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EDITORIAL

Emerging Trends in Architecture

The Theme of this conference is the 'Emerging Trends in Architecture', which is a perpetual theme for discussion on current architecture at any given time. It is now 20 years since the BBC serial 'Architecture at Crossroads', but Architecture has always been at cross-roads since the Industrial Revolution, and we have not so far come out with a lasting definition or purpose of architecture which is universally acceptable.

Trends in architecture reflect the milieu of the society it caters to. In any field of human endeavor, creativity follows the innovations in all relevant fields to find solutions for the problems of the day. The Crystal Palace by Joseph Paxton, Eiffel Tower by Gustav Eiffel and bridges by Robert Maillart epitomized the capability of concrete and steel for creative form, opening up the scope of architectural design beyond the classical revivalistic styles. In fact it was the creativity of these engineers which transpired some soul searching for the architectural fraternity, leading to the birth of modern architecture.

Today, we have witnessed all the phases of modern architecture, from the negation of ornament leading to the abstract, rectangular glass box architecture all over the world, to the conscious inclusion of icons and ornamentation to architecture in the name of contextualizing the form. But this contextualization of architecture by invoking the historical forms and ornaments had to come to an end when the supply of historical monuments gave out. De-constructivism was a reaction to all such attempts of historical revival, and it evolved a grammer of complex curvilinear and abstract forms, which have no connection with history, culture or for that matter anything that happened in the name of architecture for all these years. Environmental issues were sidelined in the architectural design all through these modern movements, and though architects like F. L. Wright did evolve theories like organic architecture, environmental compatibility was never the priority of any of these 'isms'. Major clientele of the Architecture had always been big business and the government, and that is how the humanistic agenda of the modern movement was hijacked to serve the monuments of 20th century like the World Trade Centre in New York and the Petronas Towers in Kuala Lumpur.

Most of these monuments have one thing in common. The blatant and mind-boggling consumption of energy, making you wonder how the human society survived all these 50,000 years of its existence without electricity. When Sears Tower in Chicago was built in the 70's, it was the tallest building at the time, built in the form of nine square tubes, curtailed stagewise as it rose to its 110 floor height. It was proudly announced at the time to have had electrical wiring of about 80,000 km. long, enough to wrap around the earth twice.

All this extravagance has not gone unnoticed. Contemporary to the rise of de-constructivism, there is another global movement, which encompasses not only architecture but all the fields of human endeavor, and that is eco-sensitivity - the awareness that the human activities have made a mess with the natural resources for the last 250 years of industrial revolution and that unless we do something about it now, it will lead to the destruction of the eco-system and eventual destruction of all life on earth. It is this realization that has guided a majority of green movements all over the world. Much before it became a movement in architecture, the green movement was a minority movement led by the environmentalists, and later by social activists. But it was only when the global warming became a reality and effects of pollution like the acid rain started literally hitting people on the head, that everybody took notice, including the politicians, and has now become a major political agenda all the world over.

The environmental priorities have surpassed all the other priorities of the world in 21st century. Al Gore talking about the environment may not be surprising, but the priority of the USA under Obama is also about energy independence by use of all non-conventional and renewable resources. California has already declared it would be a zero-carbon state by 2020, and by itself this is a major paradigm shift in one of the biggest consumerist economies of the world.

The UN Agenda for Sustainability, called Agenda 21 is now the agenda for the 21st century. It is not one more philosophy or 'ism' of architecture, it is an agenda for survival of the human race, and architecture has to follow that agenda if we consider ourselves as responsible professionals. LEED & GRIHA certification and compliance to ECBC is not an option now but mandatory requirement – and it deals with not only the architectural design but includes all forms of impact of the new development on the eco-system – starting from soil, water supply and drainage & solid waste disposal systems, recycling of water and so on. This sensitivity extends to both the building materials we use and the energy required for making the building comfortable for the occupants. Take any building material today, either the product or the process (most of the time both) will have to confirm to these requirements. Use of coal and fossil fuel for generation of electricity has now come under scrutiny for its impact on ecology, and the search is on renewable sources of energy on one hand, and reduction in the use of energy on the other hand.

The response of the architectural fraternity to this global aspiration is to find ways and means to reduce energy expenditure in buildings, both by using low-embodied energy building materials, and search for solar-passive architectural design solutions to use least energy for the building in use, while making it comfortable for the occupants. Incidentally, Climate compatible buildings is not a new idea. Vernacular architecture all the world over has demonstrated that it is possible to make a comfortable shelter in any climate with the use of local materials and appropriate built-form. In fact majority of architects in the third world countries have taken cue from this, interpreting the tenets of the modern movement in their own context, making architecture that

was compatible not only to their own climates, but also to their culture, lifestyle & resources. The works of stalwarts like Hassan Fathy, Geoffrey Bawa, Charles Correa, Laurie Baker et al, are a testimony to this fact. The technological innovations in the building industry for the past decade or so, have therefore concentrated on these issues. We have now softwares (developed in the USA, of course!) which can calculate the heating/cooling load of the buildings on the basis of a BIM model and climate data, and suggest a more climate responsive built form and materials. A whole new set of building materials for cladding to manage solar heat gain have evolved, right from specialized glass to ceramics to composites, and microprocessor based control of building facades to regulate the solar light & heat gain. Ken Yeang has demonstrated that vertical landscape not only makes the building climatically comfortable, but is also makes it more humane in terms of the psychological impact of nature in an otherwise concrete jungle of our cities.

The search for architecture in harmony with the ecology is thus the emerging trend today. We have to only look at the papers received for this conference: majority of them are dealing with the sustainable approaches in the various aspects of building design and execution, not to mention climate-compatibility and ecological issues related to building services. It was therefore only befitting that there was a unanimous decision to invite Architect K. Jaisim, one of the pioneers in India for Green Architecture, as the Keynote speaker for this conference. He has demonstrated though his works that architecture can be eco-sensitive and beautiful simultaneously, and has tackled all the ecological issues through his design much before any of them became fashionable.

The sensitivity to ecological issues represented in all these papers, most of which are by practicing architects and teachers in architecture, indicates that the architectural practice and education in this country are going in the right direction. We would be glad to receive your suggestions regarding the subject and the various papers presented in this document, and hope that we continue the debate on these issues to evolve appropriate guidelines and solutions for the future.

Prof. Rajeev G. Kulkarni
Editor & Chairman, Technical Committee,
National Conference on Emerging Trends in Architecture & Allied Fields
Sinhgad College of Architecture in collaboration with the University of Pune
February 27 & 28, 2014

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PROCESS OF INCREMENTATION OF INFORMAL SLUMS AND ITS APPLICATION IN FORMAL PLANNING

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Abstract:

Incrementation and cumulation are methods used by the poor via informal mechanisms to sustain their existence in the city. It is this mode of incrementation that needs to be appreciated by planning authorities rather than current all-at-once solutions. Most of these informal settlements start the process of bit by bit by putting up plastic sheets on bamboo poles. Over time, corrugated metal sheets and salvaged plywood panels replace the plastic sheets, which are later replaced by structures of bricks and mortar. Gradually, another floor is added and steel columns and beams take the load of the new vertical construction. Collective investments from the community or political interventions assist in obtaining amenities like water, electricity and drainage legally from the government or illegally from slum mafias. The vertical construction is next razed down to build a strong concrete framed structure. Incrementality is influenced by demographic profile of the household, their financial condition and other social and political factors.

The findings of the study pave the understanding of The Pattern of the informal. The idea of this research is to provide a base for studying incrementality and inferring patterns of development. Once an algorithm of the moments of cumulation can be generated, it will find application primarily in following fields of formal support. They are, financial sector, building material industry, planners and architects designing social architecture,

research teams for collaborative multi-disciplinary inputs and finally the Government and the NGOs. The process of intervention and support should also end in post occupancy surveys. Post occupancy surveys convey the success or failure of the intervention. This paper searches, identifies and proposes to apply the patterns of informality into the formal realm of development.

Overview and Objective

The absence of studies and theorization of the cumulative/incremental process gives redevelopment policies a vague basis of acceptability by the residents. Thus, there is a gap in the knowledge of how the informal grows in cities of India. Moreover, the processes identified by studies in El Salvador (Gattoni and Goethert, 2011), Delhi[1] (King, 2011) and Latin America (Greene and Rojas, 2008) are very general stages and cannot be contextualized directly to the Indian scenario.

Most of the stages correspond to construction of walls and roofs and their financial implications on the household, whereas, in the Indian context there are many more layers between the stages identified in these studies. Financial restraints and innovative use of salvaged materials delivers half pucca-half kuccha structure with half built walls, loadbearing slab of steel sections,

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[1] from the available information on King's thesis, the categorization of the process of incrementation is a superficial account of the structural type of construction, hence, is not sufficient for the multidisciplinary context

winding staircases, more than three floors of vertical construction and many other varying incrementations. The prime purpose of this study is to put together the patterns of cumulative growth observed in slums in Urban Centres of India, namely, Mumbai, Navi Mumbai and Pune.

Slum residents (ac) cumulate savings and materials and refurbish and reconstruct their residential unit across extensive time spans of four to five decades. This cumulative development initiated by residents is studied, documented and analysed for patterns of Cumulative growth which are further categorized as Moments of Development. The final objective of the study is to integrate the knowledge of cumulation in the collection of spatial maps which are prepared before formal interventions, like redevelopment proposals, are conceptualized. These spatial maps will be useful to designers, planners, community organizations and micro-finance institutions to ensure an inclusive support system for the informal settlements.

Methodology and Exploratory Study of Slums in Mumbai, Navi Mumbai and Pune

The Cumulative development of slum premises is non-latent and easy to identify using visual discretion. Satellite images are scrutinized to develop a map of slums in Mumbai. A visit to randomly selected slums from the satellite images was made to see if the growth of the slums can be viewed in cross section, i.e. whether one can identify slums in different stages of cumulation. Since longitudinal data did not give visual access to slum conditions across the stages of growth, cross sectional data is acquired. The visit to various slums made it clear that slums in fact follow a pattern of growth which could be categorized and studied in detail to confirm the observation. Temporal maps of Slums were helpful to track the year of origin of slums and thus study the early moments of evolution. These maps have temporal limitations as satellite images before 2000 are not available in Google maps India.

After identifying the clusters of informality the sites were visited randomly for a pilot study to understand the willingness of slum residents to disclose demographic and financial information. Spatial data when viewed temporally reveals substantial information about the evolution and growth of slums. If observed carefully, these satellite images would raise curiosity about the planning of slums, their incremental characteristic and their spatial designing. I would explain this using the following series of satellite images downloaded from Google Earth with a temporal range of twelve years from 2000 to 2012. The complete evolution of Banjarwasti, can be viewed from ground zero (2000) to their demolition (2005) and rebuilding (2006) to upgrading (2009) and incremental (2011) constructions.

Figure 1: Satellite Maps showing the evolution of Banjarwasti, Thane

This visual depiction of the genesis of a slum may give us a different perspective of the birth and evolution of a slum.

Although satellite images are meagre top views of the settlements and do not give an insight about the structures at ground level; from these images it can be inferred that slums do not have static temporal qualities. They grow and evolve across time. Banjarwasti presently is a slum with approximately 200 households.

Cumulation: Identification and impact of the variables

From the study it was noted that the structure grows as the household grows. The needs of the residents, their aspirations and their financial strength, strongly influence the character of structural cumulation. The open

plinth of rammed earth in the first Moment (Figure 2) closes from the sides and increases the security and privacy of the structure with salvaged materials in the second moment. In the third moment the structure goes deeper, digs foundation and achieves permanence of the brick walls.
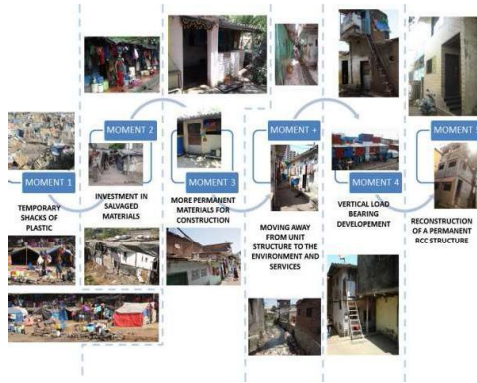
The roof however is mostly tin or asbestos/cement sheets. Brick walls are constructed by the residents with in-house family labour. Until the fourth moment the structural cumulation is by and large using salvaged materials and reusing from the previous moments. The fourth moment increases the space and volume by twice the original. It requires a large investment in construction, labour and materials. The family cannot assist in the construction as the load bearing structure of the stack is not a very stable or easy-to-build structure. Load bearing calculations are made by contractors and depending on the budget of the household the height of the structure is decided. The final stage of evolution, i.e. the Mansion is in fact not a cumulation. The construction of Moment five is decided after family discussions and calculation of the family's financial capability. Moment five is an incrementation. The previous structure is pulled to the ground, demolished and reconstructed freshly. Steel staircases are replaced by RCC stairs; kitchen platform, mori and bathroom services are planned with water inlet and waste and soil water outlet. The structure is complete with bedrooms and segregated functions. Thus

cumulation is justified in form, space and finance.

Space, design and functionality are internalized by the slum residents while designing their huts. Several factors influence the household decisions on incrementality. The process of cumulation is an accumulation of finances, materials, functions and spaces and volumes. Finance is (ac)cumulated across the years for investment in construction. The large investments start from the third Moment when the houses construct pucca. After the third Moment, the cost of incrementation increases by 750% for the fourth and 2000% for the fifth moment of cumulation. Unlike finances the cumulation of materials is an inverse graph when compared to the finances. The maximum cumulation of materials occurs in the first three moments. One may say that use of salvaged materials and financial investment are inversely co-related. The more salvaged material one can accumulate, the lesser will one invest in new materials, thus reducing the financial investment.
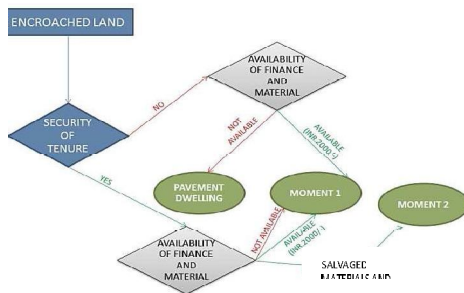
In the first moment the income of the household is close to Rs. 4000 per month. There are very little savings and hence the family largely depends on low cost alternatives and salvaged materials for construction. The scenario drastically changes by the end of 20 years; there are at least six earning members in the family, the father, his sons and their wives. The wives mostly take up home production like papad, jewellery making, etc. and support the income. The (ac)cumulation of finances happens over a long period of time and savings thus becomes a very integral part of the function of cumulative construction.

Material cumulation is the most intangible aspect of the cumulative theory of slum development; Intangible because its quantity, usage, etc. cannot be measured. The cost of construction in any phase drastically reduces by using salvaged materials. Contrary to general belief salvaged materials are used in all stages of cumulation, especially readymade elements like doors, windows, tiles, paints are always reused. Wood is stored since the first moment to use later as door frames, wall storage truss.

When a customer from the formal society sells his window frames, slides and grills to the vendor (the vendor buys the product in kilograms and sells it to the slum resident at rolled back unit cost), the product enters the resale market. Old markets are much decentralized in Mumbai and there is no one spot destination for old materials. Whereas in the case of Pune, most of the old materials even furniture like TV cabinet or storage unit can be bought from a Wednesday weekly market at Juna Bazzaar. The implications of this knowledge can help formally create a market for second hand goods which ensure both quality and cost-effective solutions. Presently most of the materials and appliances bought from the market are a gamble in terms of their quality. Similar to the Naka Material suppliers a destination for second use products can largely endow the low cost living of the slum residents.

Flowchart 1: Variables which affect the first moment of Cumulation

The house is like a growing organism cumulating in functions and use. Initially it is a blob of multi-use. The indoor and outdoor are almost permeable spaces, separated by a thin plastic membrane. The kitchen and bathing are outdoor activities and only sleeping is indoor. Soon the entire plinth is built upon and the space is engulfed by salvaged materials. The inner space is used for cooking, sleeping, resting, cleaning and sometimes working. The vertical construction expands the functions and separates the bedroom and bathroom as rooms with distinct functions. The mansion in the last stage in fact segregates living, dining, kitchen, sleeping, cleaning and washing activities completely into separate levels. Thus the functional spaces soon grow independent and isolated as the house cumulates to higher levels.
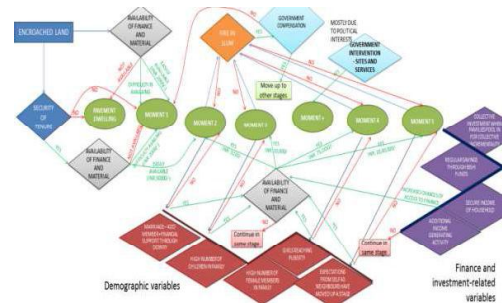
Flowchart 2: Variables and their influence on the cumulation to higher moments

The structure and pattern of Cumulation
The evolution of a house from Settling(Moment 1) to Mansion(Moment 5) is a very rational reaction of the resident to his social, financial and psychological state. The pattern will be very clearly explained in the flowchart 1 given ahead. Although the flowchart looks like a complex hodge podge of vectors and outcomes, the system of progress can also be designed for isolated moments.

When the residents first settle, there are two prime variables which affect the incremental housing; Security of Tenure and Availability of Finance (Flowchart 1). The tenure is secure if the site is a government initiated relocation scheme. The plots are laid down by the state and the residents build houses on it. Later depending on their financial condition, the residents either chose the structure in Moment 1 or in Moment 2. It would not be incorrect to say that if government security comes with financial funds for construction the household enter the third moment of construction directly. On the

contrary the insecurity of tenure and unavailability of finance is the most predicted reason for Pavement dwelling. If the tenure is not secure, yet finance is available the resident invests in building a rammed earth foundation, sticking up of bamboo poles, covering it with cloth and plastic, later recovering it with cardboard box paper to reduce the thermal sinking of plastic tarpaulin.

The second moment (Flowchart 2) of cumulation occurs in the presence of more socio-psychological and income influenced events. If in the first moment there is a wedding in the family then the grooms family most likely due to dowry and other gifts moves to the next moment of pucca permanence, whereas, the house of the bride remains in the current moment longer as the finance needed to increment is utilized in the wedding preparations and gifts. Cumulation happens even for privacy and security, esp. in houses with more female members, widows with young daughters, daughters reaching the age of puberty; stronger and seamless structures need to be constructed. When families can spare the required amount to upgrade to any stage, incrementation occurs. Special case scenarios like in the event of fire, however, if the government compensates for the loss the residents gain finance for upgrade. If the government does not support through compensation, the entire settlement returns to insecurity and in back to the stage of settling (Moment 1) and uncertainty. The later moments also follow the same pattern of upgrade and pitfall as the second moment. Additional and stable income positively support the upgrade, so do family events like marriage of son, more females and/or children in the family and personal aspirations either generated within or due to envy of neighbour's upgrade. Similarly, financial stability through secure income of household bishi/chit funds etc. also positively influence the upgrade of house The conversion of this flowchart into an algorithm would be a beneficial exercise for formal interventions like redevelopment, housing loans, material investment, etc. The algorithm can also predict the point of incrementality given the social and financial conditions of the house. It can be useful to the material industry to gauge the need for salvaged or pucca materials depending on the security and financial comfort of the household. Government and social workers can use the algorithm to understand the status of the slum and intervene accordingly. Although designing the algorithm goes beyond the scope of this research, the idea may be taken ahead by others in the academic profession.

Key findings of the Research
The main finding of the exercise on incrementality is that patterns can be deciphered in the process of incrementation of the settlements. The patterns are largely dependent on three kinds of variables; demographic, financial and political (Flowchart 2). Availability of finance and salvaged materials is the key to the initiation of the process of incrementation. The motivation is generally demographic, like privacy, security as girls grow older, addition of new member in family by birth or marriage, etc. Financial comforts like stable income, second wage earning complement and add to the income of the family. Political decisions like providing amenities and services to the settlement reinstate the confidence of the residents against demolition.

Apart from the measurable and calculative aspects of incrementality, the implied findings of the study are that the poor have learnt construction skills while building their houses. Although best practices are still unknown, residents have the tendency to build their own houses to reduce expense on labour. They design by need and not by aesthetics in the first three moments. On the contrary the last moment of Mansion is purely an aesthetic exercise with addition of spaces. The façade is treated by boxing the windows, using wall tiles, designing cornices, etc. thus one can confidently say that when the availability of finance is doubtful, need and function precedes the demand of aesthetics. However as the finances become more secure, the residents invest in aesthetics.

How do the Findings help?

The findings of the study pave the understanding of the pattern of informal. The idea of this study is to provide a base for studying incrementality and inferring patterns of development. Once an algorithm of the moments of cumulation is generated, it will find application primarily in following fields of formal support, they are, financial sector, building material industry, planners and architects designing social architecture, research teams for collaborative multi-disciplinary inputs and finally the Government and the NGOs. Contextual information should start by spatial exercises integrated with values to the variables. These variables are proxy to the financial capability and social motivation of the household. The type of solution to the problem will largely depend on the development of precincts and the urban context. For example, solutions attached to the ground plane will not work for a city like Mumbai, where the cost and speculation of land is very high. Here, redevelopment should integrate incrementality vertically. The process of intervention and support should also end in post occupancy surveys as they convey the success or failure of the intervention. Next we will address the formal actors who can integrate the informal into their milieu for more informed decisions about the interventions.

Formal modes of Support: Finance and Material Suppliers

Most of the financial institutions in India would agree that recovery rate in slums are higher than average recovery rate. The model followed is the one initiated by Mohammad Yunus in Gramin Bank. The residents esp. the women form small savings groups. These savings groups reinstate the financial stability of the household. The algorithm of incrementality informs the institutions and acts as proxies of actual information. The moment in which the household is will tell us about the investment in construction of the structure, the maintenance cost required. It will also tell us about the next moment and the funds required for the incrementation. Schemes like EMIs and instalment payments will work best for the poor. Materials supplied to the slums are second hand, cheap and sometimes derogated in quality. The spatial map of the moments will inform the market about soon to occur construction activity and thus, the materials needed for construction. That is, if parts of the slum are in the third moment the next moment, i.e. for the construction of the stack, steel sections, precast slabs and stones, finishing materials like plaster, paints and tiles are needed. Thus by looking at the whole spatial map in general a market strategy for the settlement can be devised.

Quality management of the second hand and reject pieces bought by the residents is not controlled. This leads to problems like asbestos inhalation, over heating of the space, structural failure, etc. A proper rerouting like the OLX online market should be made possible in the informal. In case one on one is not an option for buyers to meet sellers, companies like Future Group which give discounts on exchange of old items through schemes at Big Bazaar should take up the rerouting as their corporate social responsibility; to provide quality checked goods to the slum residents at second hand rates.

Formal Modes of Support: Architects and Planners

The knowledge of materials and construction activities which the poor are involved in can open up a large court of possibilities and innovations from the designers and planners. Experimental designs and proposals can use moments and the demographic, financial and political information as the brief to design for social or open source architecture.

Some of the elements of informal design which can be easily misunderstood as mere veranda, balconies or roofs, thus deleted from formal schemes of redevelopment, are in fact features

of collective exuberance. The otla/veranda is the ladies corner. The women chat and connect at the otla while doing their daily chores. Architects should keep in mind that the otla is more embedded in the social behaviour of the residents and is not just a point of service in the Moments. The roof similarly, is more than a sheltering element. The roof converts the chaos at ground plane into a reasonably seamless upper level. Children play and women dry clothes and food items on the roofs. Games like cricket and Kite flying are also played on it. The roof becomes the connecting fabric for the entire mass of the settlement especially used by young boys for sports and interaction. Thus one may say that the lack of open space on the ground is compensated by continuous plane of roof. Similar to houses in Ahmedabad and Old Delhi, the roof connects the communities at the upper level, hence, its social purpose should also be considered in redevelopment by architects.

Incrementality on ground plane and incrementality in an apartment building are different challenges for the designers. Real estate plays a very important role here. Mumbai, with its high land costs cannot afford a horizontal development. When redevelopment is vertical, the criteria of incrementality i.e. scope for additions, will make the construction of framed structure costlier. Pre cast technology is not economical for construction below 4,00,000 sq. ft. Hence, an alternative construction technology should be engineered which is cheap yet flexible. Designers and planners should reimagine the horizontal plane in the vertical structure to look for alternatives for incrementality.

Formal Modes of Support: Government and NGOs

The pattern of Cumulation is an important variable to measure the redevelopment or formal intervention by the state. The government and NGOs can use the information on cumulation to realise the acceptability of the residents towards redevelopment. Settlements where many households have invested large amounts in constructing the mansion of over 800 sq. ft. will not be satisfied with redevelopment schemes which give 300sq.ft apartments.

Here both the area of exchange and the recent heavy investment in construction are the reasons. Most approachable stages for redevelopment are before moment four and five. In that moment the floor space of the house is also less and so is the investment in construction. Spatial maps can be used to identify the clusters which can be supported for projects like BSUP or VAMBAY. NGOS can use the data for similar purpose. Infact NGOs and CBOs together can start the process of generating maps. These maps can be generated at time intervals of three to five years to study the process and new trends in incrementation.

The (re)Search Continues

The research on incrementality in India is not yet extensively covered. More inputs of professional and academic expertise need to work in a collaborative environment of co-creation. The algorithm can find innumerable applications, so can the spatial mappings of the moments. Information that is rooted on the ground plane to the household will help generate clusters for intervention. These can be termed as the singular client/market and then served through innovation of design, policies or schemes.

This study is intended to put together a generic scheme visible in the informal. The intention was to bring out the difference of approach of the informal towards solving their housing crisis from the top down interventions initiated by the government. The poor design bit by bit and planners design holistically. When the starting points are different how will the end processes meet? The need to study settlement and structural pattern of the poor is important before recommending and intervening. The purpose of this study is to lay the foundation for further site and context specific studies which can generate site specific success stories of intervention.

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