bodies. Ensuring policies that lead to the core functions of municipal bodies being financed their source revenue is a key requirement to ensure their independence and fiscal resilience. The discussion was limited by inadequate data on public finance for the period after 2020, but compiles all the critical issues that require correction from the policy makers. It is imperative that existing drawbacks such as irregular constitution of state finance commissions, heavy dependence on state transfers, inefficiencies in property tax collection and outdated operational and technological mechanisms are dealt with so that urban local bodies may be fully able to contribute to the socio-economic transition of India towards becoming a developed nation.

Endnotes

- 1 Government of India, NITI Aayog (2018). Strategy for New India @75.
- 2 Muthiah, S. (2003), 'The First Corporation', *The Hindu*, 2 April.

- 3 Office of the Registrar General and Census Commissioner, India. Population Census 2011. Table A-04 (I): Towns and urban agglomerations classified by population classified by population size class in 2011 with variation between 1901 and 2011 - Class I (population of 1,00,000 and above).
- 4 This information is obtained from the state governments by the 15th Finance Commission.
- 5 Mukherjee, S. (2024). 'India's GDP growth rate jumps to 7.8% in Q4; FY24 growth at 8.2%'. *Business Standard*, 31 May.
- 6 United Nations, Department of Economic and Social Affairs, Population Division (2018). *World Urbanization Prospects: The 2018 Revision*, Online Edition.
- 7 Government of India, Ministry of Housing and Urban Affairs. (2021). *Municipal Performance Index 2020*, p. 71.
- 8 Munshi, S. (2016). Civic plan to use laser imaging tech to map cityscape & more. *The Times of India*, July 23.
- 9 Dey, T. (2020). Internet Based GIS Applications for Local Level Planning and Development in the State of Chhattisgarh. *IOSR Journal of Computer Engineering*, p. 14.
- 10 Menezes, N. (2022). 'Karnataka Government Brings BBMP into Fiscal Responsibility Ambit'. *Deccan Herald*, 12 March.
- 11 Government of India, NITI Aayog (2021). *Reforms in Urban Planning Capacity in India*, p. 5.

References

- Abraham, C.T. (2013). *Municipal Accounting Reforms in India*. Asian Development Bank, October 2013.
- Ahluwalia I, Mohanty P., Mathur O, Roy D., Khare A. and Mangla S. (2019). *State of Municipal Finances in India: A report prepared for the Fifteenth Finance Commission*. Indian Council for Research on International Economic Relations.
- Aijaz, Rumi. (2007). *Challenges for Urban Local Governments in India*. Asia Research Centre, London School of Economics and Political Science, London.
- Bahl, R. W., Linn, J. F., & Wetzel, D. L. (Eds.). (2013). *Financing Metropolitan Governments in Developing Countries*. Cambridge, MA: Lincoln Institute of Land Policy.
- Bandyopadhyay, S. & Sharma, A. (2020). *Assessing the Performance of Kolkata Municipal Corporation: Implications for Service Delivery*. International Center for Public Policy, Andrew Young School of Policy Studies, Georgia State University, Atlanta.
- Bouchet, M., Liu, S., Parilla, J., & Kabbani, N. (2018). *Global Metro Monitor 2018*. Brookings Institution.
- Chakraborty, P. (2021). *COVID-19 Context and the Fifteenth Finance Commission: Balancing Fiscal Need and Macroeconomic Stability*. National Institute of Public Finance and Policy, Working Paper No. 351, August 2021, New Delhi.
- Government of India, Ministry of Finance, Department of Economic Affairs. (2021). *Economic Survey, 2020-21*, New Delhi.
- Government of India, Ministry of Finance. (2020). *Report on the 15th Finance Commission of India*, 15th Finance Commission.

- Government of India, Ministry of Housing and Urban Affairs. (2021). *Municipal Performance Index 2020*.
- Ray, I. & Tewari, M. (2018). *Meeting the Challenges of Climate-Proofing a Water System: How Surat Learned and Adapted*. Indian Council for Research on International Economic Relations.
- Jha, R. (2022). *Assessing the Merger of Delhi's Municipal Corporations*. ORF Occasional Paper No. 362, Observer Research Foundation.
- Mohanty, P.K., Mishra, B.M., Goyal, R. & Jeromi, P.D. (2007), *Municipal Finance in India: An Assessment*, Department of Economic Analysis and Policy, Reserve Bank of India, Mumbai.
- National Institute of Urban Affairs. (2015). *Urban Reforms in Indian Cities*.
- United Nations, Department of Economic and Social Affairs, Population Division (2018). *World Urbanization Prospects: The 2018 Revision*, Online Edition.
- Verma, M., Bazaz, A., Dubey, M. (2022). *Indian Municipal Finance: An Update*, Indian Institute for Human Settlements.

PM SVANidhi — A Livelihood Scheme for Street Vendors in India: An Evaluation

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Abstract

In India, there are about ten million street vendors accounting for 14 per cent of the total urban informal employment. For them, a central sector scheme titled “PM Street Vendors’ AatmNirbhar Nidhi” (PM SVANidhi) was launched in June 2020 by the Ministry of Housing and Urban Affairs (MoHUA). This became necessary particularly during the medical emergency due to Covid-19. Initially, Rs. fifty billion was earmarked as a stimulus package for nearly five million vendors which means Rs. ten thousand were given as collateral-free loan at concessional rate for a period of one year. Due to high demand of these, special micro-credit facility to street vendors has been extended in the second and third year till December 2024. A third loan of up to Rs. Fifty thousand was also introduced in addition to the first two loans of rupees ten and twenty thousand. The paper examines the scheme, state-wise, based on the data available on PM SVANidhi dashboard. There are some gaps in implementation of the scheme like creation of non-performing assets (NPAs) as the loans are collateral free and need to be rectified.

Keywords

COVID-19, India, Livelihood, PM SVANidhi, Street Vendors, Unemployment.

Introduction

A street vendor is extensively characterised as an individual who offers goods to be purchased by the general people without having a perpetual built-up structure from which to sell. It includes stationary (selling at pavements or public/private places) and mobile vendors. Street vending fluctuates in term of scale, timing, area, compensation, labour force, skill and types of products sold, and services provided. It tends to be a full-time, part-time, seasonal, or occasional occupation. It can be done by one individual

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yet can likewise be an establishment of a larger street business. It may be an approach for basic survival or part of a major business. But street vending has a prominent place in the urban supply chain and provides inexpensive and convenient access to goods and services to all segments of the population including the poor.

Street vendors are workers that have always existed and are growing worldwide, both due to the generalised rural mass migration of low-skilled workers towards urban areas, as well as the global economic crisis and the lack of employment opportunities. Since, there is very little information on street vendors, it is difficult to discover if their numbers are growing faster than would be represented normally by urban population growth. The street vendors face a complex coexistence of persecution, regulation, tolerance, and promotion.

In India, there are about ten million street vendors¹ and the sudden spread of the COVID-19 pandemic not only caused distressing uncertainties among the street vendors but also worsened their existing conditions. In order to provide relief to these street vendors, the Government of India launched PM-SVANidhi scheme and provided a microcredit facility to vendors in the states which have notified rules and schemes under Street Vendors (Protection of Livelihood and Regulation of Street Vending) Act, 2014.

Against this backdrop, the present paper has been organised into six sections. Besides the introductory part, the next section summarises the international scenario of street vending. Further the paper reviews the street vending in India and the policies, rules thereon. It also highlights the PM SVANidhi scheme introduced by MoHUA, Government of India for street vendors in the wake of COVID-19 pandemic. Next, the paper analyses the status of PM SVANidhi scheme with respect to the targets set thereon. The conclusion and suggestions sum up the entire paper.

International Scenario

There are no labour norms at the international level dealing with street vendors. How street vending is dealt at the domestic level differs drastically from country- to- country. Many countries regulate it by laying a clear legal framework and jurisdictional mandate, while others have overlapping jurisdictional mandate, which creates uncertainty and conflict, and in some countries street vending is still considered as illegal (Bromley, 2000).

In all Asian countries, there is a considerable base of low-skilled rural migrants in urban centres. These are more common in the developing nations like Bangladesh, Cambodia, India, Nepal, and Vietnam for two reasons, firstly, these nations lack solid industrial base and secondly, the urban labour force is engaged primarily in the informal sector. Entry and exit into this kind of business is easy as it does not need high abilities and the capital involved is also low as observed in countries like Bangladesh, Cambodia, Nepal and Vietnam. It is, indeed, ironical that despite the number of street vendors is

going up generously in countries such as Korea, Malaysia, Philippines, Singapore, and Thailand, the governments of these nations have refrained from recognising street vending as a legal activity. Further, since most of the street vendors in Asia are not unionised, the large mainstream associations are not keen to take them on board. India and Korea are the only two countries in the entire Asia, which can boast of federations or alliances of street vendors. However, these two countries are in total contrast to each other in terms of their policies. The Korean government appears unduly brutal on hawkers as it has left no means to oust them, while in India, the National Alliance of Street Vendors of India (NASVI) has been a successful organisation. It has been able to intervene at both the Central and local levels in some cases to initiate policy dialogues with the concerned authorities. Its most prominent achievement has been the initiation of the national policy (Bhowmik, 2005).

In some of the Latin American countries like Chile and Colombia, there exists a relatively clear legal system that facilitates the implementation of and compliance with written law. At the other end, countries like Peru and Venezuela have legal framework that do not effectively and easily accommodate them. Therefore, a legitimate system with clear jurisdictional mandate might create an effective working condition, especially security of workspace for the hawkers (Roever, 2010). The International Labour Organization (ILO) has suggested the need to secure street vendors and to regulate public spaces.

Two striking instances of inclusive practices from Africa were revealed in 2018 by the New Republic Liberia. First, in Liberia, the street vendors coordinated and voiced their interests to Monrovia City Corporation and set up the Federation of Petty Traders and Informal Workers Union of Liberia (FEPTIWUL) during September 2018 (Waylaun, 2018). They got *savoir faire* with their negotiation abilities and gained the admiration of authorities. In 2018, FEPTIWUL worked with the municipality to devise a spearheading approach that incorporated street trade as a component of the city's future. Second, in Kenya, the Draft Protection to Livelihood and Regulation of Street Vending Bill vows to provide licence to street vendors, livelihood rights and social security and safeguarding them from the inhuman treatment by the police.

In Europe, hawkers are mostly migrants from Africa, and they often risk their lives to enter Europe. Initially, many migrants find it difficult to get employed regardless of the official documents they possess. They have no choice but to run their own business which is mostly selling goods on streets. Sellers in Spain work in a combative legislative environment. The change of the public security law in 2015 recriminalised vending on the streets. Vendors face seizures and fines of about €500 (around INR 44,000), and a jail sentence term for six months to two years (WIEGO, 2020).

Street Vendors in India

In India, there are about ten million street vendors², mainly spread in Delhi, Mumbai, Kolkata, and Ahmedabad. The majority of them are labourers who work on an average

of 10–12 hours a day. In different areas/contexts, they are known as vendors, hawkers, *thelwala*, *rehriwala*, *theliphadwala*, and so on. They play a crucial role in ensuring accessibility of goods and services at reasonable rates at the consumers' doorsteps (Saha, 2009).

As per the government estimates, street vending accounts for 14 per cent of total (non-agricultural) urban informal employment and every street entrepreneur or trader supports an average of three others as employees or partners or workers on commission. It is a parallel economy of an estimated daily turnover of Rs 0.8 billion (Aggarwal, 2020).

India is one of the few countries in the world to have a national policy for urban street vendors. The National Policy on Urban Street Vendors was enacted in 2004 with an objective to provide and promote supportive environment for earning livelihoods to the street vendors and to ensure maintenance of hygiene in public spaces and streets (Sundaram, 2008).

In September 2013, Ministry of Housing & Urban Poverty Alleviation (MoHUPA) introduced operational guidelines for Support to Urban Street Vendors (SUSV) under the National Urban Livelihood Mission (NULM). These guidelines were revised in July 2018 after combining both the Ministries related to urban, i.e., Ministry of Urban Development and Ministry of Housing and Urban Poverty Alleviation into one i.e., Ministry of Housing & Urban Affairs (MoHUA). The scheme has been renamed as Deendayal Antyodaya Yojana-National Urban Livelihood Mission (DAY-NULM) (MoHUA, 2018).

The Street Vendors (Protection of Livelihood and Regulation of Street Vending) Act, 2014 was enacted to regulate street vendors in public areas and to protect their rights. The Act calls for the establishment of Town Vending Committees in various districts to ensure that all street vendors identified by the government are accommodated in vending zones subject to norms. However, the enforcement of the Act has been inconsistent. In the absence of any legal framework in place, street vendors continue to have to fend for themselves.

Problems faced by Street Vendors in India

Street vendors in India face numerous challenges like unacceptability in society due to lack of education, social security, irregularity in income, lack of space and infrastructure, easy displacement, harassment, disdain, and sheer neglect by the civic authorities. They often lack access to capital, have to face market competition and price fluctuations, and continue to be excluded from critical decisions on urban space management. Further, even after the Supreme Court of India ruling in 1989 that street vendors had the right to vend, the incidents of violation of right to vend have also been noticed. In August 2018, in Ahmedabad, Gujarat, for example, a razing team demolished about five thousand street vendors and 19,500 structures while the municipal corporation, as per the 2014

Act, was doing the census for street vendors. In Delhi, a Special Task Force created to deal with premises not conforming to the 2021 Delhi Master Plan has been regularly evicting vendors throughout the city. There are also cases where the implementation of the 2014 Act may well lead to a reduction in the number of vendors, for example in Mumbai and Chandigarh.

Licence quotas are impractical in most cities, such as Mumbai, which has a limit of about fifteen thousand licences compared to an estimated 0.25 million vendors. As a result, the majority of vendors sell their wares illegally, leaving them vulnerable to exploitation and extortion by the local police and the municipal officials.

Vendor organisations in India are rapidly seeking redress through the legal means. Notably, the Supreme Court of India ruled that the state governments must publish their rules governing street vendors. However, not all rulings favour vendors. For example, in November 2018, the Punjab and Haryana High Court directed the Director General of police to remove all illegal encroachments from footpaths.

Furthermore, street vending is very difficult to administer as vendors move frequently depending on events in a city, the weather, customers' location, the time of day, etc. Solutions such as the establishment of off-street markets, for example, may fail because consumers do not often follow the vendors, who are then quickly replaced by new vendors in their previous location. Street vending is generally administered at local level, implying that the rules/ policies change with the change in government at the local level. This further adds to the vulnerability of the vendors.

COVID-19 and the Street Vendors in India

The COVID-19 induced lockdown exacerbated the problem for street vendors all over the world. India had one of the stringent lockdowns which had adversely impacted the livelihoods of street vendors. The nature of their work is such that vendors must be mobile or set their shop at crowded marketplace to attract customers. The lockdown, however, left many of them without work. They were financially crushed, had to take a loan to cover their daily expenses and were in no position to repay the loan (Majithia, and Sinha, 2020). Also, majority of street vendors did not have identity cards or any government documents to avail benefits of government's subsidy scheme or free ration facilities.

Further, 30 per cent of vending population consists of women who are mostly found in weekly *haats* or street side or footpath stalls. A study on women street vendors in Delhi³ found that they have lost their sources of income completely, with 97.14 per cent of the respondents claiming that they had been affected by the lockdown (Chakraborty, and Ahuja, 2021).

Given such scenarios and circumstances, the sector adversely required a push to start again once economic activities resumed at full pace. Against this backdrop, Pradhan Mantri Street Vendors' AatmNirbhar Nidhi (PM SVANidhi) was introduced

to provide credit for working capital to street vendors to resume their businesses (Gaur, 2020). Out of the seven components of Support to Urban Street Vendors (SUSV) under DAY-NULM, one of the components of the scheme deals with the access to credit for street vendors. PM SVANidhi has its own significance as the scheme is de-linked from existing registration requirements.

Pradhan Mantri Street Vendors' AatmNirbhar Nidhi (PM SVANidhi)

The PM Street Vendors' AatmNirbhar Nidhi (PM SVANidhi) is a central sector scheme, which was launched by Ministry of Housing and Urban Affairs (MoHUA) in June 2020 amid the pandemic. Under the scheme, the Centre has earmarked a stimulus package of Rs. 50 billion for nearly five million vendors. It is a micro-credit facility that provides street vendors a collateral-free loan of Rs.10,000/ at concessional rates of an estimated 7.25 per cent for a period of one year. In the long run, the scheme would not only ascertain the credit score of the vendors but would also keep digital records of their socio-economic status to help them avail the benefits of future central sector schemes. The scheme also intends to institutionalise this informal sector of the economy by providing them with safety nets and the ability to obtain loans in the future (Tiwari, 2020, and Dastidhar, 2020).

Earlier the scheme was valid till March 2022, but the Government of India expanded the PM SVANidhi Scheme with the following measures:

- The lending period has been extended until December 2024.
- A third loan of up to Rs. 50,000/ has been introduced in addition to the first two loans of Rs.10,000/ and Rs.20,000/, respectively.
- The “SVANidhi Se Samridhhi” component will be extended to all beneficiaries of the PM SVANidhi scheme across the country.

As of November 30, 2022, 3.17 million street vendors had benefited from the first loan of Rs. 10,000/, out of which 0.58 million have availed the second loan of Rs. 20,000/. Among those who availed the second loan, 6,926 street vendors have benefited from the third loan of Rs. 50,000/ (Hindu Bureau, 2023).

The establishment of vending zones comes under the purview of the Street Vendors (Protection of Livelihood and Regulation of Street Vending) Act, 2014, which is being implemented by the respective States/UTs. According to reports from the States/UTs, a total of 13,403 vending zones have been identified so far. The PM SVANidhi scheme aims to provide benefits to 4.2 million street vendors by December 2024.

Small Industries Development Bank of India (SIDBI) is the implementation partner of the MoHUA for the scheme administration. SIDBI leveraged the network of lending Institutions including the Standard Chartered Banks (SCBs), Regional Rural Banks (RRBs), Small Finance Banks (SFBs), Cooperative Banks, Non-Banking Financial Companies (NBFCs) & Micro Finance Institutions (MFIs) for better scheme implementation.

The Scheme was implemented only in those States/ UTs which had notified both rules and schemes under Street Vendors (Protection of Livelihood and Regulation of Street Vending) Act, 2014. However, the beneficiaries from Meghalaya had also participated, which has its own State Street Vendors Act.

According to a study by Centre for Civil Society⁴, 21 states have notified both rules and schemes which are the first two steps towards implementing the Act and only two states (Andhra Pradesh and Chhattisgarh) have demarcated vending zones, the last step in implementation of the Act. However, with the introduction of PM SVANidhi scheme in June 2020, all 28 States and eight UTs, except Lakshadweep, have notified both rules and schemes.

The Scheme is available to all street vendors engaged in vending in urban areas. The eligible vendors are identified as per the following criteria:

- (i) Street vendors in possession of Certificate of Vending / Identity Card issued by municipalities;
- (ii) The vendors, who have been identified in the survey but have not been issued Certificate of Vending / Identity Card; Provisional Certificate of Vending would be generated for such vendors through an IT- based platform. Municipalities are encouraged to issue such vendors the permanent Certificate of Vending and Identification Card immediately and positively within a period of one month.
- (iii) Street Vendors, left out of the municipality- led identification survey or who have started vending after completion of the survey and have been issued Letter of Recommendation (LoR) to that effect by the municipality / Town Vending Committee (TVC); and
- (iv) The vendors of surrounding development/ peri-urban / rural areas vending in the geographical limits of the municipalities and have been issued Letter of Recommendation (LoR) to that effect by the municipality / TVC.

Vendors left out of the identification survey conducted by the municipality may apply through the PM SVANidhi portal. Municipality must complete the verification and issue LoR within 15 days of submission of the application (Ministry of Housing & Urban Affairs, 2020).

Committees for Steering & Monitoring of the Scheme

The Scheme has the following management structure at the Union, State/UT and municipality level for effective implementation and monitoring:

- (a) At Union level — a Steering Committee under the chairmanship of Secretary, Ministry of Housing and Urban Affairs;
- (b) At State/ UT level — a Monitoring Committee under the chairmanship of Principal Secretary/Secretary of Urban Development/ Municipal Administration, which is required to meet at least once in every three months.

- (c) At municipality level — a committee headed by the Municipal Commissioner/ Executive Officer (EO) and supported by the Town Vending Committee to sponsor loan applications and monitor implementation of the scheme. This committee is required to meet at least once in every month.

Benefits of the Scheme

- (i) **Interest Subsidy:** On timely/early repayment of the loan, an interest subsidy of seven per cent per annum will be credited to the bank accounts of beneficiaries through direct benefit transfer on a bi-monthly basis.
- (ii) **Escalation of credit limits:** The scheme provides for the rise of the credit limit on timely/ early repayment of loans i.e., if a street vendor repays the instalments on time or earlier, he or she can develop his or her credit score that makes him/her eligible for a higher amount of term loan such as Rs. 20,000/. After extension of the scheme till December 2024, a third loan of Rs. 50,000/ has been introduced.
- (iii) **Encourage digital transactions:** The scheme incentivises digital transactions by the street vendors through monthly cash back of up to Rs.100/.
- (iv) **Focus on capacity building:** MoHUA in collaboration with state governments also aims at capacity building and financial literacy programme for all the stakeholders like Business Correspondents (BCs)/ Agents of lending institutions like banks/ NBFCs/ MFIs, SHGs/ federations, implementing bodies like municipalities/ Town Vending Committees (TVCs) and digital payment aggregators (like NPCI) to ensure effective delivery of Scheme (Soni, M., 2020).

Information, Education and Communication (IEC) Activities

- (a) **E-governance:** In congruence with the vision of leveraging technology to ensure effective delivery and transparency, a digital platform with web portal/ mobile app is provided for the development and administration of the scheme with end-to-end solution.

This platform integrates the web portal/ mobile app with *UdyamiMitra* portal of SIDBI for credit management and PAiSA portal of MoHUA to administer interest subsidy automatically. It helps in integrating the vendors into the formal financial system.

- (b) **Branding and Communication:** Branding is an important aspect of communicating the scheme accurately to different stakeholders, especially to the target beneficiaries. For this, various vehicles of communications have been used like publicity through outdoor media, a dedicated website for the scheme, social media handles, films, digital advertisements, newspaper advertisements, printed collaterals, radio jingles, sharing of success stories, etc. In this, States/ UTs are also expected to adopt/ use the best possible mediums of communications addressing aspects such as cost effectiveness, innovativeness, and engagement of the target group.

Table 1: State-wise Status of the PM SVANidhi Scheme

State	Application (in lakh)	Sanctioned (in lakh)	Disbursed (in lakh)	Disburse- ment Target upto March 2024 (in lakh)	Disburse- ment Target Completed (%)
General Category States					
Andhra Pradesh	5.11	4.42	4.37	4.92	88.86
Bihar	2.21	1.54	1.29	1.98	65.06
Chhattisgarh	1.47	1.12	1.05	1.44	72.50
Goa	0.03	0.03	0.02	0.04	55.46
Gujarat	7.30	5.90	5.71	7.03	81.29
Haryana	2.89	1.87	1.54	2.45	62.97
Jharkhand	1.37	1.00	0.91	1.43	63.60
Karnataka	5.67	4.85	4.69	5.37	87.43
Kerala	1.29	1.11	1.03	1.33	76.93
Madhya Pradesh	13.99	11.86	11.18	11.76	95.15
Maharashtra	12.32	9.81	8.91	11.08	80.46
Odisha	1.14	0.90	0.85	1.25	68.07
Punjab	2.42	1.90	1.75	2.06	84.61
Rajasthan	3.04	2.05	1.82	3.12	58.21
Tamil Nadu	6.82	5.06	4.81	7.23	66.57
Telangana	7.71	6.67	6.58	8.44	77.95
Uttar Pradesh	19.97	18.29	17.84	19.87	89.78
West Bengal	2.67	2.01	1.83	4.13	44.39
North-Eastern / Hilly States					
Arunachal Pradesh	0.08	0.07	0.07	0.08	84.18
Assam	1.71	1.52	1.49	1.55	96.14
Himachal Pradesh	0.10	0.09	0.09	0.11	81.88
Manipur	0.22	0.13	0.13	0.24	55.02
Meghalaya	0.05	0.04	0.03	0.05	69.57
Mizoram	0.03	0.03	0.02	0.04	53.93
Nagaland	0.06	0.04	0.03	0.06	60.68
Sikkim*	0.012	0.011	0.011	0.009	118.91
Tripura	0.09	0.07	0.07	0.10	68.25
Uttarakhand	0.45	0.35	0.33	0.40	82.70

State	Application (in lakh)	Sanctioned (in lakh)	Disbursed (in lakh)	Disburse- ment Target upto March 2024 (in lakh)	Disburse- ment Target Completed (%)
Union Territories					
Andaman & Nico- bar Islands	0.011	0.010	0.009	0.012	75.46
Chandigarh	0.10	0.08	0.08	0.11	67.92
Dadar & Nagar Haveli and Daman & Diu	0.03	0.03	0.03	0.04	81.26
Delhi	3.10	2.25	1.95	2.39	81.53
Jammu & Kashmir	0.35	0.26	0.25	0.37	67.93
Ladakh	0.009	0.008	0.007	0.009	87.81
Puducherry	0.05	0.04	0.04	0.05	97.34
India	103.85	85.41	80.83	100.53	80.40

Source: PM SVANidhi Portal.

Note: *Sikkim is not given any target for the third disbursement.

Table 2: State-wise Financial Status and Beneficiaries

State	Sanc- tioned Amount (Rs. bn)	Disbursed Amount (Rs. bn)	Disbursed to Sanc- tion Amt (%)	No. of Benefi- ciaries	Avg days to Sanc- tion	Avg age of the applicant in years
General Category States						
Andhra Pradesh	5.93	5.83	98.36	327279	14	43
Bihar	1.87	1.57	83.79	104930	25	41
Chhattisgarh	1.58	1.45	91.99	73976	18	41
Goa	0.04	0.04	94.55	1499	24	51
Gujarat	7.98	7.68	96.23	435724	20	41
Haryana	2.19	1.83	83.46	134058	21	39
Jharkhand	1.22	1.10	90.06	75962	20	40
Karnataka	6.61	6.38	96.45	354303	23	43
Kerala	1.27	1.18	92.85	93538	14	48
Madhya Pradesh	16.88	15.84	93.80	797589	18	40
Maharashtra	11.88	10.74	90.40	755522	24	42
Odisha	1.29	1.21	94.02	57728	27	46
Punjab	2.27	2.07	91.30	146863	22	42
Rajasthan	2.45	2.17	88.54	147248	25	41

State	Sanc- tioned Amount (Rs. bn)	Disbursed Amount (Rs. bn)	Disbursed to Sanc- tion Amt (%)	No. of Benefi- ciaries	Avg days to Sanc- tion	Avg age of the applicant in years
Tamil Nadu	6.61	6.25	94.48	370943	26	47
Telangana	10.48	10.26	97.93	412929	21	43
Uttar Pradesh	24.72	23.89	96.63	1293467	18	40
West Bengal	2.11	1.90	90.00	175240	19	42
North-Eastern / Hilly States						
Arunachal Pradesh	0.11	0.11	96.87	4452	46	39
Assam	2.00	1.95	97.28	112595	21	41
Himachal Pradesh	0.16	0.16	97.52	5247	17	46
Manipur	0.18	0.17	97.52	9633	25	49
Meghalaya	0.05	0.05	98.25	2801	14	39
Mizoram	0.03	0.03	95.56	2078	23	45
Nagaland	0.05	0.05	95.46	2747	17	42
Sikkim*	0.01	0.01	98.20	1085	9	42
Tripura	0.10	0.09	95.62	5087	19	48
Uttarakhand	0.49	0.46	95.17	23980	18	42
Union Territories						
Andaman & Nicobar Islands	0.02	0.01	92.26	539	27	49
Chandigarh	0.13	0.11	87.77	4893	26	46
Dadar & Nagar Haveli and Daman & Diu	0.04	0.04	99.52	2133	40	44
Delhi	2.64	2.28	86.32	168511	18	41
Jammu & Kashmir	0.42	0.39	93.07	16381	21	44
Ladakh	0.01	0.01	93.62	442	16	48
Puducherry	0.06	0.06	98.38	3305	24	48
India	113.89	107.37	94.28	6124707	22	44

Source: PM SVANidhi Portal.

Note: *Sikkim is not given any target for the third disbursement.

When the scheme was launched, the Centre had set a target to disburse first term loan of 10,000/ each to five million street vendors. But due to high demand, the target got revised to 6.3 million street vendors and was again updated to around 10.1 million upto March 2024. As on 19 February 2024, about ten months before the scheme comes to an end; around rupees 8.08 million loans have been disbursed benefitting 6.12 million street vendors (Table 1 and Table 2). The total loan amount disbursed is more

than Rs. 107.37 billion which is 94 per cent of the total sanctioned amount, i.e., Rs. 113.9 billion (Table 2).

As on 19 February 2024, out of total 10.38 million loan applications received under the PM SVANidhi scheme, around 82 per cent (8.54 million) have been sanctioned and about 78 per cent (8.08 million) have been disbursed of the total applications received till February 2024. After the completion of three years of scheme, about 80.4 per cent of the 10.1 million of disbursement target has received loan (Table 1). The total sanctioned and disbursed amount by the banks to the vendors is Rs. 113.9 billion and Rs. 107.4 billion, respectively (Table 2). A look at government data discloses a stark contrast among the large states (Table 1), where, West Bengal is at the bottom, with 44 per cent beneficiaries (only about 1.83 lakh of 4.13 lakh disbursement target received loans) which is the lowest among all the States and Union Territories. Madhya Pradesh has the highest percentage of disbursement among the large states, i.e. about 95 per cent (11.18 lakh of 11.76 lakh applicants received loans). Among the best performing hilly and northeastern states, Assam, Arunachal Pradesh, Himachal Pradesh, and Uttarakhand have achieved more than 80 per cent of the disbursement target. On the other hand, Manipur and Mizoram have just reached the half of its disbursement target. In case of Union Territories, Puducherry and Ladakh have achieved more than 85 per cent of their disbursement target. But Jammu and Kashmir and Chandigarh have both achieved 68 per cent of their disbursement target and are far from reaching their disbursement target. Among all the States and Union Territories, Sikkim is the only one which has completed its 100 per cent disbursement target as it has not been given any target for the third term loan of Rs 50,000. Assam is another state which is not far from reaching its target. Table 3 gives the descriptive statistics for the progress made in the scheme.

Table 3: Summary of Descriptive Statistics

Particulars	Applica-tions	Sanctioned	Disbursed	Disburse-ment Target	Disburse-ment Target Completed (%)
Median	1.29	1.00	0.91	1.33	76.93
Maximum	19.97	18.29	17.84	19.87	118.91
Minimum	0.009	0.008	0.007	0.009	44.395
Range	11.06	7.01	6.36	8.30	98.68
Standard Deviation	4.57	3.99	3.84	4.37	15.11
Variance	20.91	15.89	14.71	19.11	228.25
Kurtosis	5.41	7.13	7.63	6.03	0.70
Skewness	2.27	2.53	2.60	2.30	0.39

Source: Authors' Compilation.

Among all the States and Union Territories, the maximum number of applicants, sanctioned, disbursed and disbursement target is highest for the state of Uttar Pradesh, and it has achieved about 90 per cent of the disbursement target, as depicted in Table 3. On the contrary, Ladakh has the minimum number of applicants, sanctioned, disbursed and disbursement target (only 850). The kurtosis shows that whether the given data is heavy-tailed or light-tailed in a normal distribution. For a normally distributed data, the kurtosis value comes out to be three and the skewness is zero. Here, the value of kurtosis for all the variables, except disbursement target completed, comes out to be more than three which means it's a leptokurtic having very long and skinny tails. The skewness is greater than one for all the variables, except disbursement target completed. Therefore, the skewness and kurtosis for disbursement target is less than one and three respectively implying that it is slightly positively skewed, and distributions are moderate in breadth with medium peaked height. This means that some of the States and UTs are outliers for the variables like number of applications, sanctioned number of loans, disbursement of loans and the disbursement target, but almost all the States and UTs are on the same level in completing the target, except the outliers like West Bengal and Ladakh.

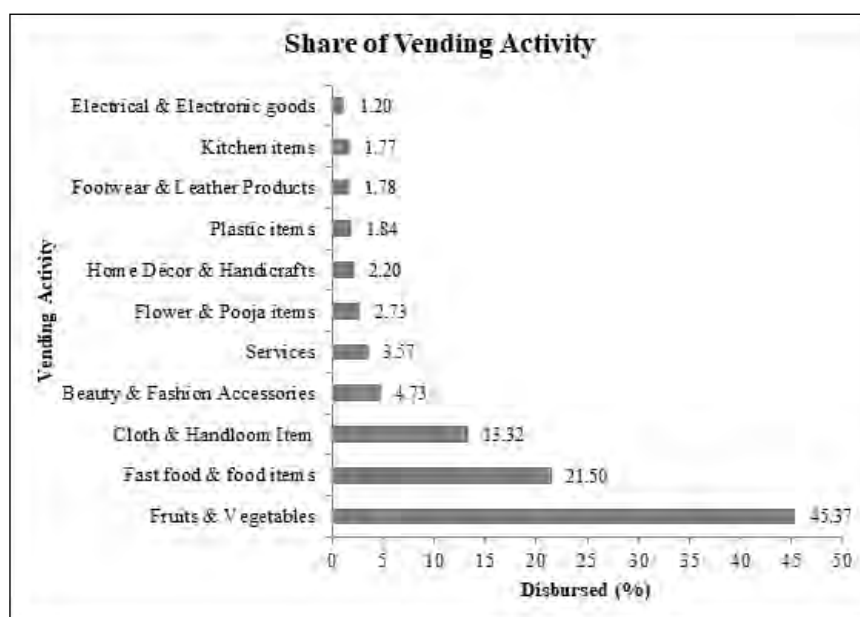


Figure 1: Share of Vending Activity.

Source: PM SVANidhi Portal.

According to the PM-SVANidhi portal, in order to get the loan sanctioned, it takes about 22 days and the average age of the street vendor applying for the loan is 44 years. This means that a middle-aged family person might have to run to banks and district administration's office for more than three weeks or more to restart his/her

hawking business. The screening and verification of the applicants should not be a long process and at the same time it should not be overlooked due to the potential it has, for increasing Non-Performing Assets. Out of the total applicants, about 43 per cent are women vendors and 57 per cent are male vendors (Jaswal, 2023). Figure 1 shows the share of disbursed percentage amount under different vending activities. Fruits and vegetable sellers are the largest borrower category (about 45%), followed by fast food and food items (about 22%); and cloth and handloom products (about 13%).

SBI is the largest lender under the scheme with 35 per cent of the total loans disbursed by them followed by Bank of Baroda (11.8%), Union Bank of India (11.6%), Punjab National Bank (8.5%) and Canara Bank (8%). The participation of private banks has been marginal.

Problems in Implementation of the Scheme

According to the guidelines of the scheme, Urban Local Bodies (ULBs) and Town Vending Committees (TVCs) are tasked with identifying qualified applicants and providing them with a Certificate of Vending, Identity Card, and Letter of Recommendation. ULBs and TVCs authenticate the applicants' information before forwarding the applications to the relevant lending institution for loan approval. Consequently, banks extend loans to urban street vendors based on the endorsements from ULBs/TVCs. Despite a seven per cent interest subsidy and verification of vendors by local authorities, numerous borrowers failed to make any repayments, leading to non-performing assets (NPAs).⁵ Since loans granted under the scheme have no collateral, banks usually lack avenues for recourse in the event of default. Thus, as highlighted by SBI officials, banks require the cooperation of municipal authorities to recover non-performing loan accounts.

The performance of private banks has been unsatisfactory, with limited involvement and loan disbursements reported. Furthermore, it was noted that certain banks are accepting applications accompanied by stamp papers ranging from Rs. hundred to Rs five hundred. Additionally, there are instances where banks request PAN cards and assess the CIBIL or credit scores of applicants, or where state authorities demand voter ID cards, which many migrant vendors do not carry with them.

Conclusion and Suggestions

The COVID-19 induced lockdown exacerbated the problem for street vendors all over the world. India had one of the stringent lockdowns which had adversely impacted all the economic activities in the nation. The lockdown had also severely impacted the livelihoods of street vendors. As these vendors usually work with a small capital base and might have consumed the same during the lockdown. Therefore, there was an urgent need to provide credit for working capital to street vendors to resume their business after lockdown was removed and economic activities began. The PM Street

Vendors' AatmNirbhar Nidhi (PM SVANidhi) is a central sector scheme, which was launched by Ministry of Housing and Urban Affairs (MoHUA) in June 2020 amid the pandemic. Initially, Rs 50 billion was earmarked as a stimulus package for nearly five million vendors which means Rs.10,000/ were given as collateral-free loan at concessional rate for a period of one year. Due to high demand of these special micro-credit, this facility to street vendors has been extended in the second and third year till December 2024. A third loan of up to Rs 50,000/ was also introduced in addition to the first two loans of Rs. 10 and 20,000/. As on 19 February 2024, out of total 10.38 million loan applications received under the PM SVANidhi scheme, around 82 per cent (8.54 million) have been sanctioned and about 78 per cent (8.08 million) have been disbursed of the total applications received till 19 February 2024. After the completion of three years of scheme, about 80.4 per cent of more than one billion of disbursement target has got loans. The total sanctioned and disbursed amount by the banks to the vendors is Rs 113.9 billion and Rs. 107.4 billion, respectively.

The Urban Local Bodies and Town Vending Committees must take the front seat and try to identify the potential vendors to achieve the target, especially in states which have not achieved even the 75 per cent of the disbursement target like Bihar, Chhattisgarh, Goa, Haryana, Jharkhand, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Rajasthan, Tamil Nadu, Tripura and West Bengal and UTs like, Chandigarh, and Jammu & Kashmir. At the same time, they should also be cautious in lending loans to potential defaulters, so that it should not create a problem of NPAs for the banks.

Considering the health and hygiene of the citizens, it is crucial to demarcate the vending zones taking into account, both the inherent vulnerabilities of vendors' workplaces and the concerns of consumers. Additionally, vendors specialising in cooked food must receive training on hygiene and social distancing protocols. Town Vending Committees (TVCs) and vendor organisations play a pivotal role in market reorganisation and training, respectively. For instance, the National Association of Street Vendors of India (NASVI) is actively involved in providing hygiene and social distancing training to cooked food vendors.⁶

To enhance job opportunities and income, the government may encourage vending in shifts, while considering the allocation of specific areas and days for different categories of vendors.

Civil Society Organisations can assist the government in identifying such initiatives. For instance, vendors offering various products can adopt shift schedules. Vendors selling fresh and cooked food, can cater to peak foot traffic times, such as evenings when people are heading home and may stop to purchase vegetables. Additionally, the government should address consumer concerns regarding hygiene by implementing measures such as providing hand-washing stations or sanitizers for vendors. Further, the International Labour Organisation (ILO) stands upon the following points for the long-term benefit of the street vendors (ILO, 2013).

Regulating Public Spaces

Legal security for public spaces is essential to foster a stable and enhanced working environment. Access to credit and training becomes inconsequential for street vendors if their right to vend on the streets or in specific public areas remains unsecured. It has been noted that guidelines regarding the usage of public space are often ambiguous or contradictory. Furthermore, this ambiguity is underscored by the fact that municipal governments may experiment with various approaches to implement conflicting national and metropolitan-level laws. There may even be conflicting claims regarding which authority has jurisdiction over public spaces (for instance, municipal authority versus local authority).

Need for the organisation of street vendors

The presence of street vendor associations is crucial for enhancing their bargaining leverage. These organisations must establish a solid foundation to effectively negotiate with municipal authorities. Additionally, these associations can serve as welfare bodies, catering to the needs of the local community. In certain cases, area-based management might also be recommended to facilitate communication between street vendors and local authorities.

Need to disseminate information on regulatory changes

It is essential to ensure that street vendors are informed about new laws, policies, and regulations. This can be achieved by disseminating information through various means such as publishing and distributing it in newspapers or pamphlets directly to street vendors, using radio broadcasts for communication, or engaging NGOs or trade unions involved in working with street vendors to bring these updates to their attention.

Endnotes

- 1 https://www.prsindia.org/uploads/media/1167478283/bill82_2006123082_National_Policy_for_Urban_Street_Vendors.pdf
- 2 https://prsindia.org/files/bills_acts/bills_parliament/2005/bill82_2006123082_National_Policy_for_Urban_Street_Vendors.pdf
- 3 https://www.isstindia.org/publications/1590050642_pub_ISST_-_Women_Street_Vendors.pdf
- 4 <https://ccs.in/sites/default/files/progress-report-2020-implementing-the-street-vendors-act.pdf>
- 5 <https://indianexpress.com/article/business/economy/banks-red-flag-loans-to-street-vendors-in-pandemic-turning-npas-7155136/>
- 6 <https://thewire.in/urban/street-vendors-lockdown-poverty>

References

- Aggarwal D. (2020). "Explained: Who is a 'street vendor' in India? What is the Street Vendors Act?" *The Indian Express*, November, 6.

- Bhowmik, S. K. (2005). "Street Vendors in Asia", *Economic and Political Weekly*, 40 (22-23), pp.2256-2264.
- Bromley, R. (2000). "Street Vending and Public Policy: A Global Review", *International Journal of Sociology and Social Policy*, 20 (1-2), 1-28.
- Centre for Civil Society. (2020). "Implementing the Street Vendors Act," Progress Report can be accessed at <https://ccs.in/sites/default/files/2022-08/progress-report-2020-implementing-the-street-vendors-act.pdf>
- Chakraborty, S. and Ahuja, G. (2021). "Emerging from the Lockdown: Insights from Women Street Vendors' Lives in Delhi" (January 1). Available at SSRN: <https://ssrn.com/abstract=3958289> or <http://dx.doi.org/10.2139/ssrn.3958289>
- Dastidhar, A.G. (2020). "Explained: How scheme for street vendors will help alleviate poverty." *The Indian Express*, November 3.
- Gaur, V. (2020). "Nobody would have imagined a welfare scheme for the poor to be implemented so quickly: PM on SVANidhi Yojana." *The Economic Times*, October 27.
- Hindu Bureau. (2023). "57.83 lakh street vendors have benefitted from the PM SVANidhi scheme" *The Hindu*, December 29.
- International Labour Organization. (2013). "The Regulatory Framework and the Informal Economy", Chapter 4, *The Informal Economy and Decent Work: A Policy Resource Guide supporting transitions to formality*, ILO.
- Jaswal, M. (2023). "India's female micro-entrepreneurs account for 43% of PM SVANidhi loan disbursement," *Mint*, October 24.
- Majithia, A. and Sinha, S. (2020). "For Street Hawkers Stripped of Their Livelihood, Direct Income Transfers Can Ease Distress," *The Wire*, July 10.
- Ministry of Housing & Urban Affairs. (2020). Scheme Guidelines for PM Street Vendors' AatmNirbhar Nidhi (PM SVANidhi).
- Ministry of Housing & Urban Affairs. (2018). Revised Operational Guidelines for Support to Urban Street Vendors (SUSV) under the Deendayal Antyodaya Yojana — National Urban Livelihoods Mission (DAY-NULM).
- Ministry of Housing & Urban Poverty Alleviation. (2013). Operational Guidelines for Support to Urban Street Vendors (SUSV) under the National Urban Livelihoods Mission (NULM).
- Ministry of Housing & Urban Affairs. (2024). PM SVANidhi Dashboard, Government of India can be accessed at <https://pmsvanidhi.mohua.gov.in/Home/PMSDashboard>.
- Roever, S. (2010). "Street Trade in Latin America: Demographic Trends, Legal Issues and Vending Organizations in Six Cities" Chapter 9, *Street Vendors in the Global Urban Economy*, Routledge.
- Saha, D. (2009). "Conditions of 'Decent Working Life' of Street Vendors in Mumbai." International Conference on Regulating for Decent Work (RDW), Geneva.
- Singh, S. and Verma, S. (2021). "Banks red-flag: Loans to street vendors in pandemic turning NPAs," *The Indian Express*, January 21.
- Soni, M. (2020). "PM SVANidhi scheme for street vendors: Benefits, loan amount, tenure." *The Hindustan Times*, October 26.

- Sundaram, S.S. (2008). "National Policy for Urban Street Vendors and Its Impact," *Economic and Political Weekly*, Vol. 43, No. 43, pp. 22-25
- Tiwari, A. (2020). "Explained: What is the PM SVANidhi scheme for street vendors, and why was it launched?" *The Indian Express*, December 31.
- WIEGO. (2020). "Street Vendors and Public Space: An interactive e-book.", February.
- Waylaun, R S. (2018). "Monrovia City Corporation (MCC), Petty Traders Sign MoU". New Republic Liberia. September 27.

Models of Privatisation in Formal Housing in India: An Appraisal

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Abstract

Housing is one of the basic needs of mankind and is recognised as a fundamental right under Article 25 of the Universal Declaration of Human Rights and Article 11(1) of the International Covenant on Economic, Social and Cultural Rights (ICESCR). In India, till the 1990s, the state governments used to provide housing to the population through the establishment of State Housing Boards, Municipal Corporations, and Improvement Trusts at the city level. During 1991, India pursued economic reforms and liberalised various economic sectors, housing was one of them. The National Housing Policy 1992, emphasised the creation of a facilitating environment by the government to increase the growth of housing rather than the building itself. In the light of the National Housing Policy, different state governments framed their policies for involving the private sector in housing. The present paper highlights the models followed by state governments of Haryana, West Bengal, Maharashtra, and Gujarat for involving the private sector in formal housing. The paper further includes a discussion on the procedure laid by state governments for registration as a promoter, the procedure for approval of private housing projects, profit margins, plot sizes, reserved areas for EWS, etc. The comparison of the procedure will help to highlight the positive features of the process that can be adopted by other state governments to make their privatisation model more inclusive, efficient, and transparent.

Keywords

Promoter, License, Plot sizes, Profit margin, EWS, Community Facilities, Maintenance.

Introduction

The UN-Habitat Urban Indicator Guidelines (2009) identify shelter as first among the five goals set for achieving sustainable development. The Habitat-III (2016) Zero

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Draft of the New Urban Agenda also stressed promoting, protecting, and ensuring the full and progressive realisation of the right to adequate housing. Thus, the need for adequate shelter is a human right to attain a better standard of living. The World Bank (1993) has stressed that housing investment typically comprises 10-30 per cent of gross capital formation in developing countries. Considering housing as an asset, it makes up 20-50 per cent of reproducible wealth in most countries. Housing, besides being a basic shelter need, also serves as a commodity that offers social status as well as financial security (Sandhu, 2013). The World Bank Policy Paper (1993) has identified housing as an economic sector rather than solely a welfare issue. It is emphasised that the housing sector is connected to the broader economy through several different perspectives such as the real, fiscal, and financial. Thus, housing occupies prime importance from social, economic, and physical perspectives.

India is the second most populous country in the world after China. Its urban population has grown by about six times during the last six decades. Since Independence, India has experienced a sharp rise in urban population. The nation's urban population rose to 19.90 per cent in 1971 against 17.29 per cent in 1951. In the year 1981, the urban population reached 23.34 per cent residing in 3891 urban centres. The urban population further increased to 27.82 per cent in 2001 with inhabitants in 5161 towns and cities. Census of India 2011 reveals that the number of towns has further risen to 7935, which accommodates 31.16 per cent citizens of the country. It is observed that the percentage of the urban population increased two-folds from 1951-2011 and the number of towns has increased about three times during the same period depicting the growth of urban population leading to the growth of urban settlements in India. McKinsey Global Institute (2010) has projected that by the year 2050, India will have an additional 416 million urban dwellers. Even the UN World Prospects (2018), has projected a similar number of urban dwellers in India. The McKinsey Institute further projects that by 2030, India's urban population will reach 590 million constituting a share of 40 per cent of India's total population. Thus, the urban infrastructure requirements, especially housing, are expected to grow much faster. There exists a huge demand and supply gap in housing as the growth rate of households is much higher than the growth rate of housing stock. The report of the Technical Group on urban housing shortage (2012-2017) has highlighted the urban housing shortage of nearly 18.78 million households in 2012. However, the housing shortage increased by about 3 million reaching 21.87 million with the inclusion of non-durable houses (Tiwari and Rao, 2016).

Privatisation and Housing Reforms in India: Theoretical Framework

Sandhu, (2005) cited that the history of privatisation dates back to 1776 when Adam Smith in his book, *The Wealth of Nations*, advocated a free, rather than a government-constrained enterprise. However, the concept of privatisation was explicitly suggested in 1969 in the form of Reprivatisation by Professor Peter F. Drucker where he suggested that companies can perform better in a decentralised form rather than in the

command and control model. In 1970, Savas recommended the option of contracting with private firms as a pragmatic policy to break up municipal monopolies and to bring cost-effectiveness to municipal services. (Savas, 1970)

As mentioned by Banerjee, (2013), the word privatise first appeared in a dictionary in 1983 and was defined as the change in ownership or control from public to private. In 1987, Savas defined privatisation as the act of reducing the role of government in an activity or the ownership of assets. He further elaborates privatisation as the transfer of enterprise ownership in whole or in part from the state to private hands, in countries with state-owned enterprises including countries in developing, post-socialist, and in Western Europe.

Linneman and Megbolugbe, (1994) stated that privatisation comes in two general forms in terms of funding the production that is “load shedding” and “empowerment.” In load shedding, the government doesn’t finance and produce goods and services. Under empowerment, the government finances public goods and services but their delivery and production is done by the private sector. Empowerment is done through contracting out whereby the government enters into a contract with the private sector to provide goods and services as demanded by the public, e.g. franchises, vouchers, and subsidies (ibid).

According to Roehrich and George, (2014),’ “Privatisation is the act of reducing the role of government or increasing the role of the private institutions of society in satisfying people’s needs. Whereas in the case of Public-Private Partnership, there is a long-term contract between a private party and a government agency for providing a public asset or service, in which the private party bears significant risk and management responsibility.” The primary objective behind this enabling strategy was to improve the performance of the housing sector as a whole and to leverage limited public resources to the greatest extent possible (Mayo and Angel, 1993).

In Britain, in 1979, the Margaret Thatcher government initiated a fundamental reform in the role of the state in the housing sector. During the 1980s, under the Housing Act, 1980 the right to buy was given by the UK government with which tenants may purchase their property at a maximum discount of 70 per cent. The Housing and Planning Act of 1986 and Housing Act of 1988 provided initiatives to the local authority as well as to the tenants. The local authority can have a business plan and 100 per cent contract with tenants and private finance packages were given by the local authority and tenants may find suitable landlords as well. The Act also covered provision for private financing for social housing, private management for social housing as well and enabling the role of local authorities (Whitehead, 1993; Linneman and Megbolugbe, 1994). UK housing privatisation, however initially showed that the transfer of ownership from the public sector to the private sector did not have effective participation of the private sector in the housing delivery system. The housing reform should consist of a wide range of policies aimed at improving efficiency by focusing on all the players (owners, managers, or financiers) of the process.

Experiencing waves of privatisation from around the world, India also joined the movement of privatisation during the 1980s with the state acting as a facilitator rather than a controller, the international institutions such as the World Bank and International Monetary Fund (IMF) also promoted privatisation (Sandhu, 2013). As a result, the nation started reforming its economic policies towards integration into the global economy. The 1980s was marked by a shift in the housing policy wherein the World Bank moved away from its affordability, cost recovery, and replicability approach of the 1970s to the 1980s approach of promoting the creation of self-supporting institutions having the capability of making long-term mortgage loans to low and moderate-income households as well as to reduce and restructure subsidies (ibid).

Housing reforms introduced in India during the 1990s had a positive impact on the development of housing and housing amenities. These reforms brought changes in the housing sector by increasing the number of acceptable housing stock and increasing access to safe drinking water, good sanitation, and lighting (Mahadeva, 2006). Housing Policy in India, which earlier focused on the construction of houses, shifted towards the creation of an enabling framework, improving access to credit and encouraging multi-stakeholder participation in the housing sector. However, the recent policies focus on sustainability and social inclusion, and they recognize the key role of the private sector (UN- Habitat III, 2016; Parashar, 2014 and Sandhu, 2005). In each Five-Year Plans, allocations were made towards housing but there has been a continuous increase in the gap between housing demand and supply due to constraints in finance and administrative systems. The government identified PPP as an important element for enabling an approach wherein the private sector is allowed to formally participate in a housing development (Parashar, 2014 and Sandhu, 2005).

The formal private sector further provides planned housing in two forms, firstly, in the form of private and corporate townships such as satellite townships on peripheries, and secondly in the form of gated colonies /communities. In 1991, the role of the private sector was identified and incorporated in development through different changes in the legislation. In light of this, different states enacted different Acts to formally allow private sector participation in housing.

Housing Shortage in India

There is about a five times increase in the number of households from 1961 to 2011. The housing stock has also shown a proportionate increase during the same period but there has been an exponential increase in the housing shortage. Figure 1 indicates that over the decades there is a proportionate increase in housing stock to that of several households. However, the absolute housing shortage in terms of the number of existing housing stock in urban areas has significantly reduced from 1.63 million in 2001 (3 per cent of the households) to 0.39 million (0.5 per cent of the households) in 2011. But at the same time, the TG-12 on Urban Housing Shortage 2012-17 estimated the

urban housing shortage of nearly 18.78 million households in 2012. So, considering the quantitative aspect that deals with the difference between the total requirements and supply of houses, there exists a housing shortage of 18.78 million which indicates the number of additional houses that would be required to provide each household with a separate house. On the other hand, qualitative aspects act and accelerate the housing requirement. The qualitative aspects mean lack of per capita housing space or household relation to minimum housing space required for healthy living, which is, of course, a socially accepted minimum standard level. It includes the age of a building and, the absence of amenities within a house like a kitchen, toilet, water supply, bathroom, etc. As per Tiwari and Rao (2016), the housing shortage increased by about three million to 21.87 million with the inclusion of non-durable houses. The issue of qualitative shortage can be further highlighted by coding the households lacking access to basic amenities including access to drinking water (53 per cent), toilet facilities (53 per cent), and electricity (33 per cent). To overcome this housing shortage, the role of the private sector has been identified by the Central government under the National Housing Policy 1992. Following the national policy, different state governments framed their legislation to allow private sector participation in housing.

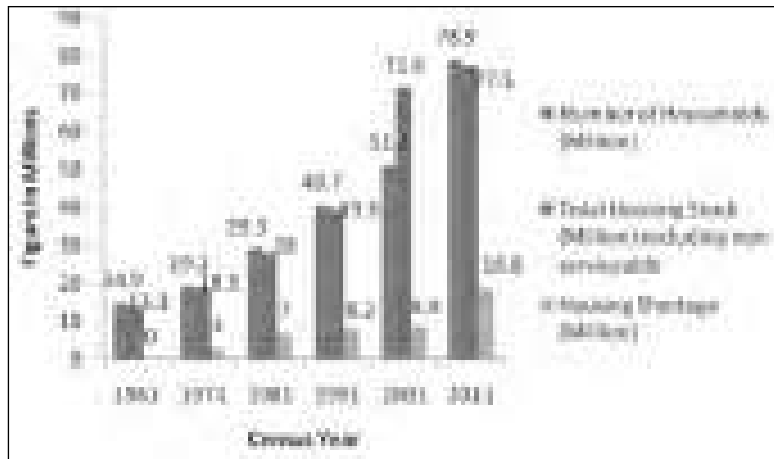


Figure 1: Urban Households, Total Urban Housing Stock and Housing Shortage in India.

Source: Census of India.

Models of Privatisation in Housing in India

Based on their laws and housing policies, different states of the country are practicing different models for the private sector's involvement in the provision of housing in their respective states. The four states selected for the study of the procedure laid for private sector involvement are— Haryana, Maharashtra, Gujarat, and West Bengal. These states represent the northern, western, and eastern zones of India and the level of urbanisation in the selected states is higher than the national urbanisation rate of 31.2

per cent that is Haryana (34.8%), Maharashtra (45.2%), Gujarat (42.6%) and West Bengal (31.9%) as per Census of India, 2011. Thus, these states are facing higher urban population pressures and are looking for more innovative practices such as private sector participation to cater to the housing needs of the ever-increasing population. These states are facing the issue of urban housing shortage that is in Haryana (0.42 million), Maharashtra (1.94 million), Gujarat (0.99 million), and West Bengal (1.33 million) (GOI, 2013). The parameters undertaken for the study of the process for granting the license to the developer/ promoter are: responsibilities of the promoter; minimum area requirement for setting up of residential township; income groups catered by the promoter and norms and standards for different components of the township. These models are discussed below:

Haryana Model

The Government of Haryana, in the year 1975 enacted Haryana Development and Regulation of Urban Area Act, 1975 (HDRUA, 1975). With this Act, Haryana State formally involved the private sector in the acquisition, development, and disposal of urban land. This Act allows private developers to assemble land at a large scale by adopting negotiated land purchase techniques. To get the license, the coloniser needs to write an application to the director for a grant of license under Section 9 of the Act and submit a bank guarantee equal to 25 per cent of the development works. The Director after completion of the inquiry and submission of the bank guarantee, grants a license to the promoter. The granted license is valid for two years and can be renewed for one year after paying the prescribed fee. The promoter enters an agreement for carrying out development works following it.

The promoter has to bear the responsibility for the maintenance of roads, open spaces, and health services for five years from the date of issue of the completion certificate and the transfer of the same is done to local authority/governments, free of cost. The schools, community centres, hospitals, and other community buildings, can be constructed by the promoter or can get them constructed from other institutions or may transfer the area to the Government free of cost. The colonisers are required to pay service charges in two equal installments. The first installment is required to be deposited within 60 days and the second installment can be deposited within 6 months from the grant of license. These service charges constitute the Haryana Urban Development Fund which the state can utilise for urban development.

The state is divided into Hyper, High, Medium, and Low potential zones by the Government. The minimum area for the colony is fixed as 40 hectares for colonies to be developed in hyper and high potential zones. The area requirement for colonies in medium and low potential zones is fixed as 25 hectares and 10 hectares respectively for plotted development. In the case of group housing, the minimum area required is 4 hectares for hyper and high potential zones. In medium and low potential zones, the area is fixed as 2.5 hectares.

The saleable area permissible in the case of a plotted colony is fixed as 55 per cent (including 4 per cent commercial area) of the total area of the colony. The promoter is required to reserve 20 per cent of the plots for EWS housing with a minimum plot size of 50 sq mts. Another 25 per cent of the total plots having an area between 125 sq mts to 225 sq mts are allotted under the 'No Profit No Loss' category; the rate for these plots is prescribed by the Director. The promoter needs to provide community buildings as per the population to be accommodated. The minimum road width in the colony is fixed at 12 meters.

In the case of group housing, the ground coverage is fixed as 35 per cent of the site area with FAR 175. The maximum height that can be achieved is 60 meters. About 0.5 per cent of the area of site can be used for convenient shopping in the form of a single-storey structure with a maximum height of 4 meters. The promoter is required to reserve 15 per cent of the total number of flats for EWS having an area of 18.58 sq. mts and 10 per cent of the main dwellings for service apartments having an area of 13 sq. mts. About 15 per cent of the site area is required to be used under parks and open spaces.

West Bengal Model

West Bengal has also invited the private sector to participate in housing development. The Government under the West Bengal Building (Regulation of Promotion of Construction and Transfer by Promoters) Act 1993 looks at Public-Private Partnership as an approach to resolve the housing shortfall issue. This Act is meant to control the building activities of the promoters and protect the interests of property buyers. It gives guidelines regarding the safety of the structures, transparent financial transactions, and clear legal transactions. The West Bengal government has initiated the planning and development of multiple township projects intending to supply land to all income groups.

The promoter needs to get registered under Section 3 of the Act. The promoter is required to write an application for permission to construct any building or block that should be accompanied by a copy of the registration certificate issued in sub-rule (1) of rule 3 along with the prescribed fee as per the estimated cost of the project. The promoter also needs to submit a copy of particulars of land, location, total covered area, carpet area, height, etc. along with particulars of electrical and sanitary arrangements, the sale price of the flats including the advance amount, and dates of each installment. In the case where the promoter fails to give possession of flats on said dates, the applicant can claim compensation from authorised officers under Section 9 of the Act. The Act also laid provisions for insurance of buildings and land by the promoter as soon as the project gets completed with a general insurance company.

In Kolkata, the major public sector partners in PPP schemes are state agencies like the West Bengal Housing Board (WBHB) and the Kolkata Metropolitan Development Authority (KMDA) and the private partners are big, reputable indigenous business

groups with established financial credentials (Sengupta, 2006). The business model for partnerships is based on a joint venture model with the equity shares of public partners ranging between 11 per cent and 49.5 per cent depending upon the social content of the project. Cross-subsidy is an integral component of such projects which acts as an incentive for the private sector to invest in housing and also to include LIG people as part of such projects. Under PPP projects, 10-15 per cent of the total construction was reserved for LIG or MIG groups and sold on “no-profit” or “little profit”. To increase the supply of housing, the government introduced the concept of multiple township projects, and 50 per cent of the total land is reserved for residential purposes. Plots in the LIG category are sold on a leasehold basis for 99 years with restrictions on any transfer/ sub-division/sub-leasing or sub-lettings of plots for 5 years, whereas MIG/HIG plots are sold on a freehold basis (Sengupta, 2006).

Maharashtra Model

The Maharashtra Housing (Regulation and Development) Act, 2012 makes provision for promoters to participate in the process of housing development/construction. A promoter intends to participate in the construction of such blocks and needs to make full disclosure of the nature of his title to the land on which flats are to be constructed. In case the land is owned by another person, then a registered copy of the agreement shall be disclosed. The Agreement shall include the following: Disclosure of the enterprise details covering name, registered address, and registration details; Disclosure of the number and size of plots, layout plan, carpet area, utility area, FSI and Transfer of Development Rights, common areas amenities, and facilities proposed; Disclosure of the time for completion of phases and connecting the project with the municipal services; Disclosure of project specifications regarding material; Specifying the date by which possession of flats is to be handed over; and complete details of the number of flats built and to be built along with a list of parking spaces provided or to be provided.

The promoter is required to apply for registration of the project along with fees not exceeding Rs 50,000 while displaying the project on the website of the Housing Regulatory Authority. The projects which do not require to get registration and get displayed on the website, are the ones which have an area less than 250 sq. mts or a total number of flats proposed is less than 50 or where the occupation certificate is granted before coming into force of this section or where the project is under renovation, repair, reconstruction of existing flats.

The promoter is required to apply sub-section (1) along with the chartered architect's authenticated copy of the proposed development and proof of submission of the plan for approval of the local authority. Within 7 days of obtaining the application, the Housing Regulatory Authority issues a password that can be used by the promoter to access the website of Housing Regulatory Authority. The flats cannot be sold by the promoter before displaying the project on the website. The promoter can accept a sum of 20 per cent of the sale price as advance payment and has to enter into a written agreement under sub-section (1) of the Registration Act with each such person.

The Act gives a detailed description of the responsibilities of the promoter that includes that the possession of a flat can only be given after obtaining the occupation certificate or building completion certificate by the promoter. The promoter is responsible for providing essential services including water supply, electricity, lifts, staircases, and sewerage network to the flat purchaser. The promoter is required to maintain a building-wise separate account in any bank. The promoter holds the responsibility of paying all the outgoings of the project till it gets handed over to the allottee. The alteration in the approved plan is not allowed once they are displayed on the website. Within five years of handing over the flat if any defect in the building or material used or any unauthorised development is noticed, it must be rectified by the promoter. The general liabilities of flat purchasers cover the payment at the proper time and place. The proportionate share of the municipal taxes, water and electricity charges, and other public charges following the agreement, is with the promoter.

Gujarat Model

The Government of Gujarat formally invited the private sector under the Policy regarding Regulations for Residential Townships in the year 2009 and these regulations are applicable within the jurisdiction of the appropriate authority constituted under Gujarat Town Planning and Urban Development Act, 1976. The residential townships to be developed are required to utilise 60 per cent of the land under the township for residential purposes after the provision of land under public infrastructure. The developer needs to undertake maintenance of public purpose infrastructure for seven years and thereafter the project can be handed over to the competent authority.

The Policy specifies the designated officer to look after the development of townships. In the case of an area having a Municipal Corporation and any other appropriate authority in its periphery, the prescribed officer could be the Municipal Commissioner, Chief Executive Authority, or the Senior Town Planner of the Town Planning and Valuation Department. The other cases where there is a Municipality Area designated as an Area Development authority, the prescribed officer would be the Collector and chairman District Urban Development Agency, Chief Officer, and Town Planner of the concerned district. The state government can appoint any prescribed officer by passing an order.

The prescribed officer is required to pass a recommendation to approve or refuse the proposal of the township within 30 days from receipt of the application. The prescribed officer is also required to monitor the progress and to recommend the government to grant incentives available under any scheme of state or Central government. The proposal for the township is required to include a detailed layout plan of the township including provision for a 30-meter-wide road on a part of the boundary for connecting the township with its surroundings. Five per cent of the area is to be kept under the school, hospital, and public amenities. Another five per cent of the area is under parks and open spaces and each such plot is required to have a minimum area of 3000 sq. mts.

The project should reserve five per cent of the land for social and EWS housing. This housing is to be developed and disposed off in consultation with the prescribed authority. About 15 per cent of the land is used for roads. Other than that, the developer needs to undertake considerations for physical infrastructure by making provision for footpaths, cycle tracks, zero discharge from the township by reusing the sewerage water, implementing a rainwater harvesting plan, to ensure a continuous supply of water and power, segregation of biodegradable and non-biodegradable waste, use solar power in street lighting, and plant a minimum of 200 trees per hectare. The promoter also needs to submit details of project finance and a proposal regarding the maintenance of the township.

The Policy further specifies the responsibility of the developer including acquisition or pooling of land at the expense of the developer, to develop buildings for a public purpose as approved. The developer is required to execute a bank guarantee equivalent to two per cent of the cost of the infrastructure after procuring the building use permission from the concerned authority. This amount is converted to the corpus fund of the members of the cooperative authority after the expiry of the maintenance period. The developer is responsible for providing connectivity of the township to the existing road or development plan road or T.P. Scheme road, to provide connectivity with water supply, arrangement to collect, treat, and disposal of waste/sewage in the township area, arrange for power supply and bear the entire cost for these infrastructures.

Conclusion

The state governments of Haryana, West Bengal, Maharashtra, and Gujarat have adopted models for private sector participation in housing provision. These models have certain set of similarities that include the fixation of areas of different components of the township, the inclusion of all income groups, and fixing the responsibilities of the promoters. However, few differences are observed in these models such as the fixation of an area of the colony as per the division of the state into different potential zones in Haryana. The model also fixes the saleable area, plot size, size of flats for EWS, and percentage of plots and flats for EWS. In West Bengal, the PPP approach is followed. The components of cross-subsidy are an integral components of the projects. This model further includes guidelines regarding the safety of the structures and transparency in financial transactions.

However, in Gujarat, an effort is seen towards innovative and self-sufficient neighbourhood development. At the same time plots for LIG are sold on a leasehold basis. In Maharashtra, the schedule for completion of project phases, possession of flats, and material specifications are taken at the preliminary stage of the project. The display of the project on the website of the authority adds to its advertisement. The main highlights of each model are further discussed like in Haryana, private developers can get registered as promoters (HDRUA, 1975). The Act provides for development by way of assembly of parcels of land by the private developers directly from the

land owners, for residential purposes according to stipulations which include financial contribution to the development authority for attributable off-site infrastructure costs. The minimum area requirement of the colonies is fixed based on their location in the potential zones like Hyper, High, Medium and Low designated by Government of Haryana. The promoter is given responsibility for the maintenance of roads, open spaces, and health services for five years from the date of completion certificate after that all these facilities are transferred to the local authority free of cost. The promoter is provided with options to construct the community buildings such as schools, community centres, and health facilities on his own or he may transfer these areas to the state government free of cost or may get these constructed from other institutions. The Haryana model further provides standards regarding a minimum road width and prescribes the plot size and their per centages. In group housing, ground coverage is fixed with FAR. The government has fixed 15 per cent of the total number of flats for EWS with minimum area of 18.58 sq. mts.

The West Bengal government initiated a PPP approach under the West Bengal Building (Regulation of Promotion of Construction and Transfer by Promoters) Act 1993. Under this Act, the government initiated the planning and development of multiple township projects to supply land to all income groups. The PPP model has shown an improvement in creating housing stock due to the technical and market expertise of the private sector as well as the accountability and morality of the public sector by making cross-subsidy an integral component of such projects. The provisions of the government are made to serve all the income groups by keeping a check on the sale price of the flats.

In Maharashtra, the government is allowing private promoters under the provisions of the Maharashtra Housing (Regulation and Development) Act, 2012. The government is allowing private promoters to display their project on the official website of the Housing Regulatory Authority which adds to the project advertisement. The project's Completion Schedule is taken from the developer at the time of approval, which helps in the project's timely completion. The Act fixed the limit of 20 per cent of the sale price as an advance from the client. The Act demarcates the liabilities of the promoter such as the provision of essential services, building-wise account in a bank, and building a completion certificate, as well as the client regarding the timely payment of all the taxes as per the agreement with the promoter.

In Gujarat, the private sector is working under the Policy regarding Regulations for Residential Townships, 2009. These regulations are applicable within the jurisdiction of the appropriate authority constituted under Gujarat Town Planning and Urban Development Act, 1976. The authority appoints a consultant to supervise the quality of construction of public-purpose infrastructure and the timely execution of the project. For this, the developer needs to deposit two per cent of the estimated cost of public-purpose infrastructure. This deposit can be refunded after the issue of the completion certificate by the consultant. The developer needs to undertake maintenance of public

purpose infrastructure for seven years and thereafter the project can be handed over to the competent authority.

The state government of Haryana, West Bengal, Maharashtra, and Gujarat had laid legislative guidelines to describe the procedure for registration as a promoter. All the privatisation models have the objective of inclusion of all income groups and fixing the responsibilities of promoters involved in the process of development. The component of cross-subsidy can be considered by other states to make housing stock affordable for all income groups as it has been done in Kolkata. The Maharashtra government tried to bring transparency to the housing sector by allowing private promoters to display their project on the official website of the Housing Regulatory Authority. This initiative is beneficial for both the promoter as well as the consumer by knowing the current stage of the project. The Gujarat model fixed 5 per cent land for EWS housing and it strives to develop self-sufficient neighbourhood units by incorporating concepts of zero waste. Thus, state governments can learn positive ideas from these models and consider them for their states to make privatisation more inclusive, responsive and innovative.

References

- Banerjee, Sonali Chakravarti. (2013). Public-Private Partnerships in Kolkata: Concepts of Governance in the Changing Political Economy of a Region. Retrieved July 21, 2017 from <https://idsk.edu.in/wp-content/uploads/2015/07/op-41.pdf>.
- Government of Gujarat. (1976). The Gujarat Town Planning and Urban Development Act, 1976 retrieved on 12 July, 2019 from <http://www.janaagraha.org/asics/report/Gujarat-Town-Planning-and-Urban-Development-Act-1976.pdf>.
- Government of Haryana. (1975). The Haryana Development and Regulation of Urban Areas (HDRUA) Act, 1975 retrieved on 12 January, 2023 from https://tcpharyana.gov.in/Notification/URBAN_AREAS_ACT_RULES.pdf
- Government of India. (2013), Ministry of Housing and Urban Poverty Alleviation, State of Housing in India a Statistical Compendium - 2013. Retrieved on July 10, 2016, from https://mohua.gov.in/upload/uploadfiles/files/Housing_in_India_Compendium_English_Version2.pdf.
- Gujarat Integrated Town-ship Policy. (2008). Government of Gujarat, Gujarat Urban Development Company, Gandhinagar retrieved on July 19, 2017 from http://www.indiawaterportal.org/sites/indiawaterportal.org/files/Gujarat%20Integrated%20Township%20Policy_Gujarat%20Urban%20Development%20Company_Government%20of%20Gujarat_2008.pdf.
- Linneman, Peter D. and Isaac F. Megbolugbe. (1994). Privatisation and Housing Policy. *Urban Studies*, 31(4/5), 635 – 651.
- Mahadeva, M. (2006). Reforms in Housing Sector in India: Impact on Housing Development and Housing Amenities. *Habitat International*, 30, 412 – 433.
- McKinsey & Company. (2010). Decoding- Urban Climate Change Resilience- the policy way. Retrieved on March 15, 2018 from <https://www.teriin.org/resilient-cities/urbanisation.php>
- Mayo, S and S. Angel. (1993). Housing: Enabling Markets to Work. The World Bank, Washington DC.

- Parashar, Dipti. (2014). The Government's role in Private Partnerships for Urban Poor Housing in India, *International Journal of Housing Markets and Analysis*, 7(4), 524-538.
- Roehrich, Jens K., Michael A. Lewis and Gerard George. (2014). Are Public – Private Partnerships a healthy option? A systematic literature review. *Social Science & Medicine* 113, 110-119.
- Sandhu, Kiran. (2005). Access to land by the urban poor in Amritsar City, India; Grim Realities and Blurred Hopes. Retrieved on January 2, 2018 from <http://n-aerus.net/web/sat/workshops/2005/papers/25.pdf>.
- Sandhu, Kiran. (2013). Formal housing finance outreach and the urban poor in India. *International Journal of Housing Markets and Analysis*, 6(3), 269-283.
- Savas, E.S, (2000). Privatization and Public Private Partnerships. Chatham House Publishers, New York.
- Sengupta, Urmi. (2006). Government Intervention & Public-Private Partnerships in Housing Delivery in Kolkata. *Habitat International* 30, 448-461.
- Sengupta, Urmi. (2010). The Hindered Self-Housing: Housing Policies, politics and Poverty in Kolkata. *Habitat International*, 34, 323-331.
- Tiwari, Piyush and Jyoti Rao. (2016). Housing Markets and Housing Policies in India. ADBI Working Paper 565, Asian Development Bank Institute, Tokyo.
- Town and Country Planning Department. (1977). The Himachal Pradesh Town and Country Panning Act, Government of Himachal Pradesh.
- UN_Habitat III. (2016). Revised Zero Draft of the New Urban Agenda. Retrieved on January 15, 2018 from <https://habitat3.org/wp-content/uploads/Habitat-III-Zero-Draft-outcome-document-May-2016.pdf>
- United Nations. (2019). World Urbanization Prospects: The 2018 Revision. Retrieved on May 5, 2020 from [https://population.un.org/wup/Publications/Files/WUP2018-Report .pdf](https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf)
- UN_Habitat. (2009). Urban Indicators Guidelines - Better Information, Better Cities. Retrieved on July 10, 2016 from https://www.ine.pt/ngt_server/attachfileu.jsp?look_parentBoui...att_display.
- Whitehead, Christine M.E. (1993). Privatizing Housing: An Assessment of U.K. Experience. *Housing Policy Debate*, 4(1), 101- 139.

Developing a Framework for Understanding Vulnerability of Public Spaces to Urban Processes: Case of Historic Cities in Rajasthan

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Abstract

Public Spaces in historic cities with their distinct spatial quality and humane character provide a 'sense of place, belongingness and bonding.' However, urban processes have transformed inner core areas in historic cities and impacted public spaces. Increased demand for housing, commerce and infrastructure have triggered urban processes that have exposed public spaces to transformation phenomena, acting as threats to their integrity. Unique experience and quality of life that these public spaces support is rapidly getting lost leading to a stressful living environment. This research has developed a novel approach for studying public spaces using the lens of vulnerability. Literature review and in-situ field study in four historic cities in Rajasthan helped identify variables of insensitive changes in public spaces. Statistical tools combined with local community assessment helped establish public space vulnerability indicators and a framework for assessment of public space vulnerability to urban processes.

Keywords

Historic Cities, Public Spaces, Urban Processes, Transformation Phenomenon, Vulnerability.

Introduction

Challenges to Public Spaces in Historic Cities

Inner core areas in historic cities are morphologically distinct, having a marked urban character and quality of life in contrast to contemporary habitat. The network of

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public spaces in the form of traditional shared spaces, such as markets, streets, transit spaces, squares, nodes and open spaces promotes sociability, walkability, creativity, and sustainability contributing greatly to quality of life of local community. However, inner core areas and public spaces therein have undergone significant changes. Inner core areas have come to be characterised by a degenerated environment, dilapidated physical infrastructure and extremely poor living conditions. Unplanned urban growth and development has caused irreversible damage to public spaces in inner core areas in historic cities.

Statement of Problem

Urban processes have triggered a complex interplay of transformation phenomenon accentuating public space vulnerability, giving rise to negative conditions in which physical integrity and experiential quality of public spaces are threatened and at risk. In addition, majority of developmental plans of historic cities do not recognise unique typologies of shared spaces in inner core areas as public spaces. Inner core areas in Indian historic cities are merely designated as ‘Special Areas’ in Master Plan without the backup of a concrete strategy and action plan to deal with peculiar developmental problems of such urban areas. Thrust is laid only on preservation of landmark buildings. Traditional housing areas locally known as *mohallas* and associated public spaces are unfortunately left to deteriorate and fall apart.

Need of the Study

Public spaces in inner core areas in historic cities form an integral part of its unique way of life and therefore its living heritage. Quality of public space and its character are a crucial determinant of a city’s attractiveness. Public spaces in inner core areas are under threat and need to be urgently safeguarded. It is critical to investigate vulnerabilities associated with public spaces with respect to threats triggered by slow but long-term urban processes and devise a strategic framework for vulnerability reduction to mitigate the negative impact of urban processes.

Objective of the Study

Public spaces in inner core areas in historic cities are impacted by a number of transformation phenomenon triggered by urban processes. One of the objectives of the study was to identify indicators of vulnerability of public spaces to urban processes.

Relevance of the Study

While global discourse on public spaces has been centred largely around its form, use, methods of study and ways of enhancing user experience looking at them purely through the lens of planning, design and behavioural sciences, this research in contrast looks at public spaces through the lens of vulnerability, examining change, identifying threats or transformation phenomenon that act as agents of insensitive change, ascertaining impact and in process taking deeper look at what is going on in public spaces in inner core areas in historic cities. By establishing a methodological framework for study

of change in public spaces this research helps negotiate the ever- increasing chasm between development and conservation in historic cities.

Theoretical Construct for Key Research Domains

Urban Processes in Historic Cities

Cities, all over the world, grow, expand, transform and even degenerate triggering urban change. Being in a state of continuous transition, cities undergo several phases of growth and development depending upon various contextual forces. This continual transition or urbanisation occurs partly in response to political, industrial, social and economic changes (Steinberg, 2008). Understanding of urban development indicates that there are four urban processes associated with growth of cities in a general time order namely urbanisation, sub-urbanisation, counter urbanisation and re-urbanisation (Gamesby n.d.) (LibreTexts n.d.) Figure 1.

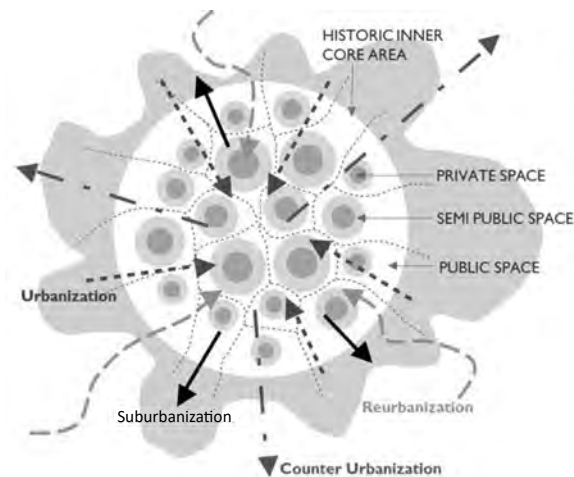


Figure 1: Graphical representation of generic urban processes in historic cities

Source: Author's Work.

Estimates indicate that two-thirds of population in Asia will live in urban areas by 2050 (Khor, et al., 2022). In India, cities have been witnessing sub-urbanisation which is happening much more quickly than expected and they are dramatically expanding physically leading to urban sprawl (Vishwanath, et al., 2013). Major Indian cities, including Tier I and Tier II ones have been witnessing high population growth rates and high urban densities, creating huge demand for urban space and amenities as well as a constant infrastructure deficit. Public spaces being an integral part of inner core areas in historic cities in India are impacted by the larger sub-urbanisation process. Lopsided and uncontrolled urbanisation has led to environmental degradation and degradation in quality of urban life (Jaysawal and Saha, 2014). As a consequence of the transformation phenomenon triggered by urban processes, public spaces in inner core areas are degenerating fast. Common underlying causes for deterioration being changes

in demographics, intra-urban migration, transportation patterns, lack of efficient land-use plans and lack of public investment in the maintenance of historic structures and neighbourhoods (UN-Habitat, 2020).

Transformation of Inner Core Areas

Both natural and anthropogenic processes exert pressures on cities. Cities may face ‘sudden and episodic shocks’, for instance natural disasters or ‘long-term stress’ on account of de-industrialisation, shrinking and aging population, sub-urbanisation or urban sprawl (Polko, 2012). While effects of natural disasters on urban habitats have been widely studied, impact of slow and long-term stress on inner core areas due to urban processes has not received much attention.

Urban processes are unstoppable, irreversible and power engines of growth and development shaping cities continuously. However, the same processes can trigger insensitive transformation of urban areas leading to a decline in quality of life of local community. A study by Lederbogen et al., has linked urban environment for the first time to social stress and states that urban living is associated with increased risk for chronic disorders, a more demanding and stressful social environment and greater social disparities (Lederbogen, et al., 2011).

In historic cities, management of change is a huge challenge for city managers and policymakers. Although scope of conservation has expanded from being monument centric to inclusion of Historic Urban Landscapes, yet there is no theoretical framework for management of change in inner core areas in historic cities (Liang, Ahmad and Mohidin, 2023). Inner core areas in India are marked by key features, like, narrow roads (*gullies*), dense built-up, often mixed use of land, small plot sizes occupying 100 per cent ground for built-up, social homogeneity, limited public spaces, usually congested developments, in comparison to modern day cities (Ministry of Urban Development, 2015). These inherent peculiarities pose constraints as cities continue to grow and expand. Rapid urban growth has led to collapse of historic urban cores in large cities as urbanisation occurs at a more rapid pace at the urban periphery than in the city centre. Historic urban cores of Beijing and Shanghai reveal this pattern, so do the cities like Jaipur, Jaisalmer, Jodhpur, New Delhi, and Udaipur in India (Steinberg, 2008).

Ageing housing stock in inner core areas in historic cities is in structurally poor condition due to a combination of factors including age, inadequate maintenance and the pressures of overuse (Verma, 1993). Physical infrastructure having been designed for few and yet used by many, is usually stressed and dense, organic patterns of development may be unable to accommodate extensions (Verma, 1993). Incompatible land uses, traffic congestion, air and water pollution create serious environmental problems in inner core areas.

Vulnerability of Public Spaces to Urban Processes

Majority of public spaces in inner core areas in historic cities being shared social spaces, are contiguous with buildings and structures thus extremely vulnerable to transformation phenomenon triggered by urban processes. Public spaces in inner core areas have increasingly become inaccessible to people. Casual activities like walking to school and local markets are becoming infrequent and risky (Efroymson, Tran and Ha, 2009). Motorised means of transportation has gained unsurpassed preference over most other public services introducing a host of problems in public spaces in inner core areas such as traffic congestion, pedestrians' conflict with vehicular traffic, unplanned parking and encroachments critically reducing independent movement of people especially children and senior citizens. Insensitive expansion of infrastructure, water, air and noise pollution and ever increasing real estate pressure have adversely impacted integrity of public spaces. *Adhoc* interventions planned in public spaces with multiplicity of execution agencies, lack coordination. Low maintenance has resulted in loss of spatial and experiential quality of public space. Just like the 'Broken Windows Theory' (Wilson and Kelling, 1982) abuse and misuse of public spaces continues unabated eventually leading to an overall degradation of the surrounding neighbourhood.

Framework for Study of Vulnerability

Historically, study of vulnerability was developed in disaster management field and was subsequently extended to climate change domain. Vulnerability as a concept primarily developed as a response to natural disasters being borne out of complex interaction of disaster events with human and environmental systems.

Developing a framework for public space vulnerability assessment requires understanding approaches developed in climate and disaster management studies. Foerster et al., state that approach for vulnerability assessment depends on phenomena being observed, scale of analysis of urban fabric and requires multi-disciplinary approach accounting not only for physical impacts, but also for less quantifiable factors such as social, environmental, organisational and institutional (Foerster et al., 2009). Three approaches have been developed to assess vulnerability namely technical sciences, social sciences and geographical sciences (Foerster, et al., 2009). Geographical sciences approach dealing with urban vulnerability is critically relevant for this study as it considers urban environment as a system with a focus on determining spatial distribution of urban vulnerability and identifying vulnerability hotspots for decision makers. Concept of urban vulnerability combines social and physical vulnerability indicators into an overall vulnerability of the urban place (Foerster, et al., 2009). Based on this understanding of vulnerability identification of indicators of insensitive change in public spaces is critical for understanding vulnerability in the context of public spaces.

Numerous studies have been conducted on identification of quality attributes of public space within the domain of urban design. Project for Public Spaces based on pioneering concepts developed by renowned public space experts namely Jane Jacobs (Jacobs, 1961), William H. Whyte (Whyte 1980) and Jan Gehl (Gehl, 2011) has developed 'The Place Diagram' (PPS, 2022) which identifies key place attributes that make a great public space. Also a Public Space Index model that evaluates 'quality of public space' for five dimensions based on a set of indicators, weightings, scoring and measuring criteria has been developed (Mehta, 2014). However, there is no model for identification of indicators of vulnerability of public spaces to urban processes.

Gaps in Research

Historic cities, with their planning and design have been a perpetual subject of research across the globe. However, there are no systematic and focused studies for understanding changes in public spaces in inner core areas in historic cities due to urban processes. Concept of vulnerability of public spaces with respect to threats triggered by urban processes has never before been investigated and there exists no theoretical framework for public space vulnerability assessment. There is a critical need to investigate transformation phenomenon triggered by urban processes that negatively impact public spaces and identify threats that have potential of putting public spaces at risk. Damages to public spaces due to insensitive transformation of the inner core areas need to be ascertained in a scientific and systematic manner and quantified.

Operationalising Study of Public Space Vulnerability

Defining Public Space Vulnerability

Theoretical construct for the study is based on concept of vulnerability as developed in climate change domain and concept of public space as developed in urban design. Definition of public space vulnerability with respect to urban processes has been adapted from and is in alignment with the definition of vulnerability provided by the Inter-governmental Panel on Climate Change (IPCC) Fifth Assessment Report (IPCC 2014). For the purpose of this study public space vulnerability has been defined as propensity or predisposition of public space components at risk to be adversely affected by transformation phenomenon triggered by urban processes. Vulnerability is further associated with key concepts namely exposure, hazard, risk and coping capacity (Salvador, 2020).

Research Methodology

This paper studies the inner core areas in four historic cities, Jaipur, Bikaner, Udaipur and Bharatpur, deploying a mixed method research strategy, using a blend of case study, historical and phenomenological research technique. Visual mapping exercise was undertaken to understand changes in public space components and questionnaire

survey was conducted for understanding local community perception. Qualitative data were collected through literature review and a field survey was conducted using in-situ observation technique, field notes, visual documentation tools (photographs, videos and maps) and chronological comparative analysis of satellite imagery. Quantitative data were collected using a questionnaire survey.

Case Study of Historic Cities in Rajasthan

Investigating Urban Processes in Four Historic Cities

In order to understand public space vulnerability to urban processes in historic urban habitats, four historic cities in Rajasthan were investigated. Jaipur, Bikaner, Udaipur and Bharatpur were selected based on spread of inner core areas, spatial structure, time period, geo-morphological context, population and scale of urbanisation.

According to NIUA report, 11 out of 40 historic cores in Rajasthan are distinctively transformed whereas remaining 29 cities have retained more than 50 per cent of the character but are under continuous pressure (NIUA, 2018). Sub-urbanisation in Rajasthan has put pressure on urban resources, services and infrastructure, has led to deterioration in quality of life, poor sanitation and solid waste disposal, water shortage, pollution, poor transport system, congestion, encroachment, dilapidated built heritage, inadequate drinking water, public toilets, health facilities and also created dilapidated ghost towns (due to migration) (NIUA, 2018).

Field study revealed that inner core areas in Bikaner, Jaipur, Udaipur and Bharatpur, limited within fortification walls, are witnessing sub-urbanisation. Residential population density is high ranging from 49,421 in Bikaner to 1,23,553 persons per sq km in Udaipur. Inner core areas have no scope for physical expansion as all the four cities undergo sub-urbanisation. Inner core areas which once boasted of grand merchant *havelis* (traditional houses) have seen loss of traditional urban fabric. Excessive commercial expansion has led to conversion of *havelis* into shopping malls and offices. Increased density has put additional load on historic infrastructure resulting in poor solid waste and garbage management and water scarcity. Traffic congestions due to commercial activities, insufficient parking and noise pollution have drastically impacted quality of life in all four cities. Insertion of new infrastructure in Jaipur has changed spatial and experiential quality of *Badi Chaupar* and *Choti Chaupar*, two most significant public squares traditionally known as *chaupars*. Unauthorised construction and encroachments are rampant in inner core areas. Tourism growth has led to conversion of *havelis* into hotels, guesthouses, cafes and commercial establishments with complete disregard for preserving authentic architectural character of historic buildings. New construction and renovation of historic buildings is widespread.

Findings from field study of transformation phenomenon in four historic cities triggered by urban processes revealed interesting insights. Degentrification, densification and gentrification have been identified as three primary transformation

phenomenon associated with other secondary transformation phenomenon (see Table 1).

Table 1: Urban process and transformation phenomenon in inner core areas in four historic cities in Rajasthan

Urban Process in Four Historic Cities	Sub-urbanization	Transformation in Inner Core Area			Historic Cities in Rajasthan			
		Primary Phenomena	Secondary Phenomena	Principal Damage Agents	Bikaner	Jaipur	Udaipur	Bharatpur
		Degentrification	Obsolescence in Buildings	Demolition/Renovation/Insensitive Addition & Alterations in Historic Buildings				
			Change in Land Value & Rentals	Lack of Historic Building Maintenance				
				Lack of Infrastructure Maintenance				
			Underutilised Infrastructure	Lack of Infrastructure Maintenance				
		Densification	Change in Building use	Demolition/Renovation/Insensitive Addition & Alterations in Historic Buildings				
			Change in Land Value & Rentals	Demolition/Renovation/Insensitive Addition & Alterations in Historic Buildings				
				New Construction				
			Change in Building use	Increased Commercial Activity				
				Demolition/Renovation/Insensitive Addition & Alterations in Historic Buildings				
				New Construction				
			Growth of Informal Settlement	Development of Slums				
			Strained Infrastructure	Infrastructure Capacity Overload				
			Environmental Degradation	Decay of Natural Features & Pollution				
			Change in Demographics	Displacement of Residents				
		Gentrification	Change in Land Value & Rentals	Displacement of Residents				
				Demolition/Renovation/Insensitive Addition & Alterations in Historic Buildings				
			Change in Building use	Increased Commercial Activity				
			Change in Dmographics	Displacement of Residents				

Source: Author's Work.

Mapping Change in Public Spaces in Four Historic Cities

Review of secondary data and detailed field study of four historic cities helped establish 'Concept of Public Space and Public Realm' in inner core areas including 'Key Components of Public Space.' A 'Parametric Framework for Understanding Public Space Components' in inner core areas in historic cities was established based on the concepts (Srivastava, Hajela and Kumar, 2024). Five physical components namely natural features, space morphology, buildings and structures, objects and ground surface features and utilities that define material public space were identified. Nine non-physical and user-related components namely image, activity, linkage, access, social interaction, right to use, safety, livelihood and participation that characterise intangible attributes of public space were also identified (see Image 1).



Plate 1: Public space components in historic cities

Source: Generated by the author.

For understanding change in various public space components exposed to transformation phenomenon triggered by urban processes, inner core areas in four historic cities were evaluated (Figure 2). It was observed that, among all the four inner core areas, exposed components of public space namely physical, non-physical and user-related were susceptible to insensitive changes due to transformation phenomenon. Based on field study, a matrix for mapping change in exposed components of public space vis-à-vis transformation phenomenon triggered by urban processes was developed (see Table 2).

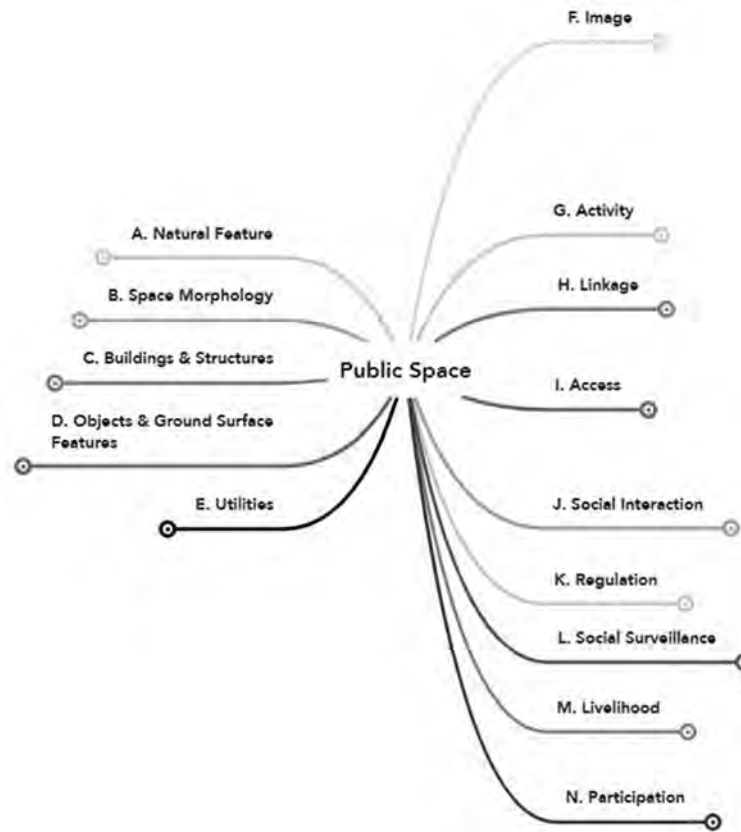


Figure 2: Exposed components of public spaces in historic cities

Source: Author's Work.

Table 2: Matrix for mapping change in public spaces

S.N.	Exposed components of public space	Exposed sub components of public space	Variables of change in public space (observable)
I.	Physical Components	A. Natural Feature	1. Change of Form of Natural Feature (vegetation/ water body/ landform)
			2. Change in State of Maintenance of Natural Feature
		B. Space Morphology	3. Change in Arrangement of Space due to subdivision and encroachment
			4. Change in Edge Response of Buildings/ Structures to Space
		C. Buildings & Structures	5. Change in Form, Layout & Scale of Building/Structure
			6. Change in Architectural Style of Building/ Structure
			7. Change in Façade Ornamentation of Building/Structure
			8. Change in Construction Material of Building/Structure
			9. Change in Use of Building/Structure

S.N.	Exposed components of public space	Exposed sub components of public space	Variables of change in public space (observable)
			10. Physical Condition of Architectural Components of Building/Structure
			11. Physical Condition of Ornamentation on Building/Structure
		D. Objects & Ground Surface Features (Decorative Object, Furniture & Paving)	12. Change in Form of Object/Ground Surface
			13. Change in Material of Object/Ground Surface
			14. Change in Physical Condition of Object/Ground Surface
		E. Utilities (Light Fixture, Water & Drainage Appurtenances)	15. Change in Design of Utility
			16. Change in Material of Utility
			17. Change in Physical Condition of Utility
II.	Non-Physical Components	F. Image	18. Change in Presence of Landmark Building/Structure
			19. Change in Presence of Eateries
			20. Presence of Visual Obstructions (insensitive hoardings, signage, high mast light, mobile towers, etc.)
			21. Change in Waste Water, Solid Waste & Garbage Management
			22. Change in Presence of Spaces for Rest & Relaxation (steps, chabootas, benches, etc.)
			23. Change in Presence of Shaded Spaces (chhatris, canopies, verandahs, trees etc.)
		G. Activity	24. Change in Presence of Diverse and Compatible Activities in Public Space
			25. Change in Frequency & Cycle of Activities in Public Space
		H. Linkage	26. Change in Connectivity with adjacent Public Spaces
		I. Access	27. Change in Availability of Walkable Paths
			28. Change in Opportunity for Walking without Conflict with Vehicular Traffic
			29. Change in Physical and Visual Connectivity with the Surroundings
III.	User Components	J. Social Interaction	30. Change in Presence of Gathering Spaces
			31. Change in Participation of People of Diverse Ages, Different Genders, Diverse Classes & Different Social Background
		K. Right to Use	32. Change in Permission to Freely Use Public Space
		L. Social Surveillance	33. Change in Presence of People of Diverse Ages, Different Genders, Diverse Classes & Different Social Background
		M. Livelihood	34. Change in Opportunities for Local Economic Activities
			35. Change in Diversity in Local Economic Activities
		N. Participation	36. Change in Engagement of Local Community in Activities in Public Space
			37. Change in Participation of Local Community in Maintenance & Management of Public Space

Source: Author's Work.

Understanding Vulnerability of Public Spaces to Urban Processes

The matrix developed for mapping change in public spaces in inner core areas in historic cities helped identify preliminary set of public space variables that are vulnerable to change due to transformation phenomenon triggered by urban processes. In order to incorporate perception of local community in identification of variables of public space vulnerability, a pilot assessment was undertaken in *Chowkri Modikhana* and *Chowkri Visheshwarji* in Jaipur walled city. A questionnaire survey of 52 respondents selected through simple random sampling was undertaken using both closed and open-ended questions.

The survey collected information regarding key physical, non-physical and user related components that define public space in the walled city as perceived by the respondents (Figure 3 and Figure 4). The questionnaire survey helped in understanding public space typologies, important public spaces and public spaces frequently used by respondents. The survey also helped understand daily life activities that connected respondents with public spaces.

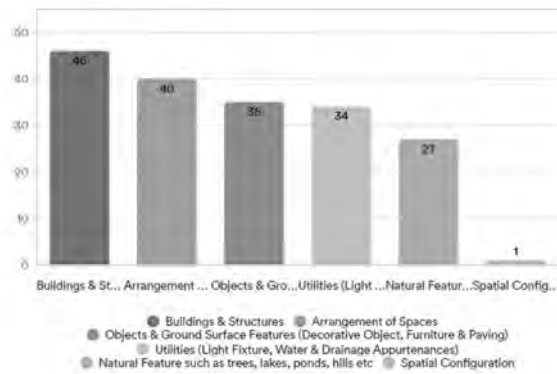


Figure 3: Key physical components of public spaces

Source: Author's Work.

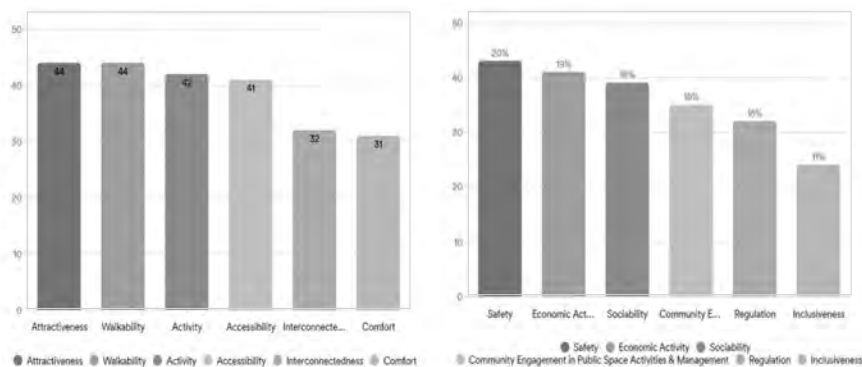


Figure 4: Key non-physical and user related components of public spaces

Source: Author's Work.

Primary field study in four historic cities and local community assessment in pilot study area in Jaipur walled city helped develop a comprehensive list of public space vulnerability variables. A total of 17 variables of physical exposed components, 12 variables of non-physical exposed components and 8 variables of user-related exposed components of public space were identified (Figure 5).

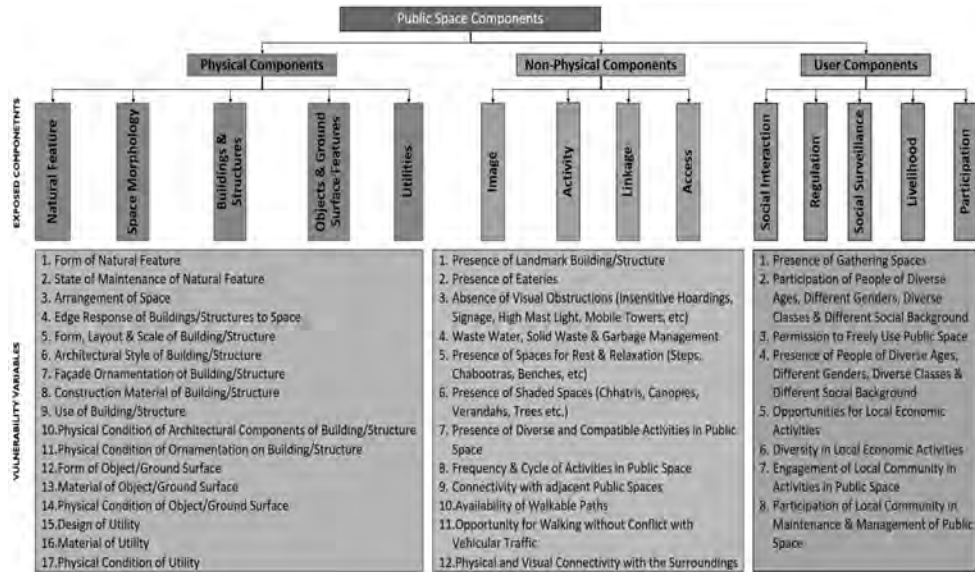


Figure 5: Public space vulnerability variables.

Source: Author's Work.

Data Collection and Statistical Analysis

Determining Public Space Vulnerability Indicators

Validation of Public Space Vulnerability Variables

An email-based Delphi study was undertaken to validate public space vulnerability variables identified through field study in four historic cities and local community assessment in pilot area in Jaipur walled city. Modified Delphi survey was conducted with 35 experts from fields of architecture, urban design, planning, engineering, social sciences, public policy and risk for validating 37 public space vulnerability variables with respect to urban processes in inner core areas in historic cities (Figure 6 and Figure 7).

The questionnaire was designed using closed ended questions defining public space vulnerability variables. The questionnaire was organised in the form of an importance scale using a 5-point semantic differential Likert scale (1=Extremely Low to 5=Extremely High). The purpose of survey was to determine expert perception of importance of identified public space vulnerability variables and build consensus.

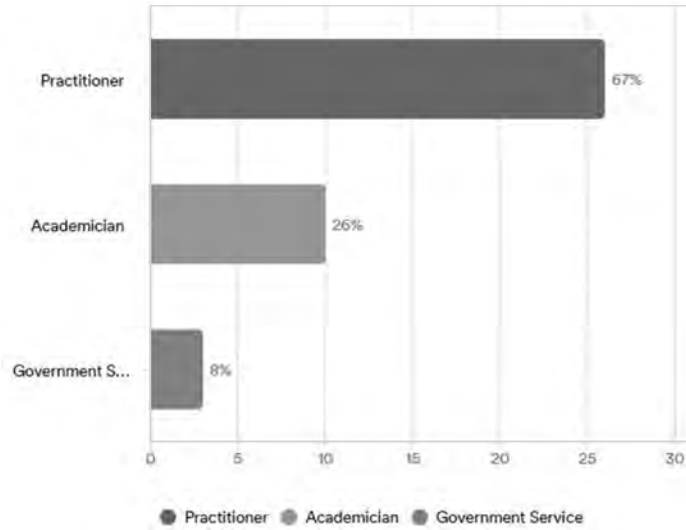


Figure 6: Respondent occupation

Source: Author's Work.

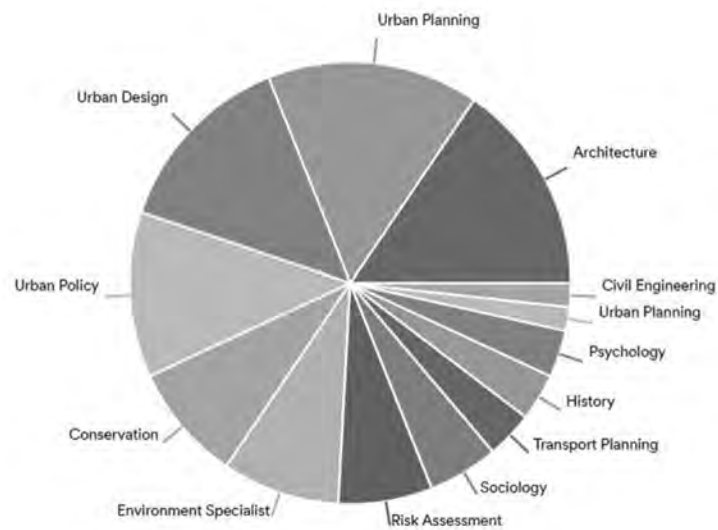


Figure 7: Respondent field of specialisation.

Source: Author's Work.

Judgment of experts was sought on 37 questions pertaining to public space vulnerability variables. Individual judgements were converted into group judgements using geometrical mean. Reliability check was undertaken using Chronbach's Alpha to assess internal consistency. The sum of term variance was reported as 23.15 with a

variance of total scores reported as 712.96 and Cronbach's Alpha was ascertained to be significantly high at 0.99. Consensus was concluded for vulnerability variables with an Inter Quartile Range ≤ 1.0 . After two rounds of modified Delphi survey consensus on all 37 variables was achieved and public space vulnerability variables to be used for factor reduction were ascertained (Figure 8).

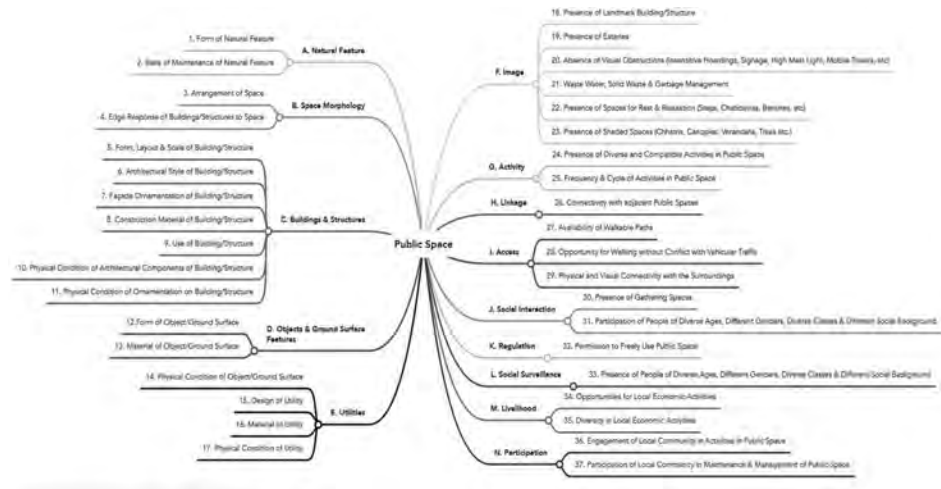


Figure 8: Public space vulnerability variables used for Exploratory Factor Analysis

Source: Author's Work.

Establishing Public Space Vulnerability Indicators

Results of modified Delphi survey were analysed through Factor Analysis to search for a relationship between public space vulnerability variables and reduce large number of observed variables to latent variables or composite factors. Exploratory Factor Analysis using Principal Factor Extraction Method was utilised to transform the set of interrelated variables into a set of uncorrelated linear combinations of these variables for relationship building. Statistical analysis was executed using extraction method based on principal component analysis and orthogonal rotation method based on varimax with Kaiser normalisation. Correlation matrix (Pearson (n)) was created. Optimum number of initial un-rotated factors extracted were ascertained as 20. Scree plot reported 8 factors for which eigenvalue > 1 and accounted for most of the total variability in the data (Figure 9). The eight factors explained a total of 73.43 per cent cumulative variance shared by 37 variables. Factor pattern after varimax rotation reported variability of 24.084 along D1 axis and Cronbach's Alpha as 0.924. Based on the factor loadings 20 factors were found to be significant and were extracted. Further the 20 observable variables (sub-indicators) were grouped into 12 factors (indicators) across three components of public space namely physical, non-physical and user related (Figure 10).

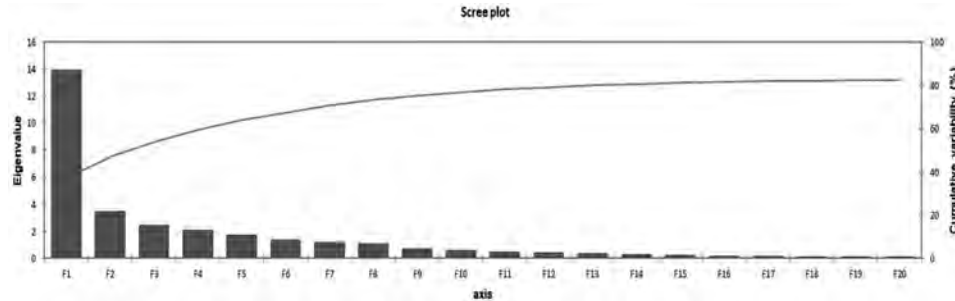


Figure 9: Scree plot of factors with eigenvalues.

Source: Author's Work.

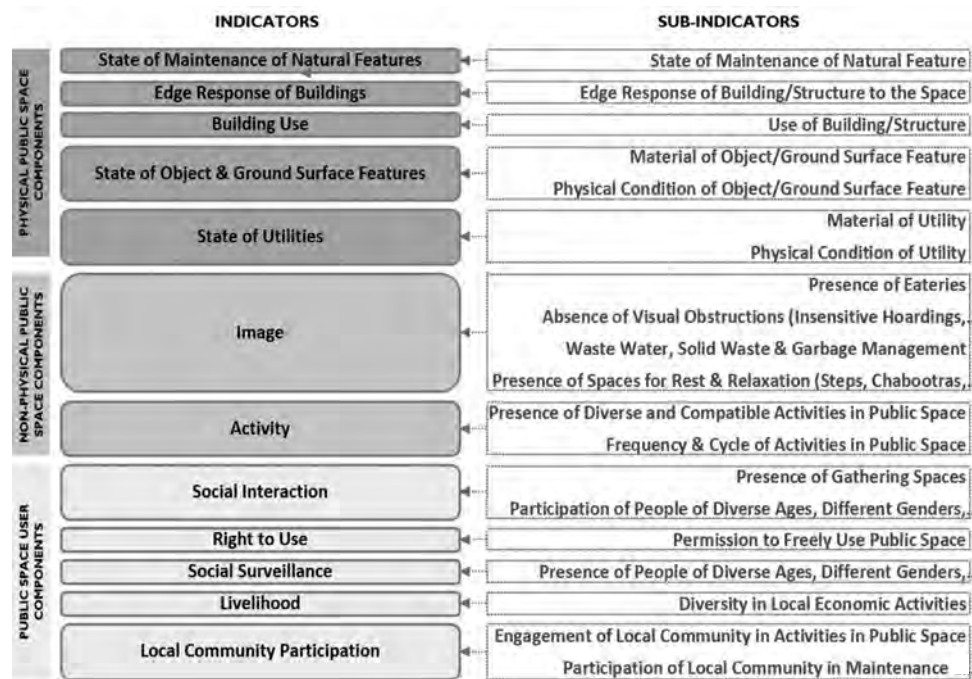


Figure 10: Public space vulnerability indicators and sub-indicators identified through factor analysis.

Source: Author's Work.

Determining Public Space Vulnerability Indicator Weights

Analytical Hierarchy Process (AHP) technique was used to ascertain weightages of established public space vulnerability indicators using an expert questionnaire survey. Questionnaire survey was run with 22 experts out of the pool of 35 participating experts identified earlier for the modified Delphi survey and was based on pairwise comparison of the established 12 public space vulnerability indicators and 20 sub-indicators. Questionnaire with pair-wise comparison matrices asking the question 'Which of

the two vulnerability indicators is more important for public space vulnerability assessment?’ was run with the experts.

Saaty’s assessment scale of 1-9 (1=Equally Important; 9 = Extremely Important) was used for assessing significance of public space vulnerability indicators. Individual expert judgements were converted into group judgements using geometrical mean. Reliability check of comparison matrices was undertaken to assess for internal consistency in accordance with standard value of Consistency Ratio (CR) <0.1.

Results for Physical Public Space Indicators. Weights, Consistency Index (CI) and Consistency Ratio (CR) values for five vulnerability indicators and corresponding two sub-indicators for physical public space components were calculated. CI was reported as 0.002222 and CR 0.001984 was less than permissible range 0.1 hence weights were accepted. Out of five indicators ‘state of maintenance of natural feature’ and ‘use of building’ were reported to be of maximum significance rated at 0.26 and 0.24 respectively (Figure 11).

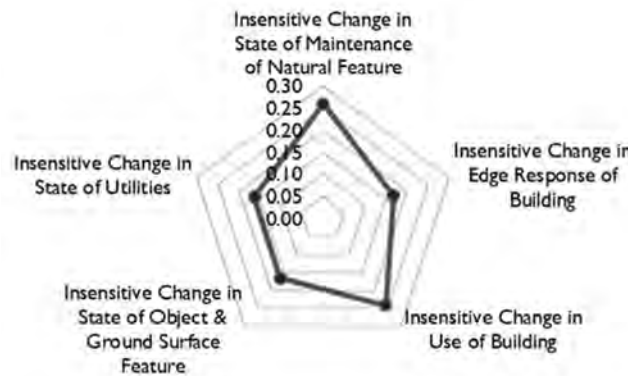


Figure 11: Significance of change in vulnerability indicators of physical public space components.

Source: Author’s Work.

Weights for two sub-indicators ‘material’ and ‘physical condition’ for the two indicators ‘state of object and ground surface features’ and ‘state of utilities’ respectively were also calculated. Weight of sub-indicator ‘physical condition of object and ground surface features’ was reported as 0.66 and was found to be more significant than the sub-indicator ‘material of object and ground surface features.’ Similarly weight of sub-indicator ‘physical condition of utilities’ in public space was reported as 0.62 and was found to be more significant than the sub-indicator ‘material of utilities’ at 0.38.

Results for Non-Physical Public Space Indicators: Weight of indicator ‘activity’ in public space was reported as 0.57 and was found to be more significant as compared to indicator ‘image’ of public space which was reported as 0.43 (Figure 12).

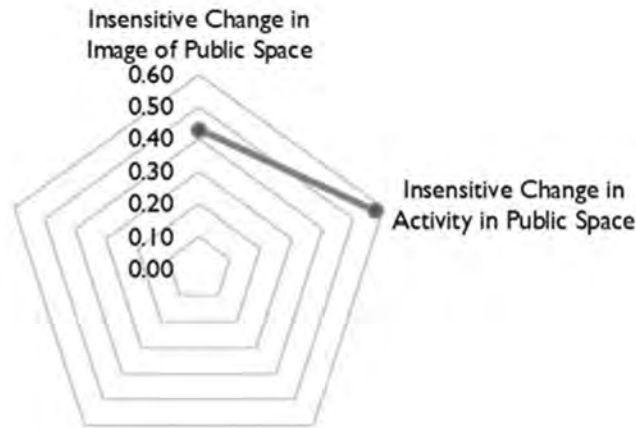


Figure 12: Significance of change in vulnerability indicators of non-physical public space components.

Source: Author's Work.

Weights for four sub-indicators of the indicator 'image' of public space were also calculated. CI was reported as 0.011245 and CR was reported as 0.012495 and since CR was less than permissible range 0.1, weights for the four sub-indicators were accepted. Sub-indicator 'waste water, solid waste and garbage management' rated at 0.39 was found to be more significant in comparison. Sub-indicators 'absence of visual obstructions (insensitive hoardings, signage, high mast light, mobile towers, etc.)' and 'presence of spaces for rest and relaxation (steps, *chabootras*, benches, etc.)' rated at 0.22 were found to be equally significant and slightly more important than the sub-indicator 'presence of eateries' at 0.17 (Figure 13).

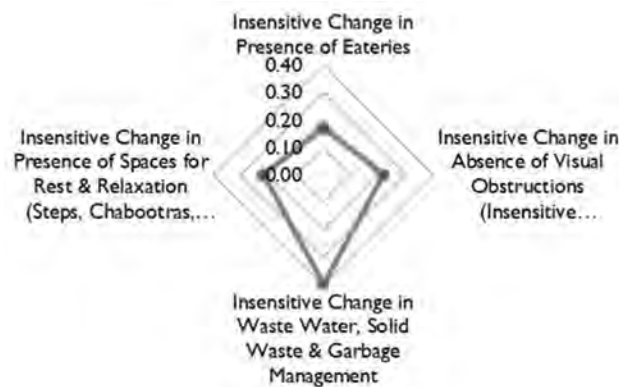


Figure 13: Significance of change in sub-indicators of the vulnerability indicator image of public space of non-physical public space components.

Source: Author's Work.

Results for User-related Public Space Indicators. Weights, CI and CR values for five vulnerability indicators were calculated. CI was reported as 0.013519 and CR

was reported as 0.012071 and since CR was less than permissible range 0.1 weights were accepted. 'Right to use' public space was rated as extremely significant with highest weight of 0.26. 'Livelihood' in public space rated as 0.21, 'local community participation' in public space rated as 0.20 and 'social surveillance' in public space rated as 0.19 respectively were identified as other significant indicators (Figure 14).

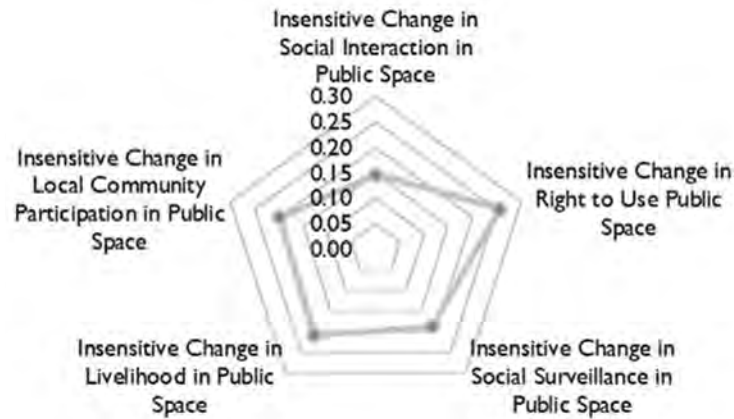


Figure 14: Significance of change in indicators of vulnerability of public space user related components.

Source: Author's Work.

Sub-indicator 'participation of people of diverse ages, different genders, diverse classes and different social backgrounds' was rated as slightly significant at 0.51 as compared to 'presence of gathering spaces' rated as 0.49 (Figure 15).

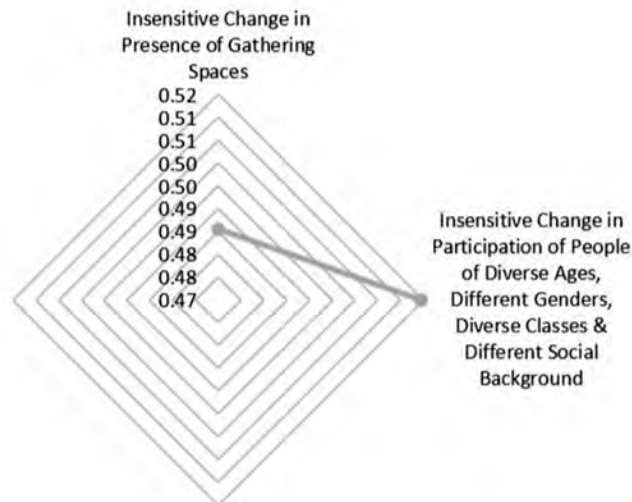


Figure 15: Significance of change in sub-indicators of the vulnerability indicator social interaction in public space.

Source: Author's Work.

Sub-indicator ‘engagement of local communities in activities’ in public space was rated as slightly significant at 0.53 as compared to ‘participation of local communities in maintenance and management’ of public space rated at 0.47 (Figure 16).

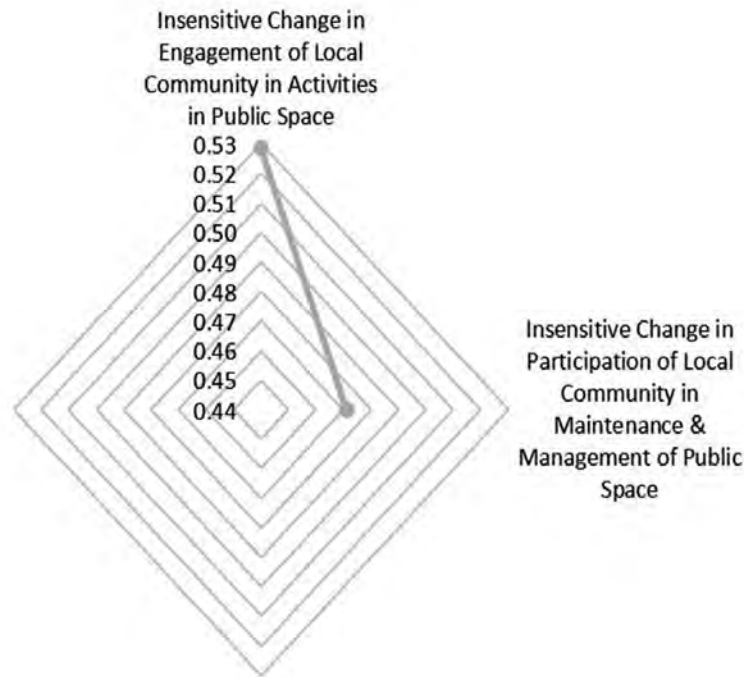


Figure 16: Significance of change in sub-indicators of the vulnerability indicator local community participation in public space.

Source: Author's Work.

Local Community Assessment of Significance of Public Space Vulnerability Indicators

Validation of the weighted significance of public space vulnerability indicators ascertained using AHP was undertaken through a detailed study in *Chowkri Modikhana* and *Chowkri Visheshwarji* in Jaipur walled city.

Study Area Profile

Study area *Chowkri Modikhana* and *Chowkri Visheshwarji* located in Jaipur walled city founded in 1727 C.E. (Figure 17 and Figure 18) is spread over an area of 0.64 sqkm with a total population of 26,246 in 2020, as reported in the Notification of Rajasthan Gazette Extraordinary LSG/20/1. *Chowkri* density is high at 41,009 persons/sq km and there has been a declining trend in the *chowkri* population from 30,555 in 2014 to 26,246 in 2020 with an increasing trend of local residents moving out. *Chowkri* has high daytime floating population.



Figure 17: Morphology of Study area Chowkri Modikhana and Visheshwarji.

Source: Author's Work.

Base Map: Google Earth

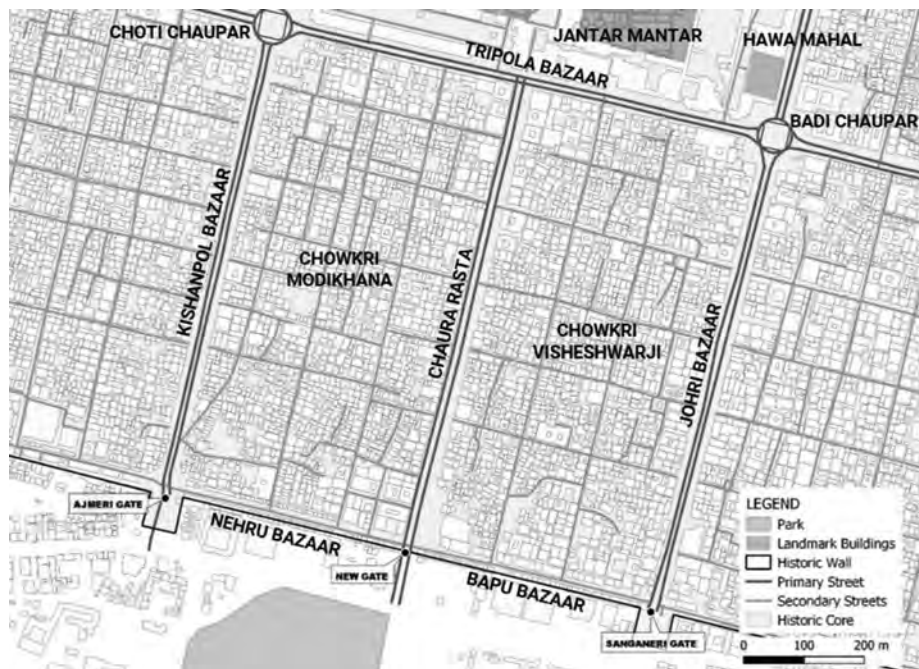


Figure 18: Detailed study area in Jaipur walled city.

Source: Author's Work.

Base Map: Google Earth.

A questionnaire survey with a sample size of 386 respondents given a Confidence Interval of 95 per cent at five per cent margin of error was chosen from the local community comprising of resident and non-resident users of public space through simple random sampling in the study area. Questionnaire was designed using both closed and open ended questions to validate weights of the 12 indicators of public space vulnerability ascertained earlier through expert survey using AHP technique. Questionnaire was designed for ascertaining rating of public space vulnerability indicators. Questionnaire was organised in the form of an importance scale using a 5 point semantic differential Likert scale (1=Extremely Low to 5=Extremely High).

Of the total number of 386 respondents surveyed 58 per cent male and 42 per cent female respondents comprising of business owners (54%), employees (17%), vendors (17%) and visitors (13%) to walled city in resident category and business owners (26%), employees (17%), vendors (20%) and visitors (37%) to walled city in non-resident category were surveyed (Figure 19).

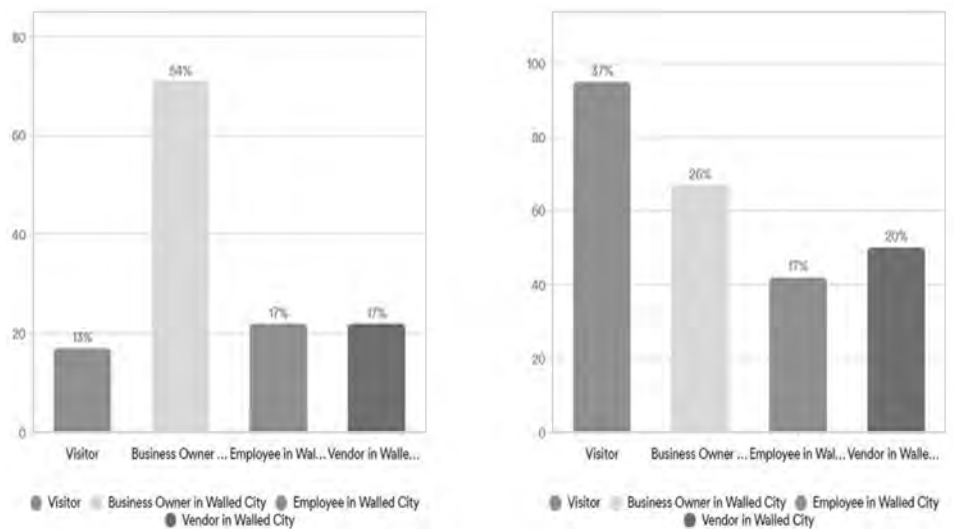


Figure 19. Type of public space user surveyed.

Source: Author's Work.

Around 34 per cent of respondents surveyed had either been visiting, residing or operating from walled city for 0-5 years and 25 per cent had either been visiting, residing or operating from walled city for more than 20 years (Figure 20). Respondents belonged to age group of 16-85 years (Figure 21).

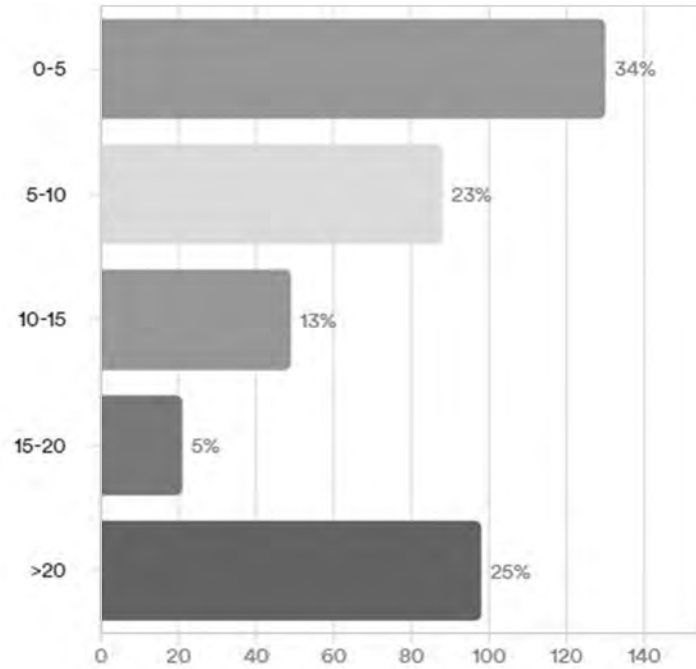


Figure 20: Respondent time period of engagement with public space.
Source: Author's Work.

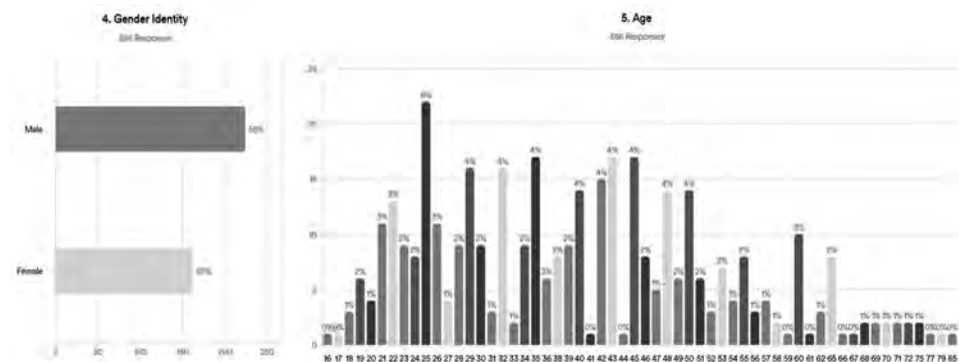


Figure 21: Gender identity and age of public space users surveyed.
Source: Author's Work.

Rating of respondents with respect to the 12 public space vulnerability indicators reported high values of 4 (high importance) and five (extremely high importance) on Likert scale. Individual judgements were converted into group judgements using geometrical mean. Values were reported as shown in Table 3.

Table 3: Rating of respondents with respect to public space vulnerability indicators

Vulnerability Components		Local Community Assessment			
Category	Indicator	Geometric Mean (Indicator)	Local Weights (Indicator)	Geometric Mean (Category)	Global Weights (Category)
Public Space Physical Components	1. Insensitive Change in State of Maintenance of Natural Feature in Public Space	3.48	0.19	3.58	0.34
	2. Insensitive Change in Edge Response of Building to the Space	3.57	0.20		
	3. Insensitive Change in Use of Building	3.66	0.20		
	4. Insensitive Change in State of Object & Ground Surface Feature	3.58	0.20		
	5. Insensitive Change in State of Utilities	3.59	0.20		
Public Space Non-Physical Components	6. Insensitive Change in Image of Public Space	3.42	0.49	3.47	0.33
	7. Insensitive Change in Activity in Public Space	3.51	0.51		
Public Space User Components	8. Insensitive Change in Social Interaction in Public Space	3.53	0.20	3.55	0.33
	9. Insensitive Change in Right to Use Public Space	3.54	0.20		
	10. Insensitive Change in Social Surveillance in Public Space	3.48	0.20		
	11. Insensitive Change in Diversity in Livelihood in Public Space	3.66	0.21		
	12. Insensitive Change in Local Community Participation in Public Space	3.54	0.20		

Source: Author's Work.

Combined Expert and Local Community Public Space Vulnerability Assessment

Significance of 12 public space vulnerability indicators as ascertained by experts using AHP and rating by 386 local community respondents was combined (Figure 22).

Final weights were calculated for each public space vulnerability indicator. Both local weights for each indicator within the three categories of public space components and global weights of the three categories were calculated.

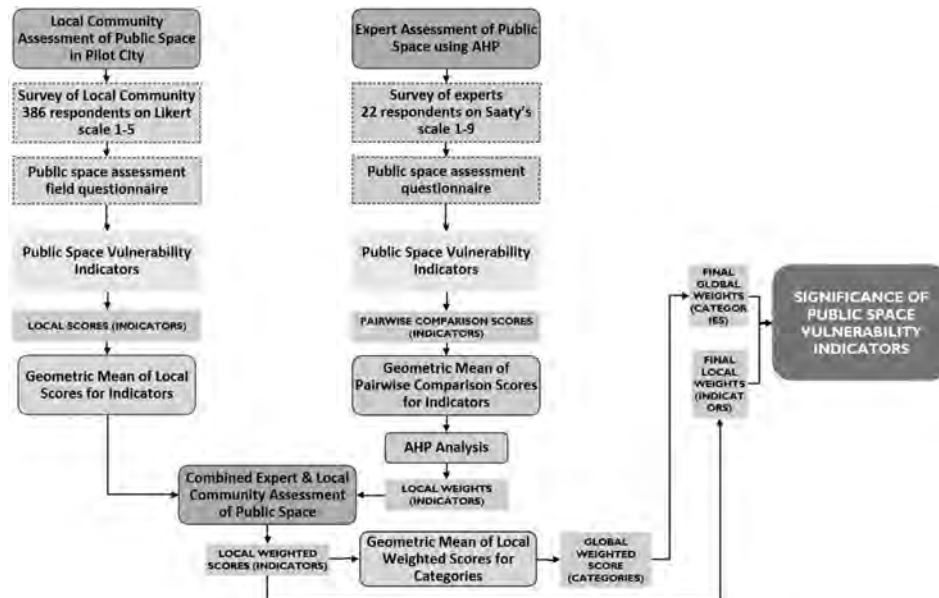


Figure 22: Methodology for combined expert and local community public space vulnerability assessment.

Source: Author's Work.

Establishing Public Space Vulnerability Index

Combined weights for 12 public space vulnerability indicators and 20 sub-indicators established through joint assessment by experts and local community in the study area was organised to create a hierarchical relationship model 'Public Space Vulnerability Index' (PSVI) with respect to transformation phenomenon triggered by urban processes in inner core areas in historic cities (Figure 23).

INDICATORS	LOCAL WEIGHTS	SUB-INDICATORS	LOCAL WEIGHTS
PHYSICAL PUBLIC SPACE COMPONENTS			
State of Maintenance of Natural Features	0.25	State of Maintenance of Natural Feature	0.25
Edge Response of Buildings	0.17	Edge Response of Building/Structure to the Space	0.17
Building Use	0.25	Use of Building/Structure	0.25
State of Object & Ground Surface Features	0.17	Material of Object/Ground Surface Feature	0.34
		Physical Condition of Object/Ground Surface Feature	0.66
State of Utilities	0.16	Material of Utility	0.38
		Physical Condition of Utility	0.62
NON-PHYSICAL PUBLIC SPACE COMPONENTS			
Image	0.42	Presence of Eateries	0.17
		Absence of Visual Obstructions (Insensitive Hoardings, Signage, High Mast Light, Mobile Towers, etc)	0.22
		Waste Water, Solid Waste & Garbage Management	0.39
		Presence of Spaces for Rest & Relaxation (Steps, Chabootrais, Benches, etc)	0.22
Activity	0.58	Presence of Diverse and Compatible Activities in Public Space	0.67
		Frequency & Cycle of Activities in Public Space	0.33
PUBLIC SPACE USER COMPONENTS			
Social Interaction	0.15	Presence of Gathering Spaces	0.49
Right to Use	0.26	Participation of People of Diverse Ages, Different Genders, Diverse Classes & Different Social Background	0.51
Social Surveillance	0.18	Permission to Freely Use Public Space	0.18
Livelihood	0.21	Presence of People of Diverse Ages, Different Genders, Diverse Classes & Different Social Background	0.21
		Diversity in Local Economic Activities	0.21
Local Community Participation	0.20	Engagement of Local Community in Activities in Public Space	0.53
		Participation of Local Community in Maintenance & Management of Public Space	0.47

Figure 23: Public space vulnerability index.

Source: Author's Work.

Results and Discussion

Public Space Vulnerability Index (PSVI) reports important findings pertaining to nature of vulnerability in public spaces with regard to transformation phenomenon triggered by urban processes in inner core areas in historic cities. It was found that significance of vulnerability of non-physical public space components is highest at 0.55 as compared to vulnerability of physical and user related public space components rated at 0.23 and 0.22 respectively.

Within physical public space components ‘state of maintenance of natural features’ and ‘building use’ in public space were found to be most vulnerable at 0.25 followed by ‘edge response of buildings’ at 0.17, ‘state of object and ground surface features’ at 0.17 and ‘state of utilities’ at 0.16 (Figure 24).

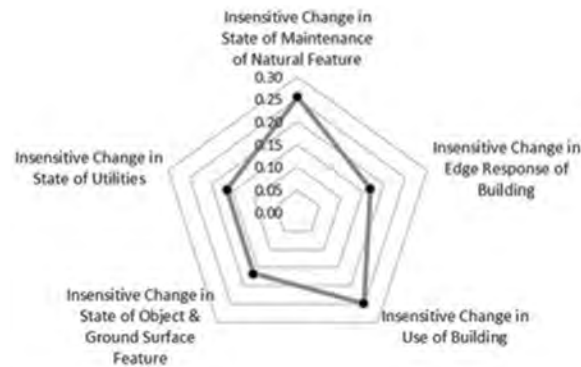


Figure 24: Significance of change in physical public space components.

Source: Author's Work.

Within non-physical public space components ‘activity’ in public space was found to be more vulnerable at 0.58 as compared to ‘image’ of public space at 0.42 (Figure 25).

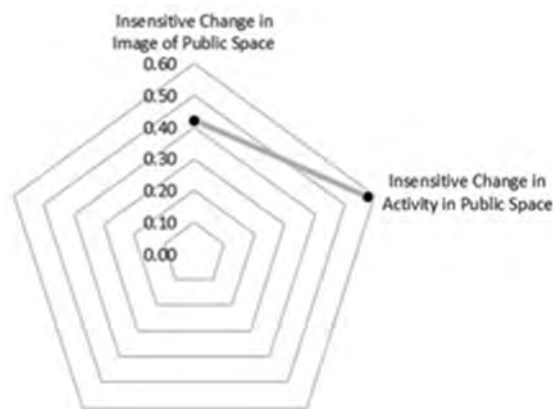


Figure 25: Significance of change in non-physical public space components.

Source: Author's Work.

Within user related public space components, ‘right to use’ public space was found to be most significant at 0.26 followed by ‘livelihood’ at 0.21, ‘local community participation’ at 0.20, ‘social surveillance’ at 0.18 and ‘social interaction’ at 0.15 (Figure 26).

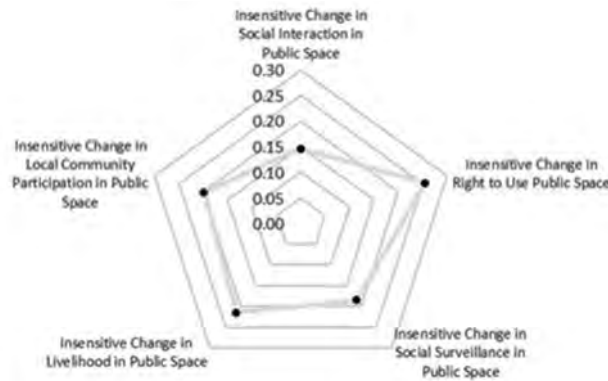


Figure 26: Significance of change in public space user components.

Source: Author's Work.

Conclusion and Recommendations

Urban processes triggered by population growth, economic activities and changes in social structure and lifestyle are irreversible and transform the inner core of historic cities making public spaces vulnerable. There is a need to systematically investigate transformation phenomenon triggered by urban processes in inner core areas and ascertain their impact on public spaces. Since change is inherent in cities, it can only be guided and not controlled therefore public spaces in inner core areas need to be examined as a dynamic and evolving domain rather than a static physical space.

This study has revealed that damages to public spaces due to urban processes are not just material losses but are intangible as well and are not always solely direct and visible but can also be indirect and disguised. The study establishes that it is critical to identify components of public space exposed to transformation phenomenon triggered by urban processes in order to understand their vulnerability. Public Space Vulnerability Index (PSVI) developed through the study identifies most critical vulnerability indicators and establishes a hierarchical model for indicators.

Three categories of exposed public space components physical, non-physical and user-related have been identified. The study indicates that while physical public space components namely natural features, building edges, building use, objects and ground surface features and utilities (category weight 0.23) and user related components namely right to use, livelihood, local community participation, social surveillance and social interaction (category weight 0.22) are important indicators of vulnerability, non-physical components namely activity and image of public space are distinctly more significant (category weight 0.55) for understanding vulnerability to urban processes.

This understanding of nature of vulnerability of public spaces with respect to urban processes is of critical importance for management of change in public spaces.

Detailed field studies in four historic cities in Rajasthan has helped establish a methodology for quantitative assessment of qualitative indicators of public space vulnerability. Public Space Vulnerability Index established through this study is a novel model for assessing public space vulnerability to urban processes. Application of the index can help devise tactical interventions targeted at most vulnerable public space components to arrive at a prioritised action plan ensuring optimum utilisation of limited financial resources. Appropriate planning and mitigation strategies based on public space vulnerability assessment can help in timely reduction of the extent of exposure of public space components to urban processes. Understanding of the concept of ‘vulnerability’ with respect to public spaces in inner core areas in historic cities with regards to urban processes has the potential of helping safeguard and conserve not only the unique attributes of public spaces but also help in making them resilient to the continuous insensitive changes triggered by urban processes thereby contributing greatly to their continuity as sociable, liveable and sustainable urban habitats.

References

- Efroymson, D, Ha Thi Kieu Thanh Tran, and Pham Thu Ha. (2009). *Public Spaces: How they humanize cities*. HealthBridge, WBB Trust.
- Foerster, E, Y Krien, M Dandoulaki, S Priest, S Tapsell, G Delmonaco, C Margottini, and C Bonadonna. (2009). “ENSURE Project-WP1: State of the Art on Vulnerability Types-Del. 1.1.1: Methodologies to Assess Vulnerability of Structural Systems.”
- Gamesby, Rob. (2021). n.d. *Urban Processes*. Accessed 02 21. https://www.coolgeography.co.uk/advanced/Urban_Processes.php.
- Gehl, Jan. (2011). *Life between Buildings: Using Public Space*. Washington DC: Island Press.
- IPCC. (2014). “Annex II: Glossary.” In *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)*, by R K Pachauri and L A Meyer, edited by K J Mach, S Planton and C von Stechow, 117-130. Geneva, Switzerland: IPCC. https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_Glossary.pdf.
- Jacobs, J. (1961). *The Death and Life of Great American Cities*. New York: Vintage Books.
- Jaysawal, N, and S Saha. (2014). “Urbanization in India: an Impact Assessment.” *International Journal of Applied Sociology* 4(2), 60-65.
- Khor, Neil, Ben Arimah, Raymond Otieno, Matthijs van Oostrum, Mary Mutinda, and Judith Oginga Martins. (2022). *World Cities Report 2022 Envisaging the Future of Cities*. United Nations Human Settlements Programme (UN-Habitat). Accessed 3 9, 2023. <https://unhabitat.org/>.
- Lederbogen, F, P Kirsch, L. Haddad, F. Streit, F. Tost, P. Schuch, S. Wüst, et al., (2011). “City Living and Urban Upbringing affect Neural Social Stress Processing in Humans.” *Nature*. doi:474. 498-501. 10.1038/nature10190.

- Liang, W, Y Ahmad, and H.H.B. Mohidin. (2023). "The development of the concept of architectural heritage conservation and its inspiration." *Built Heritage* 7. doi:<https://doi.org/10.1186/s43238-023-00103-2>.
- LibreTexts. n.d. *The Process of Urbanization*. Accessed March 23. (2023). [https://socialsci.libretexts.org/Bookshelves/Sociology/Introduction_to_Sociology/Sociology_\(Boundless\)/17%3A_Population_and_Urbanization/17.03%3A_Urbanization_and_the_Development_of_Cities/17.3E%3A_The_Process_of_Urbanization](https://socialsci.libretexts.org/Bookshelves/Sociology/Introduction_to_Sociology/Sociology_(Boundless)/17%3A_Population_and_Urbanization/17.03%3A_Urbanization_and_the_Development_of_Cities/17.3E%3A_The_Process_of_Urbanization).
- Mehta, V. (2014). "Evaluating Public Space." *Journal of Urban Design* (Routledge Taylor & Francis) 19:1, 53-88.
- Ministry of Urban Development, Government of India. (2015). "Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines." New Delhi.
- NIUA. (2018). *Inclusive Revitalization of Historic Towns and Cities-Strategic Framework for Rajasthan State Heritage Programme*. New Delhi: National Institute of Urban Affairs.
- Polko, A. (2012). "Public Space Development in the Context of Urban and Regional Resilience." *Journal of Economics and Management* Volume 10: 47-58.
- PPS. (2022). *Placemaking: What if We Built Our Cities Around Places*. Accessed 2021. https://assets-global.website-files.com/581110f944272e4a11871c01/638a1fe260f36b92be75784f_2022%20placemaking%20booklet.pdf.
- Salvador, Begoña Peiró. (2020). *Climate Change Vulnerability and Risk – a Guide for Community Assessments, Action Planning and Implementation*. Nairobi: UN-Habitat. https://unhabitat.org/sites/default/files/2020/05/climatechange_vulnerabilityandriskguide.pdf.
- Srivastava, Urvashi, Hajela Amit, and Kumar Jaya. (2024). "Understanding Notion of Public Spaces: Learnings from Historic Cities in Rajasthan for Planning Sustainable Urban Habitats." Edited by D Bajaj, T Gajendran and S Patil. Singapore: Springer, Singapore. 169-190. doi:https://doi.org/10.1007/978-981-99-8842-6_10.
- Steinberg, F. (2008). *Revitalization of Historic Inner-City Areas in Asia, The Potential for Urban Renewal in Ha Noi, Jakarta, and Manila*. Mandaluyong City: Phil.: Asian Development Bank.
- UN-Habitat. (2020). *New Urban Agenda*. Nairobi: United Nations Human Settlements Programme . https://unhabitat.org/sites/default/files/2020/12/nua_handbook_14dec2020_2.pdf.
- Verma, G D. (1993). "Inner City Renewal: The Indian Experience." *Habitat International* 17(1): 117-132.
- Vishwanath, T, S V Lall, D Dowall, N Lozano-Gracia, S Sharma, and H G Wang. (2013). *Urbanization beyond municipal boundaries: Nurturing Metropolitan Economies and Connecting Peri-urban Areas in India*. Washington, D.C.: World Bank Group. <http://documents.worldbank.org/curated/en/373731468268485378/Urbanization-beyond-municipal-boundaries-nurturing-metropolitan-economies-and-connecting-peri-urban-areas-in-India>.
- Whyte, William H. (1980). *The Social Life of Small Urban Spaces*. Washington, D.C: Conservation Foundation.
- Wilson , James Q, and George L Kelling. (1982). "Broken Windows." *The Atlantic*.

Assessing Knowledge and Practices of E-Waste Management Among Consumers in Mangaluru City

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Abstract

Electronic waste (E-waste) is a rapidly growing waste stream globally, with adverse environmental and health effects, if not managed properly. Mangaluru, a growing city in India, has seen a significant increase in the generation of E-waste in recent years due to increased consumerism and the penetration of electronic devices in households. However, the proper management of E-waste in Mangaluru has been a concern, and there is a lack of awareness among consumers about its proper disposal. This paper aims to assess the knowledge and practices of E-waste management among consumers in Mangaluru City. The results showed that the majority of the respondents were aware of the adverse environmental and health effects of E-waste, but their knowledge about the proper disposal of E-waste was limited. Most of the respondents disposed the E-waste with regular household waste or in landfills, indicating a lack of awareness. The findings of this study emphasise the need for consumer awareness and their education about E-waste management in Mangaluru.

Keywords

Electronic waste, Consumer behaviour, Waste management, Awareness, Recycling, Hazardous substances, Environmental impact.

Introduction

E-waste refers to any electronic device that has reached the end of its useful life and is discarded. These devices include computers, mobile phones, televisions, refrigerators, and other electronic gadgets. E-waste contains hazardous substances such as lead,

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mercury, cadmium, and brominated flame retardants, which can cause environmental pollution and health hazards if not managed properly (Liu et al., 2019; Pandey et al., 2020).

Mangaluru, a growing city in India, has seen a significant increase in the generation of E-waste in recent years due to increased consumerism and the penetration of electronic devices in households. The city of Mangalore, was estimated to have generated approximately 3750 tonnes of Waste Electrical and Electronic Equipment (WEEE) in the year 2015 (Kumar, P., & Shrihari, S. 2007). Although this data is not recent, it offers a foundational understanding of the historical E-waste generation trends in the city. According to a report by the Central Pollution Control Board, India generated around 3.2 million metric tons of E-waste in 2019, and this figure is expected to increase to 5.2 million metric tons by 2025 (CPCB, 2020).

Efforts to tackle the burgeoning issue of electronic waste (E-waste) in Mangaluru, have been underscored by a series of initiatives aimed at enhancing its proper management. To address the lack of awareness among consumers about responsible E-waste disposal, the Mangaluru City Corporation (MCC) took a proactive step in 2016 by installing E-waste collection units at key locations including the MCC main office, City Centre, and the Surathkal MCC Sub-Office. This move not only provided accessible collection points for discarded electronic devices but also encouraged citizens to dispose of their E-waste responsibly. In 2019, the city launched the “eSwachh Bharat” campaign, which focused on E-waste management and collection from apartments in Mangaluru, fostering awareness and participation in the proper disposal of electronic devices. Complementing these efforts, educational institutions like St. Agnes College organised E-waste collection drives in 2023, further emphasising the community’s commitment while addressing the E-waste challenge. These ongoing campaigns and drives reflect a concerted push to rectify the lack of awareness and instill responsible E-waste management practices among the residents of Mangaluru. (*Daijiworld, Times of India, Mangalore Meri Jaan*) The improper management of E-waste can have adverse environmental and health effects. E-waste contains toxic substances that can leach into the soil and groundwater, leading to pollution and environmental degradation. These toxic substances can also contaminate the air and water bodies, leading to health hazards for people living in the vicinity (Liu et al., 2019; Pandey et al., 2020). Additionally, E-waste contains valuable resources such as gold, silver, and copper, which can be recovered through proper recycling and reuse. However, the improper disposal of E-waste leads to the loss of these valuable resources (Ramesh et al., 2017; Visvanathan et al., 2017).

The generation of E-waste has evolved into a global concern due to its potential adverse environmental and health repercussions. Mangaluru, a burgeoning city in India, has witnessed a notable surge in E-waste production in recent times, propelled by the widespread adoption of electronic devices in households and an upsurge in consumerism. This escalation in E-waste generation has accentuated the urgency of effective E-waste management. Despite this pressing need, the proper disposal of

E-waste within Mangaluru has remained a worrisome challenge. Notably, consumer ignorance pertaining to the correct methods of E-waste disposal is a key contributing factor. Research has indicated that consumers frequently dispose of E-waste alongside regular household waste or in landfills, underlining the need for comprehensive consumer education and awareness (Huysman et al., 2018; Kumar et al., 2020; Ramesh et al., 2017).

Addressing this confluence of challenges, the present paper seeks to evaluate the awareness and practices of E-waste management among consumers in Mangaluru City. Recognising consumers as pivotal generators of E-waste, enhancing their awareness and knowledge is fundamental for achieving effective E-waste management practices. The significance of this study lies in its potential to uncover the extent of consumer awareness, gaps in E-waste management practices, and the factors influencing these behaviours. By systematically analysing the current state of E-waste understanding and disposal practices among consumers, this paper provides valuable insights into the avenues for enhancing E-waste management strategies within the city.

Literature Review

Reasons for Increase in E-Waste

Scholarly investigations into the surge of E-waste have coalesced around two primary themes. The first theme, comprising studies by Al-Salem et al., (2011), Cucchiella et al., (2015), Ismail and Hanafiah (2019), and Awasthi et al., (2018), accentuates the urgency of holistic E-waste management. This involves curbing E-waste generation, promoting electronic product reuse, and ensuring efficient recycling while considering supply chain integration, technological advancements, and the environmental and health impacts of improper disposal. In the second theme, Shreyas Madhav et al., (2022) offer insights into leveraging artificial intelligence to enhance household E-waste collection and segregation in India.

Consumer Awareness and Knowledge

Consumer awareness and knowledge have been identified as pivotal aspects influencing E-waste management practices. Bhattacharyya and Joshi (2016) discovered that consumers in India lacked awareness and knowledge about E-waste management, posing a considerable barrier to effective solutions. Ezeah et al., (2013) and Kaur et al., (2019) found similar trends in Nigeria and India, respectively. Mahmood et al., (2020) identified a lack of awareness in Pakistan as well. These findings underscore the need for robust public awareness campaigns and educational initiatives to bridge the information gap among consumers.

Environmental and Health Impact

The dire consequences of inadequate E-waste management for both the environment and the human health form a pivotal concern in the literature. Wang et al., (2020)

demonstrated that consumers' attitudes are shaped by environmental concerns and knowledge about E-waste, suggesting that understanding the adverse effects of poor E-waste management can positively influence behavior. This sentiment is echoed by a range of studies, including Li and Achal (2020), Kumar and Singh (2019), Sutawong et al., (2020), and Rajesh et al., (2022), which collectively underscore the criticality of addressing these repercussions through effective E-waste management practices.

Motivations and Barriers

The complex interplay of motivations and barriers driving consumer behavior towards E-waste reuse, recycling, and disposal is evident across studies. Giudice et al., (2018) observed in Italy that recycling behaviour hinged on factors like convenience, perceived value, and social norms. De Silva et al., (2019) highlighted in Sri Lanka that consumer attitudes were molded by age, income, education, and environmental awareness. Tailored strategies are imperative to promote responsible E-waste practices, as illustrated by Sonogo et al., (2022) in their exploration of consumer practices and Leclerc and Badami (2023) in their investigation of municipalities' contributions to E-waste management.

Gaps in the Literature

The synthesis of the existing studies highlights significant gaps that call for comprehensive investigation and intervention within the realm of E-waste management. One prominent gap involves devising effective strategies to enhance global consumer awareness and knowledge. While studies reveal the persistent challenge of inadequate consumer awareness across various countries, there is a clear lack of in-depth exploration into innovative methods to bridge this information gap. Developing, implementing, and assessing tailored awareness campaigns that can effectively enhance public understanding of E-waste management practices, is an imperative area for research.

Furthermore, the intricate tapestry of motivations and barriers driving E-waste behaviors demands deeper examination. While some studies touch upon the factors influencing consumer decisions, a more thorough understanding of how these motivations and barriers interact across diverse social, economic, and cultural contexts remains absent. Longitudinal studies tracking shifts in motivations and barriers over time, along with cross-cultural analyses unveiling variations in these influences, could illuminate the nuanced dynamics shaping consumer behaviour towards E-waste.

By addressing these pivotal gaps, this study seeks to significantly contribute to the E-waste management field, offering practical insights that can guide targeted interventions and strategies. The completion of these research gaps holds the potential not only to enhance the efficacy of E-waste management practices but also to foster enduring shifts towards responsible consumer behaviours, further advancing the global mission of sustainable E-waste management.

The study's focus on E-waste management is indeed of paramount importance, especially given India's significant role as the third largest generator of E-waste globally (Mohan, 2020). The staggering production of approximately 16 lakh tons of E-waste in the year 2021-22, with only 33 per cent undergoing recycling, underscores the urgency of addressing this issue (Gupta, 2023). With technology becoming an inseparable part of our daily lives and lifestyles evolving, it is anticipated that the volume of E-waste will continue to surge.

This paper makes a crucial contribution to the existing body of knowledge by delving into consumer behaviour and its underlying determinants in the context of E-waste management. This research has the potential to significantly advance the ongoing discourse on responsible E-waste management practices, offering valuable insights for policymakers, industry stakeholders, and the wider public alike. It is imperative that such studies continue to receive attention and support, as they play an instrumental role in addressing the burgeoning challenges posed by E-waste in contemporary society.

The Objectives of the Paper are:

- (i) To assess the level of knowledge among consumers about E-waste management, including knowledge on the health and environmental effects of E-waste, handling electronics before final disposal, final disposal options for E-waste, and E-waste legislation in the country.
- (ii) To investigate the misconceptions among consumers regarding E-waste management, such as storing E-waste at home being harmless and E-waste should be disposed of along with general waste.
- (iii) To examine the personal attachments of consumers to electronic equipments and how it influences their E-waste disposal practices.
- (iv) To identify the disposal practices of electronics consumers for different electronic devices, such as mobile phones, computers/laptops, televisions, refrigerators, and air conditioners.

Methodology

Data Collection

The data for the study was collected using a structured questionnaire. The questionnaire was developed based on the research questions and objectives of the study. It consisted of both closed-ended and open-ended questions. Closed-ended questions were used to collect information on respondents' demographic characteristics, knowledge on E-waste management, and E-waste disposal practices. Open-ended questions were used to collect more detailed information on respondents' knowledge and practices of E-waste management.

The questionnaire was pre-tested on a small sample of respondents (n=30) to check for clarity and validity in December 2022.

The data collected was analysed using descriptive statistics such as frequencies, percentages, and means. Inferential statistics such as chi-square test and logistic regression analysis were also used to determine the associations between variables. The analysis was carried out using software of SPSS version 26.

Ethical Considerations

Ethical considerations were taken into account throughout the study. Informed consent was obtained from all respondents before the start of the study. Respondents were assured of the confidentiality and anonymity of their responses. The study was conducted in accordance with the guidelines for research involving human subjects.

For this study, there was a population of electronic device users in Mangaluru city. The aim was to estimate the proportion of the population with knowledge and practices of electronic waste management. A confidence level of 95 per cent and a margin of error of five per cent were assumed. Since the proportion of the population with knowledge and practices of electronic waste management was unknown, a conservative proportion of 50 per cent was assumed (Israel, G. D. 1992 & 2013).

Using the formula, the sample size was calculated as follows:

$$n = (Z^2 \times p \times q) / E^2 \text{ where } n = (1.96^2 \times 0.5 \times 0.5) / 0.05^2$$

$$n = 384.16$$

where n: Sample size

Z: Z-score, which corresponds to the desired confidence level (for 95% confidence, $Z \approx 1.96$)

p: Estimated proportion of the population that has the characteristic (if unknown, 0.5 is used as it maximizes the sample size)

q: $1-p$ (the proportion of the population that does not have the characteristic)

E: Margin of error (the maximum acceptable difference between the sample proportion and the true population proportion).

A sample size of at least 385 was needed. However, to increase the precision of the estimates and account for potential non-response, the sample size was increased to 710 and this survey was conducted during January 2023 to March 2023. This sample size was statistically justifiable based on the population size and margin of error. It also allowed for comparisons between different subgroups of the population with reasonable statistical power.

Data Analysis

Table 1: Demographic Profile

Particulars		Respondents / Per centage
Gender	Male	180 (25.35%)
	Female	530 (74.65%)
Age	Less than 24	510 (71.83%)
	25 to 54	200 (28.17%)
Education	Up to Primary	20 (2.82%)
	Up to secondary	80 (11.27%)
	Up to graduation	610 (85.91%)
Occupation	Formal	320 (45.07%)
	Informal	290 (40.85%)

N = 710

Source: Survey Data.

The survey respondents were predominantly female, accounting for 74.65 per cent of the total sample, while males made up 25.35 per cent. The distribution of respondents by age highlights a notable generational trend in the sample. A significant 71.83 per cent of the participants fall below the age of 24. This age group is often associated with a higher level of technological familiarity, given that they have grown up in an era characterised by rapid advancements in digital technology. As a result, they are likely to possess a more intuitive understanding of E-waste management, which may be influenced by their exposure to information and education on environmental issues through various media channels and educational institutions (Refer to Table 1).

Conversely, the 25 to 54-year-old demographic comprised the remaining 28.17 per cent of respondents. This group may not have had the same level of exposure to technology during their formative years as the younger cohort. Their practices and knowledge regarding E-waste management may stem from a different set of experiences and educational backgrounds. This distribution provided a comprehensive view of the sample, allowing for the exploration of potential age-related trends and attitudes towards E-waste management practices. Regarding education, the majority of the respondents had completed up to graduation level, accounting for 85.91 per cent of the sample. About 11.27 per cent of the respondents had studied upto secondary level while only 2.82 per cent had studied up to primary level.

In terms of occupation, 45.07 per cent of the respondents were engaged in formal jobs. These positions are characterised by a structured and regulated working environment, typically involving a formal contract between the employer and the employees. Formal jobs often come with benefits like regular salaries, social security contributions, and paid leave. They encompass roles in government, corporations,

institutions, and large businesses, usually requiring specific qualifications or skills and adhering to established labour laws and regulations.

Conversely, 40.85 per cent of the respondents were employed in informal occupations. These jobs lack formal structure and often occur in unregulated or partially regulated sectors of the economy. Workers in informal roles typically do not have formal contracts or access to benefits like health insurance or retirement plans. Informal jobs encompass a wide range of activities, including self-employment, small-scale businesses, casual labour, and day-to-day work without long-term job security. They are prevalent in areas such as street vending, small-scale agriculture, domestic work, and unregistered or small businesses. Workers in informal employment may face challenges such as job instability, low income, and limited access to social safety nets. They may also have fewer opportunities for career advancement or professional development compared to those in formal positions.

The survey sample consisted mostly of young, educated, and predominantly female respondents. The majority of them were engaged in formal or informal employment.

Table 2: Level of Knowledge

Level of knowledge	Yes	%	No	%
Understanding of electronic waste management	610	85.92	100	14.08
Awareness of health and environmental consequences associated with E-waste	630	88.73	80	11.27
Familiarity with handling options for electronics before their final disposal (reuse, repair, recycle, donate)	570	80.28	140	19.72
Knowledge of proper options for final disposal of E-waste	440	61.97	270	38.03
Awareness of E-waste legislation in the country	330	46.48	380	53.52

Source: Survey Data.

The data in Table 2 shows that the majority of respondents (85.92%) had an understanding of electronic waste management, while a small percentage (14.08%) were not aware about it. Similarly, a large percentage (88.73%) of respondents knew about the health and environmental consequences associated with E-waste, while 11.2 per cent of the respondents had no idea about it.

When it comes to familiarity with handling options for electronics before their final disposal, 80.28 per cent of the respondents appeared knowledgeable about reuse, repair, recycle, and donate, while 19.72 per cent of them did not know anything about

it. In terms of knowledge of proper options for final disposal of E-waste, 61.97 per cent of the respondents were well aware, while 38.03 per cent were not.

When it comes to awareness of E-waste legislation in the country, 46.48 per cent of the respondents were aware, while 53.52 were not. Overall, the analysis of primary data suggests that while there was a relatively high level of knowledge and awareness about E-waste management among respondents, there was still room for improvement, particularly in terms of knowledge about proper options for final disposal and awareness of E-waste legislation.

Table 3: Perceptions towards E-waste

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	SD
Storing E-waste at home is harmful	130 (18.31%)	150 (21.13%)	300 (42.25%)	80 (11.27%)	50 (7.04%)	2.47	1.14
E-waste recycling is harmful to the environment	90 (12.68%)	100 (14.08%)	320 (45.07%)	80 (11.27%)	120 (16.90%)	3.02	1.00
E-waste can be recycled	200 (28.17%)	210 (29.58%)	180 (25.35%)	80 (11.27%)	40 (5.63%)	2.07	1.04
E-waste recycling has effects on human health	110 (15.49%)	140 (19.72%)	270 (38.03%)	120 (16.90%)	70 (9.86%)	2.59	1.12
There are health effects associated with E-waste	110 (15.49%)	180 (25.35%)	230 (32.39%)	140 (19.72%)	50 (7.04%)	2.46	1.11
E-waste has negative effects on the environment	150 (21.13%)	150 (21.13%)	240 (33.80%)	80 (11.27%)	90 (12.68%)	2.73	1.11
Have personal attachments to electronic equipment even when out of use	60 (8.45%)	130 (18.31%)	340 (47.89%)	130 (18.31%)	50 (7.04%)	3.06	1.08
E-waste should be disposed with general waste	40 (5.63%)	50 (7.04%)	100 (14.08%)	150 (21.13%)	370 (52.11%)	4.03	0.93

Source: Survey Data.

The statement with the highest agreement among respondents was “E-waste can be recycled,” with a mean of 2.07 and a standard deviation of 1.04. This suggests that most people believe E-waste can be recycled (Refer Table 3).

The statement with the highest disagreement among respondents is “E-waste should be disposed of with general waste,” with a mean of 4.03 and a standard deviation of

0.93. This indicates that most people disagree with the idea of disposing of E-waste with general waste.

Most statements have means between 2 and 3, which suggests that respondents generally hold moderate opinions on the topics.

The statement with the highest standard deviation is “Storing E-waste at home is harmful,” with a standard deviation of 1.14. This suggests that there is a relatively wide range of opinions among respondents on this topic.

The statement with the lowest standard deviation is “E-waste should be disposed with general waste,” with a standard deviation of 0.93. This suggests that respondents were more consistent in their opinions on this topic compared to the other statements.

Overall, the analysis of Table 3 suggests that while there is some variability in opinions among respondents on the topic of E-waste, there are also some areas of relatively strong agreement or disagreement. Additionally, the data suggests that the most respondents have moderate opinions on the topics presented.

Table 4: Disposal Practices of e-Waste among Electronics Consumers

Gadgets / Practices	Out of Use	Sold	Donated	Dumped	Burnt	Row Total
Mobile Phones	230	280	170	10	20	710
Computers/ Laptops	170	350	160	30	00	710
Television	140	300	190	80	00	710
Refrigerator	130	350	170	30	30	710
Air Conditioner	180	320	180	30	00	710
Column Total	850	1600	870	180	50	2550
Expected frequencies	167.65	314.28	171.29	35.52	10.26	

Source: Survey Data.

Null hypothesis (H₀): There is no association between the disposal practices of E-waste and the type of electronic device.

Alternative hypothesis (H_a): There is an association between the disposal practices of E-waste and the type of electronic device.

To calculate the chi-square statistic, we use the formula:

$$\chi^2 = \sum ((O - E)^2 / E)$$

The degrees of freedom for this test are $(5-1) * (5-1) = 16$. We can look up the critical value for a chi-square distribution with 16 degrees of freedom and a significance level of 0.05 to be 26.30.

Since our calculated chi-square value of 59.16 is greater than the critical value of 26.30, we reject the null hypothesis and conclude that there is evidence of a significant association between the disposal practices of E-waste and the type of electronic device.

Since we have a significant chi-square value, we can perform *post-hoc* tests to determine which electronic devices are most associated with certain disposal practices of E-waste.

One commonly used *post-hoc* test for chi-square analysis is the adjusted residual analysis. Adjusted residuals are standardised values that indicate the degree to which the observed frequencies differ from the expected frequencies, taking into account the size of each cell and the overall pattern of the contingency table. A residual of ± 1.96 or greater (corresponding to a p-value of 0.05 or less) indicates a significant deviation from the expected value.

Table 5: The adjusted residuals for each cell

Gadgets / Practices	Out of Use	Sold	Donated	Dumped	Burnt	Row total
Mobile Phones	2.70	-2.15	-0.27	-5.79	1.89	710
Computers/ Laptops	-1.11	3.07	-1.38	1.95	-3.92	710
Television	-1.42	-1.64	3.24	3.51	-2.67	710
Refrigerator	-0.96	2.75	-0.60	-2.06	1.37	710
Air Conditioner	1.32	-1.49	-0.89	1.39	-1.05	710
Column Total	850	1600	870	180	50	2550
Expected frequencies	167.65	314.28	171.29	35.52	10.26	

Source: Survey Data.

Looking at the adjusted residuals, we can see that there are several cells with significant deviations from the expected frequencies. Specifically:

- (i) Mobile phones are significantly more likely to be sold or burned than expected, and significantly less likely to be dumped or out of use.
- (ii) Computers/laptops are significantly more likely to be sold or donated than expected, and significantly less likely to be out of use or burnt.
- (iii) Televisions are significantly more likely to be donated, dumped, or burnt than expected, and significantly less likely to be out of use or sold.

- (iv) Refrigerators are significantly more likely to be sold or donated than expected, and significantly less likely to be out of use or burned.
- (v) Air conditioners are not significantly associated with any disposal practice.

These results suggest that certain electronic devices may be more likely to be disposed of in certain ways, and that consumer behaviour regarding E-waste disposal may vary depending on the type of electronic device.

Discussion

The findings of the study demonstrate a commendable level of knowledge and awareness regarding electronic waste management within the surveyed population. Notably, respondents exhibited a strong understanding of the environmental and health implications associated with E-waste. However, there exists a notable gap in knowledge concerning appropriate avenues for final disposal and familiarity with E-waste regulations. This highlights an opportunity for targeted education initiatives to enhance comprehensive understanding.

Regarding opinions on E-waste management, the majority of respondents held moderate perspectives. It is noteworthy that there was a consensus on the potential for E-waste recycling, reflecting a positive attitude towards sustainable practices. Conversely, there was a prevalent disagreement regarding the notion of disposing of E-waste with general waste. This underscores the importance of distinguishing E-waste from regular waste streams in public discourse and awareness campaigns.

The adjusted residuals analysis revealed noteworthy deviations from anticipated frequencies in the disposal practices of various electronic products. Notably, mobile phones were more inclined towards sale or incineration, while computers/laptops exhibited a higher tendency for resale or donation. Televisions leaned towards donation, dumping, or incineration, and refrigerators showed a propensity for resale or donation. These distinctions emphasise the need for tailored disposal guidance, particularly for specific types of electronic products.

These findings collectively advocate for a multi-faceted approach to enhance E-waste management practices. Firstly, heightened educational efforts targeting diverse electronic products and their respective disposal methods are essential. This would empower individuals with the knowledge needed to make informed decisions, contributing to more sustainable practices. Furthermore, incentivising and promoting reuse and recycling through public campaigns and policy measures could substantially mitigate E-waste accumulation.

Additionally, there is a pressing need for more accessible E-waste recycling facilities. Some respondents indicated a lack of awareness regarding appropriate disposal options, underscoring the necessity for improved accessibility to recycling centres. Governments and businesses should collaborate to expand the availability of such services, thereby ensuring a convenient and environmentally responsible option for E-waste disposal.

Moreover, E-waste legislation should be bolstered and made more transparent. The study revealed a notable lack of awareness among respondents regarding existing E-waste regulations in their respective countries. Governments should undertake efforts to streamline and communicate these legal frameworks effectively to the public, fostering a culture of compliance and responsible E-waste management.

Finally, robust monitoring and enforcement mechanisms are imperative to curbing improper E-waste disposal practices. Despite the majority of respondents demonstrating adequate knowledge, some still engaged in improper disposal. Governments should implement rigorous monitoring protocols and enforce penalties for non-compliance to ensure all E-waste is managed in an environmentally sound manner. This holistic approach, encompassing education, incentives, accessibility, legislation, and enforcement, stands poised to significantly enhance E-waste management practices within the surveyed population.

Conclusion

This study underscores the pressing need for enhanced E-waste management practices and heightened public awareness surrounding this critical issue. Evidently, a significant portion of the population lacks crucial knowledge regarding appropriate E-waste disposal options and remains unaware of existing E-waste legislation within their respective countries. Furthermore, the challenges and potential solutions in E-waste management within developing nations, as exemplified by Ghana, have been extensively discussed by Oteng-Ababio et al., (2020). Brüggemann and Leroy (2020) provide a comprehensive overview of contemporary discourses and strategies surrounding E-waste management, while Chen et al., (2021) delve into the factors influencing residents' E-waste recycling behavior in China. These studies collectively underscore the vital importance of policy interventions, stakeholder engagement, and infrastructure development in fostering sustainable E-waste management practices.

Therefore, it is imperative for policymakers and relevant stakeholders to persistently invest in comprehensive public education and awareness campaigns aimed at promoting sound E-waste management practices. These initiatives should be tailored to specific demographics, including young individuals and those with lower levels of education, ensuring that all segments of society are well-informed about E-waste and equipped with the knowledge to dispose of it responsibly. Additionally, there is a critical need for heightened enforcement of E-waste legislation, as our findings suggest that awareness of such laws remains relatively low.

Future research endeavours in this domain should focus on investigating the determinants that influence individuals' E-waste disposal practices. This may encompass demographic factors, levels of knowledge and awareness, and attitudes towards environmental sustainability. Such research would offer valuable insights for designing more targeted public education campaigns and policy interventions, ultimately contributing to substantial improvements in E-waste management practices.

By addressing these major determinants through policy, regulation, and guidelines, responsible E-waste management can become a reality, aligning with global efforts towards a more sustainable and environmentally-conscious future.

References

- Al-Salem, S. M., Lettieri, P., & Baeyens, J. (2011). Recycling and recovery routes of plastic solid waste (PSW): A review. *Waste Management*, 31(8), 1727-1740.
- Awasthi, A. K., Wang, M., Awasthi, M. K., Wang, Z., & Li, J. (2018). Environmental pollution and human body burden from improper recycling of E-waste in China: A short-review. In *Environmental Pollution*, Vol. 243, <https://doi.org/10.1016/j.envpol.2018.08.037>
- Bhattacharyya, S., & Joshi, K. (2016). An empirical study on consumer behavior towards E-waste management in India. *Resources, Conservation and Recycling*, 113, 32-40.
- Brüggemann, R., & Leroy, P. (2020). What to do with E-waste? An overview of contemporary discourses and strategies. *Journal of Cleaner Production*, 246, 118977.
- Central Pollution Control Board (CPCB). (2020). E-waste management in India: A roadmap for the future. Retrieved from https://cpcbenvvis.nic.in/Docu/E-Waste_Management_in_India_A_Roadmap_for_the_Future.pdf
- Chen, M., Yin, Y., & Lai, C. (2021). Factors affecting residents' E-waste recycling behavior: A case study of China. *Waste Management*, 118, 369-377.
- Cucchiella, F., D'Adamo, I., Lenny Koh, S. C., & Rosa, P. (2015). Green supply chain management: A review and research direction. *Sustainability*, 7(1), 415-431.
- De Silva, S. R., Samarathunga, M., & Visvanathan, C. (2019). Consumers' attitude towards electronic waste recycling in developing countries: A study from Sri Lanka. *Journal of Cleaner Production*, 208, 808-816.
- Exploring E-waste recycling behaviour intention among the households: Evidence from India, *Cleaner Materials*, Volume 7, 100174, ISSN 2772-3976, <https://doi.org/10.1016/j.clema.2023.100174>.
- Ezeah, C., Fazakerley, J. A., & Roberts, C. L. (2013). Emerging trends in electronic waste management in Nigeria. *Waste Management*, 33(11), 2528-2539.
- Giudice, F., Bof, F., & Pietrapertosa, F. (2018). Exploring the factors affecting consumer behavior in the recycling of electronic waste: An empirical study in Italy. *Sustainability*, 10(7), 2325.
- Gupta, S. (2023). Recycling has gone up in last 5 years, but 67% of E-waste remains unprocessed. *Indian Express*. <https://indianexpress.com/article/world/climate-change/recycling-gone-up-last-5-years-67-E-waste-remains-unprocessed-8530613/>
- Huysman, S., Verdonck, F., de Lathauwer, L., & Van Langenhove, H. (2018). Municipal E-waste collection: A case study in Flanders. *Waste Management*, 71, 70-78.
- Ismail, H., & Hanafiah, M. M. (2019). Discovering opportunities to meet the challenges of an effective waste electrical and electronic equipment recycling system in Malaysia. *Journal of Cleaner Production*, Vol. 238, <https://doi.org/10.1016/j.jclepro.2019.117927>
- Israel, G. D. (1992). Determining Sample. *University of Florida IFAS EXTENSION*.

- Israel, G. D. (2013). Determining Sample Size Degree Of Variability. PEOD6. Retrieved from https://www.gjimt.ac.in/wp-content/uploads/2017/10/2_Glenn-D.-Israel_Determining-Sample-Size.pdf
- Kaur, G., Gupta, N., & Bansal, P. (2019). Public awareness and attitude towards E-waste management: A case study of India. *Journal of Cleaner Production*, 208, 1003-1013.
- Kumar, A., Singh, R. K., & Singh, P. (2020). Perception of consumers towards E-waste management in India: A review. *Journal of Material Cycles and Waste Management*, 22(4), 902-914.
- Kumar, P., & Shrihari, S. (2007). Estimation and material flow analysis of waste electrical and electronic equipment (WEEE)—a case study of Mangalore City, Karnataka, India. In *Proceedings of the International Conference on Sustainable Solid Waste Management*, Vol. 5, pp. 148-154.
- Leclerc, S. H., & Badami, M. G. (2023). Extended producer responsibility: An empirical investigation into municipalities' contributions to and perspectives on E-waste management. *Environmental Policy and Governance*. <https://doi.org/10.1002/eet.2059>
- Li, W., & Achal, V. (2020). Environmental and health impacts due to E-waste disposal in China—A review. *Science of the Total Environment*, 737, 139745.
- Liu, L., Nie, Y., Yan, D., & Ding, Y. (2019). A review of E-waste management in China. *Journal of Cleaner Production*, 232, 222-233.
- Mahmood, T., Rahman, I., & Basheer, F. (2020). Public awareness and behavior towards electronic waste management in Pakistan. *Journal of Cleaner Production*, 245, 118978.
- Mangaluru: E-Swachh Bharat initiative to be launched on October 2- Daijiworld- <https://www.daijiworld.com/news/newsDisplay.aspx?newsID=623981>
- MCC opens first E-waste collection unit, 2 more to come- *Times of India* - <https://timesofindia.indiatimes.com/city/mangaluru/mcc-opens-first-E-waste-collection-unit-2-more-to-come/articleshow/53882298.cms>
- Mohan, V. (2020). India third largest E-waste generator in the world, capacity. The Times of India http://timesofindia.indiatimes.com/articleshow/76780611.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst
- Oteng-Ababio, M., Ameyaw, B., & Osei-Bonsu, K. (2020). Electronic waste management in Ghana: Challenges and prospects. *Resources, Conservation and Recycling*, 157, 104772.
- Pandey, K., Kumar, A., & Kumar, P. (2020). E-waste management: A review of contemporary approaches and challenges. *Journal of Cleaner Production*, 261, 121066.
- Pandey, S. K., Das, B., & Baig, M. A. (2020). Environmental pollution caused by electronic waste: a review. *Journal of Cleaner Production*, 264, 121674.
- Rajesh, R., Kanakadhurga, D., & Prabakaran, N. (2022). Electronic waste: A critical assessment on the unimaginable growing pollutant, legislations and environmental impacts. *Environmental Challenges*, Vol. 7, <https://doi.org/10.1016/j.envc.2022.100507>
- Ramesh, A., Prasad, G., & Manvi, S. S. (2017). E-waste management and disposal practices in India: stakeholders' perceptions and awareness. *Journal of Cleaner Production*, 168, 854-862.
- Ramesh, S., Prakash, S., & Deo, S. (2017). Analysis of electronic waste recycling in the United States and potential application in India. *Resources, Conservation and Recycling*, 123, 129-140.

- Shreyas Madhav, A. v., Rajaraman, R., Harini, S., & Kiliroor, C. C. (2022). Application of artificial intelligence to enhance collection of E-waste: A potential solution for household WEEE collection and segregation in India. *Waste Management and Research*, 40(7). <https://doi.org/10.1177/0734242X211052846>
- Sonego, M., Echeveste, M. E. S., & Debarba, H. G. (2022). Repair of electronic products: Consumer practices and institutional initiatives. In *Sustainable Production and Consumption*, Vol. 30,. <https://doi.org/10.1016/j.spc.2021.12.031>
- St. Agnes College Students collect E-waste - *Mangalore Meri Jaan* - <https://mangaloremerijaan.com/st-agnes-college-students-collect-E-waste/>
- Sutawong, P., Wattanachaiyingcharoen, D., Itsubo, N., & Suvannarat, K. (2020). The risks to human health and environmental impacts from community E-waste separation. *Geographia Technica*, 15(Special Issue). https://doi.org/10.21163/GT_2020.151.33
- Visvanathan, C., Trankler, J., Kuehr, R., Sinha-Khetriwal, D., & Mathur, V. (2017). E-waste in India: Assessment of recent trends and future challenges. *Environmental Science & Technology*, 51(5), 2509-2516.
- Wang, J., Xiao, L., & Cao, Y. (2020). The effects of public awareness and attitudes on E-waste recycling behavior in China. *Resources, Conservation and Recycling*, 162, 105049.

Application of Biomimicry in Transport Planning: Challenges, Potentials and Possibilities

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Abstract

The present-day transport systems and networks struggle with a vast number of problems, from inefficient designs, vehicular collisions to environment degradation. Modern transport systems and networks seek innovative and multidimensional planning approaches. The transport problems can only be efficiently mitigated by exploring different disciplines. Nature has a vast source of knowledge and humans have long been learning from it. Biomimicry is the science of exploring the form, process and ecosystem in nature to solve human problems. Biomimicry holds great potentials to efficiently mitigate the transport problems by integrating nature-inspired strategies and solutions to long-term and short-term planning practices. The present paper is concerned with exploring applications of biomimicry at different levels in transport solutions in different cases to explore challenges, potentials and possibilities so as to make the transport systems and networks more efficient, safe and to make cities more connected to nature.

Keywords

Biomimicry, Transport Planning, Environment- friendly cities.

Introduction

Transport, because of its pervasive nature, occupies a central position in the fabric of a modern-day urbanised nation (O'Flaherty 2018). The field of transport planning often stumbles upon convoluted and complex problems, which require complex calculations and meticulous research and development (R&D) practices to reach up to

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a viable solution. It is usual in such circumstances that the results formulated based on mathematical operations lack the desired outcomes as a few factors which might have affected the project were not considered in the analyses. The mathematical operations lack the key aspect of ‘cross field analysis’ which refers to solving a problem of one field by obtaining an idea or inspiration from another field; with the help of which, a number of factors can be identified, which were not previously at the horizon (McGregor, 2013).

The transport planning process relies upon statistical/mathematical operations and R&D which are often confined to certain time limitations. Hence, in order to solve human problems in a more efficient and time saving manner, the problem-solving skills developed by life on earth for over 3.8 billion years must be considered, which is far greater for any Research and Development programme ever done on the planet by humans for any deal of purpose (Benyus, 2009; Lee, 2011; Vox, 2017). All organisms have developed methods of overcoming problems, perfected over a long time and passed through generations, in contrast to the human beings, who have only been solving problems for fewer generations (Stacey, 2015).

Performing ideas obtained or inspired from biology or life on earth to solve problems in other fields is known as Biomimicry. Biomimicry comes from the Greek word for life “*bios*” and imitate “*mimeses*.” Popularised by Janine Benyus, a scientist and author at the university of Montana, biomimicry is an emerging scientific discipline that aims to study nature’s models and emulate these forms, processes, systems and strategies to solve many of the problems faced by mankind. (Verbrugge, 2011). Biomimicry offers a transformational approach for meeting the needs of society through emulating natural form, function, process and systems (Kenny, et al., 2012). The aim of biomimicry as well as cross field analysis is to understand the world (humans, non- humans and nature) and its complexities, then obtaining insights from non-humans and nature to fulfill human requirements and to solve human problems (McGregor, 2013).

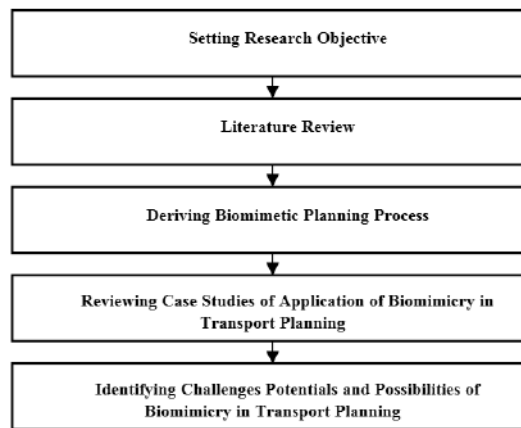
Transportation can be defined as the process of movement of freight and people from one place to another and the various means to achieve this movement (Rodrigue 2020). The present research paper attempts to explore the applications of biomimicry in the field of transport planning by studying different cases of successful and beneficial attempts of nature inspired practices in the field.

Objectives

The research focuses on two key objectives. First, it explores what biomimicry and biomimetics mean — these are about taking ideas from nature to solve human problems and improve technology. Second, it looks at how these ideas are used in city transportation and urban planning. By answering these questions, we aim to understand how nature-inspired thinking can make our cities eco-friendlier and more efficient.

Research Methodology

The research is based on a systematic literature review learning from concepts, theories and case studies across the globe. There has been no primary survey conducted in the research and various databases have been referred like Scopus, Web of Science. Various articles, books on biomimicry, biophilic and biomimetics system have been reviewed and linked to transport planning. Refer to the flowchart given below.



Flowchart 1

Source: Based on the authors' study.

About Biomimicry

History and Definition of the Term-- Biomimicry

The history of application of biomimicry in the field of transportation goes back to the time of Leonardo da Vinci who made sketches of bird-mimetic flying machines; the Wright brothers were inspired by the flight of birds to design, build, and fly the first aircraft in 1903 (Jabbari, et al., 2014).

Otto Schmitt first coined a similar term “*biomimetics*” in 1957, for describing the transfer of ideas obtained from biology into technology and innovation (Ivanić, Tadić and Omazić 2015). The term biomimetics entered the Webster’s dictionary in 1974 and is defined as ‘*the study of the formation, structure, or function of biologically produced substances and materials (such as enzymes or silk) and biological mechanisms and processes (such as protein synthesis or photosynthesis) especially for the purpose of synthesizing similar products by artificial mechanisms which mimic natural ones*’ (Merriam-Webster). Biomimetics and Biomimicry are both aimed at solving problems by first examining, and then imitating or drawing inspiration from models in nature (Shahda, Elhafeez and Elmokadem, 2014).

The term *bionics*, in 1960, was coined by engineer Jack Steele of the US Air Force in 1960 at a meeting at Wright-Patterson Air Force Base in Dayton, Ohio; he defined the term as ‘the science of systems which have some functions copied from nature, or

which represent characteristics of natural systems or their analogues’ (Vincent, et al., 2006). Thus, the term bionics was actually used earlier to cover, more or less, the same area as the term biomimicry does today (Ivanić, Tadić and Omazić, 2015). The term biomimicry first appeared in 1982 and was popularised in the 1997 book, *Biomimicry: Innovation Inspired by Nature*, by scientist and writer Janine Benyus who defines the term as ‘new science that studies nature’s models and then imitates or takes inspiration from these designs and processes to solve human problems’ (Benyus, 2009; GMIS, 2019). Benyus suggests looking to Nature as a “Model, Measure, and Mentor” (refer figure 1) and emphasises sustainability as an objective of biomimicry (Benyus, 2009; GMIS, 2019; Shahda, Elhafeez, & Elmokadem, 2014).

Nature as a Model	Nature as a Measure	Nature as a Mentor
Biomimicry is a scientific approach that addresses human problems by studying natural models and drawing inspiration from them. For instance, it might involve creating a solar cell design based on the structure of a leaf.	Biomimicry employs ecological criteria to evaluate the appropriateness of our innovations Nature, through 3.8 billion years of evolution, has discerned what is effective, suitable, and enduring.	Biomimicry represents a fresh perspective on nature, emphasizing a shift away from merely taking from the natural world to embracing a new era focused on learning from it.

Figure 1: Characters of Biomimicry.

Source: (Benyus 2009).

Levels of Biomimicry

The different levels of biomimicry are the different dimensions by which the nature can be imitated; there are basically three levels of biomimicry—the organism level, process or behaviour level and ecosystem level (Benyus, 2009). In the context of transport planning, these levels of biomimicry are discussed as below:

Level-1: Imitating Form (Organism Level)

This level involves the process of imitating the form of an organism, the structure that the nature has given to the organism which helps in certain tasks (Benyus, 2009; Vox, 2017); for example, the structure of the beak of the Kingfisher bird helping it to dive underwater with efficient displacement of water, imitating this organism’s form has helped in improving the efficiency of Shinkansen Train in Japan (Shahda, Elhafeez, & Elmokadem, 2014; Stacey, 2015; Verbrugge, 2011; Vox, 2017).

Level-2: Imitating Process (Network Level)

At this level, the imitation is inspired by the group functioning of a species, that how a group of organism responses and behaves in a particular situation (Benyus, 2009;

Vox, 2017). In nature, the organisms form complex networks and communication methods which can be helpful in making our technological networks (such as traffic management) more efficient.

Level-3: Imitating Ecosystem (Surrounding Environment Level)

Nature has given birth to complex ecosystems where a number of species live harmoniously with each other. The mimicking of ecosystems is an integral part of biomimicry (Benyus, 2009; Vox, 2017). The term ‘ecomimicry’ has also been used to describe the mimicking of ecosystems in design (Marshall, 2007; Zari, 2018). Ecomimicry is a kind of biomimicry in which flora and fauna of a particular place are studied in order to learn methods and solutions that are best suitable to the unique and specific conditions; these methods and solutions tend to be best suitable because they are inspired from those natural entities (flora and fauna) which have been evolved to work in accordance to the climatic conditions and local resource constraints (Zari, 2018). In transport planning, imitation of nature at this level includes studying the functioning of these ecosystems to make the man-made ecosystems, which are our cities and transportation systems, work more efficiently and harmoniously with the natural and man-made surroundings.

Biomimetic—Planning Process

Involving biomimicry in the general transport planning process may include the stages as shown in Figure 2. The transport planning process considered here is, following the systems approach as suggested by Black, (2018). The process begins with the identification of the transport problem, this can be at vehicular level, network level or ecosystem level. Based upon the nature of problem, the formulation of solutions is worked with the help of traditional methods and biomimetic research.

The traditional methods follow the collection of data, pertaining to the problem, involving primary data collection (surveys/ interviews and public opinions) and secondary data (literature); analysing the collected data sets with mathematical and statistical methods to derive the findings (Richardson, et al., 1995) The data analyses were necessary to strengthen the activities in critical areas which can be identified during this initial analysis (Herna'ndez, et al., 2008). On the other hand, the inspiration from nature includes– involvement of experts, exploring the related literature to get ideas from nature about the possible solutions to the problem and their detailing. Both these sub-processes of traditional methods and inspiration from nature must be well co-ordinated for best results.

The final outcomes from both the traditional methods of mathematical/ statistical derivations and inspiration from the nature are then to be combined to finalise the solution which is to be practised and implemented. The outcomes of the implemented solution are then to be reviewed so as to contribute to the literature, to help the future

practices. The study of these outcomes is helpful in both secondary data collection for traditional methods and in research of the existing discoveries related to nature inspired solutions and thus helpful in derivation of findings based on literature.

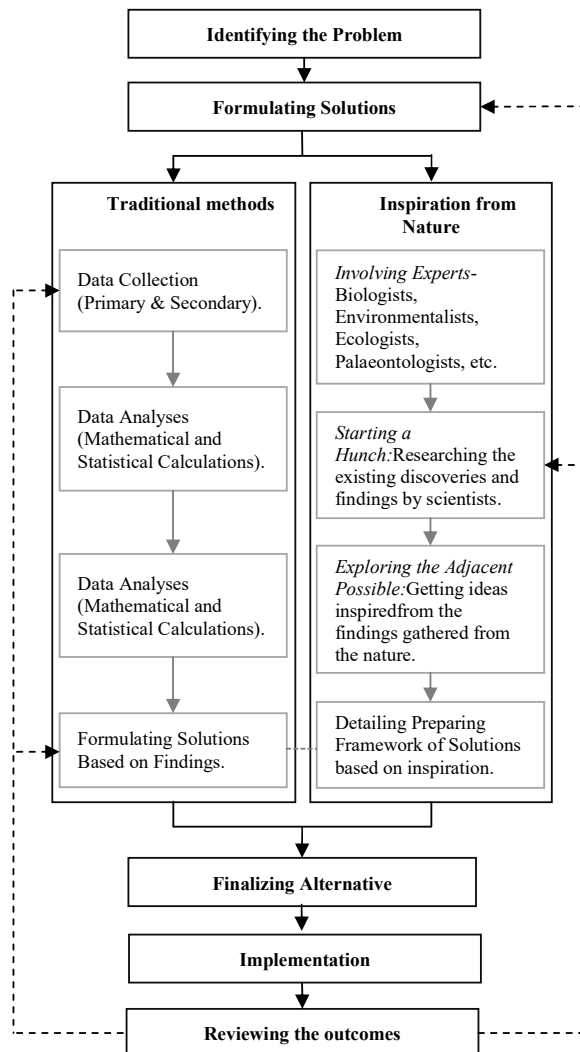


Figure 2: Biomimetic-Planning Process.

Source: Based on the authors' study.

Case Studies

The application of biomimicry in transport planning is in diminutive number of cases, but those are proven to be fruitful at times and again. The most significant cases of biomimicry at different levels in the field of transport planning are as follows:

Level-1 Applications

The level-1 applications of the biomimicry in transport planning are made at vehicular level; which means to improve the vehicular functioning and structural oddities by taking inspiration from an organism that nature has designed. The examples of level-1 applications of biomimicry in transport planning are as follows:

Shinkansen Train

(A) Introduction

The West Japan Railway Company's *Shinkansen* is a bullet train travelling at 200 miles per hour, is one of the fastest trains in the world; the earlier versions of this train travelled at 170 miles per hour in 1989 which also suffered from serious problems of noise (Verbrugge, 2011; Vox, 2017).

(B) Problems

When air hits pantographs on the train providing electric supply, it creates huge amounts of noise. Also, earlier models were having round heads which were loud, usually causing noise due to the phenomenon of '*tunnel boom*,' were deafening as compressed air rushes out of the tunnel opening when a train exited through the tunnel, this can affect residents within a proximity of 400-meters (Vox, 2017).

(C) Nature Inspired Solutions

The chief engineer of the project Eiji Nakatsu, who happened to be a keen birdwatcher looked for the inspiration from nature to solve this problem (Vox, 2017). His team of engineers studied the silent flight mechanism of owls; they learned that the plumage of owls contains small saw-tooth feathers, called *serration feathers*, which extend from the rim of their primary feathers; these feathers generate small vortexes in the airflow, thereby breaking up larger vortexes responsible for producing noise (Verbrugge, 2011). The engineers were able to replicate this principle by creating similar serrations on the pantographs; this technology also termed *asvortex generators*, which reduces noise significantly (Verbrugge, 2011).

To solve the problem of sonic boom created when trains exit tunnels, the engineers took inspiration from Kingfisher bird (Shahda, Elhafeez, & Elmokadem, 2014; Verbrugge, 2011; Vox, 2017). They found that the kingfishers are able to move from a low-resistance medium to a high-resistance medium (air to water), without producing splashes and losing energy (Verbrugge, 2011). This helped in improving the form of the nose of the train with design based on the kingfisher beak; this model ultimately caused much less noise while exiting the tunnels (Verbrugge, 2011).

(D) Outcomes

After incorporating the nature inspired design changes, in 1997 the train was not only quieter, but also reduced air pressure by 30 per cent, used 15 per cent less electricity and travelled 10 per cent faster (Verbrugge, 2011; Vox, 2017).

Level-2 Applications

The level-2 application of biomimicry in transport planning can be done at network level, in other words, a network of interaction between a number of vehicles, for example— a car responding to other vehicles on the road to avoid collision. The examples of level-2 applications in transport planning are as follows:

Locusts-Inspired Collision Avoiding System—Volvo Corporation

(A) Introduction

Vehicular collision is the most concerning aspect related to the road safety of both vehicles and pedestrians. To make efficient collision avoidance systems, the safety engineers at Volvo's Safety Center developed methods to eliminate car collisions by doing extensive research on African locusts (Palmebäck and Wei, 2007). This was inspired by the research of Dr. Claire Rind's locust studies at Britain's Newcastle University back in 2002 (Martinez, 2008).

(B) Problem

One of the biggest challenges of the automotive industry is to make cars which are safe on road, providing collision free movement for both vehicles and pedestrians (Liñán-Cembrano, et al., 2008). Hence, systems and mechanisms enabling efficient detection, avoidance and reducing the impact of vehicular collisions are very important aspects of industrial research (Stafford, Santer and Rind, 2007).

The Volvo Car Corporation is already having a variety of collision avoiding systems, yet they desire to improve the performance of their existing systems with the help of more efficient techniques, particularly in the aspect of pedestrian detection as the current systems are dealing primarily with detecting collision threats pertaining to vehicles (Palmebäck and Wei, 2007).

(C) Solution

Locusta Migratoria (Locust) is exceptionally good at detecting and reacting to the visual motion of an object approaching on a collision course (Liñán-Cembrano, et al., 2008). Studying this ability can help to construct efficient artificial vision systems capable to deliver collision-warning alarms for cars (Liñán-Cembrano, et al., 2008). The lobula giant movement detector (LGMD) of locusts is a visual interneuron which responds to an object on a direct collision course by producing a burst of spikes that increases in frequency as the object moves closer (Stafford, Santer and Rind, 2007). Computer simulations of the neuron have been developed and have demonstrated the ability of mobile robots, interfaced with a simulated LGMD model, to avoid collisions (Yue, et al., 2006).

(C) Outcomes

The system is capable to provide alerts efficiently towards collisions before the impact which enables it to deliver conducive collision mitigation responses like pre-tensioning

of seatbelts or pre-deployment of an airbag (Yue, et al., 2006). The tests also prove that the system is helpful in efficient detection of pedestrians, most notably during the side movements; this makes the system helpful specially in residential areas where children are playing; such detection system was so far missing in the products of the Volvo Car Corporation (Palmebäck & Wei, 2007).

The major issue faced by the system includes the false collision alerts getting produced in response to the objects in translating motion and sometimes to the objects in rapid rotational motion, however, promising results were observed in majority of scenarios involving rotating or turning motion (Yue, et al., 2006). The system irrefutably requires improvements in the Locust sensor algorithms (Palmebäck and Wei, 2007). However, the LGMD model has provided a useful beginning for future endeavours in the development of nature-inspired collision detection systems for vehicles (Yue, et al., 2006).

Traffic Signals Inspired by Ants

(A) Introduction

Dr Ozan Tonguz, a Professor in the Department of Electrical and Computer Engineering at Carnegie Mellon University (CMU) in Pittsburgh, US, has invented the Virtual Traffic Lights (VTL) algorithm to help control traffic on busy streets based on ants and termite movements (Tolfree and Smith, 2019).

(B) Problem

Managing the flow of cars is a big challenge for many transport planners (Ortiz, 2013). With rising number of vehicles on the streets, the management of vehicles on intersections has become problematic as new techniques and innovations are required to mitigate the issue.

(C) Solution

Ozan Tonguz, a telecommunications researcher from Carnegie Mellon, examined how ants and termites navigate their own versions of gridlock to create Virtual Traffic Lights, an algorithm that helps control human traffic on busy streets. It's called a "virtual" traffic lights because instead of the lights being at intersections, they are located in each car, on windshield. The algorithm uses information collected from GPS devices, short-range communicators and other sensors to manage whether a driver sees a green, yellow or red light on her windshield (Ortiz, 2013).

(D) Outcomes

Through the simulations, the scientists found that traffic drive time was reduced for urban commuters by 40-60 per cent; the newest set of algorithms being tested will also take into account pedestrians and cyclists in the flow of traffic (Ortiz, 2013).

Level-3: Applications

The organisms live in a strong harmony with the nature, being a part of the process of everlasting circle of upcycling and recycling. The level-3 applications of biomimicry involve inspiration from the nature to learn such harmonic systems of the organisms with nature. In terms of transport planning, the biomimetic approach includes the planning of such transport, networks and systems which work harmoniously with the ecosystem without causing any disturbance to the natural setting of the surrounding urban-scape. The examples of level-3 applications in transport planning are as follows:

Biophilic Streets

Streets must be reconceived as not only (or primarily) infrastructure for the conveyance of cars and traffic but as places that harbour native plants and biodiversity, that collect and treat storm-water, and where pedestrians can experience intimate contact with nature as part of their daily routine (Beatley, 2011). An urban street is not merely a traffic conveyor but an urban canvas where the culture and urban life flourish. A modern urban street often lacks life, culture and nature as it has become home to deafening vehicular movements and discouraging pedestrians and nature. An urban street can be compared to an evolving organism adapting and responding to its environment (Cabanek, Baro and Newman, 2020). Biophilic urbanism has developed a series of science and engineering approaches that mimic natural systems within denser urban environments; these emerging biophilic urbanism approaches mean urban greenery is no longer limited to undeveloped land, but can also be integrated on, in and over built structures (Thomson and Newman, 2021). The design elements of a biophilic street include—sidewalk gardens, urban trees, low impact development, vegetated swales, skinny streets (providing more space to pedestrians and cyclists so as to encourage pedestrians and cyclists and discouraging private vehicles and high-speed movements), edible landscaping and high level of permeability (Beatley, 2011). Roads and highways planned in such green and biophilic manner and by using nature inspired carbon neutral materials can help in several ways, from reducing emissions released from fossil fuels and other greenhouse gasses to make people and cities more connected to the nature. The examples of such biophilic street planning are discussed in Table 1.

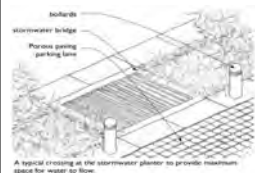
Table 1: Biophilic Streets- Case Studies

Project	Park Connectors, Singapore	Green Grids, Seattle	SW Montgomery Street Portland, Oregon	Green Alley, Chicago	Vitoria-Gasteiz, Basque Country, Spain
Year of Initiation	1991	2001	2004	2006	2012
Status	Complete	Complete	Ongoing	Ongoing	Complete
Year of Completion	2015	2007	2007	-	2014

Project	Park Connectors, Singapore	Green Grids, Seattle	SW Montgomery Street Portland, Oregon	Green Alley, Chicago	Vitoria-Gasteiz, Basque Country, Spain
Scale	City Scale	Neighbourhood Scale	Neighbourhood Scale	City Scale	Neighbourhood Scale
Biophilic Applications	• Turning underutilised land, such as drainage reserves, foreshores, and road reserves, into canopy-covered green corridors for enjoyment and connectivity for pedestrians and bicycles. • Green walls designed for biodiversity enhancement and ecological restoration. • Permeable paving facilitating rainwater infiltration. • A 10-metre green buffer is mandatory on both sides of the road, and tree or plant removal is disallowed.	• Ordinary alternatives to conventional street, walkway and yard design. • Demonstrating Low Impact Design (LID) techniques by adapting existing roadways. • Swales along the side of the road. • Porous pavement is used for streets and walkways • Larger storms are absorbed by a conveyance system and a retention pond.	• Improving a current planting strip to allow rainwater in and to add water-absorbing and filtering plants. • Created curb extensions where plantings replace street parking. • Transformation of unused space along roads into parklike settings. • Porous pavement is used for streets and walkways. • Landscaped curb extensions, bioswales, planter strips, pervious pavement, and street trees.	• Permeable paving • Rain gardens, bioswales and rain barrels. • Use of lighter, more reflective pavement materials. • Alley drainage may be improved by properly pitching and grading alleys. • High Albedo Pavement • Recycled Construction Materials • Dark Sky Compliant Light Fixtures	• Heat island effect mitigation by tree canopies, landscaping and waterbodies. • Infiltration via permeable surfaces. • Purification using bio-filters. • Recycling via green wall and roof systems; • Bio-filtration through daylighted stream. • The installation of a vertical garden. • Vacant units are being turned into fresh green areas.
Outcomes	• As of 2015, 300 kilometres of the park connector network had been built. • Safe walking and cycling routes by travelling through Singapore.	• The amount of runoff was decreased by 98 per cent at a cost that was 25 per cent less than that of traditional roadway designs. • Traffic flow has been reduced, and walkability has been improved.	• Green Street facilities filter water to remove 90 per cent of total suspended particles, 90 per cent of organic pollutants/oils, and more than 90 per cent of heavy metals.	• Up to 80 per cent of the rainfall that falls on these surfaces over the course of the year may be absorbed by permeable pavement and returned to the ground.	• Car usage was replaced by pedestrians and bicycles. • Pedestrian surface was increased from 45 per cent to 74 per cent.

Project	Park Connectors, Singapore	Green Grids, Seattle	SW Montgomery Street Portland, Oregon	Green Alley, Chicago	Vitoria-Gasteiz, Basque Country, Spain
	550 species of butterfly and birds have been found there.		Green Streets have been found to lower peak flows from drainage regions by at least 80 per cent and as much as 94 per cent.	- Reducing localized flooding, recharging groundwater. - Thousands of light fixtures ensure a secure atmosphere. - Reduced glare and light pollution.	
Sources	(Newman 2014); (Ministry of National Development 2012); (National Parks Board 2020).	(Wise, 2008); (Beatley 2011); (Seattle Public Utilities 2021).	(Triman 2016); (CPA 2021); (Cabanek, Baro and Newman, Biophilic streets: a design framework for creating multiple urban benefits 2020).	(Beatley 2011); (Commissioner Department of Transportation 2006); (Newell, et al., 2012).	(Civitas.EU 2014); (Vitoria-Gasteiz City Council 2018).

Source: (Newman 2014); (Wise, 2008); (Triman 2016); (Beatley 2011); (Civitas.EU 2014)

1. Park Connectors, Singapore	 Source: https://pcn.nparks.gov.sg/	 Source: http://surl.li/mpgmv	 Source: http://surl.li/mpggig
2. Green Grids, Seattle	 Source: https://nacto.org/case-study/pinehurst-green-grid-seattle/	 Source: https://nacto.org/case-study/pinehurst-green-grid-seattle/	 Source: https://nacto.org/case-study/pinehurst-green-grid-seattle/
3. SW Montgomery Street Portland, Oregon	 Source: http://surl.li/mpgjr	 Source: http://surl.li/mpgjr	 Source: http://surl.li/mpgjr

4. Green Alley, Chicago	 Source: https://nacto.org/publication/urban-street-design-guide/streets/green-alley/#footnotes	 Source: https://nacto.org/publication/urban-street-design-guide/streets/green-alley/#footnotes	 Source: https://www.thelanewayproject.ca/blog/2015/7/3/chicagos-destruction-of-the-laneway-climate-myth
5. Vitoria-Gasteiz, Basque Country, Spain	 Source: https://blog.sankalptaru.org/climate-crisis/urban-heat-islands-and-the-role-of-trees-in-mitigating-them/	 Source: http://nwrn.eu/measure/permeable-surfaces	 Source: https://www.frontiersin.org/articles/10.3389/fsufs.2020.00076/full

Discussion

Engineers and planners often work on the assumption that their technical solution is the optimum solution which should be accepted by the politicians and the public at large. In reality this acceptance is not always forthcoming. Through the logical and cultural analyses, a better understanding can be developed of, or between, all the relevant actors (Jeppesen, 2009; Kane & Mistro, 2003).

Biomimicry follows a trans-disciplinary approach, if trans-disciplinary solutions to world problems necessitate a holistic coupling of the human and the natural, as well as the inclusion of many voices and perspectives, it makes sense that trans-disciplinarity gain inspiration from biomimicry, with its focus on nature. Trans-disciplinarity based on the principles of nature (biomimicry) is promising. It supports visionary approaches to solve complex messy problems that require people to “rethink and reorient humans’ relationship with the planetary environment, leading to society being able to work together with nature”.

The present-day transport systems and networks are the outcomes of the unplanned and rapid growth of cities resulting from the Industrial Revolution (Kenny, et al., 2012; Szostak, 1991). The resultant development and the infrastructure systems such as transportation, are highly resource dependent and are subject to numerous threats (Kenny, et al., 2012). To meet the needs of 21st-century civilisation, it is apparent that the design and operation of urban infrastructure must be significantly different. By replicating natural form, function, process, and systems, biomimicry offers a

transformative approach to satisfying society's demands. The benefits observed from the examples of applying biomimicry to infrastructure systems indicate a clear opportunity for this design approach to be used extensively throughout the infrastructure industry. It is proposed that a framework for considering biomimicry informed urban infrastructure design is needed (Kenny, et al., 2012). As urban planners both shape policy and approve development within cities, they are the key actors to enable widespread uptake of urban green infrastructures and biophilic urbanism. The city planners can develop policies to encourage different green infrastructure and Biophilic Urbanism (Thomson and Newman, 2021).

Biomimicry focuses on natural processes or functions that humans can apply to the man-made world (Goss, 2009). Natural forms are relevant in so far as they speak to or support the function of an organism or process (Goss, 2009). In this approach, Biomimicry adheres to a key Modernist principle: form follows function. Unlike the Modernists, however, who emphasised new industrial materials and the virtues of mass production (early industrial designers), Biomimicry is directed towards natural materials and natural processes (Goss, 2009). Nature uses minimum resources to produce maximum results (Bar-Cohen, 2006).

Challenges

Biomimetics is not a new way of adapting ideas from biology, but it is currently empirical in its approach (Vincent, et al., 2006). Applying biophilic street solutions require strong and dedicated political and decision-making will, due to which such sustainable and innovative solutions often remain on paper and not in practice, thus there must be mandatory Sustainability Rating Systems meant for the transportation sector (Meyer, Hunter and Eisenman, 2012).

Integrating research and development with urban biomimetic practise is a key issue. The findings revealed a disconnect between biomimetic and biological research teams and urban designers. It is a big issue to promote information transfer from biological and ecological sciences to architecture and urban design practise. The importance of rethinking design team composition and projects design phase organization to bridge this gap is established by Blanco, et al., in 2021.

One of the challenges lie in the complexity of transport with all the technical, socio-economic and environmental facets, which may be seen, when people of the same organisation take different decisions (Kölbl, and Martin Niegl, 2008). Thus, further involving bio-experts tends to make the transport planning process more complicated. To overcome this challenge, there must be establishment of umbrella bodies, having responsibility of establishing co-operation and providing/ensuring cohesive environment between various other bodies involved in a transport planning process. This makes the process more unified and easier to manage.

Another challenge that occurs in the science of biomimicry is the duration of the period in which an idea gets processed from a concept to a final product (Ivanić, Tadić and Omazić, 2015). A common characteristic of great ideas or innovations is the emergence of the idea or innovation by independent thinkers in different places at often slightly different times (Bar-Cohen, 2012).

There is a need of Biological Information System (BIS) like Geographic Information System (GIS) as suggested by Goel, McAdams, and Stone, (2014). Such information systems can help to connect the ideas between different researchers and inventors of different fields, thus, simplifying the collaborative process. These systems can not only help for connecting ideas but these can also help in conservation of biodiversity in urban areas by creating a database of different species of flora and fauna (Theobald, et al., 2000). The important ingredient for success is action. An idea or inspiration not shared, acted upon, or used is no better than no idea at all (Bar-Cohen, 2012).

Potentials and Possibilities

The developing countries like India are currently facing the issues of urbanisation, climate change and resource constraints. It has become imperative to understand the role of ecology in city planning and development. Biomimicry can be used by planners to reduce embodied energy in construction products, reduce material use, produce better explorative designs in architecture and reduce maintenance (Toor and Kaur, 2017).

At vehicular level, biomimicry has proven its usefulness in the areas of technology, products and design which have adopted concepts from nature (Lipholt, 2019). Due to their neutrality, carbon neutral materials used in the building of green roads and highways can absorb temperature and excess pollutants generated by cars (Attahiru, et al., 2019). Mimicking these bio-inspired materials structures and processing could lead to the development of a new class of advanced engineering materials useful for various applications ranging from transportation (e.g., aircraft and automobiles) to energy production (e.g., turbine blades, artificial photosynthesis) (Xia, 2016).

Road Traffic Collisions (RTCs) are a significant cause of mortality, killing more than 1.3 million people per year throughout the world, half of whom are between the ages of 15 and 44 (WHO, 2018). More than 50 million wounded people are further disabled as a result of these. It is possible to reduce fatality rates by taking vehicle safety measures and changing highway designs. The most important motor vehicle crash safety innovation which contributed to reduction in mortality, has been the installation and proper use of seatbelts (Abbas, Hefny and Abu-Zidan, 2011). At network level, bio-inspired collision avoidance systems and intersection traffic signals, as discussed in the previous stage of this paper have shown promising results by significantly reducing the problems, highlighting the usefulness of biomimicry in mobility planning.

At ecosystem level, the nature inspired concept of biophilic streets has also shown tremendous positive results as already discussed. The application of road design

elements which establish harmony with the nature and urban activities has the potential to change completely our perspective of cities.

Hence, incorporating an understanding of how the living world works is a step towards the creation and evolution of sustainable and regenerative cities (Zari, 2018). Biomimicry in evolutionary process caters to the potential of creating 'living;' cities (Toor and Kaur, 2017).

Conclusion

Transportation is the core component of the urban environment on which all other aspects are dependent, this makes transportation a defining aspect of the future development and efficient functioning of an urban environment. At present, the transportation systems and networks struggle incontrovertibly with environmental and cultural issues by making people disconnected from nature. The rapid outgrowth and expansion of the cities in the past have made the cities, home for unsafe streets, overnumbered vehicles, pollution and void of natural environment. The modern transportation problems are complex and hard to eradicate, which requires the contribution of various fields. Nature is a vast ocean of knowledge holding solutions for various human problems. Mimicking nature can help in solving transport related issues by applying the nature inspired solutions to the long-term and short-term transport planning strategies.

A number of cases of bio-inspired practices and ideas in transport planning at different levels of biomimicry have been discussed, highlighting the potential of biomimicry in the field of transport planning. From birds inspired design of trains; locust inspired collision avoidance system and bugs inspired virtual intersection traffic signals to the natural ecosystem inspired biophilic streets; the application of biomimicry in transport planning shows promising results. The challenges are also there in involving biomimicry in the transport planning process, but as the results tend to be positive, the challenges must be overcome as discussed in the present paper. Adopting nature inspired approaches has the potential to make cities less effecting to nature and to make our earth a better place to live.

References

- Vitoria-Gasteiz City Council. (2018). *Implementation of the Vitoria-Gasteiz Green Urban Infrastructure Strategy*. 19 01. <https://climate-adapt.eea.europa.eu/metadata/case-studies/implementation-of-the-vitoria-gasteiz-green-urban-infrastructure-strategy>.
- Abbas, Alaa K, Ashraf F. Hefny, and Fikri M. Abu-Zidan. (2011). "Seatbelts and road traffic collision injuries." *World Journal of Emergency Surgery* 1-6.
- Attahiru, Yusuf Babangida, Md. Maniruzzaman A. Aziz, Khairul Anuar Kassim, Shamsuddin Shahid, Wan Azelee Wan Abu Bakar, Thanwa Filza NSashruddin, Farahiyah Abdul Rahman, and Mohd Imran Ahamed. (2019). "A review on green economy and development of green roads and highways using carbon neutral materials." *Renewable and Sustainable Energy Reviews* 101: 600-613.

- Bar-Cohen, Yoseph, ed. (2006). *Biomimetics- Biologically Inspired Technologies*. Boca Raton, Florida, USA: CRC Press, Taylor & Francis Group .
- Bar-Cohen, Yoseph, ed. (2012). *Biomimetics- Nature Based Innovation*. Boca Raton, Florida, USA: CRC Press, Taylor & Francis Group.
- Beatley, Timothy. (2011). *Biophilic Cities- Integrating Nature into Urban Design and Planning*. Washington, DC: Island Press.
- Benyus, Janine M. (2009). *Biomimicry- Innovation Inspired by Nature*. Harper Collins.
- Black, John. (2018). *Urban Transport Planning: Theory and Practice*. Routledge Library Editions: Urban Planning. Vol. IV. Routledge.
- Blanco, Eduardo, Estelle Cruz, Chloé Lequette, Kalina Raskin, and Philippe Clergeau. (2021). "Biomimicry in French Urban Projects: Trends and Perspectives from the Practice." *MDPI-Biomimetics* 1-16.
- Cabaneck, Agata, Maria Elena Zingoni de Baro, and Peter Newman. (2020). "Biophilic streets: a design framework for creating multiple urban benefits." *Sustainable Earth* 1-17.
- Cabaneck, Agata, Maria Elena Zingoni de Baro, and Peter Newman. (2020). "Biophilic streets: a design framework for creating multiple urban benefits." *Sustainable Earth* 1.17. doi:<https://doi.org/10.1186/s42055-020-00027-0>.
- Civitas. EU. (2014). *Case Study - Streets designed for sustainable mobility in Vitoria-Gasteiz*. Vitoria-Gasteiz: ICLEI – Local Governments for Sustainability,.
- Commissioner Department of Transportation. (2006). *The Chicago Green Alley Handbook*. Chicago: Department of Transportation, City of Chicago.
- CPA. (2021). *Case Study | Green Infrastructure/Resilience*. 04 07. <https://cityparksalliance.org/resource/portland-green-street-program/>.
- GMIS. (2019). *Biomimicry: Nature Inspired Technology*. Global Manufacturing & Industrialisation Summit.
- Goel, Ashok K., Daniel A. McAdams, and Robert B. Stone. (2014). *Biologically Inspired Design- Computational Methods and Tools*. London: Springer-Verlag London.
- Goss, Julie. (2009). *Biomimicry: Looking to Nature for Design Solutions*. Washington, DC: Department of Interior Design, Corcoran College of Art and Design.
- Herna'ndez, Jorge E., Josefa Mula, Francisco J. Ferriol, and Raul Poler. (2008). "A conceptual model for the production and transport planning process: An application to the automobile sector." *Computers in Industry* 842–852.
- Ivanić, Kasandra-zorica, Zoran Tadić, and Mislav Ante Omazić. (2015). "Biomimicry- An Overview." *The Holistic Approach to Environment* 5, 19-36.
- Jabbari, Esmail, Deok-Ho Kim, Luke P Lee, Amir Ghaemmaghami, and Ali Khademhosseini. (2014). *Handbook of Biomimetics and Bioinspiration*. Singapore: World Scientific Publishing Co. Pte. Ltd.
- Jeppesen, Sara L. (2009). *Sustainable Transport Planning- A Multi-Methodology Approach to Decision Making*. DTU Transport.
- Kane, Lisa, and Romano Del Mistro. (2003). "Changes in transport planning policy: Changes in transport planning methodology?" *Transportation* 30, 113–131.

- Kenny, Jillian, Cheryl Desha, Arun Kumar, and Charlie Hargroves. (2012). "Using biomimicry to inform urban infrastructure design that addresses 21st century needs."
- Kölbl, Robert, and Hermann Knoflacher Martin Niegl. (2008). "A strategic planning methodology." *Transport Policy* 15, 273–282.
- Lee, Dora. (2011). *Biomimicry: Inventions Inspired by Nature*. Toronto: Kids Can Press Ltd.
- Liñán-Cembrano, Gustavo, Luis Carranza, Claire Rind, Akos Zarandy, Martti Soinen, and Angel Rodríguez-Vázquez. (2008). "Insect-Vision Inspired Collision Warning Vision Processor for Automobiles." *IEEE Circuits and Systems Magazines (Second Quarter)* 6-24.
- Lipholt, Author: Nicole. (2019). *Biomimicry – Where Nature is Changing Innovation*. Enschede, Netherlands: The Faculty of Behavioral, Management and Social Sciences, University of Twente.
- Marshall, Alan. (2007). *The theory and Practice of Ecomimicry*. Sustaining Gondwana, Curtin University of Technology.
- Martinez, Nate. (2008). *Volvo looks to locusts for future pedestrian safety technology*. 17 September. Accessed June 20, 2021. <https://www.motortrend.com/news/volvo-looks-to-locusts-for-future-pedestrian-safety-technology-2374/>.
- McGregor, Sue L. T. (2013). "Transdisciplinarity and Biomimicry." *Transdisciplinary Journal of Engineering & Science* 57-65.
- Merriam-Webster. n.d. *Biomimetics*. Accessed July 3. (2021). <https://www.merriam-webster.com/dictionary/biomimetics>.
- . n.d. *Biomimicry*. Accessed July 3. (2021). <https://www.merriam-webster.com/dictionary/biomimicry>.
- Meyer, Michael, Michael Hunter, and Ana Eisenman. (2012). *Sustainable Streets and Highways: An Analysis of Green Roads Rating Systems*. Georgia: Georgia Institute of Technology.
- Ministry of National Development. (2012). *Ministry of National Development*. 09 01.
- National Parks Board. (2020). *Heritage Roads*. 04. Accessed 07 01, 2021. <https://www.nparks.gov.sg/gardens-parks-and-nature/heritage-roads>.
- Newell, Joshua P., Mona Seymour, Jennifer Renteria, Travis Longcore, Jennifer R. Wolch, and Anne Shishkovsky. (2012). "Green Alley Programs: Planning for a sustainable urban infrastructure?" *Cities* 1-12.
- Newman, Peter. (2014). "Biophilic urbanism: a case study on Singapore." *Australian Planner* 47-65.
- O'Flaherty, Coleman A., ed. (2018). *Transport Planning and Traffic Engineering*. CRC Press.
- Ortiz, Christina. (2013). "Traffic Signals Inspired by Bugs." *Mashable*. 8 January. Accessed June 17, 2021. <https://mashable.com/2013/01/07/traffic-signals-bugs/>.
- Palmebäck, Pär, and Jonny Wei. (2007). *Locust System Integration into Demo Vehicles*. Linköping, Sweden: Department of Electrical Engineerin, Linköping University.
- Richardson, Anthony J., Elizabeth S. Ampt, and Arnim H. Meyburg. (1995). *Survey methods for transport planning*. Melbourne: Eucalyptus Press.
- Rodrigue, Jean-Paul. (2020). *The Geography of Transport Systems*. 5th. New York: Routledge. Accessed June 27, 2021. <https://www.britannica.com/technology/transportation-technology>.

- Seattle Public Utilities. (2021). *Broadview Green Grid Project*. Accessed June 29, 2021. <https://www.seattle.gov/utilities/neighborhood-projects/broadview-green-grid>.
- Shahda, Merhan Mohammed Mohammed, Mostafa Mohammed Abd Elhafeez, and Ashraf Abd Elfattah Elmokadem. (2014). "Biomimicry Levels as an Approach to the Architectural Sustainability." *Port Said Engineering Research Journal*.
- Stacey, John. (2015). "Biomimicry- Materials that imitate life." *Catalyst, December 2015* 4-5.
- Stafford, Richard, Roger D. Santer, and F. Claire Rind. (2007). "A bio-inspired visual collision detection mechanism for cars: Combining insect inspired neurons to create a robust system." *BioSystems* 87, 164–171.
- Szostak, Rick. (1991). *Role of Transportation in the Industrial Revolution: A Comparison of England and France*. McGill-Queen's Press - MQUP.
- Theobald, David M., N. T. Hobbs, Tammy Bearly, Jim A. Zack, Tanya Shenk, and William E. Riebsame. (2000). "Incorporating biological information in local land-use decision making: designing a system for conservation planning." *Landscape Ecology* (Kluwer Academic Publishers, Netherlands) 35–45.
- Thomson, Giles, and Peter Newman. (2021). "Green Infrastructure and Biophilic Urbanism as Tools for Integrating." *Urban Planning* 6 (1): 75-88.
- Tolfree, David, and Alan Smith. (2019). "Transport systems and materials inspired by nature." *CMM Magazine*. 4 March. Accessed June 17, 2021. <http://www.cmmmagazine.com/cmm-articles/transport-systems-and-materials-inspired-by-nature/>.
- Toor, Sirat, and Parul Kaur. (2017). "Theory of Biomimicry in Urbanscape." *Journal of Civil Engineering and Environmental Technology* 253-257.
- Triman, Julia. (2016). "Handbook of Biophilic City Planning and Design." In *Green Streets in a River City*, by Timothy Beatley, 93-102. Washington: Island Press.
- Verbrugge, Katrina. (2011). "Biomimicry- Harnessing Nature's Idea to Power our World." *Harvard Science Review, Winter 2011*, 16-19.
- Vincent, Julian F. V., Olga A. Bogatyreva, Nikolaj R. Bogatyrev, Adrian Bowyer, and Anja-Karina Pahl. (2006). "Biomimetics: its practice and theory." *Journal of the Royal Society- Interface* 471-482.
- Vox. 2017. "The world is poorly designed. But copying nature helps." *Youtube*. 9 November. Accessed June 19, 2021. <https://www.youtube.com/watch?v=iMtXqTmfta0>.
- WHO. (2018). *Global status report on road safety*. World Health Organization.
- Wise, Steve. (2008). "Green Infrastructure Rising- Best practices in stormwater management." *American Planning Association*.
- Xia, Zhenhai. (2016). *Biomimetic principles and design of advanced engineering materials*. West Sussex, United Kingdom: John Wiley & Sons, Ltd.
- Yue, Shigang, F. Claire Rind, Matthais S. Keil, Jorge Cuadri, and Richard Stafford. (2006). "A bio-inspired visual collision detection mechanism for cars: Optimisation of a model of a locust neuron to a novel environment." *Neurocomputing* 69, 1591–1598.
- Zari, Maibritt Pedersen. (2018). *Regenerative Urban Design and Ecosystem Biomimicry*. Abingdon: Routledge.

Stakeholders' Participation in Freight Logistics: An Overview

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Abstract

Goods movement is increasingly becoming recognised as an integral component of urban transport planning. The ability to transport goods quickly, safely, economically and reliably is seen as vital to a nation's prosperity and capacity to compete in a globalising economy. The movement of goods within urban areas is vital since cities are at the centre of economic and social life. As cities are now facing global competition for investment and trade, an efficient transport system is necessary for their sustained economic prosperity. Freight movement in the cities often puts considerable strain on urban transport infrastructure and imposes high social costs. The objectives of logistics planning in particular are to enable goods movement at desired levels of efficiency. Stakeholders' participation is extremely important to arrive at a sustainable freight strategy which benefits the community at large. This paper attempts to describe an urban logistics ecosystem and its function and various concepts, methods and approaches of stakeholders' engagement in urban freight including global best practices.

Keywords

Urban Freight, Logistics Ecosystem, Stakeholders' Engagement, Best Practices.

Introduction

Importance of Freight Logistics

Freight transport is the main element that supports global supply and commodity chains, from raw material transformation to market distribution and after-market services. Urban freight transport aims to establish an effective interface between regional or global freight transport and the last miles of urban freight distribution. Goods Transport

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is an essential part of urban environment. It aims to establish an effective interface between regional freight transport realms and the last mile of urban freight distribution. It concerns a wide range of activities ensuring an adequate level of service for a variety of supply chains in urban areas. The distribution of goods in urban areas has become increasingly complex because of increase in demand, government regulations, traffic congestion, high-frequency deliveries using lighter vehicles and environmental issues (Crainic et al., 2004).

Urban logistics incorporates many activities (i.e. production, trade and supply) between different actors in the form of internal urban goods transport or inter-urban freight distribution, making a significant contribution to economy, city life and operation.

Figure 1 depicts the urban logistics geographical scope adapted.

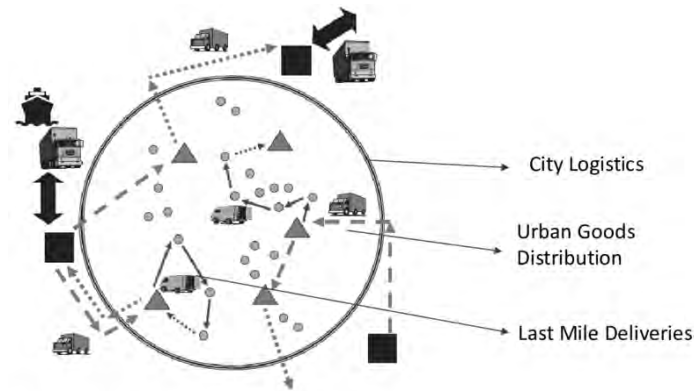


Figure 1: Urban Logistics' Geographical Scope adapted

Source: Cardenas, Ivan, et al (2017).

Freight Logistics Ecosystems

Urban logistics, according to De Groot, permits a framework of the ecosystem parts and their relationships with stakeholders in the context of city planning.

As per De Groot et al., (2006) “the capacity of natural processes and components to provide goods and services that satisfy human needs, directly or indirectly.” The natural processes are distinguished with the basic concept of energy and matter, resulting in the complex interactions between the ecosystems’ biotic (living organisms) and abiotic (chemical and physical) components.

According to De Groot, observed ecological functions are redefined as “ecosystem goods and services”, when it comes to human values. The idea of “ecosystem *goods and services*” is anthropocentric because people value intermediaries that transform ecological processes into values. Similarly, environmental functions in the urban environment are various conditions, for example, the main characteristics of the city

Values of Logistics Ecosystem

1. Ecological Values,
2. Socio-cultural Values and
3. Economic Values, *sphere of impact*.

[illegible]

Source: De Groot et al., (2006).

Ecological Values

The key ecosystem processes and components that supply commodities and services determine an ecosystem's capability to do so, while ecological criteria like resilience, honesty, and durability set boundaries for sustainable use. The transportation sector

uses finite resources, including energy, natural and human habitats, and the ability of the atmosphere to hold carbon. Thus, it is crucial to create urban transportation ecosystems with the goal of using natural resources at sustainable levels. When assessing the environmental consequences on the urban ecology, the noise pollution from freight vehicles, the accompanying air pollution, and the changes in habitat and climate are the most important aspects to consider. Therefore, it is critical that a strategy on city logistics resolves these routing conflicts, supports efforts to lower greenhouse gas emissions, and boosts environmental benefits.

Socio-Cultural Values

The significance of natural ecosystems and their functions to human society are greatly influenced by social ideals and expectations. Considerations related to logistics sector must be made while working with sustainability policies. Since local residents are the ones who are affected by the decisions made by the authorities, they place importance on the results of these regulations.

The other members of the network are also impacted by every single policy. As a result, the stakeholders' perspectives determine the value attached to the operation of such a transformed environment. The degree of comfort and limitation for various groups of people has also to be considered. For instance, trucks blocking a roadway, parking issues brought on by freight transport, etc. However, a system that reduces congestion and creates more parking spots—or at the very least, creates the impression that there aren't any no big commercial vehicles in the city Centre—will be seen as a beneficial option. Therefore, the frequency of accidents caused by moving cars, the disruption of freight transportation from inhabitants' daily lives, and the ensuing urban livability are the primary factors to be taken into account when evaluating the socio-cultural influence on the urban ecology.

Economical Values

De Groot et al., describe economic valuation as efficiency and cost-effectiveness-based methods. There is a close relationship between the economics of goods transportation and the application of this theory to the field of urban logistics. The efficiency and effectiveness of an urban transportation solution, and consequently its cost to the carrier and the recipient, are directly impacted by the regulatory and habitat functions.

Jesus Gonzalez-Feliu & Morana, (2014) emphasise that one of the main factors in urban logistics solutions is their economic continuity: most of the solutions showed interesting results in the pilot and test phases, but could not survive after the substantial public funding support had been halted. Thus, the primary factors to be taken into account while evaluating the economic impact on urban ecosystems are the expenses associated with traffic congestion, travel distance, delivery time, infrastructure expenditures, and financial viability.

Stakeholders' Participation: Approaches and Methods

Stakeholders in urban freight transportation, such as individuals and groups of people, businesses, and organisations, are interested in the transportation system.

According to Hensher and Brewer, (2000) several stakeholder theories emphasise the individuality and uniqueness of each stakeholder, who belongs to an extended network of strategic relationships.

According to Lindholm, (2014) different stakeholders have different interests and prerequisites associated to urban freight transportation.

According to Lindawati et al., (2014), one of the aspects that makes the effective implementation of the City Logistics projects, a complex task is the presence of a high number of stakeholders involved (i.e., traders, transporters, traditional couriers, innovative and “green” transport companies) with contrasting interests.

Even when all stakeholders are present, they may lack the necessary knowledge required to fully comprehend the nature and extent of the problems and frequently fail to see important details. A number of strategies (such as the Multi-Actor Multi-Criteria Analysis (MAMCA), a methodology to evaluate different policy measures whereby different stakeholders' opinions are explicitly taken into account) have been put out to address stakeholder engagement in order to address these problems, with the goal of assessing the opinions of various stakeholders during the decision-making process. However, stakeholders need assistance in comprehending and managing the complexity of their ecosystem before a decision-making process starts.

Stakeholders' Types

Urban logistics is a multifaceted field with many players. In general, people who are involved in the decision-making process—even if they are not the ultimate decision-makers or have no formal role in the process—are considered stakeholders. Stakeholders in the public and private sectors can be divided into several primary categories, including freight carriers, transport operators authorities, operators of public transportation (PT), shippers, transport operators, and residents, etc. Participants in a primary division include road and traffic authorities and Government, shippers, receivers, truck companies, drivers, terminal operators, governments, and forwarders. Inhabitants, tourists and end-consumers are also considered as stakeholders. According to Cherrett, (2012), the freight transport sector is often recognised, particularly in urban areas, as one of the major contributors to congestion and road accidents. Therefore, in order to comprehend the network of diverse stakeholders and how these interact, it is vital to comprehend each of the underlying individual stakeholder characteristics. Figure 3 depicts the detailed overview of the various stakeholders as perceived by Lindholm, (2012).

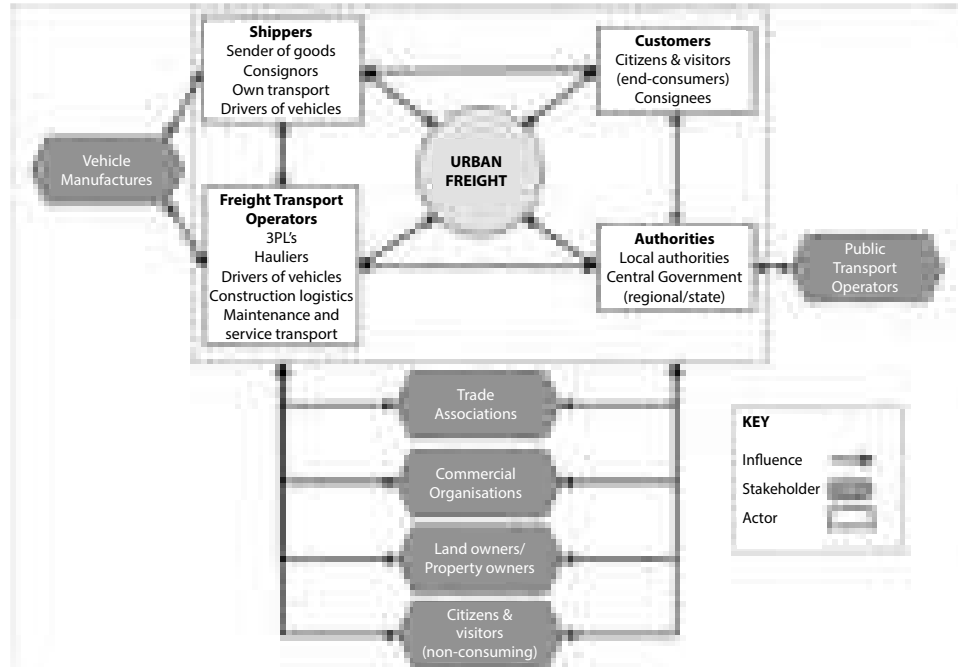


Figure 3: Urban Freight stakeholders and their relationships.

Source: Lindholm (2012).

Shippers

According to Lindholm (2012), shippers are interest groups that ship freight and order transportation service either with the help of a third-party logistics service provider or by performing the service in-house.

Wohlrab et al., (2012) identify shippers, including manufacturers, wholesalers, and retailers, as the most important stakeholders in urban freight transport.

Quak (2008), acknowledges shippers as the initial stakeholders in the process of urban freight transportation.

According to Flodén (2007), on time deliveries and prices are important in connection with urban freight transport.

Moreover, according to Lumsden (2007), shippers are also concerned with creating the utility of place and time and thus optimally meet the needs of the clients.

Transport service can never be done without shippers, as they emphasise the importance of optimising the use of resources to increase productivity, efficiency and consumer satisfaction, making it an important factor.

Customers

According to Lindholm, (2014), the consumers are the recipients of the products and owners of stores, restaurants, associations and offices.

Rosati and Comi, (2011), opine that this group also includes residents and visitors of the urban areas, called final consumers.

As per Flodén, (2007), the urban freight industry is, therefore, continuously seeking alternative ways to meet the changing demands of the customers.

According to Lumsden, (2007), customers also pressurise the shippers to deliver the right products at the right time and in the right quantity, therefore it is necessary to achieve a high efficiency of urban freight transport.

The urban freight transport system creates a lot of ties between transportation partners. Inadequate utilisation of urban freight vehicles can lead to an increase in street vehicles in urban areas, which can worsen traffic, reduce the urban attractiveness, and raise the danger of road accidents.

Freight Transport Operators

According to Lindholm, (2012) freight companies, mostly third-party logistics service providers or carriers, are responsible for delivering goods to consumers by providing freight services in urban areas. According to Lumsden (2007), these stakeholders also provide adequate route planning and resource efficiency.

These stakeholders emphasise the significance of both appropriate and safe loading locations in urban regions and accessibility to the final urban destination. Taniguchi et al., (2014) discussed the significance of considering the behaviours and characteristics of the shippers and freight operators. This makes it possible for urban planners to evaluate transportation strategies while simultaneously addressing environmental concerns and traffic congestion in metropolitan settings. Wohlrab et al., (2012) opined that the shippers and freight operators are concerned with the same goals of keeping down costs and satisfying customer demand.

Authorities

Freight transport understanding is often needed and viewed as the first step in the creation of freight partnerships between authorities and freight actors (Cherrett, 2012).

Cherrett, (2012) emphasises that a common characteristic for authorities is the need to simplify goods and deliveries and find incentives to do so in order to create efficient solutions for freight transport in urban environments.

According to Lindholm (2012), the other stakeholders are the local and national government authorities and their respective characteristics. This group consists of the national government, which is focused on minimising external externalities and maximising economic gains associated with urban freight transport, as well as the local

government, whose goals impact a desirable city for the inhabitants. Hence, the main goals due to this type of stakeholders are to maintain the attractiveness and support the quality of life for both urban residents and visitors.

Other Stakeholders

There are other fragmented stakeholders in addition to the ones listed above. This is why cutting-edge vehicle technology is crucial for providing effective urban freight transportation solutions. According to Cherrett et al., (2012), the public transport operators must also be considered as important stakeholders, since urban transport for passengers is often preferred over urban transport for goods, i.e. the goal of more efficient public transport is often more important in urban areas than creating optimal mobility for the freight transports.

According to Lindholm in (2012), landowners also eventually form certain types of interest groups, where demands are made as to where and when urban freight transports should be allowed and to what extent. For financial gains, landowners place a strong emphasis on maintaining the neighbourhood. Landowners are frequently interested in influencing urban freight transportation due to the needs and desires of tenants residing in certain metropolitan regions. Maritime shipping companies, port terminal operators, port authorities, real estate promoters, rail and rail terminal operators, the automobile industry, third-party logistics providers, freight forwarders, and air freight transport companies are the main players in urban freight distribution as shown in Figure 4.

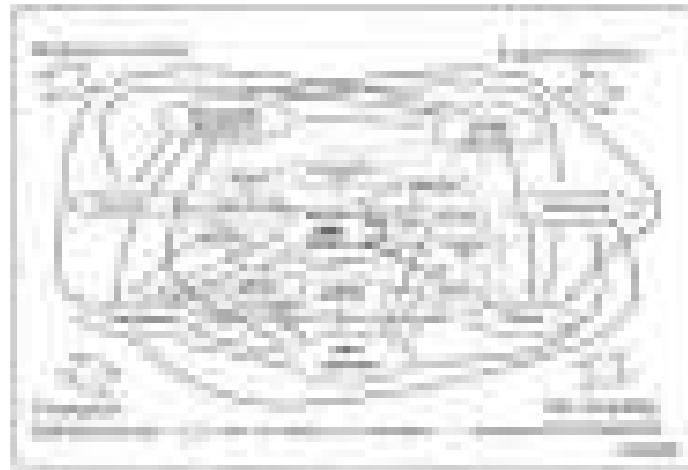


Figure 4: Main stakeholders, relations and effects in urban freight transport.

Source: Transman Consulting.

Methods of Engagement with Stakeholders

Methods and techniques for involving stakeholders in the creation of urban logistics policies differ, though they are all focused on understanding that greater inclusiveness

and extension of stakeholders will facilitate policy adoption and the effectiveness of the corresponding outcomes. Various methods for engagements with stakeholders are described in Table 1 below:

Table 1: Methods for Engagement with stakeholders

Methods	Scope	International Examples
Experimentation	The execution of a project in real time with the goal of tracking stakeholders' responses under typical, realistic circumstances.	The City of Stockholm piloted its off-peak project from 2014 to 2016, with a few specific objectives to be fulfilled. One of the unintended consequences was the emergence of remarks from non-user stakeholders (landlords and tenants) complaining about noise disruptions during their sleep as a result of the off-peak plan.
Stakeholders' Interviews	Interviews are a valuable outreach tool since they allow for in-depth conversations with influential people. Interviews, which last an hour on an average, provide insightful and practical information on a variety of topics.	Stakeholder engagement has been found to yield multiple benefits, including bridging the divide between public and private stakeholder partnerships and providing useful bases for policy hypothesis confirmation or rejection. This was discovered in a similar project conducted in New York City (Holguín-Veras et al., 2016).
Focus Groups	Focus groups use a pre-selection technique in which members from various stakeholder categories are chosen to take part in sessions where they converse about certain policy issues.	UK-A driver's perspective on their company's work schedule policies in the presence of managing director during the group discussion (Lagorio et al., 2016; Ballantyne et al., 2013).
Participatory Workshops	Mechanisms for decision-making and participatory involvement that are based on a workshop have been suggested.	Lindholm and Ballantyne (2016) give an example of comparable processes: the authors of this study maximise stakeholder participation in the urban logistics systems planning phase by using the Delphi technique. In this case, the Delphi panel included twenty experts from local government, academic, and relevant goods stakeholders. The research makes recommendations for a revised theoretical framework that enables local authorities to fully account for goods when planning transport projects.

Methods	Scope	International Examples
Surveys	With a wider range of respondents, this approach concentrates on the numerical outcome estimates of how different stakeholders view policy initiatives.	London and Paris

Source: Based on author's study.

Types of Stakeholders Engagement & Global Best Practices

Stakeholders' engagement is to understand the needs of logistics system users and create public-private partnerships to enhance system performance. Effective communication between government and industry stakeholders is essential to comprehend the overall effectiveness of the logistics system and, more importantly, to determine how to improve it. Urban logistics systems require many forms of stakeholders' interaction at multiple geographic levels due to their number of public and commercial actors as well as their physical connection to bigger national transportation networks. Stakeholders' participation can take several forms, some of which are briefly discussed below: Freight Quality Partnerships (FQP), Public-Private Partnerships (PPPs) for certain measures, peer-to-peer exchange, local freight networks, BIDs, and freight charters, etc.

Freight Quality Partnerships: Logistics stakeholders can communicate with municipal authorities on matters affecting the efficiency of logistics in the urban core through freight quality partnerships. Commercial actors make up the majority of freight quality partnerships, and they are the ones who suffer the most from last mile inefficiencies.

Public-Private Partnerships (PPPs): Collaborations between a private company and a public entity are known as Public-Private Partnerships, and they can be used to fund, build, and run projects like parks, convention centres, and public transportation networks. A project can be financed through a PPP, enabling it to start or be completed sooner.

Peer-to-peer Exchange: The sharing or exchange of assets, information, or data between parties without the need for a centralised authority. Peer-to-peer, or P2P, networks approach interactions between users and groups decentralised. This method has been used for currency trading, computers, and networking (peer-to-peer file sharing).

Metropolitan Planning Organisations: Effective logistics requires a coordinated policy response from various levels of government to concerns related to urban and metropolitan freight since these systems are interwoven with national transportation networks. An essential component of developing an urban logistics policy is inter-governmental coordination.

Freight Advisory Committees: In order to maximise the efficiency of urban freight, it is also essential to coordinate the development of urban logistics with wider networks, as most urban freight movements start outside the urban core and frequently in nearby jurisdictions. Public-private partnerships with local, state, and federal stakeholders must be established in order to accomplish it. Freight Advisory Committees (FACs) must solicit input from a variety of stakeholders while developing infrastructure policies and plans.

The literature review provides valuable insights into the significance of stakeholder engagement in urban freight logistics and the diverse methods employed to facilitate effective participation. It highlights the complexity of urban logistics ecosystems, which encompass various stakeholders with differing interests and priorities. Understanding the needs and perspectives of stakeholders is crucial for developing sustainable urban logistics solutions that address economic, social, and environmental concerns. The review underscores the importance of collaborative approaches such as freight quality partnerships, PPPs, peer-to-peer exchanges, and metropolitan planning organisations in optimising urban freight systems. By integrating stakeholder input and leveraging global best practices, policymakers and industry stakeholders can navigate the challenges of urban freight logistics more effectively, leading to improved efficiency, reduced environmental impact, and enhanced urban livability.

Global Best Practices of Stakeholders' Participation in Urban Freight

The purpose of this section is to review benefits of city initiatives and to highlight involved stakeholders, e.g., city, government, shippers, consignees, carriers, citizens, etc.

Freight Quality Partnerships

Freight partnership, planning and routing (Ploiesti, Romania)

In order to discover other routes for the transportation of products and to limit the entry of heavy goods vehicles into the city core, Ploiesti developed a strategic logistics strategy. The objective of Ploiesti was to promote collaboration among relevant parties for the purpose of streamlining delivery and transportation networks. In order to carry out the measure, the following tasks had to be completed: creating a citywide strategic logistics plan; designing facilities for the distribution of goods; determining freight routes; and creating a freight forum, which is a very useful tool for bringing stakeholders together to discuss problems and find solutions. The objective was to promote cooperation among operators, improve signing, encourage best practice. And finally, there were designated and marked freight routes. Heavy traffic was consequently diverted to the sizable commercial district on the outskirts of the city, and entrance for large goods vehicles to the city centre was totally prohibited. As a result, there was less traffic, pollution, and noise inside the city.

Central London Freight Quality Partnership-London

The Central London Freight Quality cooperation is an illustration of a strong freight quality cooperation. Policymakers, logistics firms, trade associations representing different kinds of merchants, academic departments with an emphasis on urban transportation, and others make up this group. Through this relationship, the sector has provided input on several policy initiatives related to logistics performance, including low-emission zones, congestion charges, modifications to traffic management regulations, and time limits on logistical tasks like loading and unloading. Various topics were addressed in by FQPs in the UK such as lorry routing, signing, loading and unloading restrictions and fines, good practice in freight operations, strategic planning, water freight issues, urban consolidation centres, environment-friendly vehicles, vehicle utilisation, Rail freight work, enforcement issues, home deliveries, Telematics, overnight parking, loading and unloading provisions, traffic information, out-of-hours deliveries, low-emissions zones/emissions regulations, lorry lanes, Vehicle access (times or weights/sizes), and road pricing.

Freight Advisory Committees

Freight Transport Working Group (FTWG) — New York

As mentioned earlier, the FAC connected to The New York Metropolitan Transport Council (NYMTC) is the Freight Transport Working Group (FTWG). It is made up of political authorities, civil society organisations, MPOs in nearby cities, shippers, receivers, and carriers, as well as other regional logistics partners. The aforementioned group works in conjunction with NYMTC to formulate its regional freight strategy, elevate the significance of freight development in the policy-making process, and provide the MPO with information and understanding to proficiently oversee and enhance the network.

Developing a strategic freight holders club (Norwich, UK)

The purpose of this measure was to create a group of stakeholders in freight so that they could collaborate to create a strategic effort in freight for the urban region of Norwich. In order to determine delivery and collection needs and pinpoint areas where these could be consolidated and made more efficient, resulting in fewer trips, lower vehicle emissions, and less fuel consumption, it made an effort to involve important private sector haulage, logistics, and freight distributors as well as the local authorities. The below mentioned tasks were performed:

Task 1: Undertook initial enquiries with freight operators serving Norwich to identify their willingness to join stakeholders' group.

Task 2: Established strategic freight stakeholders' group.

Task 3: Attempted to work with strategic freight stakeholders' group to identify areas where the results of the integration of resources could be demonstrated.

Operators showed very little interest in creating a stakeholder group. Alternatively, interested operators could be invited to participate in strategies and consultation work as needed.

Local Freight Network

The complete set of demonstration actions in the SMART cities was planned with inputs from the local freight networks. Here is a brief description of Local freight network Göteborg.

Göteborg: In 2006, the Swedish Road Haulage Association and the Traffic and Public Transport Authority established a Local freight network in order to gain feedback and cooperation from the transportation industry. Göteborg has made an attempt to include players from various links in the transportation network. Four times a year, the network organises half-day meetings. The agenda and hosts of the meeting are determined in collaboration with the Haulage Association and the Traffic and Public Transport Authority.

These initiatives showcase the importance of stakeholders' collaboration in optimizing urban freight logistics. Key learnings include the need for comprehensive strategic planning, effective communication among stakeholders, and flexibility in addressing diverse interests and challenges. Emphasising such best practices can guide policymakers and industry stakeholders in developing effective urban logistics strategies globally.

Key Learnings, Gaps and Way Forward

A critical literature review of stakeholders' engagement in urban freight sector provided the following key learnings, gaps and way forward:

Key Learnings

- Involving stakeholders is essential for the accomplishment of urban logistics projects.
- Local authorities need expertise or expert solutions that leverage decision support systems in order to acquire optimal stakeholders' choice, overlap in the mapping, consultation, and decision-making process for urban freight solutions.
- Stakeholders' engagement techniques currently utilised by local authorities in India are not sufficient and require further development.
- More participatory approaches are required, involving local authorities in the creation of institutional frameworks that facilitate the practical implementation of models and techniques by a variety of local authorities.

- India must establish a specific consultation mechanism; that is, freight-related concerns must be addressed to the appropriate parties and cannot simply be included in regular “neighborhood consultations.”

Gaps

- There is lack of clarity/understanding of the participation process in Indian cities.
- Method of conducting stakeholders’ engagement approach in urban freight projects is not clear in Indian Cities.
- There is no proper communication strategy in India for urban logistics.
- There is no permanent contact with stakeholders as in UK or Paris but only a temporary meeting /interviews etc. just for the purpose of publication.
- The ideas/suggestions/views of various stakeholders after engaging them are just bypassed by contractors/authorities, etc. for saving money.
- It is usually seen in India, that many consultants do not want to waste time to engage public or other stakeholders, contrary to the case in London, as discussed earlier.
- No clarity for implementing the public participatory results in plan making. Some authorities do engage various stakeholders but they do not know that how to use the results of stakeholders’ engagement in plan making.
- As stakeholders’ engagement is considered as temporary project in India so there is no focus on impact assessment after engaging various stakeholders to assess social impact assessment or environmental impact assessment, etc.

Way Forward

- Stakeholders’ engagement systems are often complex processes. Therefore, it is recommended, that stakeholders’ engagement must be under the jurisdiction of a municipality, etc.
- In order to optimise planning very early, i.e. in the conceptualisation and design phases of various city logistics projects, more collaboration is required between different stakeholders.
- More comprehensive decision support systems at local authority level will help stakeholder analysis, communication and rational decision-making.
- Freight Quality Partnerships, Freight Advisory Committee, Local freight Network, Freight Club, etc. can play a strong role in encouraging uptake of freight and logistics initiatives.
- Since urban freight transit is a part of a bigger supply chain and is therefore, not only sufficient at the local level, freight consultations need to be conducted on a metropolitan or even regional level. To guarantee performance, municipal decisions must be paired with regional consultations.

- A specific consultation procedure must be put in place. The consultation body/entity must have sufficient legal and political influence to implement the decisions taken at the time of consultations.

Conclusion

This paper explores the theoretical ecosystem structure in the field of biology for the study of city logistics solutions and deciphered it in terms of city logistics. Different approaches and methods of stakeholders' participation has been discussed in this paper. As it can be seen that there is no proper strategy in India to engage various stakeholders. Various international best practices reveal the fact that investigating the various perceptions and preferences of all those involved in the process of distribution of urban goods is vital to mitigate externalities and city logistics related issues. Many efforts are needed to achieve the lessons learned by various global best practices to encourage transferability of data and to engage various stakeholders in India. There is a need to evolve a standardised approach for carrying out stakeholder participation in Indian cities and to implement a dedicated consultation process in urban logistics.

References

- Cardenas, I., Borbon-Galvez, Y., Verlinden, T., Van de Voorde, E., Vanelslander, T., & Dewulf, W. (2017). City logistics, urban goods distribution and last mile delivery and collection. *Competition and Regulation in Network Industries*, 18(1–2), 22–43. doi:10.1177/1783591717736505
- Cherrett, T., Allen, J., McLeod, F., Maynard, S., Hickford, A., & Browne, M. (2012). Understanding urban freight activity – key issues for freight planning. *Journal of Transport Geography*, 24, 22–32. doi:10.1016/j.jtrangeo.2012.05.008
- Comi, A., & Rosati, L. (2015). CLASS: A DSS for the analysis and the simulation of urban freight systems. *Transportation Research Procedia*, 5, 132–144. doi:10.1016/j.trpro.2015.01.007
- Crainic, T. G., Ricciardi, N., & Storch, G. (2004). Advanced freight transportation systems for congested urban areas. *Transportation Research. Part C, Emerging Technologies*, 12(2), 119–137. doi:10.1016/j.trc.2004.07.002
- De Groot, & Stuij, M.A.M. & Finlayson, Max & Davidson, Nick. (2006). Valuing Wetlands: Guidance for Valuing the Benefits Derived from Wetland Ecosystem Services.
- Floden, J. (2007). *Modelling Intermodal Freight Transport. The Potential of Combined Transport in Sweden*. Department of Business Administration Foretagsekonomiska Institutionen.
- Hensher, David A., & Puckett, S. M. (2005). Refocusing the modelling of freight distribution: Development of an economic-based framework to evaluate supply chain behaviour in response to congestion charging. *Transportation*, 32(6), 573–602. doi:10.1007/s11116-004-7615-6
- Holguín-Veras, J., Sánchez-Díaz, I., & Browne, M. (2016). Sustainable urban freight systems and freight demand management. *Transportation Research Procedia*, 12, 40–52. doi:10.1016/j.trpro.2016.02.024

- Lagorio, A., Pinto, R., & Golini, R. (2016). Research in urban logistics: a systematic literature review. *International Journal of Physical Distribution & Logistics Management*, 46(10), 908–931. doi:10.1108/ijpdlm-01-2016-0008
- Lindawati, A. (2014). A Study of Collective Entrepreneurship model as an Alternative in Empowering Micro, Small and Medium Enterprise (MSME) Cooperatives. *Journal of Economics, Business, and Accountancy – Ventura*, 17, 171–186. doi:10.14414/jebav.14.1702002
- Lucassen, I., Klievink, B., & Tavasszy, L. A. (2014). A Living Lab Framework: facilitating the adoption of innovations in international information infrastructures. Paris: TRA.
- Lumsden, K. (2007). *Fundamentals of Logistics, Compendium, Department of transportation and logistics*.
- MDS Trans modal Limited in association with CTL. (2012). *MDS Trans Modal Limited in Association with CTL*.
- Morana, J., Gonzalez-Feliu, J., & Semet, F. (2014). Urban consolidation and logistics pooling. In *Sustainable Urban Logistics: Concepts, Methods and Information Systems* (pp. 187–210). doi:10.1007/978-3-642-31788-0_10
- Quak, H. J. (2008). *Sustainability of Urban Freight Transport Retail Distribution and Local Regulations in Cities*. Diss., Erasmus University Rotterdam.
- Teo, J. S. E., Taniguchi, E., & Qureshi, A. G. (2014). Multi-agent systems modelling approach to evaluate urban motorways for city logistics. *International Journal of Urban Sciences*, 18(2), 154–165. doi:10.1080/12265934.2014.929020
- Wohlrab, J., Harrington, T. S., & Srail, J. S. (2012). Last Mile Logistics Evaluation - Customer, Industrial and Institutional Perspectives. In *POMS 23rd Annual Conference*. Chicago, Illinois, U.S.A.