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Modular City Design Methodology- 21st Century Cities

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Background:

The world is becoming increasingly urbanized, and with this accelerating process comes a host of challenges. Urban areas now contain more than 50 per cent of the world's population, occupy just two per cent of the world's terrestrial surface, and consume up to 75 per cent of natural resources.

According to the UN State of the World Population 2007 report, sometime in the middle of 2007, the majority of people worldwide will be living in towns or cities, for the first time in history; this is referred to as the arrival of the "Urban Millennium" or the 'tipping point'. In regard to future trends, it is estimated 93% of urban growth will occur in developing nations, with 80% of urban growth occurring in Asia and Africa.

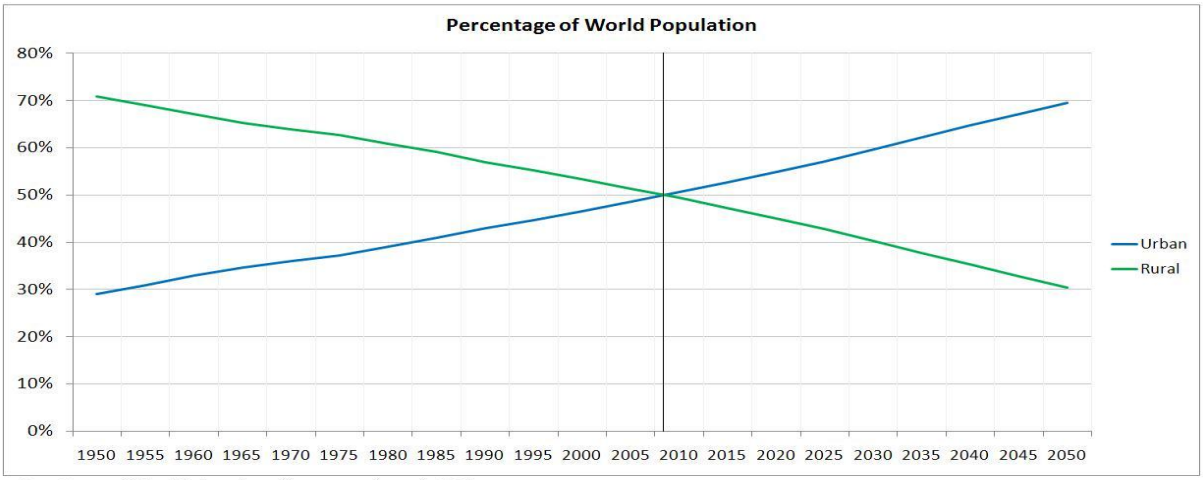
From 2007 to 2025, the annual rate of change of urban population is expected to be 2.27% (developing regions) and 0.49% (developed regions), as per a report by UN Habitat, year 2008. The result of such a phenomenon is that while some of the cities in the West are experiencing 'Shrinkage', others in the East are becoming 'Mega-cities' of the future. This causes problems in terms of infrastructure management and local governance.

The urban population in 2014 accounted for 54% of the total global population, up from 34% in 1960, and continues to grow. The urban population growth, in absolute numbers, is concentrated in the less developed regions of the world. It is estimated that by 2017, even in less developed countries, a majority of people will be living in urban areas.

The world's urban population is expected to surpass six billion by 2045. Much of the expected urban growth will take place in countries of the developing regions, particularly Africa. As a result, these countries will face numerous challenges in meeting the needs of their growing urban populations, including for housing, infrastructure, transportation, energy and employment, as well as for basic services such as education and health care. Managing urban areas has become one of the most important development challenges of the 21st century.

Thus such concerns have refocused attention on urban planning. The findings that show approximately 17% of the cities in the developing world are experiencing an annual growth rate of around 4% or more have lead to the growing concern of accommodating such population in the cities of the future. As, in many parts of the world old and conventional methods of Urban planning still exist, new methods of sustainable urban planning need to focus on Pro-poor dwelling developments, Improved resource utilization and better access to the local economies to reduce unemployment.

TABLE 1: RISE IN URBAN POPULATION



Data Source: United Nations, http://esa.un.org/unup/p2k0data.asp

Case (ethiopia):

Urbanization & Ethiopia:

In comparison to other African countries, Ethiopia has a low urbanization rate. According to the World Bank World Development Report (WDR) 2009, Sub-Sahara Africa is 30% urbanized, whereas Ethiopia is only 10.9% urbanized. Urbanization rates differ according to methodologies and data base utilized: the United Nations classifies Ethiopia as 14.9% urban, while the Central Statistical Agency of Ethiopia reports a 16% urbanization rate. But the contrasting picture is evident from the table below which shows the formation of many cities in the times to come and the widespread of urbanization in Ethiopia.

Table 2: Number of cities over 20 and 50 thousand people during the census years

	*Cities in 1984**		*Cities in 1994*		*Cities in 2007*	
Region	Over 20,000	Over 50,000	Over 20,000	Over 50,000	Over 20,000	Over 50,000
Tigray	1	1	5	1	10	3
Oromia	7	3	17	4	32	8
Amhara	5	3	7	3	18	7
SNNPR	4	0	7	1	18	5
Gambella	0	0	0	0	1	0
Benishangul - Gumuz	0	0	0	0	1	0
Harari	1	1	1	1	1	1
Dire Dawa	1	1	1	1	1	1
Addis Ababa	1	1	1	1	1	1
Somali	1	0	4	1	5	1
Afar	0	0	0	0	0	0
Total	**21**	**10**	**43**	**13**	**88**	**27**

* In 1984, Ethiopia considered Eritrea as a region of Ethiopia and reported Asmara (total population 281,110), Keren (26,339) and Assab (32,457) as Ethiopian cities over 20,000 population. We do not include those cities in this table.

Present master plan status & history:

For the better understanding of the present scenario let us analyze Addis Ababa's development from existence up to the present situation. The whole evolvement of Addis Ababa can be classified into various stages of developmental planning of the city as follows:

1. ORIGINAL SETTLEMENT: TAYTU'S ERA MASTER PLAN
2. THE ITALIAN TOWN PLANS
3. POST-LIBERATION TOWN PLANNING (BRITISH TOWN PLANNING PRACTICE)
4. THE FRENCH TOWN PLANNING EXPERIENCE
5. ADDIS ABABA'S MASTER PLANS DURING THE DERG PERIOD
6. THE ETHIO-ITALIAN MASTER PLAN (1986)

The different stages plans mentioned so far were loaded with alien planning ideologies, values and principles, which were not very relevant for the socio-economic and physical conditions of the city. Addis Ababa appears to be an experimental city where different planning ideologies have influenced its development throughout its entire history. These planning traditions ranged from Taytu's organic planning to modern town planning by some well-known planners such as Patrick Abercrombie. The political, socio-economic and the cultural set-ups under which these plans were formulated and implemented had a profound impact on the present morphology of the city. Even though Addis Ababa was assumed to be an indigenous city with no significant influence of colonial town planning, it can be argued that each of the planning practices discussed has left some imprints, which are visible, and evidence that the city has passed through diverse planning practices in the course of its socio-economic and physical development. Consequently, Addis Ababa seems to be a city with multiple identities inherited from the successive planning legacies which influenced its development in one way or another. In the following, I will discuss briefly the impacts of the planning practices and their significance in shaping the development of Addis Ababa.

As we know, the contemporary morphology of cities in developing countries is the outcome of the interaction between socio-economic and political factors within their physical and social environments. Devas (1993) argues that many developing countries' cities inherited their present form from colonial planning practices, indigenous settlements or from other developed countries' planning traditions which were dominant at the time for ideological or cultural reasons (Devas 1993). The indigenous planning practice of Addis Ababa, which has guided its development for more than three decades, has laid the foundation for the subsequent development of the city. The traditional feudal land allocation system has shaped the city in a way that its development is partly influenced by feudal spatial organization and space utilization. The names of some residential neighborhoods and buildings in the city, which are inherited from the feudal socio-economic structures, are still visible in the city as a living testimony.

The short-lived Italian occupation and its planning practice had also its influence in shaping the development of the city. The land use patterns in the Italian master plan showed the Italian ambition to introduce a colonial form of town planning. The plan which proposed the division of residential areas between native and European quarters, the creation of 'Merkato' as a market centre for the natives and Piazza centre for Italians, as well as the renaming of important places and streets with Italian names are some of the legacy of Italian planning practice. More importantly, Addis Ababa inherited some of its architectural styles from the colonial period.

The post-colonial British town planning also played a significant role in shaping the development pattern of many African cities. Even though it was a minor influence, the revised master plan of Sir Patrick Abercrombie also had impacts on the growth and the layout of the city. Unlike the Italian master plan, which was mainly based on racial and economic segregation, Abercrombie's master plan was based on creation of arterial roads, land use control, and the development and establishment of satellite towns. The ring roads and green belt, which were designed to control the growth of the city, were adopted exactly from Greater London planning practice (Fig. 5).

The French planning tradition also left its own imprint on the planning practices of Addis Ababa. L. de Marien's plan mainly reflected his planning experience in Paris 23through the formation of a north-south road axis between the railway station and municipal building (which faced each other) resembling Parisian broad avenues.

The Derg regime, inspired by socialist ideology, introduced a megalopolis planning concept which also had its own impact on the physical form and socio-economic development of the city. The aim of creating development poles and the extension of the city up to 100 km encouraged the expansion of the city along the major roads that link to the nearby towns. Addis Ababa showed significant linear expansion as its planning region is extended south-eastwards up to 100 km. Although the approach considers a region as a spatial planning unit, the plan had an influence only in some parts of Addis Ababa.

The Ethio-Italian master plan was praised as the most 'remarkable plan' with regard to its approach and scope. The plan gave due attention to some of the planning elements that were lacking in previous master plans. Regardless of its theoretical and technical feasibility, the master plan was not able to address the basic problems of the city, particularly regarding housing problems, poor sanitation and shortages of basic infrastructure. This was mainly due to the lengthy bureaucratic processes involved during the preparation and legal approval of the plan. The plan was legally endorsed after eight years of preparation. Unfortunately, the plan was outdated by the time of its implementation. Hence, the city was left to grow freely without any proper plan intervention. The Ethio-Italian master plan for Addis Ababa became irrelevant to guide the city in the context of the market economy, which the country adopted after 1991. This master plan also suffered from a lack of institutional set-up and legal framework for its proper

implementation. Since then, Addis Ababa has shown a tremendous growth and this happened in the absence of a timely responsive plan and institutional framework to guide its development.

Regardless of their partial implementation, all previous master plans had their own influence on the physical and socio-cultural developments of the city. In general, from a planning history perspective, all of the master plans guiding development in Addis Ababa for more than a century have influenced the growth of the city in one way or another. The diverse planning traditions and their intended objectives, as well as the ways in which the plans were implemented gave Addis Ababa the characteristics of other hybrid cities, which are manifested in the development and layout of present-day Addis Ababa.

Lesson Learned from the Past Master Plans of Addis Ababa

Apart from being documents in the municipality office, most of Addis Ababa's master plans did little to address the actual planning problems of the city. For most of its development history, Addis Ababa has grown without considerable economic development as well as competent institutional frameworks capable of providing basic urban services and monitoring the growth of the city. Yet a new plan was considered as a solution whereas the previous master plans had little influence on directing the physical and socio-economic development of the city. Urban planning and management involve a political decision in allocating resources for its citizens. Urban planning as part of decision-making processes mostly reflects the interests of the prevailing political system (Richard 1993).

The naturally endowed opportunities of Addis Ababa, together with its exposure to the experiences of many contemporary urban planners, could have been an advantage to creating the type of city imagined by Hennessy (1961). Unfortunately, the city has lost these opportunities because the plans guiding its development were not accompanied by the necessary legal framework and institutional capacity. The failures of these master plans to direct the city's development can be attributed to many factors. In conclusion, some of the major shortcomings of the plans are summarized as follows:

1. Most of the master plans proposed for Addis Ababa were comprehensive and future oriented rather than being relevant to the actual problems within a given time frame. In this regard, the master plans of Addis Ababa suffered from poor coordination and haphazard implementation. Most of the master plans were already outdated at the time of their legal endorsement. Most of the master plans proposed for Addis Ababa were already outpaced by the growth of the city before their actual implementation. Hence, their implementation was more problematic than solving the problem of the city. In the case of the Ethio-Italian master plan, full implementation was possible only by destroying and rebuilding 75% of the city's built-up areas (Dierig 1999).
2. Substituting one master plan with another was mistakenly perceived as a solution to the basic problems of the city since the problems required institutional and structural changes that bring efficiency and competency to enable effective implementation of the plans.

3. Despite having many planning proposals there were no attempts to learn from the successes and the failures of previous master plans. Most of the planning documents lacked critical evaluation of previous master plans' constraints, bottlenecks and shortcomings, which were the main causes of their failure. This was a result of lacking institutional memory (high turnover), which could be a lesson to learn from past mistakes. Therefore, the weaknesses of previous master plans have persisted in the new plan too.

4. Most of the previous master plans were biased in favor of the planners' own experiences and foreign values and estimation rather than grounded in research. Hence, such master plans overlooked the rapid population growth, limited resources, and poorly developed social and physical infrastructure.

5. For most of its development history, Addis Ababa lacked a clearly defined municipal boundary and the territorial jurisdiction for effective management of urban growth and services. More importantly, the municipality (which is responsible for managing the city) is not strong enough to coordinate the different urban sectors involved in implementation, monitoring and evaluation of development plans.

6. The time gap between the preparation of a master plan, its legal approval and subsequent implementation is a long process, which rendered previous plans outdated by the time of their approval. For this reason, the city has been expanding beyond its municipal boundary into subserviced and unplanned areas.

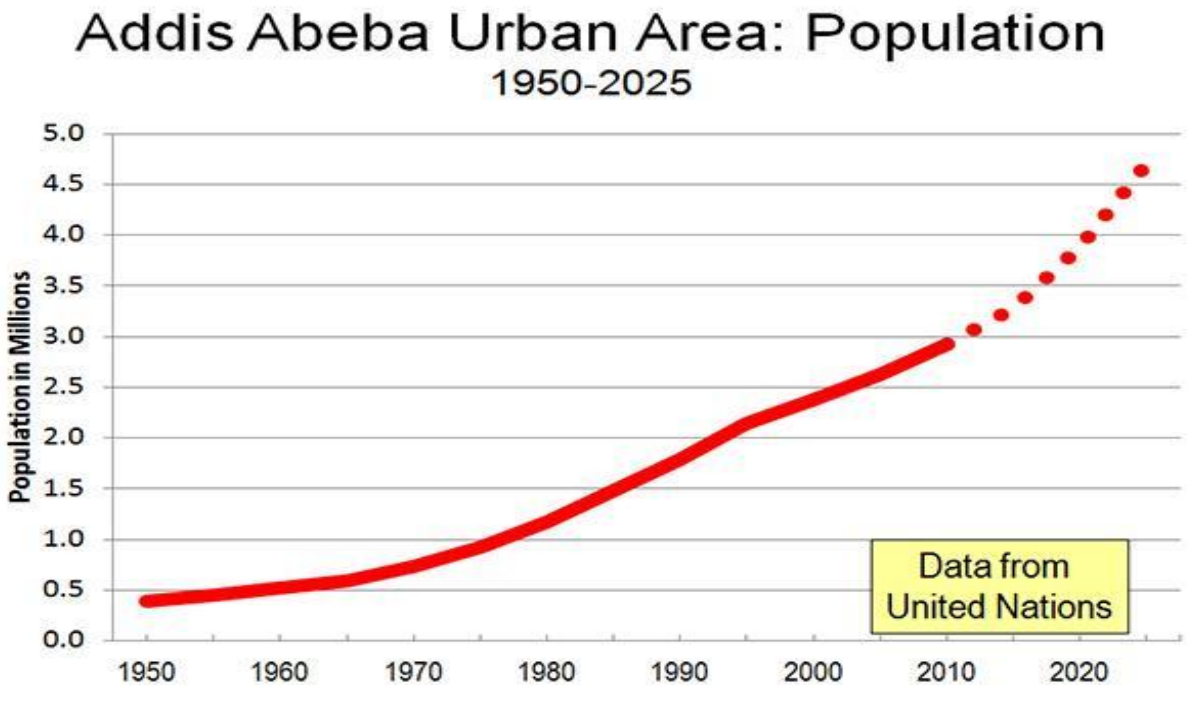


Figure 1

Conclusions derived:

1. Addis Ababa has always been a subject to haphazard development leading to improper distribution of infrastructure & services along with deficiency of basic human necessity of shelter.
2. No concrete measures have been devised till now to address the growing population of the city. Only the solution devised is upgrading and addition of infrastructure in the present situation.
3. In the race to develop the city much of the resources are lost in the expansion process in terms of demolition and reconstruction. This is not only leading to economical looses but also making the lives of the present citizens hard.
4. Addis Ababa in no case looks to be prepared to handle the present growth rate of around 4 % which is increasing year by year.
5. A new strategy of urban planning has to be devised in order to be timely prepared for the urban outburst that is going to take place in the coming decade.

Urban planning:

Urban planning (urban, merged urban regions, regional, city, and town planning) is a technicaland political process concerned with the use of land and design of the urban environment, including air and water and infrastructure passing into and out of urban areas such as transportation and distribution networks. Urban planning guides and ensures the orderly development of settlements and satellite communities which commute into and out of urban areas or share resources with it. It concerns itself with research and analysis, strategicthinking, architecture, urban design, public consultation, policy recommendations, implementation and management.

A plan can take a variety of forms including strategic plans, comprehensive plans, neighborhood plans, regulatory and incentive strategies, or historic preservation plans. Planners are often also responsible for enforcing the chosen policies.

The modern origins of urban planning lie in the movement for urban reform that arose as a reaction against the disorder of the industrial city in the mid-19th century. Urban planning can include urban renewal, by adapting urban planning methods to existing cities suffering from decline. Alternatively, it can concern the massive challenges associated with urban growth, particularly in the Global South.

In the late 20th century, the term sustainable development has come to represent an ideal outcome in the sum of all planning goal.

Brief history:

- Classical and Medieval Europe
- Renaissance Europe
- Enlightenment Europe
- Modern urban planning
  - Garden city movement
  - Urban planning profession
  - Modernism
  - New Towns
- Reaction
- New Urbanism
- Sustainable development and sustainability

Modular city design:

Introduction:

Modular city design methodology is a theory based on the study of earlier theories in

urban planning. Earlier theories in urban planning such as garden city, neighborhood planning etc. always represented the situation and solutions to overcome the present problems at that particular instance. My theory revolves on the fact that a problem has not only to be solved but as well as demolished from the coming future. Modular City Design Methodology is a humble effort towards the achievement of this goal.

Why Theory?

Although not useful on its own merits, theory is crucial in providing the needed frame of reference. The reliance on theory tends to provide organization to the field and a systematic guidance in cases of disagreements. It also provides a system of knowledge organization to clearly delineate the boundaries and parameters for each distinct subject, which provides a knowledgebase for the development of future research and the expansion of the field. With the help of theories, future research can build upon theories of the past that have been developed as a reaction against previous and existing planning thinking and practice. Otherwise, an intellectual community at a given time, not fully aware of what has been already done before, will always tend to start from scratch in their quest for new knowledge.

Why Planning Theory?

Planning is unique and its uniqueness stems partially from the inability to be defined in a single, narrow definition that fits it all. This is because planners are not a single entity that could fit into one category, nor can they fully agree on what planning really is. Rather, planners can vary across a continuum of interests, ranging from environmentalists and advocates, to even developers. These aspects of planning appear to differ, or even contradict each other, a great deal. For instance, environmentalists often clash with developers regarding issues pertinent to preserving the integrity of the environment. Although both sides theoretically agree on the principle of environmental protection, practical application almost always suggests otherwise. Recognizing the aforementioned difficulty in defining the field of planning, a number of reasons are identified to support the definition of a clear planning theory. First, the defining differences that strongly characterize planning personify an enduring tension, and sometimes an overlap, between planning and other disciplines. Due to the fact that there is no such thing as indigenous planning theory, planning tends to borrow ideas and principles from other practices, which caused confusion about the very purpose, role, and task of planning as a profession (Allmendinger, 2002). This trifecta of tension, overlap, and confusion, calls for the need to develop a sound and independent body of thought as planning theory. A well-defined planning theory is, therefore, an essential component of the planning profession.

The theory:

The absolutely creative and free mind may find this approach to city design a bit too constrictive, it has a few advantages over ad hoc and other building methods, and I'll discuss some of the pros and cons in the later part of this method.

Personally, I think Modular City Design (MCD) has an inherent beauty to it in the way that it builds larger and very complex structures out of very simple objects. It reminds me of when I was younger and sat on the floor building houses and spaceships with my Lego. Nowadays I'm an Architect and here modular design principles are so important that they govern every aspect of design.

So what is this MCD?

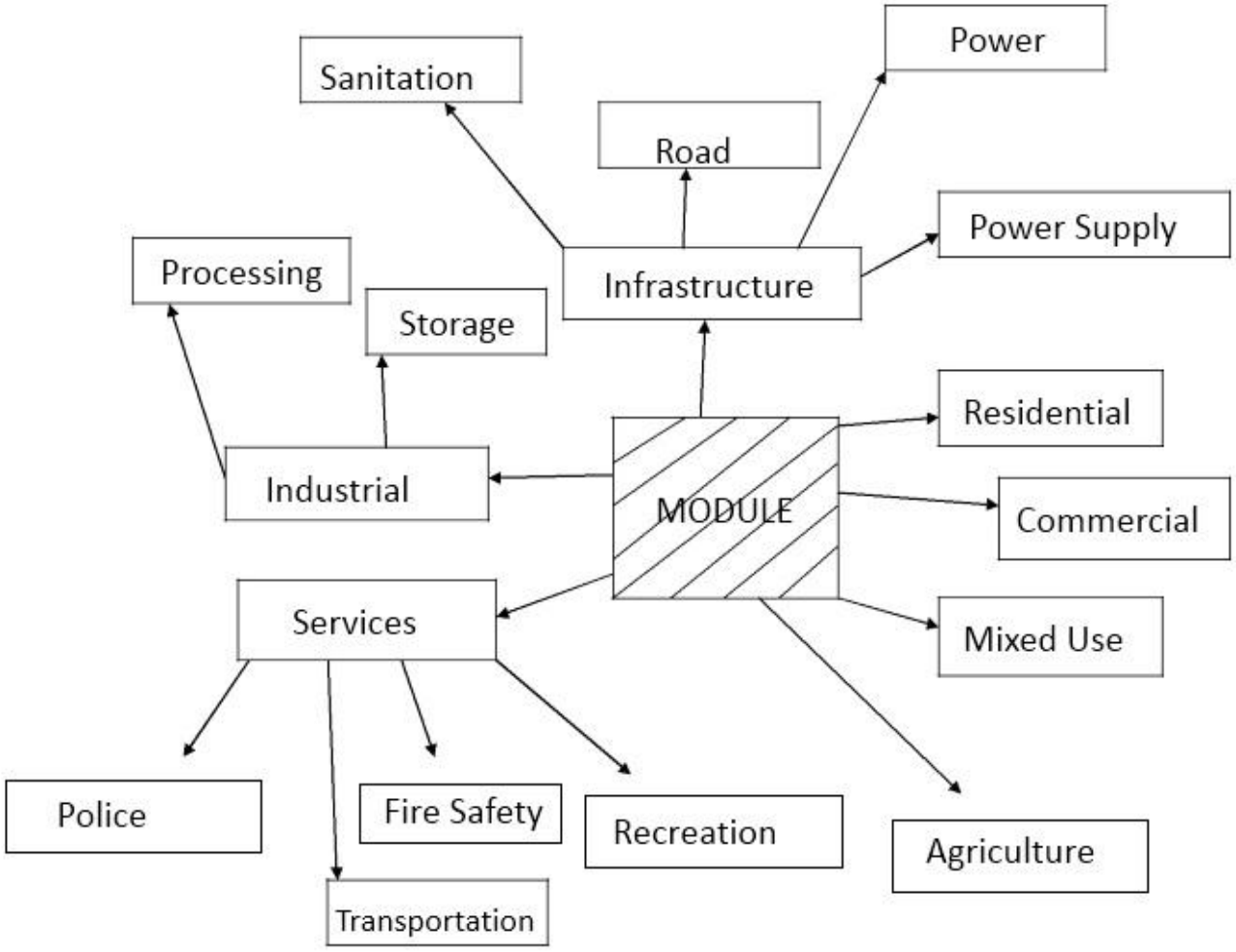
My first experience with city design was

simply overwhelming. So many things to do, so many things to take into account, it seemed to me that anyone who could build a good working city right away had to be some kind of genius. You start to mix housing, commerce and industry on the fly as needed and before you know it you have negative cash flow, pollution that even kills the rats and a riot gang knocking on the door of your hard-earned dwelling. Obviously, this doesn't work, so what do you do?

Let's assess the situation a bit. You've got a thing to construct (a city) and things to build it with (roads, the different types of zones etc. etc.). It might be worth wile to note that a city is a very complex thing indeed in terms of internal interactions while the basic building blocks are very, very simple. The situation is sketched below:

Roads, zones, basic buildings -> city

Let’s sketch out the basic idea of modularization in the below table:



In the above example the module consists of various factors which are essential to the formation of a self-sufficient city. There might be various other constrains, but let's take the above as an example. So each module consists of various smaller bits which are direct factors such as housing, industries, services, infrastructure etc. these smaller bits are termed as Basic Building Modules (BBM). These BBM in turn have subordinate functions required for its achievement. These subordinates are termed as Basic Building Blocks (BBB).

This is rather like constructing a house from individual bricks, pieces of furniture and different appliances. Things change if we consider a house to be built of rooms. Rooms can perform certain functions (a bathroom, a living room, a kitchen) and in assembling those rooms together we only have to consider these functions and not the actual contents of the rooms. We are free to change the layout of a room (without changing the rest of the house), provided we don't alter its

functionality, it is, as they say, abstracted away. And this is just the paradigm that can be useful in city design. In a sense, we introduce a new level of complexity: the basic building block. Now our scheme looks like this:

Roads, zones, basic buildings -> basic building blocks ->basic building module-> city

A basic building block is then a small, modular part of your city, which performs a

certain function, such as a living block, a commercial block with parks and a police station, etc. etc. The careful reader may interject that we have made the situation worse: Not only need we build a city, but we also have to come up with the basic building blocks. That means more work. And that's true. Designing good basic building blocks (BBB's) from scratch takes a lot of time, practice and experience. However, there are three points I'd like to make, that follow directly from modularity.

- You only have to design a basic building block once. After that you can use it as often as you like, even in other cities.
- If you have designed a city with a certain BBB, and after that you find a more efficient BBB which corresponds to the present needs and situation in terms of technology and other socio economic factors, all you have to change is the BBB in question (provided you don't alter its functionality).

So, in the long run, this approach saves time, especially in big developing countries where big changes occur all the time and careless planning are costing us dearly.

Now, how do we go about designing BBB's? I've identified three basic design principles which I shall discuss below:

Ideally,

- A BBB should implement certain functionality, and nothing less (encapsulation).
- A BBB should be self-sufficient (limited to terms of transportation & recreation).
- A BBB should not inherently impose any requirements on adjacent or any other BBB's (loose coupling).

These principles should be viewed as guidelines, not as strict requirements. I should like to add at this point that I use the term BBB both for the abstract object (i.e. its functionality) and a particular implementation. I hope this deliberate abuse of notation does not create confusion.

BBM are the major collectors that make a module and the guidelines to be followed are:

Encapsulation

What functionality should a BBM implement? This is one part where the study area comes. These encapsulation will be based on all the variables such as population, socio economic scenario, needs etc. for e.g., a living BBB, a commercial BBB and an industrial BBM will be few of the mandatory requisites. Taking this one step further, we could implement the three densities

light, medium and dense, or better yet, create a finer scale to better suit your evolving city's needs. Also, a City Services BBM would be workable, providing access to police, the fire department and health care services. One thing you have to keep in mind is that other BBB's need to use the functionality of this particular BBM, so you'll have to think about how they are going to get access to one another. You'll have to provide a means of interconnectivity or 'interface'. These can range from something as simple as putting a road around the block to more advanced methods such as a subway-station and should be a part of the BBM. This compromises the loose coupling design principle a bit, but it is the best we can do. Second of all, think of the encapsulated functionality as minimal functionality. That is, feel free to leave open some space in a BBB for other structures. If you decide to add a structure to it (such as a police station or a park) you won't have fundamentally changed its function, just augmented it. (If

you put a dishwasher in a kitchen it is still a kitchen, only more so). This is called extendibility.

Self-sufficiency

Ideally, a Module should be totally self-sufficient, which in turn also applies to BBM, but this is pushing it a bit. If a BBM self-sufficiency can be limited to needs of infrastructural supply rather than entities whereas a Module will be totally self-sufficient, it would have its own power station, its own water supply etc. etc., in other words, it would be a full-blown city. That is, to make sure the people can get from one module to another.

Loose coupling

This is the hardest principle to follow, yet failing to obey it in more than a mild way can have disastrous effects on the benefits which I have mentioned. But again, this is a guideline, not a law. For example, we have already met one factor which enhances the coupling, namely the interface. There is another more practical problem that compromises this principle too: size requirements. The BBB's have to fit together. If you want the BBB's to be interchangeable, they even have to have the same size! In the simplest case, you would choose a rectangle with a fixed size (say 9x9). But in a sense, you could also say that this is part of the interface.

The loose coupling should only apply to the particular implementation of a BBB, not to its functionality (though you might have a good idea what the implementation is given its functionality). For example, a living BBB depends on the presence of a commercial BBB and an industrial BBB, but it should not care what these BBB's look like inside (or maybe even whether they are light or dense).

The point I'd like to make is the looser the coupling, the more chance you will be able to freely plan for a bigger mega city.

Seeing the bigger picture

Once we have a certain set of BBB's we can begin to construct a Module from it. We can say that all we have to do now is to put the different functions that a healthy city must perform together in a sensible way. Learning to exploit the encapsulation is the biggest step towards using MCD. It also deals with complexity on another plane. If you, like me, implement the same level ofmodularity i.e. transport and recreation you don't have to worry anymore about these things and you can focus your attention on other more important issues. The loose coupling kicks in when your city's needs change or your city needs to harbor more people or industry.

Also, I'd like to say that MCD doesn't necessarily have to impose any symmetry-conditions on your city, but it can help, just let your imagination do the work.

Tangibility of MCD:

The theory of modular city design holds a highly effective ground because we can apply the theory to a small city, medium city and even to mega cities. In fact each Module can itself act as a city as well as each BBM can also act as a Module to make a city. In addition multiple self sufficient Module can create a Mega City. In case of Mega Cities the situation will be like identified by Patrick Geddes in his book “Cities In Evolution” as conurbation, but the scenario will be completely different as each Module will be self sufficient and interdependency of the modules will be negligible.

Also the same applies from the theory of neighborhood planning and garden cities which propagates the idea of modularization and construction of BBB which will be partially of fully self sufficient.

Below is a graphical illustration of the tangibility of MCD:

In case of creation of Mega Cities:

MODULE (A): Planned for a population

of existing 100,000 and added values up to 25 years.Note: the added values have to be limited considering the initial cost and maintenance cost.

This module will be complete self sufficient sustaining city in itself. As the time will pass and due to urbanization whenever the value of population will near to reach the maximum limit a new Module will be created.

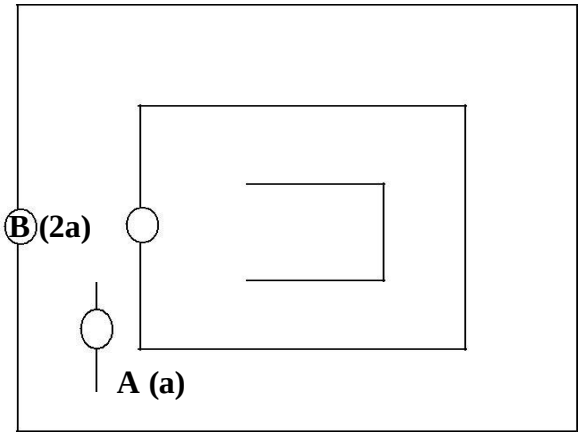
MODULE (B): This module will be planned according to the current rise and again will add upvalues up to the next 25 years rise. This Module in itself will be self sufficient and function like a city.

Furthermore again when Module B will come up to the brink of reaching maximum limit a new Module will be created and so on.

In the process of creation of these modules there has to be utter care taken to establish the multiplier in accordance to the population size which in turn can be applied to each and every BBB. That means there will be a continuous increment in the modules at every stage.

Each of these Modules will have loose couplings/interface BBM such as services, recreation etc. and these loose couplings will be the linking thread to turn each of these modules (which in itself is a city) as a mega city.

Diagrammatic representation:



Where,

A: Module A

B: Module B

C: Module C

: Coupling/ Interface

And a, 2a, 3a are the constants used to multiply the BBB.

In case of smaller cities:

In the case of smaller cities each BBM will function as a Module in itself and the BBB will act as the BBM and the smaller details will work as BBB. In this case also it works as the principles adhering to Module and BBM are the same. In smaller cities we add BBB according to the present needs and function as always a BBB will also have loose couplings.

Back to the drawing board

There are also naturally some disadvantages to MCD. I'll discuss some of them here. The first disadvantage is

that BBB's and an erratic landscape don't go well together. If you are one of those architects that just loves cities on a mountain or woven between an intricate networks of rivers, then MCD will be a tough option. It would just take too many BBB's to work properly. The ideal landscape for MCD is a flat countryside, void of rivers with maybe a sea at one side. I'm not saying it wouldn't be possible, just that it wouldn't be easy.

Second of all, the design of BBB's requires careful planning indeed, especially when it comes to self-sufficiency. Last, but certainly not least, is that using MCD slows down the development of your city in the early stages. It's more of a nuisance than a blessing when you're starting up, and the real benefits of MCD only come out at a later stage, where they most count. Because youplan so far ahead (using more roads for example than your city actually needs and leaving open spaces) the maintenance costs of your city will be a big problem if you are not careful.

To conclude

The keys to good MCD practice are:

- Identifying the different functions within a city
- Encapsulating them in well designed BBM's, paying attention to self-sufficiency, loose coupling and extendibility.
- Incorporating these BBM's into your Module in a sensible way, using the defined interfaces.

Some governing factors can be listed below:

1. In creation of mega cities these modules should be added in such a way that the city as a whole functions in to out and not out to in. For e.g. the first module designed in it is self sufficient with respect to the calculated users and any intruders will create a panic in this condition. Yes there will be a cushion to handle such intruders but it will be limited.
2. There are no factors which restricts the arrangement of these modules. It can be arranged radial, linear, concentric etc but always the interface or loose coupling on the first module will decide the further arrangement and expansion i.e. addition.
3. Application of MCD to a present scenario or problem will yield fewer results as compared to a newly creation or establishment of cities.
4. Successful implementation of MCD still largely depends on complete understandingof the established theories in Urban Planning.

One thing this document is a new theoretical approach to deal with the present urban explosion and solving the complexities of city design to create a city which in itself can last for few hundreds of year at least. Also the city will be free of chaos and all the people will live a healthy life. Theory still can't compete with imagination! I hope this gets at least someone excited. If someone has a city based on MCD, I'd love to see and hear about it.

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