URBAN OPEN SOURCE: Synthesis of a Citizen-Centric Framework to Design Densifying Cities

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Prominent urbanizing centres across the globe like Delhi, Dhaka or Manila have exhibited that development often faces a challenge in bridging the gap among the top-down collective requirements of the city and the bottom-up individual aspirations. When this exclusion is intertwined with rapid urbanization and diversifying urban demography: unplanned sprawl, poor planning and low-density development emerge as automated responses. In parallel, new ideas and methods of densification and public participation are being widely adopted as sustainable alternatives for the future of urban development. This research advocates a collaborative design method for future development: one that allows rapid application with its prototypical nature and an inclusive approach with mediation between the 'user' and the 'urban', purely with the use of empirical tools.

Building upon principles of 'open-sourcing' in design, the research establishes a context-responsive 'open source development framework' that can be used for on-ground applications. In its process, the research has referred to the Sarojini Nagar large-scale redevelopment in the core of New Delhi as a field experiment – a case that encompasses extreme physical, demographic and economic diversity. This framework is used for a simulated model development at five prevalent scales in design: master planning, urban design, architecture, tectonics and modularity, in a chronological manner. At each of these scales, the possible approaches for open-sourcing are identified and validated, through hit-&-trial, and subsequently recorded. Over the five-step framework, a two-part subsidiary process is also suggested after each cycle of application, for continued appraisal and refinement. The research is an exploration – of the possibilities for an architect – to re-calibrate the architectural design process and make it more responsive and people-centric, to assume the role of a creator for a dynamic and responsive development framework.

BACKGROUND

The last few decades of urbanisation have witnessed a continued failure of our processes to respond to a rapid expansion and diversifying demography. In 20 years, Lagos has grown from 2 to 7 to 15 million; Istanbul has doubled from 6 to 12[1]. India has nearly one-third of its huge 1.21 billion population in urban settlements for now. By 2025, Mumbai and Delhi, its two largest megacities are expected to occupy the second and third spot, standing at 26.4 and 22.5 million respectively[2]. As an unwanted consequence of globalization, many of the resources necessary for development, especially in the Global South, remain embedded only in selective urban nodes parked over global financial and corporate networks. Such networks prepare cities purely for production with hyper-concentration of facilities, and cause tremendous pressure to increase infrastructure efficiency and improve service delivery[3]. Increasing sprawl, growing squatter settlements and unorganized low-density development are visible traits of such pressure on authorities and governments[4]. Such statistics and trends bring forward the debate on sustainable urban development: the goal 11 of UN Habitat's 2030 Agenda for Sustainable Development aims to 'make cities and human settlements resilient and sustainable[5].

The Primacy Index in UN's World Cities Study of 2016 reveals that the lopsided urbanization, dominated by top-down development models, has led to a massive increase in two kinds of cities: evolutionary cities like Istanbul, Jakarta and Manila characterized by rise of the informal economy with lowering standards of living, and fast-growing megacities like Delhi, Mumbai and Shenzhen characterized by reduced citizen engagement and access to resources[6]. These trends, emerging from the disconnect between the conventional urban development models and prevailing market-led mechanisms for development, place the global and national stakeholders over the local citizen, as a result of which the citizen interest and local socio-culture face relegation and alienation.[7]

The future of the Global South stands to be determined by the disbalanced dynamics in its cities: between the top-down development policies and the bottom-up stakeholder aspirations. The urban conditions created for such centralized development exist in stark contradiction with the local needs and demands in these regions[8]. Citizen's disapproval and resentment, visible more than ever, is the core of popular modern movements of Tactical Urbanism and Peer-to-Peer urbanism that promote the idea of 'access' to the citizens. Such an urban scenario is a critical opportunity for creation of

a people-centric urban development framework that can integrate this idea of 'access' in mainstream planning processes: combining the organizational rigor of centralized development with the functional viability of public participation.[9]

INTRODUCTION

With the urban population share in the Global South growing at an ever-increasing pace, new ideas and methods of 'shared ownership, digitization and open access are being considered by the governments as sustainable alternatives for urban development[10]. With the emergence of informality at the urban level, technological literacy at the architectural level, and participative culture among users, design is increasingly produced by a network of stakeholders. The relevance and practice of architecture and urbanism is moving from the sole authority of the designer to participatory equity of the stakeholders and users[11]. Furthermore, the Human Capital Theory of regional development posits that the Creative Class - the largest and fastest growing group of working individuals in the cities - values openness to diversity and opportunities to express their creativity over the physical attraction of malls, apartments, infrastructure and such. Citizens are more interested in the process over the product. The notion of 'access' - to tools, information, design etc. - has become the single most important factor determining perceived quality of life in urban centres.[12]

(Free/Libre) Open Source in design exemplifies a new model of production with a social vision, building on the emancipatory potential of non-hierarchical and equality-driven setups where users can access, modify and distribute the knowledge and technologies they possess.

VISION – FEEDBACK – RESPONSE LOOP

Building upon the concepts and principles of 'open source' for cities, the research establishes a design framework based on a vision – feedback – response loop that serves the current user requirements while allowing for future citizen-driven modifications:

Vision: Grounding in physical and socio-cultural context

The first part focuses on interpreting the project context with respect to:

1. Socio-economic status and mindset of the users who will engage with the project
2. City- level forces such as capital and political influence that cause changes to the city fabric
3. Emerging consumer trends – such as the rise of shared culture- generated by technological and creative innovations

This study and analysis is then used to design the project development parameters (area programme, typologies, architectural and urban character etc.)

Feedback: Socio-spatial analysis

The second phase focuses on generating a transaction log between the user and the spaces he/she uses with respect to:

1. Level of engagement with the existing typology – physical, social and economic
2. Appropriation of spaces to perform recreational and livelihood functions
3. Modification of spatial infrastructure for personal use

The documentation and its analysis is used to define the character and spatial tectonics of the project.

Response: Creating responsive tectonics for Open Systems

The last part of the loop generates a design catalogue for the project with respect to:

1. Sub-divisions of the city-building process clearly demarcating the lines of decision making and responsibilities between the stakeholders
2. Design specifications for connections between building parts
3. 'Ultimate consumer' on each level/front: for instance, consumer on the infill level, developer at the support front etc.

This loop is applied to all 5-scales of design - master planning, urban design, architecture, tectonics and modularity - and through trial-and-error, is used to create a prototypical open-sourcing framework for urban development. The architect, designer and urbanist, here play the role of 'middlemen' - providers of an open infrastructure that can be appropriated by the user as per his/her requirements.

URBAN OPEN SOURCE: APPROACH

The approach to an Open-Sourced Urban Development, after multiple case reviews and experiments carried out under the research, is suggested under 3 stages: to set out the project intent, formulate a response, and devise an open source design framework, elaborated as under.

Setting-out Project Intent

The first stage aims to clearly conceptualize the project ideology, formulate development objectives and identify broad design elements through a comprehensive understanding of the socio-cultural character of the region, requirements of the people residing in the development area, and references to global precedents, using a 5-part process:

1. Regional Character

The project groundwork shall be laid out on a historical and socio-cultural premise of the region undergoing development. This is done through:

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o *Historical Grounding:* Analysis of evolution of the fabric through secondary sources and/or primary interviews.
o *Socio-Cultural Grounding:* Region-specific identity analysis, focused group techniques for collecting primary information from citizens, and everyday life observational studies.

2. Context-Specifics
A citizen grievance analysis is carried out to synthesize specific issues that need redressal. It is extremely important to carry out this process on grassroots level so that an un-biased, up-to-date picture of the citizen requirements and aspirations can be generated. This process is carried out at 2 scales:

o *City-Level:* Digital surveys to understand the broader scenario in the city as a whole through generic questions and development aspirations.
o *Region-Specific:* Personal interviews to gauge specific interests for the region.

Focused group techniques should be avoided for collection of information under this part of the process so as to avoid any information suppression.

3. Proposal Brief
The identified needs and aspirations form the broader objectives for the proposal, which are to be further broken down into micro-objectives to be specifically addressed by the proposed project. The micro objectives shall be achieved using specific ideological and/or theoretical tools that are appropriate to be used as per the nature and complexity of the issues. Such tools, which take the form of broad proposal ideas, should be identified after a thorough analysis of their global precedents.

4. Design Elements
Selected ideological / theoretical tools shall be elaborately studied to comprehend the influencing factors and parameters that need to be dealt with, with detailed case studies of these tools carried out to understand the nitty-gritties of their application and impact. The intent of such studies and review is to identify specific design elements that shall be incorporated in the proposed project.

5. Conceptualization
The design elements are organized as a conceptual premise, under key project features that will incorporate them, to create a thematic urban development proposal for selected region.

Formulating the Response
Open source design works on a user need-product design-user modification model to ensure that the experts in the field - the software developer in this case - can grasp people's requirements and convert these into specific design solutions, while allowing for continuous change by the users. This seemingly simple process as an urban development model is suggested to be carried out in 5 steps:

1. Identification of user requirements using surveys, interviews and data collection techniques.
2. Mediation between the current user requirements, development protocols and possible future uses of the development to arrive at a design vision and objectives.
3. Design development to achieve all objectives, under a constant guidance of the vision.
4. Impact analysis of schematic proposal using simulation and on ground tactical experiments.
5. Detailed design of identified pivot points across the proposal.

Open Source Development Framework
The 5-step design process, carried out at 5 respective scales, aims at devising a complete model for open sourcing all urban development initiatives. The same loop of user need-product design-user modification, as defined in the theory of open sourcing, is employed at each step. It is imperative to note that the user-inputs, tools of analysis, process objectives and approach to design change drastically across these 5 scales; however, the underlying idea of open source is constant throughout.

Step I: Creation of an Inclusive Urban Fabric
The city is a complex metaphor for retention and evolution, simultaneously. It has a history, that gives it a sense of identity and a present, which in turn constantly tries to build upon or move away from that identity[13]. Aligning the past and the present leads to the most astute basis for future development: a 'vision'. Step 1 of this framework aligns the development aims of the proposed project with the larger vision of the city, and is undertaken as follows:

1. Aligning the past and the present using detailed condition mapping.
2. Forming basis for future development using wider development plans and policy.
3. User group identification and recording of their responses.

Step II: Alignment with Urban Vision
Architecture operates on the interdependencies created by urban ecosystems, and hence needs to acknowledge its criticality. The 21st century urban fabric can no longer by segregated into neat rows as the hybrid urban elements that have formed due to the changing dynamics of the city beg to be accounted for[14]. Step 2 aims to create an inclusive urban fabric spanning complex user groups and diverse

built uses by a further development of the masterplan framework sketched in the last stage:

1. Categorization of programmes into 'Urban Driver' groups.
2. Analysis of user - to - programme nature of each driver to create plausible combinations.
3. Spatial placement of the selected programmes.
4. Zoning, massing development and overall distribution of built-use.

Step III: Addressing Rapid Programmatic Mutations
The conventional definitions of 'function' and 'program' no longer work: they are rapidly changing, and so is the subsequent essence of architecture. There is a need to use combined investigations that explore these unlikely confrontations and relationships[15]. Step 3 aims to identify and harvest the potential of these mutations: creating possibilities that accommodate programmatic dynamism. These investigations are used to further develop the massing and proximities:

1. Identification of critical programmatic debates to be addressed by design framework.
2. Debates: character mapping, activity mapping, occupancy and area requirement calculation, and development of volumes.
3. Development as per National Building Codes and Byelaws.
4. Setting of design rules.
5. Spatial Placement as per laid-out design rules.

Step IV: Incorporating Spatial Temporality
The conventional design process seldom takes this into consideration the thermodynamic 'time' associated with creation, formation, degradation, and process[16]. In this process, architecture is seen as a transient formation that, like all physical objects, is a system of matter and energy that incessantly transforms with the flows and processes that constitute its actuality[17]. Step 4 aims to further develop the massing, proximities and spaces based on activity patterns and time-based spatial configurations:

1. Mapping out programmes: active hours and nature of use.
2. Creation of activity combinations based on similarity of nature and use hours.
3. Placement of created combinations in spatial fabric.
4. Prioritizing tectonic requirements, and subsequent evaluation as typical day simulations.
5. Development of tectonic systems incorporating activity and use requirements.

Step V: Optimization through Modularity
Fundamentally, the physical manifestations of architecture incorporate human activity. However, the ordering and arrangement of forms also determines how architecture might promote endeavours, elicit responses, and communicate meaning.[18] The ideas of aligning with a vision, creating inclusivity, responding to mutations and harnessing temporality can only work if provided impetus at the most primitive level: Spatial Modules. Step 5 aims to engrain the idea of open source at the most fundamental level, where even a single person can harness its potential. It attempts to create spatial modules deep rooted in the principles of open sourcing:

1. Simulations of space to identify spatial pressure points during transitions.
2. Geometrical vocabulary for each module based on use, function, logistics and aesthetics.

OBSERVATIONS & OUTCOMES

The observations throughout the research process, and the achieved outcomes have been classified under various baskets as key pointers and parameters to help in field application of the Open Source Development Framework.

Design Process

Design Process	Objectives	User Input	Area of Analysis	Open Source Vision
Aligning with City Vision	Mediating between existing conditions and future plans	Development process must cull out and retain the integral parts of fabric	Understanding the identity of the place and reacting sensitively	*Create Development Plans in synergy between the User, the Existing and the Proposed*
Creating an Inclusive fabric	Create a social ecosystem & subsequent responsive massing	There must be a strong balance between dense and breathing zones: built & program-wise.	Understanding elements of architecture as cogs in the larger urban dynamic	*Create clusters and character that can integrate with the urban dynamic*
Addressing program mutations	Mediate critical architectural debates that arise out of program behaviors	Interpretation of conventional programs must be re-visited & changed as per to-day's needs	Understanding architecture through Movement, Event and Program framework	*Create programmatic proximities and dynamics that accommodate changing use patterns*
Addressing Temporality	Maximize spatial efficiency through creation of an efficient & adaptable tectonic vocabulary	Spaces must be designed to allow for change in use and expansion-contraction through a day	Understanding architectural spaces through the lens of anachronisms and temperament	*Create spaces that can overcome the limitations of time-based occupation & tectonic-bound activities*
Optimization through module	Simplify transition logistics to integrate adaptability & optimize micro details	Construction and assembly details must be simple enough to be useful to the lay-man	Understanding human-perception of spatiality and devise basic required modules for adaptability	*Create configurations and details whose simplicity gives them relevance to lay-man*

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Application and Feasibility

Scale of Application	Regional Considerations	Possible gaps between user needs and existing development	Methods and tools for creating an Open Source solution
Master Planning (Scale 1)	Preservation of site ecology, reduction of motorized transport, integration of site identity with proposed development	Disregard for specific-needs of sub-strata of demography, and existing character of site of intervention	*Collage City: Colin Rowe, 5 Points: Kevin Lynch*
Urban Design (Scale 2)	Integration of existing informal economy, optimization of existing pedestrian networks, maximization of habitable space & density	Absence of networks creating cross-demographic interaction, inequitable distribution of critical infrastructure	*New Urbanism: Rem Koolhaas, Urban Artifacts: Aldo Rossi*
Architectural Tectonics (Scale 3)	Incorporation of current trends of spatial occupation, application of local material and construction procedures	Refusal to re-calibrate the currently abandoned social infrastructure, disregard for informal markets	*Movement&Event: Bernard Tschumi Theoretical Geomatics*
Spatial & Volumetric Design (Scale 4)	Promotion of time-bound occupation of spaces, optimization of volumetrics for maximized user-engagement	Creation of single-use inefficient spaces, spaces incapable of rapid response to user requirements	*Metabolism in Architecture: Kisho Kurokawa, Ephemeral in Architecture: Anastasia Karandinou*
Modularity & Detailed Design (Scale 5)	Cater to critical individual-requirements of citizens, maximize user modification of spaces at the detail level	Disregard of individual requirement in favour of the generalized whole, use of unviable logistics in the user-oriented details	*Performance over Shape: Rem Koolhaas, Prefab Architecture: Ryan Smith*

Design Framework

Using observations and inferences from the experiment, a development model is suggested for Open Source Development. This model involves a 5-part process that brings contextual specificity, while creating a participatory and constantly adaptable environment for development projects:

Part I: Regional Character
Laying the historical and socio-cultural premise for understanding the project background.

Part II: Contextual Specifics
Identification of region-specific citizen requirements, and subsequently project vision and objectives.

Part III: Proposal Framework
Identifying programmatic features required to achieve the objectives and their translation to spatial and physical form using precedent case studies and tactical experiments.

Part IV: Prototype Assembly
Grouping spatial features into chronological design stages and integrating 'open-source' with development framework.

Part V: On-ground Manifestation
Stage-wise execution of the development framework in a step-by-step User Input-Theoretical Grounding-Design Evolution loop.

After the 5-part process, it is suggested to continuously monitor the project for post-occupancy performance and/or failure-analysis. These auxiliary 2-parts result in continuous appraisal and renewal of the process itself, refining it before its re-application in the same or next project.

Part VI: Appraisal of Project
Summarization of project output to update the replicable open source development model, its circulation for peer review & post occupancy analysis.

Part VII: Refining for further testing
Incorporation of review and feedback from experts and stakeholders to refine the open source development model and subsequent implementation on next site.

OUTLOOK AND WAY FORWARD

The 21st century city is evolving at a pace never witnessed before in the history of built environment. The future of the city is being driven by the culture of collaboration and the creative class' need for creation as opposed to the traditional thought of consumption[19], and promises to have expertise of all fields - from the technical to the creative - providing the tools to people to shape their environment. People will inhabit naturally, based on their preferences, yet exist harmoniously in the shared built environment[20]. With each new development, however, rise completely new urban scenarios and dynamics. The framework derived in this research, therefore, cannot be seen as an absolute solution but as a basic toolkit to be applied as per contextual requirements[21].

The research suggests a new model for participatory urban development with an on-ground implementation methodology. Based on multiple appraisals of the methodology across various pilot cases, it has been observed that this method can produce satisfactory results for urban development projects with significant demographic, cultural and social diversity. Furthermore, the interactive nature of the methods and tools employed allows the designer and authority to explore a vast array of plausible solutions.

The peer reviews and expert feedbacks from collaborating architects and urbanists suggest that the open source development framework can gradually be incorporated in the urban processes in practice. In the modern urban practice, where public participation is an ever-important pillar for creating sustainable design, the open source model allows for specific requirements of the people and the contextual region in question. With digital advancement, this model can harness the capacities of machine intelligence and multi-criterion optimization. For specific user analysis, capabilities of big data can be further introduced into the system.

The research is a simulated site-specific empirical analysis, to obtain a suggestive outcome based on explored pilot cases. In

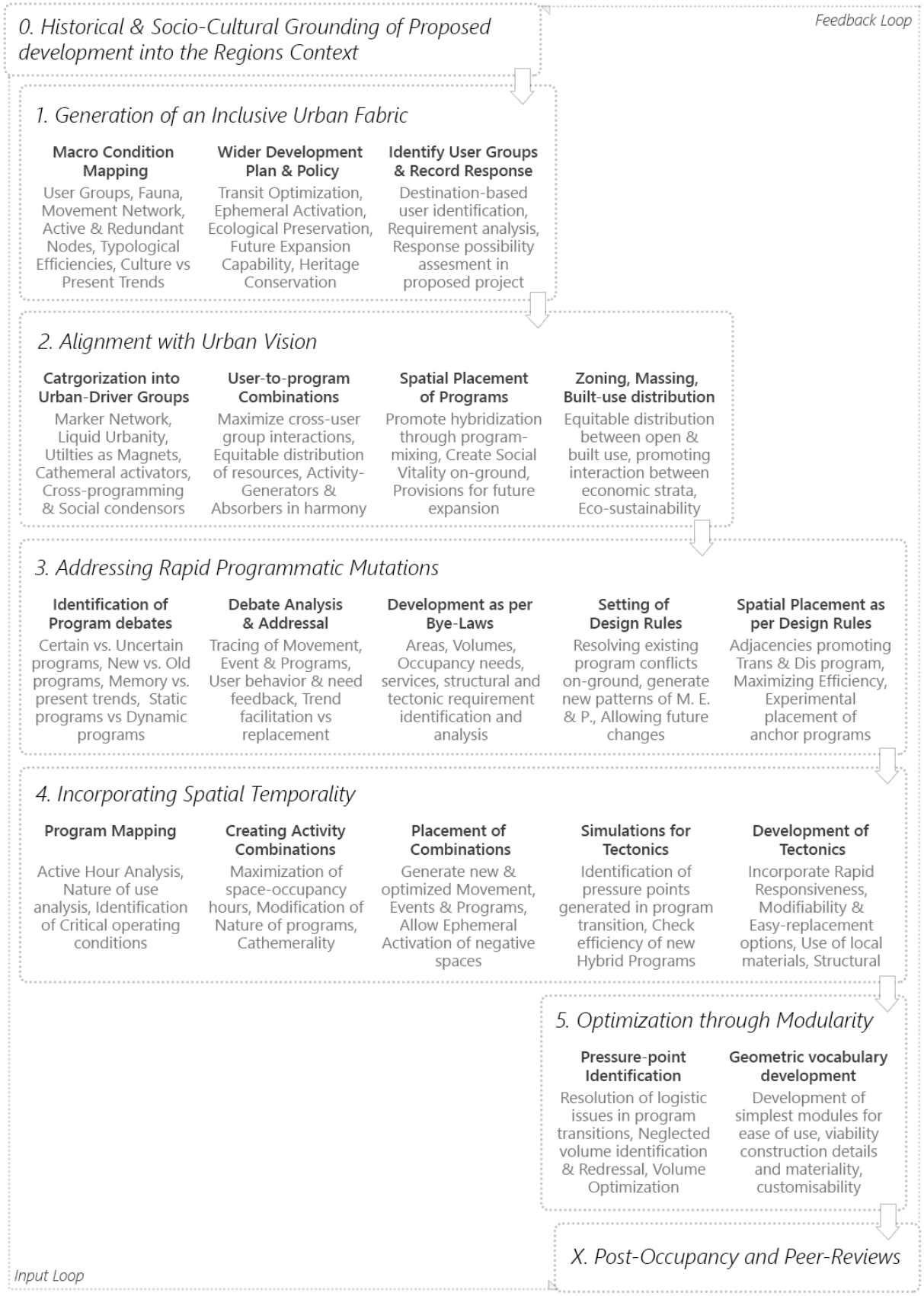

Figure 1. Open Source Development Framework.

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ENDNOTES

1. Rem Koolhaas, S, M, L, XL. (New York: The Monicelli Press,1995), 979.
2. Chander Chandramouli, "Rural-Urban Distribution of Population" Census of India, 2011, http://censusindia.gov.in/2011-prov results/paper2/data_files/india/Rural_Urban_2011.pdf>
3. Sasskia Sassen, "The Global City: introducing a Concept." Brown Journal of World affairs 11 (2005): 30-36.
4. Peter Ellis, Leveraging Urbanization in South Asia: Managing Spatial Transformation for Prosperity and Livability. (Washington D.C.: World Bank, 2016), 32.
5. UN DESA, Sustainable Development Knowledge Platform. (New York: UN DESA, 2015), 9.
6. John Batten, Citizen Centric Cities:The Sustainable Cities Index. (Hong Kong: ARCADIS, 2018), 14.
7. Beatriz Colomina, "Towards a Global Architect" Domus, April 2011, https://www.domusweb.it/en/architecture/2011/04/30/towards-a-global-architect.html
8. Kioe Shang Yap, "Urban Challenges in South-East Asia" Environment and Urbanization ASIA journal 2 (2010), 48-49.
9. Kailash Vadera, Open Source Technology. (New Delhi: Laxmi Publications, 2009), 12-29.
10. Ana Laura Mohirta, "Towards Open Source Architecture." The Question of Technology 0078 (2018): 17.
11. Theodora Vardouli, "Open Source Architecture: An Exploration of Source Code & Access in Architectural Design." Leonardo Journal 47 (2012): 24-28.
12. Richard Florida, Cities and the Creative Class. (New York: Routledge, 2005), 83-85.
13. Sasskia Sassen, "The Global City: introducing a Concept.", 63-68.
14. Colomina, "Towards a Global Architect" Domus.
15. Stewart Brand, How Buildings Learn: What Happens After They're Built. (New York: Penguin USA, 2001), 55-61
16. Christopher Alexander, The Timeless Way of Building. (Oxford: Oxford University Press, 1979), 156
17. Nicholas Negroponte, Soft Architecture Machines. (Massacheussets: MIT Press, 1975), 27-43.
18. Bernard Tschumi, Architecture & Disjunction. (Massachussets: MIT Press, 1994), 85-86.
19. Carl Elefante, "Accelerating Change: Disruption or Progress? American Institute of Architects." (paper presented at the 2018 AIA Conference on Architecture, Washington, 2018).
20. Greg Bryant, "The Oregon Experiment after Twenty Years." Rain Magazine, Spring 1991, http://www.rainmagazine.com/archive/1991-1/the-oregon-experiment-revisited
21. Carlo Ratti, Open Source Architecture. (London: Thames & Hudson Ltd., 2015), 61-66.

BIBLIOGRAPHY

Alexander, Christopher. The Timeless Way of Building. Oxford : Oxford University Press, 1979.

Bacon, Derek. The Rise of the Sharing Economy. New Delhi: The Economist, 2013.

Batten, John. Citizen Centric Cities:The Sustainable Cities Index. Hong Kong: ARCADIS, 2018.

Bhagat, Ram. Urban Growth in Developing Countries: A Review of Projections and Predictions. New Delhi: Population and Development Review, 2009.

Brand, Stewart. How Buildings Learn: What Happens After They're Built. New York: Penguin USA, 2001.

Bryant, Greg. "The Oregon Experiment after Twenty Years." Rain Magazine, Spring 1991, http://www.rainmagazine.com/archive/1991-1/the-oregon-experiment-revisited

Carlo, Giancarlo De. Architecture's Public. Oxford: Spon Press, 2007.

Chandramouli, Chander. "Rural-Urban Distribution of Population" Census of India, 2011, http://censusindia.gov.in/2011-prov results/paper2/data_files/india/Rural_Urban_2011.pdf>

Colomina, Beatriz. "Towards a Global Architect" Domus, April 2011, https://www.domusweb.it/en/architecture/2011/04/30/towards-a-global-architect.html

DESA, UN. Sustainable Development Knowledge Platform. New York: UN DESA, 2015

Elefante, Carl. "Accelerating Change: Disruption or Progress? American Institute of Architects." (paper presented at the 2018 AIA Conference on Architecture, Washington, 2018).

Ellis, Peter. Leveraging Urbanization in South Asia: Managing Spatial Transformation for Prosperity and Livability. Washington D.C.: World Bank, 2016.

Florida, Richard. Cities and the Creative Class. New York: Routledge, 2005.

Heineman, Zachary R. "Architects without Architecture." Journal of the American Institute of Architects 69 (2010): 2-13.

Kaspori, Dennis. "A Communism of Ideas: towards an architectural open source practice." Archis 3 (2003): 6-18.

Koolhaas, Rem. S, M, L, XL. New York: The Monicelli Press,1995.

Maki, Fumihiko. Investigations in Collective Form. St. Louis: Washington University, 1964.

Mohirta, Ana L. "Towards Open Source Architecture." The Question of Technology 0078 (2018): 10-28.

Negroponte, Nicholas. Soft Architecture Machines. Massacheussets: MIT Press, 1975.

Price, Cedric. Non Plan: an experiment in freedom. New Society, 1969.

Ratti, Carlo. Open Source Architecture. London: Thames & Hudson Ltd., 2015.

Sassen, Saskia. Cities in a World Economy. SAGE Publications, 2018.

Tschumi, Bernard. Architecture & Disjunction. Massachussets: MIT Press, 1996.

Vadera, Kailash. Open Source Technology. New Delhi: Laxmi Publications, 2009.

Vardouli, Theodora. "Open Source Architecture: An Exploration of Source Code & Access in Architectural Design." Leonardo Journal 47 (2012): 20-33.

Yap, Kioe S. "Urban Challenges in South-East Asia" Environment and Urbanization ASIA journal 2 (2010), 44-56.