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Sustainable Mobility Services in Kolkata

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In the context of increasing globalisation, many Indian cities are expanding, both in terms of economic activity and size. The growing scope and volume of economic activities is increasing the urban populations. This, in turn, is putting pressure on public mobility services.

Due to lack of proper planning and investment in the public mobility sector and the monopolistic policy of government, the existing public mobility systems of many cities are becoming inefficient and are failing to fulfil the needs of various kinds of passengers. The deprivation of urban mobility facilities or services can restrict passengers from carrying out their daily life activities according to their preferences.

Furthermore, flawed government policies may be increasing the gap of inequality in the city. Unfortunately, our social imaginary, a "constructed landscape of collective aspirations,"[1] is dominated by 'the crisis of uncertainty of availability of public facilities or services'. As a result, information-rich and time-poor(!) passengers with increasing buying capability try to cope with the situation by personalized mobility solutions of their own

(i.e., buying a car).[2] To pursue eco-efficient production of personal vehicles answers just half of the sustainability challenge. It must be accompanied by concepts and approaches dealing with fundamental changes in consumption patterns before sustainability can be achieved. It is becoming a challenge, day by day, to influence this social imaginary towards sustainable values, to break out of the expressive space of the individual, and to initiate social action among the ordinary lives of ordinary people in the practice of their everyday lives.[3] As Michael Braungart put it, "If you make the wrong system efficient, it's even more deadly".

Existing examples of sustainable mobility services can help us understand the socio-economic and environmental issues of sustainable production and consumption in emerging contexts. In order to move towards sustainability, production and consumption systems should give more attention to values, elementary human needs, product and service functions, and local conditions in developing countries. There are many such examples of sustainable production and consumption scenarios of mobility activities available in Indian cities. Kolkata is not exceptional in this regard.

Context of Urban Culture in Kolkata

Kolkata (formerly Calcutta) is one of the most populated mega-cities (population 13,216,546, Census 2001) with population density of 24,760/km^2. It is situated on the bank of river Hooghly in the eastern part of India and is the capital of the state of West Bengal. Always referred to as the 'Cultural Capital of India' it is a vibrant city with a distinct socio-political background. Kolkata is noted for its revolutionary history and commercially, industrially and intellectually is considered the most important. Kolkata's literacy rate of 80.86% exceeds the all-India average of 59.8% (Census 2001). Kolkata witnessed economic stagnation in the years following India's independence in 1947. Since the year 2000 however, economic rejuvenation has arrested the decline, leading to a spurt in the city's growth.

The city has a grid pattern combining four major roads, one local EMU (electric multiple unit) train line and one underground Metro rail line running from north to south connecting the city with other adjacent districts. Smaller roads running from west to east connect these major roads and rail lines. One can see the densely populated urban settlement of residential and other activities throughout the city. Mostly, a mixed and neighbourhood pattern of settlement can be observed throughout Kolkata. Generally, large public transport vehicles do not enter these congested areas, with small public transport vehicles being used to run mobility services within the limit of these congested areas. So, the transportation activity of the passengers of Kolkata is more or less rectangular and networked.

The rising demand for housing is being forced to opt for vertical increase, because every body wants to stay near the core facilities of the city for various kinds of daily life purposes. In this way, the density of population increases in the residential areas. The mixed use of land and a neighbourhood pattern of all ages and mix of economic-classes create a secure urban community throughout the local areas. Most of the people in Kolkata are not rich. Most belong to the middle class and have a lesser tendency to do shopping in big air-conditioned urban district shopping malls. So local businesses get enough opportunities to trade in local neighbourhoods and mixed use markets rather than in the centralised business centres, where the trade activities are mainly controlled by business giants.

Local government policies also try to safeguard these local trade activities in many ways – so a market is not only a market of trade, but a centre of interaction, attracting local people and filling the roads with local activities. The local movement of local people for their daily life activities (e.g. going to the vegetable market, post office and bank, going to school, meeting friends or neighbours, etc.) mostly by walking or bicycling within a certain reach of these local pockets, makes the locality very lively. The continuous interaction among known people, moving about for their daily activities creates a continuous watch and exchange of information about the locality. Furthermore, all of these activities become a part of the local culture.

Most of the spaces of activities (e.g. residential, administrative, commercial, educational, entertainment, etc.) occur across Kolkata. These spaces were not always planned but developed according to growing requirements. Mostly, residential spaces are spread throughout Kolkata, except some specific pockets of administrative areas, so most places are very lively, even in the late evening. In fact, the increasing outdoor activities of the people make the city more secure. It is even safe for women to stay out and move about the city till night without being accompanied. When a woman walks along the road after alighting from a public bus, on the way to home in the late evening, the activity of the market or local shopping place, etc, can create a sense of safety and security in her mind. And this is not a new phenomenon in Kolkata.

Problems of Mobility Sector in Kolkata

The dense patterns of settlement of Kolkata largely developed as unplanned, with no future vision, in the British colonial period in the pre-auto era, resulting in proportions of urban road space relatively low compared to those of planned cities. The recent economic development in the state of West Bengal has increased the buying power of a particular market segment in Kolkata, resulting in growing numbers of personal motorized vehicles. Between

12–13 percent of the total population can now travel by their own motorized vehicles in this city.[4]

The road space of Kolkata is 6.4% compared to planned city like Paris (25%) or Tokyo (24%). Consequently, Kolkata registers comparatively higher emission levels for a given vehicular mile travelled (VMT), given the link between congestion and pollution.

Within hours of the Indian government's budget announcement of 2006–07, which cut the duty on small cars from 24% to 16%, small car makers came out with price cuts to attract more customers. This duty cut is not really as citizen-friendly as it seems. People may think that having a car will mean that they can enjoy the 'good life' now, but more cars will only add to their problems. The government will have to spend more on providing the infrastructure for these cars – e.g., in the form of roads, flyovers or parking lots. This will stifle the limited resources and investment for more pressing needs such as water supply, sanitation, healthcare and education, even the public mobility service sector itself.

Predictably, such auto friendly policies induce further traffic growth, congestion, and pollution.[5] The widespread auto friendly bias lowers the level of resources available and thus works against the development of strong urban public transit systems, which are crucial to the mobility of the majority of low and moderate-income residents of the city. In some cases, public transportation systems may be weakened further by policies such as instituting low fares, which prevent the recovery of operating and capital costs of the transit service. This, in turn, leads to a vicious circle of deteriorating vehicles, worsening service, dropping transit usage and further downward spiralling service. Given the per capita income levels and the costs of owning and using cars and motorcycles, clearly personal vehicles are within reach of only a minority of residents of Kolkata. So the question is: how are the other 87% to 88% of the total population surviving in Kolkata? That is the challenge – sustainable developmental policy to serve the majority of the population who move about the city without personal motorized vehicles.

Sustainability and Systems

Sustainability is a system level concept, and the city can be considered as a socio-technical system. Creating a sustainable scenario for one part of the city is not sufficient, as all parts are very much connected in a networked system. System innovation requires changes to overcome the traditional inertia of all stakeholders in accepting, adopting and using new products and services. It is true that it is much easier to change a product than a system; therefore, we often see inefficient products just because our present system does not have the necessary infrastructure or awareness to accept a better one. Instead of improving the system, products are produced that suit the current, very inefficient system.

The opposite is true as well; present day society creates an entire system around one product. For example, the car has become the dominant mode of transport, and an entire societal infrastructure has been created to suit only this product.[6]

Systems thinking promotes gaining insights into the whole by understanding the linkages and interactions between the elements that comprise the whole 'system'. Systems thinking also recognizes that all human activity systems are open systems and are systemic in nature; therefore, they are affected by the environment in which they exist.[7] The key to more 'sustainable mobility', for instance, lies in town planning and systems optimization, not in vehicle technology.

The mobility activity and service system (i.e. Product-Service Systems, PSS) can be thought of as a man-mind-resource activity and treated as an integrated part of the whole system of the city. It owes its character to the wishes of the individuals and the designs of stakeholders. In every society there are mechanisms which shift and sort out the production and consumption processes which are possible in a given geography or culture. This selection activity is a continuous process having properties, which are recognizable to any stakeholder that would seek to change its passengers' consumption patterns. It imposes a certain kind of constraint or necessity upon passengers to the extent that there is sufficient rationale for them to conform their behaviour to the practices, which comprise the mobility activity and service system (PSS). All this happens in such a subtle psychological frame that people are quite unaware of the process of interaction.

The idea that human beings have to be motivated in order to make their behaviour comply with a sustainable mobility service system of optimum resource consumption depends upon many sociological and psychological factors. The major supposition is that such mobility service systems can be remade after the image of an ideal and the passengers have to be considered as system users. The passengers as agents conditioned by customs and traditions, function on the basis of psychological resistances. The role of culture is so pervasive in defining a passenger's perception and manipulation of mobility oriented activity that different social groups though occupying the same networked system may have made use of different sets of mobility activity and service system (PSS). The mobility activity sets are not what they are; they are what cultures make them to be according to the functional theory of resources as expressed by Erich Zimmermann.[8]

The assumption is that there is a limited supply of resources for mobility purposes in a city in which productive factors are available. That means the resources are fixed in amount, and it is a closed system of resources. Now because of the limited supply, passengers are confronted with a necessity for choice and therefore with the problem of economizing their use of

productive factors. In order to maximise their want satisfaction according to Pareto optimum, the productive factors have to be combined in certain proportions rather than others, so that certain scales of output are adopted.[9] Let us assume that the target is to minimise the consumption of personal motorised vehicles and to maximise the functional economy[10] through allotment of mobility services for all the passengers of Kolkata, and to reduce the production of resources and the generation of environmental pollution per capita within a limited amount of resources. Two propositions may be advanced: first, that a system can be manipulated to answer the purposes of an ideal; and second, that the system used must be gainful in order to be viable. So, understanding the passengers' consumption activities from environmental, social and economic points of view in an open system will help to create more efficient policy for resource planning and utilisation. If resource plans and policies are to succeed, they must have some theoretical rationale. It has been pointed out that resource policies must conform to the social order. At this point the problem becomes empirical.

Mapping Experience of Mobility Activities in Kolkata

All passenger-related urban mobility activities in the city of Kolkata can be characterised according to the type of service (*enabling-relieving*) and organizational model (*centralised-networked*).

One should be clear about the types of stakeholder participation in this economic activity of urban mobility in Kolkata. Local government also takes part in providing infrastructure for mobility activity, such as construction of a road network according to the city development schemes and road lighting at night.

Mainly these services are divided into enabling-centralised services, relieving-centralised services, relieving-networked services and enabling-networked services.

Models of Service

Enabling Service: enables the passenger to perform their own mobility activity by her own personal or hired resources.

Relieving Service: the service provider provides mobility services via its own setup so that the passenger does not have to carry out their own mobility activity.

Types of Organisation

Centralised Organization: provides mobility services to passengers by its own setup without help or collaboration from any other organizations. The services will be centralised under one management, creating more hierarchical relationships.

Networked Organization: a collaboration of more than one organization to provide networked mobility services to passengers.

Those organizations may remain independent and equal in relationship.

These mobility activities or services can be described according to intensity of resource consumption and production of polluting gases per capita. For example, when one vehicle is used by more passengers, obviously the intensity of resource consumption and volume of polluting gases per capita will be less in comparison to the use of a vehicle by one person. And if the vehicle is used by many passengers again and again, then obviously the intensity of resource consumption per capita will be further reduced. Following are the detailed explanations of characteristics of various types of mobility activity and their consumption and production patterns.

Enabling-Centralised Services

Here, passengers use their own personal vehicles like car, motorcycle, scooter, bicycle, etc, or their own effort, by walking, to reach their destination. Walking and bicycling are very flexible, and have low resource and energy consumption per capita, while the use of personal car, motorcycle or scooter are higher in resource and energy consumption per capita.

Relieving-Centralised Services

Here, various kind of service providers offer mobility services to passengers via their own setup such as public bus, metro rail, tram, ferry steamer, electric train, auto rickshaw, tricycle rickshaw, etc. There are no fixed passengers, but because these mobility services have fixed routes, they get used regularly by passengers. This is very profitable, as the density of demand for these kind of services are very high in this city.

Another kind of centralised service is offered on contract basis for daily permanent passengers, from the beginning to the end of their journey by one fixed mobility service provider. Generally advanced payment is made to the service providers, and it is renewable every month. Examples include: chartered bus for office workers; school bus or tricycle rickshaw for school children.

Mostly, larger numbers of passengers are accommodated, thus more profit is generated according to the rule of economy of scale. The per capita consumption of resources and energy is less in these cases.

On the other hand, a taxi service from any point to any other point, shows medium resource and energy consumption per capita. The cost is also high according to economy of scale, as it is generally used by an individual passenger, a family or a small group on each journey. The taxi relieves the passenger from having to drive a vehicle themselves. Another advantage, compared to other public mobility services (e.g. public bus) is that taxis are available late at night, but the cost is higher.

Relieving-Networked Services:
There are fewer of these: some service providers form a network to provide passengers with the combination of bus, ferry steamer and bus, etc. Passengers, who come from outside of Kolkata for their daily jobs, often use these kinds of facilities. These networked facilities indicate low resource and fuel energy per capita.

Enabling-Networked Services:
These kinds of mobility services are slowly mushrooming in Kolkata because of growing complex needs and demands according to economic growth. Various corporate firms hire cars from transport agencies and provide services to their office executives. Even sometimes families like to hire cars from small transport agencies and drive them themselves for various purposes or particular occasions. Overall, these kinds of services exhibit a mixed profile of consumption of resources and energy per capita depending upon the context of use.

Regular passengers represent the mass of public transport users in Kolkata. They can be divided into two segments: (i) passengers who use chartered vehicles services and (ii) passengers who use a combination of mobility activities or services for their daily routine.

i) Those office workers and school children, who use chartered vehicle services, have their fixed schedules every day. In the morning they are picked up from some pre-fixed points and dropped at those pre-fixed points at the end of the journey, which is very profitable according to economy scale also. These are secured services for regular passengers with an assurance of seating facility.

ii) The second kind of services are used by most regular passengers. From large size public bus, mini bus, midi bus, local electric train, metro rail, tram, auto rickshaw, tricycle rickshaw, there are variety of services used by these passengers according to the nature of demands and situations (Figure 1).

If one follows the urban pattern of Kolkata and available mobility services, one can observe that not every passenger is lucky enough to live close to a large or medium sized road. Most residential plots are some distance from a large or medium sized road. Smaller roads connect these residential plots to the nearby main road. Passengers generally like to walk or use manual tricycle rickshaw services to reach the nearby medium sized road. These manual tricycle rickshaws can carry one or two passengers at a time. So it is purely a micro level service provided at personal level.

Figure 1
Mobility activities and services for passengers of Kolkata.

After reaching the nearby medium sized road they can use the existing shared auto rickshaw service (4 to 5 passengers at a time). These auto rickshaws run shuttle services between major popular junctions. They work as feeder services to the larger scale mobility services, which run on the major roads.

When passengers arrive close to their destinations, they alight and again use more micro or personal level services/activity such as auto rickshaw, tricycle rickshaw or walking to reach their final destinations in every pocket of the urban area.

This is a chain of services that passengers use according to their requirements. They have reasons to value it. The combination of services may vary from passenger to passenger according to their situations within the city; and individually, a passenger may not use the same combination everyday.

Passenger's Freedom and the Process of Sustainable Mobility Consumption

It has been argued that the unsustainable product-focused industrial economy is not able to properly address the problems of social inequality and human development. On the other hand, Product-Service Systems (PSS) as the basis of an economy, may be more effective, e.g., by providing enough freedom and choice for passengers to fulfil different mobility functions for their daily life purposes within the city without needing to buy a personal motorised vehicle. Sen's arguments about equality and opportunity are relevant here. He has argued that differently situated people require different amounts of primary goods to satisfy the same needs, so that 'judging advantage in terms of primary goods leads to a partially blind morality'.[11] One cannot construct an adequate theory of equality on the combined grounds of Rawlsian equality[12] and equality under the two welfarist conceptions – utilitarian equality and total utility equality.[13] While equality of opportunity for welfare survives Rawls's criticisms of equality of welfare, Sen advanced something like opportunity, but it was not welfare. Sen proposed two large changes of view: from actual state to opportunity, and from goods (and welfare) to what he sometimes called 'functionings'.

According to Sen, 'what people get out of goods depends on a variety of factors, and judging personal advantage just by the size of personal ownership of goods and services can be very misleading… It seems reasonable to move away from a focus on goods as such to what goods do to human beings'.[14]

Goods (a bus) → characteristics (transport) → functioning (moving) → utility (pleasure)

Functionings represent parts of the state of a person – in particular the various things that he or she manages to do or be in leading a life. The capability of a person reflects the alternative combinations of functionings the person can achieve, and from which he or she can choose one collection.

Commodities (a bus) → Functionings (mobility) → Capabilities (to use mobility service) → Utility (pleasure)

The weight of different functionings may vary from person to person though they all may be valuable and the assessment of individual and social advantages must be alive to these variations. Some functionings are very elementary and strongly valued by all, whereas some are complex and less widely valued. Mobility activity can be a necessary function in urban daily life.

Capabilities are defined derivatively from functionings. In the space of functionings any point, representing an n-tuple of functionings, reflects a combination of the person's doings

and beings, relevant to the exercise. The capability is a set of such functioning n-tuples, representing the various alternative combinations of beings and doings any one (combination) of which the person can choose.[15]

That means the effect of 'other regarding' concerns on one's well-being has to operate through some feature of the person's own being.

The view of freedom that is being taken here involves both the processes that allow freedom of actions and decisions, and the actual opportunities that people have, given their personal and social circumstances. Both 'process' and 'opportunity', the two aspects of freedom, are very important in these regards. Because the domain of interest cannot be confined only to the outcomes in the form of the promotion of high output or income, or the generation of high consumption, but also a process of participation in political decisions and social choice as the means to development.[16]

Being free to live the way one would like may be enormously helped by the choice of others, and it would be a mistake to think of achievements only in terms of active choice by oneself. A person's ability to achieve various valuable functionings may be greatly enhanced by public action and policy,[17] and these expansions of capability are not unimportant for freedom for that reason. Thus, both the process aspect and the opportunity aspect of freedom require us to go well beyond the traditional view of development in terms of "the growth of output per head".

The above discussion can be expressed as the strategic part of the sustainable mobility activities of a passenger; but the physical process of consumption is also equally important to understand in the context of complex urban networked mobility activity systems. A human being as a dynamic entity does not adapt to the environment directly as it is, but progressively moves into and restructures the environment in which she resides for her daily life activities.[18]

The effect of activity between passenger and context is not additive but interactive. The passenger is both the product and partial producer in the process of her own mobility activities. Both the environment and passenger require a process of mutual accommodation because of the two-directional character of permissive and restrictive interaction between them.[19] And the environment defined as relevant to development processes is not limited to a single, immediate setting but is extended to incorporate interconnections between such settings, as well as to external influences emanating from the larger surroundings.[20]

Space is not physical but psychological – consisting of the environment not as it exists in the so-called objective world (where, for us, practical matters are usually thought to reside) but in the mind of the person, in her phenomenological field.

Freedom in Sustainable Mobility Activities of a Passenger

In the following example of a journey of a young woman who is coming home from outside the city to enjoy her winter vacation, the phenomenological behaviour of the passenger demonstrates the freedom afforded by the combination of mobility services available in Kolkata.

After reaching Howrah rail station at 10 pm, which is one of the busiest rail stations adjacent to Kolkata, the young woman decided to travel by public bus instead of hiring a taxi, because the bus costs less than a taxi. If she had taken a taxi she would be travelling alone. Travelling by public bus would be much safer as there would be more passengers in comparison to a taxi . She was not in a hurry, and the journey would be convenient for her. She got into the particular public bus, which would drop her at a far distance from her house, this, because there was no service available from Howrah rail station which could drop her close to her house. The bus was congested as many passengers were going home after their evening shift (i.e. 2 pm to 10 pm). But she was lucky; she got a chance to sit, as there were some seats reserved already occupied by women. That means women were habituated to travel by that public bus, because they were assured by the confirmed quality service of the service provider. Ultimately she alighted from the public bus at an auto rickshaw stand not far from her house. There, she took a shared auto rickshaw to reach her home. (Figure 2).

There was only a difference of few minutes between the journey by public bus and hired taxi. But there was a huge difference in cost of those journeys. Also hiring a taxi at night she considered to be a little bit risky for her. But she enjoyed a lively assured service by public bus and shared auto-rickshaw. Thus she chose a combination of mobility services, which achieved the highest level of secured journey for her.

The kind of freedom enjoyed in the city of Kolkata that this example demonstrates is only possible through culture and a seriousness about sustainable mobility activities. This culture is not only developed by the socio-technical setup, but through the age-old culture of the city itself, characterised by the trust and support that people create through their daily life practices.

Kolkata is a city with a very low crime rate, a high level of mutual repect among people and thus a high degree of public security. In recent lectures, Sen has described it as follows.[21]

> My humble Kolkata, notorious for its grinding poverty, has the lowest incidence of most kinds of violent crimes among all the sizable cities in the world for which I could get data, and particularly the lowest rate of murder and homicide. I had not seen this fact discussed anywhere,... It also

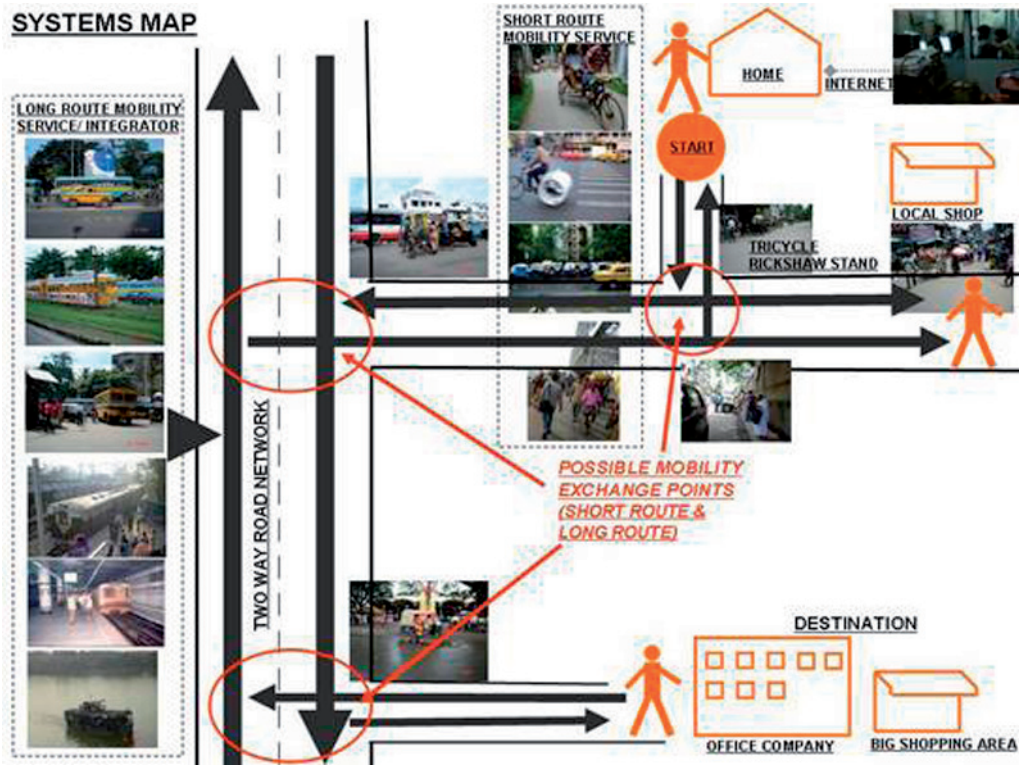

Figure 2
Phenomenological system map of mobility activities of passengers in Kolkata.

> emerged that while Kolkata was by a long margin the city with the lowest homicide rate in India, the Indian cities in general, almost without exception, are strikingly low in the incidence of violent crime by world standards …
>
> The average incidence of homicide in the principal Indian cities (including all the 35 cities that are counted in that category) is 2.7 per 1000,000 people. The figure for Delhi is 2.9, for Chennai 1.9, and for Mumbai 1.3. The corresponding rate for homicide is as low as 0.3 in Kolkata. If one compares this with other principal cities in the world, one can find, Paris has a homicide rate of 2.3, London 2.4, Dhaka 3.6, New York 5.0, Buenos Aires 6.4, Los Angeles 8.8, Mexico City 17.0, Johannesburg 21.5, Sao Paulo 24.0, and Rio de Janeiro an astonishing 34.9.

Kolkata has the maximum variety of mobility services in India, which are also available well into the night. This gives passengers enough freedom to choose according to their budget and convenience. Sen has speculated on "…the influence of different parameters in keeping the homicide rates and violent crimes low in India in general

and in Kolkata in particular", mentioning "mixed neighbourhoods, the hold of family life, the role of cultural lives, and in the case particularly of Kolkata, perhaps the mainstreaming of economic discontent in regular politics rather than leaving it to find violent outlets in irregular crime." [22]

"It will be a big mistake to blame violence on economic inequality and poverty," according to Sen. He referred to "Kolkata, where Muslim, Sikh, and Christian minorities had a sense of security." And he concluded:

> … the world may get something from India's experience even when we do little to help others in an active way. While some lessons are in well-known fields, including democracy, freedom, secularism, the media, and others, there are further areas that may be worth bringing into comparative analysis. The incidence of violent crimes and of homicide may well prove to be an area of great importance for global comparisons and for learning from experience.

Conclusion

Any mega-city like Kolkata is like a stage where people move from one corner to another to reach the various spaces of their daily activities. They can have considerable choice in fulfilling their mobility needs and they can act in such a way that their movements are part of a sustainable urban consumption process. For this to happen, government policy and bottom-up mobility solutions need to work in combination to create such a sustainable situation in a city.

Notes

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5. A study, 'Environment and Social Sustainability of Transport – Comparative Study of Rail and Road', done by Asian Institute of Transport Development in 2002, reveals that

passenger cars with carbon dioxide emission level ranging between 21.04–28.07 grams per passenger kilometre made it the least friendly of transport modes.

Cars are also the most energy intensive: 0.28–0.38 mega-joules per PKM. The Rocky Mountain Institute, quoted by Scientific American in a survey of energy in 2005, states that only 13% of fuel energy used in a car reaches the wheels, the rest dissipating as heat and noise in the engine, the drive train, air conditioning, and idling. Moreover, 95% of the accelerated mass is the car itself and only 1% of fuel is utilized to move the driver.

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22. He adds: "But these are all highly speculative conjectures, and we badly need probing empirical investigation of this momentous but neglected issue." Ibid.He adds: "But these are all highly speculative conjectures, and we badly need probing empirical investigation of this momentous but neglected issue." Ibid.