In concern to transportation road angularity, it is necessary to account for each transportation pathway, including its:

1. Number of intersections. A roadway intersection is a point where two or more roads or streets meet or cross each other, allowing vehicles and pedestrians to transition between these different paths. Intersections are crucial parts of road networks where traffic flow needs to be managed efficiently and safely to prevent accidents and ensure smooth transportation. Note here that every intersection is a location of heightened potential for [danger for] collision (i.e., points of collision).
2. Number of intersecting pathways at each intersection. Intersections can vary in complexity, ranging from simple intersections with two roads meeting at right angles to more complex configurations involving multiple roads, lanes, traffic signals, signage, and sometimes roundabouts or traffic circles.
3. Number of types of transportation types intersecting at each intersection (e.g., heavy vehicles, light vehicles, pedestrians, etc.).
4. Number of continuous (circular roadways), and circular distances.
5. Number of straight roadways, and distances.
6. Number of roadways approximating a circle.

3.7 The network of cities

A.k.a., The cities network, the grid of cities, the city grid network, the city network, the geometric network of cities, the global network of cities, the global city network, the community-city network, the city-community network, networked cities, the city system, polycentric urban configurations.

A city network is a specific type of spatial structure formed through the combination of city agglomeration and connection within and between cities. (Ni, 2017) A community-type societal system is materially composed of a network of integrated city systems that operate together to create a unified, global habitat service system (i.e., a single, global economic/access system). In community, there exists a global network of cities (i.e., a global city network, or global cities network). In other words, said society materializes as a network of integrated city systems that operate through a unified, global habitat service system consisting of all the cities in the [community] network. Cities in community are set within an enormous, global city network connected by the various flows of information and materials.

It is important to clarify here the difference between a network of cities and a single city's internal network, both of which exist and are accounted for simultaneously in community:

1. Individual cities are laid out with their internals showing an internal city [transportation] grid (e.g., circular, square, octagonal, etc.). Here, each habitat service system is a functional node in the gird/network (because, it requires resources transported to and from it).
2. Individual cities are laid out on a geometric [transportation] grid to form a network of cities that share resources and people. Each city is a node in the network. The whole system is a socio-technical network of people and resources.

An analytical framework for a city network must account for:

1. Centrality (intra-city development) - the design and development of a single city; .
2. Inter-connection (inter-city development) - development and access between cities.

Note that the market-State defines a network of cities as two or more previously independent cities that work toward jurisdictional and/or economic "cooperation" to achieve faster and more reliable trade, transport and communications infrastructure. The evolution of cities in the market-State is toward a network of jurisdictionally interrelated cities that trade with one another (i.e., "trading cities"). (Batten, 1995)

INSIGHT: *A city inter- and intra-network can distribute the load of production [to the global community population].*

Further, in the market-State, State/jurisdictional relations and political situations determine whether there is a weak or strong socio-political connection between cities. Therein, global socio-political situations and changes play a significant part in the remodeling of cities, thereby affecting the jobs, wealth, mobility of occupying inhabitants (e.g., mass migration due to unrest in other geographic locations).

Cities in a community-cities network are unified under a single societal information system that standardizes the reconfiguration of common heritage resources into better and more optimal habitat service systems for optimal human fulfillment and ecological restoration. Herein, the network of city systems is represented by the Global Habitat Service System (a.k.a., a true global access system), followed by the local city systems, represented by the Local Habitat Service Systems. Simply, there is one global conception, model, and "digital twin" simulation of a service system for global design and accounting, and then, there are many locally customized [materialized] city expressions. Cities in a community-city network are both independent (in that they are self-integrated) and interdependent (in that they share access to resources and services). Cities in community are part of a global network of common heritage cities. Cities in the market-State are part of a nation of cities (federated State) that are networked by trade-based socio-technical relationships.

> **NOTE:** *The total material system of community operates as a united network of cities with shared, coordinated access to global resources and services.*

Generally, cities in community are laid out in a geometric grid-like manner. When viewed from above, cities in close proximity to one another in a community network of cities are often seen to be laid out in a geometric arrangement, wherein individual cities are located at the vertices ("points") of whatever shape the geometric grid of the arrangement takes. For example, cities could be laid out in a hexagonal-like grid structure with cities at each vertex of the repeating hexagonal shape, wherein the transportation network between cities is placed at the edges of the repeating hexagonal shape. In other words, when zooming out from an integrated city systems, there is a visible return to nature before a network of such cities appears in geometric formation, and possibly, clustered.

> **NOTE:** *Each city in the community network is part of a unified community [habitat service] system, and connected via a mass rapid transportation system.*

Frequently, the total global city network is divided to city clusters, wherein many cities are clustered in geometric proximity to one another. However, this clustering arrangement is highly dependent upon geographic region, with clustering not being possible in some geographic regions.

3.7.1 Fulfillment profiles

Cities in community could be viewed as "fulfillment centers". Therein, if "you" don't like a particular fulfillment center (i.e., a particular city, a local habitat), then there are other cities/habitat in the community network that may resonate more greatly with "your" fulfillment profile.

3.8 City expansion

> **INSIGHT:** *What is a tumor? A tumor is a growth untethered to the consequence of it growing; a growth for its own sake, otherwise known as a suburb. A suburb is a type of societal tumor.*

Society can expand its population density in several ways:

1. Strategically planned (community):
   A. By re-master planning an integrated local city system so that its capacity is larger.
   B. By build a new capacity planned city some distance away, and in an appropriate transport grid location.
2. Organically planned (market-State).
   A. By the State authority zoning (and re-zoning) of land for market-State functions.
   B. By the commercial buying and selling of land for profit and consumption.
   C. By the preserving of wild lands by the State.

Individual cities can grow in three ways:

1. **Outward** - expanding horizontally across the landscape (i.e., take up more land area; land area consumption).
2. **Upward and downward** - expanding vertically (or downward); as in, adding more above and/or below ground floors to buildings.
3. **Toward greater density** (a.k.a., densification, in-fill) - expanding interstitially (i.e., filling up every free space and reducing the space available for inhabitants); often the least pleasant for inhabitants.

Expansion of a city be held to the standards of a strategic community master plan, or it can be an organic process of market-State master planning.

Expansion of a city can take several forms:

1. **By master plan integration of the total grid/ layout:**
   A. **By individual city blocks that DO maintain a state of master planned integration with the whole city:**
      1. In the context of a circular master planned city. It is possible to re-master plan the whole city with additional circular sectors added after the current outer ring. Here, a city only adds a new outside sector, or changes an inside sector according to a re-master plan of the whole habitat.
   B. **By individual city blocks that DO NOT maintain a state of master planned integration with the whole city:**
      1. In the context of a circular market-State, organically developed city, then additional sectors after the outside perimeter will be added without strategic re-master planning of the whole habitat [to ensure optimized integration].
2. **By a city's modular shaped layout/grid expansion:**
   A. **Compacted circular sectors grid expansion** - new radial sectors are added to the next layer(s) of the original circular grid of the city.
   B. **Compacted circular modular grid expansion** - new circular areas are added to the gird with parallel transportation lines and with space

other than transportation in between.

C. **Compacted square modular grid expansion (a.k.a., rectilinear modular)** - new square areas are added to the gird without space other than transportation.
D. **Compacted hexagonal modular grid expansion (a.k.a., hexalinear modular)** - new hexagonal areas are added to the gird without space other than transportation.
E. **Non-compacted hexagonal modular grid (a.k.a., hexagon-triangle grid)** - new hexagons separated by triangle areas are added to the gird with parallel transportation lines and space other than transportation in between.

Simplistically, cities can be designed around [city] blocks of the same and/or different shapes, that form a grid. Cities can be designed as an integrated system, or not. Cities can be designed with a finite size in mind, or they can be "designed" to expand (continuously).

The market's solution to overcoming population congestions is, most often, to spread out horizontally. All early 21st century cities have done this (i.e., spread and sprawled outward), only to create more problems. Moreover, expansion is generally not uniform, making the problem of transportation even more complicated. This has come to be known as urban and sub-urban sprawl.

Cities in community are designed with a planned, specific carrying capacity. When a city hits a certain size, it stops and mostly thereafter, everything is allowed to return back to nature between this and the next city; there is no urban sprawl. The iterative design for a city in community is "organic" to the extent that new information evolves the system; but, its operation is planned, and so, there is no sprawl (i.e., no "suburb") or haphazard/chaotic development (as is the case with the "organic" development of nearly all prior cities).

INSIGHT: *To "suburbia" a society leads to the separation of the individual from a place of meaningful effort, meaningful relationships, and meaningful results. Do you live in a suburb? Is it considered acceptable to randomly hug your neighbour?*

Cities in community are not meant to be ever expanding, as is the case with early 21st century cities and suburbs. Instead, circular cities can be reconfigured internally, but the diameter is mostly fixed. Instead of expanding cities horizontally (i.e., over the surface medium they are built upon), a new city is created nearby and

Life Systems Hierarchy

Living Systems	Service Systems
Natural [Law] Systems	Physics (Universal Service)
Biosphere (Resource System)	Earth's Ecosystem Services
Human Made Systems	Human Contribution Service
Societal System	Societal Information Service
Social System	Conceptual-Physical Services
Decision System	
Material System	
Lifestyle System	
Habitat Service System Network	Application of Services
Habitat Service System Locals (cities)	Physical objects of service
Socio-Technical Services	Socio-Technical Services
Socio-Technical Products	Local Socio-Technical Services

Figure 12. *The societal life systems hierarchy of a community-type society. The left column contains systems that are dynamic and feed back into a total human life system. The service systems in the right column provide the informational and physical generations (material relationships) that complete human material requirements.*

connected by a transportation network so that nature is left between cities. Community cities can be iterated and updated internally, and also expanded vertically, but they are not intended to be expanded in surface area coverage.

It is true that squares can be more easily compacted [next to one another] than circles, but when designing city systems for community, beyond the perimeter of the city, the environment is allowed to return to wild [caretaken] nature. So, whereas a linear or squared city would just continue to add more blocks/modules [to itself]; instead, community would allow a return to nature prior to the creation of another [circular] city. Note that the one exception to this rule may be extreme desert environments where there is little to no life beyond the perimeter of the city.

> **NOTE:** *In community, we don't want indefinite [city, economic, or otherwise] expansion on our finite planet. In general, when a city reaches carrying capacity, another city will be built, separated by nature some calculated distance away from the prior.*

A city with square blocks can expand indefinitely by placing another block next to the prior, while a city with a single circular block cannot do so with compact geometric alignment. A circular city is one circular grid reducing to a central axis. Of course, if a circular city requires expansion for some reason, it is still possible to do so with geometric alignment by extending the city radially, segment by segment.

3.9 City layouts in community

A.k.a., City shape, urban pattern.

Most, though certainly not all, cities in community are of a circular arrangement (a.k.a., radial-concentric, ring-radial, circular radio-centric, or polar coordinate configuration) with the central area acting as a representative centerpiece of that particular city. There are non-circular cities, some of which are non-circular because the geography won't allow for a fully circular configuration. Cities aren't generally built on a flat surface, even planned cities have to work around natural features in the terrain; that is, to the degree to which the site has been appropriately selected and the terrain is capable of being modified. There are cities in community that take on a more rectilinear, octagonal, and linear form. There are also many cities in community that take on cellular block forms with the buildings in each block being toroidal (circular) in shape with the inner central area acting as natural green space. The circular city is simply a theoretically "optimal" design, local topography and geography will, in many cases, change the design slightly.

> **NOTE:** *Living organisms have bi-lateral symmetry. If the city is viewed as a living organism, then it may be designed with bi-lateral symmetry (i.e., city symmetry).*

The proposed circular configuration of many of the cities in community is not a just stylized architectural conceptualization. It is the result of reasoning and evidence into providing an environment that can best serve the needs of the inhabitants and conserve resources. The circular arrangement effectively permits the most sophisticated use of available resources and construction techniques with minimum expenditure of energy. The efficiency of the circular design allows us to make available to all people the most advanced amenities that our knowledge and energy can provide.

A circular city is most practically divided via pathways into areas known as [radial] sectors and circular belts (a.k.a. "circulars" or "rings"). The radial sectors (separated by pathways) are subdivided by circular belts (also separated by pathways), which extend outward from a central point, forming a widening circular grid structure. As the circle widens, more circular belts follow until the perimeter is reached wherein the environment is allowed to return to wild nature without any form of sprawl. In other words, these circular cities are composed of a central area beyond which the geometry takes the form of radial sectors and circular segments. In most configurations, there is a differentiation of primary functioning between belts (and sometimes within segments of a belt itself). In other words, each circular belt (and/or radial segment) maintains a particular set of functions, some of which will be unique to that circular belt and will give the belt its name. Other functions are shared between belts. The core function of the recreation belt, for example, is to provide recreational services and structures. Secondarily, however, the recreational belt maintains permacultural land and aquatic spaces for the growth of food and natural beauty. Although every circular belt will have a core identifying function, all belts are multi-functional.

There are a variety of reasons why a circular city scheme is more efficient than other city layouts. Firstly, when you start at one point on a circle, and move along that point, you eventually come back to the same point. When it's a linear city within which you are moving, you have to travel back again (i.e., backtrack) over the same area [instead of just going around). Hence, when traveling within a circular city someone could easily return to the same place from where they started without having to take the same route back, as is the case with most linear cities. Secondly, circular designs place frequently used facilities (mass transit, medical, and other common access locations) near the center. This puts most of the residential population very near (in time and space) to the city center, and ensures that travel throughout the city is relatively easy. Hence, no matter where you are in a circular city, you would be within a reasonable distance to access every facility the city has to offer. A circular shaped city ensures that no [access] point on the circle is ever further away than half the circumference of the circle itself, which is an important design consideration for emergency response. Conversely, a squared shape maintains that no point is further from another than the "Manhattan-distance" (i.e., the distance between two points, as 90° horizontal and vertical paths on a square grid; versus an acute diagonal(s) with a circular grid). Fourth, a planned circular design minimizes the length of all transportation and distribution lines (in comparison to a linear design) -- less to build, less to maintain, and hence, more efficient. Fifth, consider that a grid inside a circle would combine the advantages of best use of space with a most understandable addressing system. Of course, either a square grid or circular grid are better than a random or disorganized configuration. A circle, however, provides the most efficient form of infrastructural elements required for its outside perimeter. Only 1 shape of interlocking element is required over 2 shapes (straight and right angled) for a square. Sixth, the circular design allows for one "pie-like" sector of the city to be designed, and then replicated around the circle six to eight times (with slight adaptations for functional differentiation) to form the entire city. In the design and production of a circular city we work out 1/6th or 1/8th (for example) of the city system, and then we reproduce it around a central point. The replication of a radial sector around a central axis (returning to the original sector itself) uses fewer resources than conventional construction methods for linear cities. In market terminology, these cities are extremely cost efficient because only one radial sector needs to be designed, which can then be duplicated repeatedly and slightly versioned for the completion of an entire city. Seventh, a circular layout is easily replicated at different scales. These cities can be designed for a couple hundred people, or scaled up to population sizes of 100,000 or more. And finally, at least for this discussion, the circular arrangement is also a useful geometric design for mirroring natural symbiotic cultivation cycles. Circular symbiotic farming, for example, is often applied as part of the last circular belt of these cities.

In general, a well-designed and aesthetic circular city tends to feel more harmonious and open than its equivalent as a linear city. We do live on sphere (of sorts), and from a two dimensional perspective the planet upon

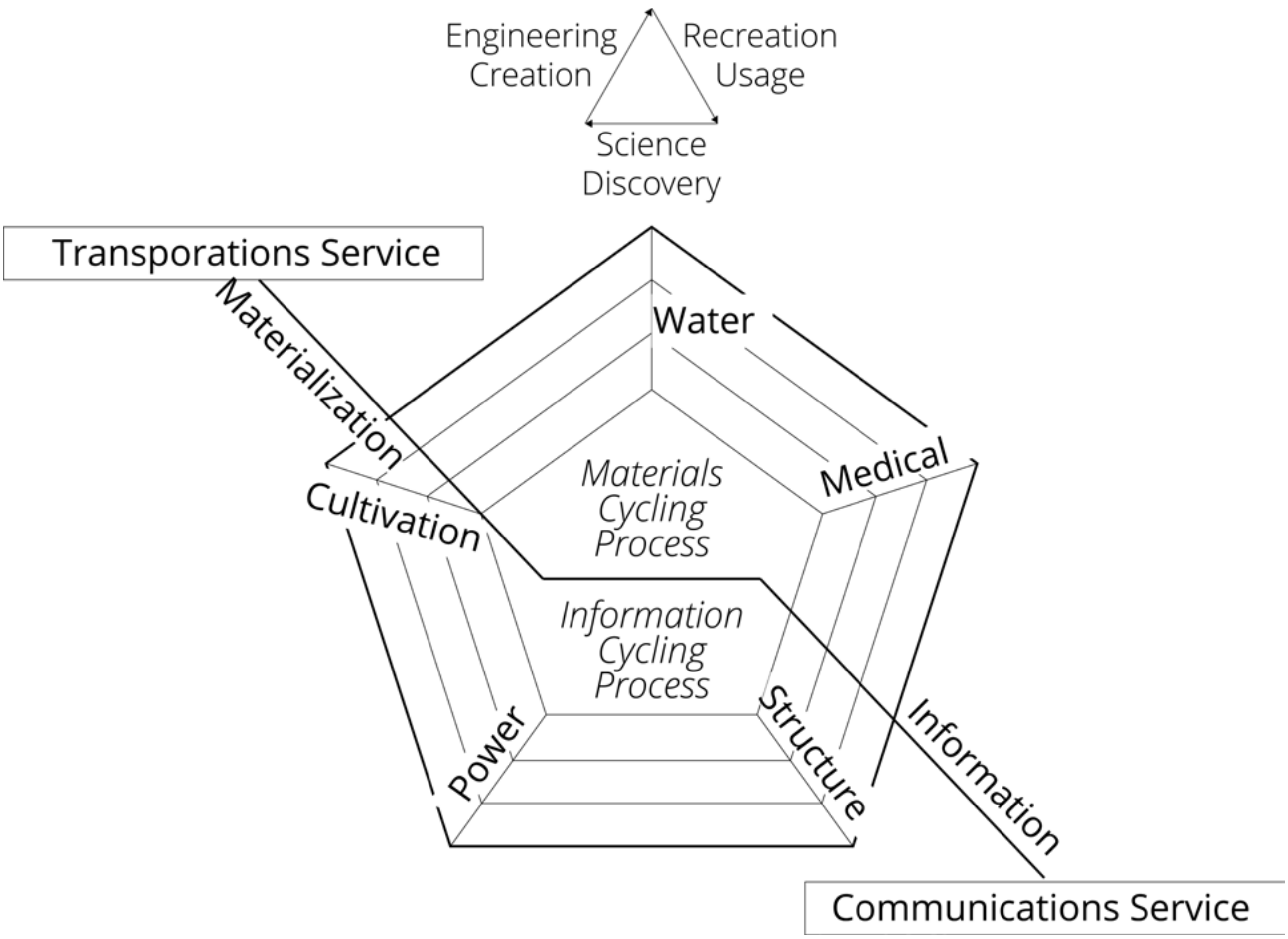

Figure 13. *Integration of life support and technological support into a model that produces the likelihood of societal structures of the informational and spatial order that sustain, and may even optimize, human fulfillment under dynamic and changing environmental conditions.*

which we live takes the shape of a circle. It may be further interesting to consider that our eyes, the stars in the sky, including our sun, and the moon are also all circular in shape. Even our galaxy has a circular symmetry. It may be interesting to consider that the motions of nature move in spheres and rings, and all cosmic bodies seem to move in spiralling arcs.

The round architectural shape of a circle provides a natural sense of unity. Historically, it has also been a practical form of defense against dangers coming in from all sides. Further, the circle is one of the emblematic tools to express one-ness in a visible environment. Corners break the non-hierarchy of unity. All planets and suns take the shape of a circle. There is clearly a connection between central planning (optimal socio-technical organization), the search for unity (optimal information organization, and the shape of a circle (optimal structural/geometric symmetry). (Delen, 2016)

The relative current scarcity of circular cities on the planet in the early 21st century can probably be explained by considering two causes. Firstly, the prerequisite for a circular city is a suitable geography (the natural factor) and a deliberate plan to continue city development along concentric lines (the human factor). Ideally, the round city is situated on a plane (or terrain modified environment) without significant natural obstructions. Such natural areas are common all over the world, but there are, nevertheless, very few circular cities that are built in those natural, ideal geographical areas. Hence, the absence of circular cities on a wider scale must have another reason, which is likely found in the human factor. It seems that people in power are not interested in the idea of circularity and its inherent neutrality. The combination of a strong government, which can implement ideas by force versus a non-hierarchical message of the circle-in-general is an dissonant one. Powerful governments, based on a vigorous application of law and order, are hardly ever the keepers of peaceful ideas. The main reason is, that otherwise they would not be in command. (Delen, 2016)

> *"The preference of the circle as an architectural feature is the result of a resistance and opposition against squareness. However, the circle is also – in a non-oppositional ambiance – the beginning (or end) of a path of insight." (Delen, 2016)*

The growth of most cities in the 21st century is the result of ad-hoc market and political decisions. The concentric design needs a deliberate planning in a fairly unprejudiced setting. Rapid urban developments have no time for the relative forethought of a circular configuration. Such types of city layouts only come into being under special (i.e., thoughtful) circumstances. (Delen, 2016)

Continuum approximation (CA) optimization models can be formulated and tested to design an optimal city-wide transit system with correlation to optimal city layout. Chen et al. (2015) used two models for comparison. Model 1 assumes that the city streets are laid out in ring-radial fashion. Model 2 assumes that the city streets form a square grid. Therein, Chen et al. assumed transit routes lie atop a city's street network. Model 1 allows the service frequency and the route spacing at a location to vary arbitrarily with the location's distance from the center. Model 2 also allows such variation but in the periphery only. Chen et al. (2015) shows how to solve these CA optimization problems numerically, and how the numerical results can be used to design actual systems. The results show that Model 1 is distinguished from Model 2 in that the former produces in all cases: (i) a much smaller central district, and (ii) a high frequency circular line on the outer edge of that central district. Parametric tests with all the scenarios further show that Model 1 is consistently more favorable to transit than Model 2. And, cost differences between the two designs are typically between 9% and 13%, but can top 21.5%. This is attributed to the manner in which ring-radial networks naturally concentrate passenger's shortest paths, and to the economies of demand concentration that transit exhibits. Thus, it appears that ring-radial street networks are better for transit than grids. (Chen et al., 2015)

3.9.1 Circular city naming

> *A.k.a., 2D Circular grid, radial grid/plot, polar grid/plot, hemisphere mesh, circular layout, circular or polar graph.*

A circular city has the following identifiable elements (Hakan, 2020):

1. **Circle** - a circle is the path traced out by a point, moving in a plane, that is always a fixed distance (the radius) from a fixed point (the centre).
2. **Center** – location of the grid origin, [point]
3. **Central area** - area of central most circle. The formula for the area (A) of a circle is:
    - $A = \pi r^2$
    - Wherein, A = Area; π = 3.14...; r = radius
4. **Inner** – The inner radius of the grid, [number]. Radius of inner circular sector.
5. **Outer** – radius of the grid, [number]. Radius of outer circular sector (radius of city boundary).
6. **Sectors** – sets the number of sector dividers, [array].
7. **Rings** (belts, circulars) – number of concentric dividers of the grid, [number].

The parts of a circle are (*The circle*, 2011):

1. **Radius** - A radius is any interval (or line segment) drawn from the centre of a given circle to any point on the circle is called a radius, (plural radii).
2. **Diameter** - A diameter is any interval joining two points on the circle and passing through the centre

is called the diameter of the circle.

3. **Semicircle** - A diameter divides the circle into two congruent parts. Each part is called a semicircle (2 total semicircles to a whole circle).
4. **Quadrants** - If a radius is drawn perpendicular to the diameter in a semicircle, there are two congruent quadrants (4 total quadrants to a whole circle).
5. **Sector** - Any two radii divide the circle into two pieces. Each piece is called a sector (from the Latin word secāre − to cut).
6. **Circumference** - The distance around a circle.

There are a variety of different layouts of circular city, including but not limited to:

1. **Concentric** - denoting circles, arcs, other shapes that share the same (com-) center.
2. **Overlapping** - denoting circles, ars, other shapes that overlap.

3.9.2 City construction

Cities can be constructed much faster when the construction technique uses a circular deployment method. This can take two forms:

1. Buildings themselves can be constructed in a circular manner, with the construction crane-like machine fixed to the center of the circle. The crane then assembles the building around itself.
2. Cities can be constructed sector by sector, with the circular arrangement again being the most efficient.

There are two basic ways to assemble a circular city (note that these two ways can be mixed):

1. Radially - radial segment by radial segment (i.e., radial sector by radial sector rotating around a fixed center point).
2. Circularly - circular belt by circular belt until the planned perimeter is met (i.e., sector-ring by sector-ring).

Note that if circular farming was used on the outer segmented belt during the city's phased construction, the soil base could be built up as the city was assembled (belt by belt) to its planned size. For example, originally the city may have only have three circular belts constructed with planned eight. The third circular belt of the initial construction could a circular farm, which would build up a soil base on that belt. When the next belt is added, the circular farming is moved to the fourth belt, and so on. This would obviously create a more lengthy time frame for the construction of said city, but the result would be a higher quality soil base for all belts where circular symbiotic farming was applied.

4 The life radius

A.k.a., The human life movement space.

A city is essentially a demarcated material 'life radius' within which a population sustainably controls environmental variables and optimize human fulfillment. Individuals spend the majority of their time in the same places, and that environment dictates how easy or difficult it is to make healthy life choices and express one's highest potentials. The term "life radius", itself, describes the space where a population spends the vast majority of their lives (~80 - 90%). To clarify exactly what a life radius is, someone might ask themselves, What are the places I walk to and through on a daily basis? In this life radius are the spaces and places frequented on a regular (e.g., daily/weekly) basis.

> **CLARIFICATION:** *A 'life radius' is a place where individuals spend approximately 90% of their current life.*

Everything that occurs within the life radius is considered to have an impact on everything else, making it possible for an aware population to control and optimize for their fulfillment within that life radius.. When individuals have to drive a car, that radius can be quite large. But, the ideal life radius is much smaller than city arrangements where cars are necessary. In community, cities are designed at a scale based upon the human being, and not the motorcar or some abstraction. To clarify exactly what a life radius is, someone might ask themselves, What are the places I walk to and through on a daily basis?

> **NOTE:** *Individuals [are likely to] entrain to their environment. If individuals live in a depressed environment, they are likely to be depressed (or, become desensitized to the depression). If individuals live in a happy environment they are likely to be happy, and become sensitive to the happiness of those around us.*

Community is designed in a people-oriented way. The average human being walks two kilometers in approximately twenty minutes. What if that two kilometer walk was beautiful, attractive, safe, enjoyable, and an individuals could meet their needs, contribute, and develop themselves, with others who are doing similarly. A bicycle extends the radius, or makes movement in the radius more efficient. Certainly, a bicycle or mass rapid transport system has a potential of extending what may otherwise be the ideal walking life radius. But, the point is that "you" want most of the things "you" are going to do, for some large percentage of "your" time, to be inside that radius. Having access to what is needed within a walkable radius is strongly correlated with well-being (happiness).

Think about your own life for a moment, where do you work, where are your friend's homes, your enriched gathering and relaxation spaces, and the locations that produce and distribute your material necessities? Of those key things that compose your life radius, how many can you access by foot or bicycle, and is the experience safe, comfortable, and enjoyable.

> **INSIGHT:** *It is possible to make the healthy and "right" choices the easy ones, with appropriate challenge and preference layered in.*

In community, the life radius is designed to:

1. Generate a social and economic decision structure, an environment, where it is it easier to get up and move, eat healthy, make new friends, find a reason for being, and live longer, more optimized lives.
2. Create an environment where people move naturally each day without thinking about it. Community makes it pleasant and enjoyable to leave ones dwelling and participate in activities.
3. Facilitate healthy food choices while bringing attention to foods that are more nutritious (and hence, flavorful).
4. Support personal interconnectivity—between individuals and community activities, teams, and groups.

> **INSIGHT:** *Historically, cities grew because more people move to them than died inside of them.*

4.1 *Moveability / walkability*

The more thought responsive the world becomes (due to technological automation), the less individuals technically have to move their bodies. And so, humanity might as well design its city environments so movement is intrinsic and facilitated.

4.1.1 Needs versus inculcated expectations

In concern to city design, the question must be asked, Do we need to drive anywhere in the city? Certainly a city population has a need for transportation (personal locomotion, mass locomotion, and emergency locomotion), but is there a need for transportation via cars within the city boundary. It is possible to design and plan a city environment so no one needs a car. It is possible to create walking garden cities where walking and biking are the primary form of movement, and where vehicles are used for emergencies, mass rapid transportation, scenic transportation, and automated distribution functions (e.g., delivery robots).

5 An example integrated city system

Generally speaking, at the level of the material architecture of a human community with a sufficiently large population, and access to digital information technology, are (primarily) circularly configured walking-garden cities. As we zoom out from one of these cities we see a branching network of cities, each separated by nature. Different cities in the network may display different functional configurations and architectural aesthetics, although they are all still based around a unified community information system. While many of the cities in the network would be circular, others may be linear, underground, or constructed as floating cities in the sea.

This example will first start with a description of the center of the city and work my way outward through the different circular belts. Take note that the stylized elements of buildings and areas in these cities can be customized to the preferred and traditional cultural aesthetics of the local geographic population. For example, buildings in a community-city in China, Japan, India, Europe, the Americas, Africa, or the Middle East may have stylized design elements traditional to those locales.

The following is a hypothetical example. Herein, the land area belts of the circular city are operationalized under the service of a habitat system for functional differentiation. Each belt is a spatial boundary allocated to a different functional service. Between the belts there are circular pathways, and positioned radially around the circle are radial pathways.

5.1.1 The central area

The first area of the circular city arrangement I would like to point out is the city's center; its central access point. Here in the center of one of these circular cities you may find medical care, conference centers, exhibition and art centers, and a whole host of other spaces where social interaction occurs. This central area may also be a transportation hub if the city includes a mass rapid transportation system. Note that if medical facilities are placed in the central hub, then you are never further away from receiving medical care than if you were in the same belt in another sector of the city, which is an important consideration for an active and playful population. And of course, under other city configurations the central area may not have any buildings, but instead it may be a garden for common gathering and natural beauty.

5.1.2 Permacultural gardens

Moving out from the central area, this configuration [we are imagining] has perma-cultural and aqua-cultural walking gardens and parks. These are beautiful landscapes organized for food cultivation and aesthetic relaxation. As you walk through them fresh food is available seasonally for harvest, and there is ground for playing and contemplation. A habitat with permacultural zones might include 'sectionally robotic cultures' designed to fully and autonomously cultivate, caretake, steward, and distribute food (Read: technological permaculture).

5.1.3 The habitat systems service sector (InterSystems Operations Sector)

The next circular belt out is mostly composed of buildings used for the completion of work relevant to the continuity of the entire city system (it is more commonly known as the InterSystems Operations Sector). These buildings house access hubs, maintenance and operations facilities, as well as research and production spaces. Here, we primarily complete work which updates and cycles services and technologies through the city. All belts are multi-functional, and so within these buildings there are also many common access spaces for a wide variety of technical- and creativity-oriented activities.

5.1.4 Recreational area

As we move away from the service belt we come to the recreational area, which has courts, gyms, and all of the games and recreational activities that people require, amongst beautiful terrain and landscaping. This belt has art centers, theatres, and various spaces for practice and entertainment. There may also dining facilities here, and other amenities.

5.1.5 Low-density house dwelling area

As we move outward, again, we come to the low-density dwelling and housing area where there are winding streams, ponds, waterfalls, and lovely gardens throughout, giving each dwelling a view of beauty and a feeling of being at restorative peace with the world. The residential area of the city continues the idea of coexisting harmoniously with nature. All of the houses are similar in their modern rounded design, but at the same time are very different. Their uniqueness is a reflection of the owner's personality and desired functioning of the home. The architectural elements of all dwellings are flexible and coherently arranged to best serve individual preference. The features of all dwellings in the city are selected by the occupants themselves.

In between every home are natural barriers like bushes and trees, isolating one from another with lush landscaping. So, people who prefer to live in houses and maintain gardens may prefer to live in this area.

5.1.6 High-density dwelling

The next belt we come to primarily functions for high-density dwelling. Its dwellings are for those who prefer apartments. The reason some people may want to live in an apartment is because the apartment buildings themselves have a large number of services built into the tower, providing immediate and close access for those who might want that sort of dwelling placement. People who choose to live in apartments may prefer a more socially dense dwelling arrangement. These dwellings are also above the ground, and so, they provide beautiful views of the city and the surrounding natural environment.

Secondarily, this belt maintains energy production systems, as well as lovely gardens and relaxed common gathering areas.

5.1.7 Water channels and controlled cultivation

Passing out of the high-density dwelling belt on our way to the outer ring of the city we come to the primary food cultivation belt in-between two water channels. On the food cultivation belt we organically grow a wide-variety of plant and insect species, both outdoor and inside greenhouses. Here, a beautiful walking and bicycling path encircling the entire belt. The primary function of this cultivation belt is to grow sufficient food for all the inhabitants of the city.

When looking at the water channels consider for a moment the wisdom of our ancestors in their choice to developed their living systems around a water source. Here, the waterways provide water storage, harvesting, irrigation, and purification. On the water channels there are water harvesting atmospheric generators with solar distillation units. These evaporative condensation systems are one means by which the city creates clean drinking water. And, at least one channel is always available for swimming. There may be other primary rings closer to the center where water management occurs.

5.1.8 A natural barrier

Just beyond the final waterway is a ring constructed as a geomorphic vegetation-barrier. It is designed to prevent ecological disruption to the inner city and purify environmental run-off from the next belt outward. The vegetation selected for this natural barrier will have a second purpose, it will be used for harvesting into food, textiles, and many other useful materials.

5.1.9 A circular holistic farming system

In this configuration the outer perimeter ring is [in part] a “circular farm”, a holistically planned grazing system also known by the names circular symbiotic cultivation, regenerative agriculture, rotational grazing, and syntropy farming. It is a biomimicry process that mirrors what occurs in nature. Here, the “farming” follows natural ecological cycles. This circular area is primarily a combination of pasture and orchard land that we move different animals through in a particular order to mimic natural cycles, which builds our soil base and provides food.

In this area there is grass between trees, and often, when left unchecked, the grass will grow up and choke out the tress (same with shrubs). Early 21st century society generally prevents this consequence by using a lawn mower. But, nature provides an alternative. Imagine running a number of different organisms around this circular ringed area. We send cattle through the orchard and let them mow down all the grass. And, as they go the cattle fertilize the tress. They deposit their waste, and then, trample it into the ground to create fertile, carbon rich soil. A few days after the cattle, we send the goats, who eat the shrubbery that the cattle wouldn’t necessarily eat. The goats also climb up and prune the bottom 6 feet of the trees. They also fertilize. Pigs are run through as left-over waste consumers. Then we send through the chickens in a mobile chicken coup. The chickens also fertilize the soil and eat all the bugs that hatch from the manure of the first two ruminants that went through. Chickens come in after the pigs have dug up big clumps of grass. They “cleaning out” the area and fertilize with their high nitrogen manure. So, at the least, we intentionally run 4 different animal species through this area, and as a result, we get multiple cultivations, we build up our soil base, and we have the opportunity to play a role in the well-being of other symbiotic species, while giving ourselves a picturesque environment to enjoy in a variety of fashions.

Among the circular farm, this ring may also be used for recreational activities such as biking, golfing, hiking and riding. Areas herein may be set aside for renewable, clean sources of energy, such as wind, solar, heat concentrating systems, geothermal, and others. There may also be large activity domes positioned around this ring if that is what the population of a particular city desires. Further, there could be lower-rise apartment type structures close to the outer edge for people who prefer apartments, but would like a more outdoors-type of living, close to where the city returns to wild nature. And finally, this outer perimeter could be considered another natural barrier, designed to prevent ecological disruption to the inner city.

5.1.10 Return to nature with care

Beyond the outer belt we allow the environment to return to nature, while still caretaking our total habitat. When a city reaches its planned size, we stop, and let everything go back to nature between this and the next city. There is no urban sprawl; mostly, we let everything return to nature between cities -- we let the environment return to its natural homeodynamic equilibrium. Out in nature we can wild food forage and re-learn the skills or our ancestors. Here, we ask ourselves, “What is it like to be just another animal in the wild?”

5.1.11 Wildlife preservations and corridors

Wildlife habitats, preservations and corridors, facilitate the restoration and preservation of natural ecologies, and provide many other useful functions, such as nature connection and education. A wildlife corridor, habitat corridor, or green corridor is an area of habitat connecting wildlife populations separated by human activities or structures. Simply, wildlife preservations are wild areas (which may still be caretaken by humans), where wildlife flourish and migrate. Wildlife corridors are purpose-built pathways that provide wildlife with the ability to travel safely from one separated habitat to another. Between cities in community there are many interconnecting wildlife preservations and corridors. Wild animals need to move to complete their life cycles.

5.1.12 Transportation

In concern to transportation, these cities generally contain two to four primary transportation gateways (i.e., entrances and exits). Few transportation gateways are needed for the city because of its efficient design. Transportation within the city and between cities is shared between autonomous transveyors, specialized electric motor vehicles, self-powered vehicles (e.g., bicycle), and mass rapid transporters (MRTs) – all in the form of emissions-free transport. The design of these cities removes the need for each individual (or family) to have a personal automobile. Of course, mostly, these cities are designed for walking. Some cities, however, are large enough to necessitate transveyors and/or an MRT system within their limits.

> **NOTE:** *With a population of over 7 billion people on the planet it is essential for us to merge our knowledge of nature with a fulfillment-orientation that can guide the things we do and the cities we create.*

6 Biophilic design

> *A.k.a., Biomimicry design.*

Biomimicry is the study of the function of biological structures. Biomimicry takes design guidance from nature. We are now beginning to remember that other organisms are doing things very similar to what we need to do in ways that have allowed them to live gracefully on this planet for billions of years. Herein, biophilic design is a concept used to refer to the connectivity of occupants with some form of natural (often, plant-populated) environment; generally, through the use of direct nature, indirect nature, and space and place conditions that reflect patterns found in nature (in the wild). Biophilic design is the creation of specific primitive objects and bio-mimiced patterns of connection within the built environment (reflective of nature order and complexity, as seen in the structure, dynamics and compositions of living organisms). Biophilic design is the practice of connecting people and nature within the built environment, within the habitat. Biophilia design principles suggests that human beings have evolved with certain basic aesthetic and physiological needs: the presence of vegetation, water, sunlight, animals, and also the geometric relationships that have accompanied human evolutionary experiences with these structures. Fundamentally, humans have positive physiological and psychological responses to natural environments encompassing aural, musculoskeletal, respiratory, circadian systems and overall physical comfort. Physiological responses triggered by connections with nature include relaxation of muscles, as well as lowering of diastolic blood pressure and stress hormone, among many other benefits.

> **INSIGHT:** *Whole habitats can be designed to reflect biophilic principles and shapes; the whole habitat is intuitive, inspirational, beautiful, functional and promoting of well-being.*

Leveraging the principles of biophilic design, which draws upon nature-inspired motifs and elements, offers a vast array of design opportunities that enable both creative expression and the fulfillment of human needs; because, it is what is still aesthetic to all, a non-objectionable aesthetic preference. This approach not only nurtures human well-being but also addresses the ecological requirements of the environment. Biophilic design involves the integration of Euclidean (geometric) and biomimetic (or biomorphic) forms and patterns into built-material designs, and aims to embed a nature-optimal representation of elements in the built environment. Such integration facilitates a seamless and functional connection between users and their surroundings, emulating the experience of engaging with the natural, evolving world. Research suggests that humans possess an inherent appreciation for beauty and may have a genetic inclination towards certain natural landscapes and vistas. Specifically, the preference for savanna-like environments, as theorized by Gordon Orians and Judith Heerwagen, illustrates how deep-seated affinities for particular ecosystems can influence design preferences at a macro-habitat level. (Orians, 1986) Visual preference research indicates that the preferred view is looking down a slope to a scene that includes copses of shade trees, flowering plants, calm non-threatening animals, indications of human habitation, and bodies of clean water (Orians & Heerwagen, 1992). This is often difficult to achieve in the built environment, particularly in already dense urban settings.

> **INSIGHT:** *Biophilic design is not a luxury, it's a necessity for our health and well-being; for global flourishing; a need for aesthetics. Bioohilic design (refers to intuitive beauty, intuitively beautiful spaces, and includes intuitive usage and the facilitation of flow within life).*

True, people have enormous varieties of experiences and tastes — and it's wonderful that they do — but these phenomena are generated by a common set of structural processes that are identifiable and shareable. Some experiences are unquestionably damaging to health and well-being, in the same way that, say, the structure of car exhaust molecules is damaging to health and well-being. It does no good to say our narrative about car exhaust is such and such, we want people to experience it and be provoked by it — that will not change the fact that we are making people unwell.

Doctors have learned that certain aspects of the patient environment promote well-being, and they now use this "evidence-based design" to improve the quality of life of their patients. In the same way, adaptive, human-scale architecture and urbanism rely upon discoverable rules of design. We proposed the existence of such rules while at the same time conjecturing that a non-adaptive aesthetic is easily reached from the adaptive design rules by simply reversing them. That is, since guidelines for designing adaptive, contextual environments are known instinctively, do the opposite to generate a form that strikes an observer by its visual novelty and lack of context.

> **INSIGHT:** *Awareness of a timeless language is present in people, but they learn to suppress it.*

Nature sees everything as a complex and continuous interaction where information is not separate from matter. Information has materiality, which has properties.'Digital materialization' refers to a two way conversion between matter and information. A system with the following four characteristics:

1. Symbolic - it has to be similar to the way we deal with other exact systems, like mathematics, or indeed, is mathematics itself.
2. Volumetric - it can't just be defining a 2.5D (a set of surfaces arranged in 3D space) it has to define at least 3D space, if not 4D.
3. Constructive - it needs to be modular; constructors must be able to work in chunks (e.g., like a Legos construction).
4. Continuous - it has to have continuous/infinite surface. can keep zooming in, you can keep going down to any resolution you want, you aren't limited.
5. Exact[ness] - the system has to have exact inputs and exact outputs.

It is possible to convert the built environment into one that reflects natural primitive geometric objects and living-organism object-patterns (in nature). Nature/ design of the biophilic space:

1. Visual connection with environment/nature.
    A. Via sight-line to object shapes, orientations, and compositions.
2. Non-visual connection with nature.
    A. Rhythmic sensory stimuli.
        1. Sound (frequency, auditory).
        2. Light (frequency, illumination).
        3. Thermal (temperature).
3. Non-rhythmic sensory stimuli.
    A. Skin touch (whole body, primarily, hands, haptic).
    B. Gas touch (nose, olfactory,).
    C. Food touch (stomach, gustatory).
    D. Water touch.
    E. Connection with natural systems via symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature.
4. Boundaries of objects in space.
    A. Thermal and airflow variability.
    B. Presence of water and flow or water.
    C. Presence of mineral materials.
    D. Presence of organic materials.
5. Presence of dynamic and diffuse sunlight, shadow, and artificial light after daytime.
6. Individual sense of discovery, prospect, mystery, learning spaces (e.g., workshop, lecture hall, laboratory). The promise of more information, of doing a play-type activity, and of practicing something enjoyable.
7. Individual refuge, restoration, privacy, recovery spaces (e.g., personal dwelling, private-common and scheduled full-service food x-themed facility, private scheduled park, etc.). place for withdrawal from environmental conditions or the main flow of activity, in which the individual is protected. Strong or routine connections with nature can provide opportunities for mental restoration, during which time physical and higher cognitive functions can take a break.

8. Social unfocused spaces (e.g., common open park, common garden, common plaza, etc.).
9. Social focused spaces (e.g., cafeteria, common climbing wall, workshop, etc.).
10. Risk/peril (e.g., racetrack, downhill ski track). An identifiable threat coupled with a reliable safeguard
11. Productive spaces (assembly and disassembly spaces).
12. Transport space interconnect space via a grid-layout.

INSIGHT: *Even small instances of connection with nature can be restorative.*

7 Well-being design

A.k.a., Design for human well-being and neuroscientific concern.

In the design of cities it is essential to use enhanced knowledge of the human experience and applied science as a basis for decisioning. It is important to design cities, and particularly, architecture therein, in a manner that accounts for the science around human well-being. For example, hospital designs are crucial to a patient's healing process. (Khuller, 2017) Only with a proper understanding of physiological and psychological factors, and a familiarity with available technologies, can decisions about habitat design be made for proper effect. City design in general, and architectural design in particular, can shape humans and their behaviors in ways that they don't realize, and yet, are highly predictable. Certainly, there are predictable emotional connections between humans and the architectural forms they build and surround themselves with. Architecture can get in the way and block, or alternatively, facilitate, individuals experiencing well-being from an environment.

INSIGHT: *We shape our cities and later our cities shape us.*

The perception of an environmental space is heavily influenced by individuals' different past experience and memories, which can result in a difference in perception and experience. However, research into integrated neuroscience and the built environment can reduce the variety of these perceived perceptions by ensuring that designs are tailored to the needs of human beings. Hence, to ensure that an environment facilitates well-being for its users, designs must account for human needs as well as their personal preferences. A lack of detail in specifying the needs and characteristics of a user population will likely lead to misalignment of city design and users' experience. To minimise this difference in perception, the relationship between the task and environment must be defined as specifically as possible. The science of human requirements as well as neuroscience provides the scientific basis for more informed design decisions.

"The bad formation of towns influence the bad formation of minds." (Pemberton, 1854)

8 Aesthetic design

INSIGHT: *There are places and environments that are just going to depress your heart rate variability.*

The human eye "likes things" in certain positions; it finds some positioning and proportioning more pleasing. Hence, community environments are often built in the proportion(s) of true beauty. Community developers often seek to create a sense of harmony and alignment with the pattered expression of nature in all space.

How the body relates to a space can be studied independently of what is going on in the mind (e.g., ergonomics), but how the mind engages space has to include the body and the brain of the individual. At the level of core, or basic, consciousness, humans are consciously and unconsciously registering the environmental variables' effects on their nervous system -- heat, light, noise, smells, tactile sensations, and a perception of movement and spatial orientation arising from stimuli within the body itself. All of these sensations are silently registering in the viscera as well as the somatosensory cortex via signals of which individuals are often not aware. At the level of extended consciousness, individuals are simultaneously experiencing space as assembled by their sensory system and combining this experience with memories of places similar to the one they are in. Individuals' minds are sorting through all of this to let them know they are dealing with a "reality". Part of the brain's internal environment is generated by a ceaseless pressure to seek out new stimuli. This is why humans are sometimes called "infovores", a term coined by neuroscientists Irving Biederman and Edward Vessel to mean a person who desires and seeks out information gathering. This hunger for information is one of the fundamental properties of the brain, and it is reflected in human individuals' most basic reactions (Biederman, 2006).

By understanding the biological basis for stress, we understand the potential for induced illness within a cognitive environment, as well as how to induce wellness. By understanding how lighting, acoustics, thermal conditions, and windows affect cognitive activity, we will have evidence for enriching the environment.

NOTE: *In Japan there is a term for the rejuvenation provided by being in nature. Shinrin-yoku, also known as "forest bathing" is a simple practice for enhancing health through sensory immersion in forests and other naturally healing environments.*

Parks and other green spaces make people happier, and the proof is in their brain activity. The understanding that nature-based environments facilitate health is the reason that walking in nature or a park is recommended for rehab patients and athletes in recovery. Nature also, perhaps, facilitates resource appreciation. Certainly, survival training facilitates an appreciation of resources.

INSIGHT: *Our environment has a profound impact on the way we feel and perform. We can create through cooperation and intelligence a micro environment inside nature that is supportive of us and our evolution.*

9 A habitat service system

A.k.a., A city service system, a city operation architecture, a city system, a metropolis service, a village service, a town service.

A city is a habitat service system, and a habitat service system is the materialized aspect of society. The material elements of a society exists within the material, physical environment. The location(s) where humans live and operate within this environment is referred to as a 'habitat'. A habitat (which is Latin for "it inhabits") is an ecological or environmental area that is inhabited by a particular species of animal, plant, or other type of organism. It is the natural environment in which an organism lives, or the physical environment that surrounds (influences and is utilized by) a species population 'habitat'. A habitat sustains a social population through the encoded recognition of a reciprocal interchange between that population and its material environmental reality. Fundamentally, a habitat service system coordinates the control and flow of material resources for human fulfillment. Effectively, cities/habitats are platforms for human material fulfilment and flourishing.

NOTE: *A city could be seen as the fundamental basis of a service platform (toolkit) that gives rise to kinds of civilization that human beings have thus far been able to create. In this sense, cities are the essence of civilization.*

A material environment can be restructured into "intentional" service environments. In other words, out of a common material environment, humans may cooperatively create an intentional habitat to service their common needs. The intentional output of these services systems is: freely and openly accessible services, goods and technical productions (i.e., "products").

Each specific habitat service system (or "service platform") acts as an organizational resource for the structured flow of energy and information (resources) into systems that by their very structure generate a higher potential state of existence within a commonly known environment. The habitat service systems structurally organize common resources toward the fulfillment of individual needs. It could be said that the habitat service system is a platform for the transforming of energy and information into a state that has a higher potential to "support a purpose" and "fulfill a need" [in response].

Herein, operational processes constitute the core functions of these systems and they represent the primary "value stream" (i.e., the end-to-end system process which delivers a service or "product" to an person, subject, or entity). A value stream is composed of a sequence of activities (and tasks) required to design, produce, distribute, and maintain a specific service, with all relevant accompanying information, materials, and knowingly desired conditions (i.e., values).

The habitat service system model represents the functional model of a city. A community city is, in part, a physical space where people, resource, and technologies mix to provide services through contribution-based teams to meet the fulfillment needs (requirements) of the human population. Therein, functions can be defined as the abstracted behavior of a city. Functions are described in terms of the logical flow of information, energy,

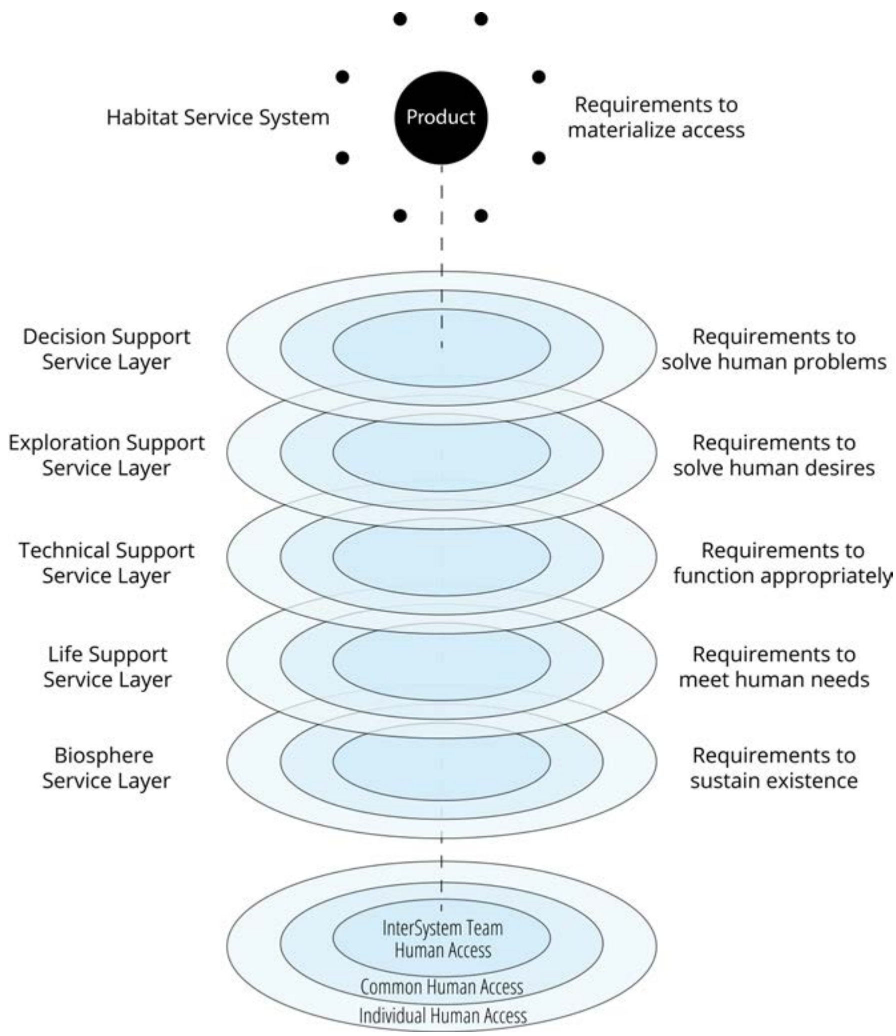

Figure 14. *The service layering of a unified societal system.*

materials and signals. Functions and sub-functions can correspond to well-defined basic operations on well-defined flows leading to a taxonomy of functions (*as described below*). The functional structure (or, functional architecture) of a city is a form of a conceptual model of the functional domain. A conceptual model of the functional domain is a qualitative representation of the physical behavior of the informational and physical (spatial) structuring of a city as well as the [global] city network within which any city resides. Therein, the physical structure in interaction with a physical environment gives rise to a city's behavior. Behaviors are related to structural-physical descriptions of a city. Behaviors are derived from city functions and their interaction with a material environment. (Stepandic, 2019)

The habitat service system conceptualizes and models the city as a series of homogeneous (Read: alike) and sorted layers, structured around the set of domains representational of human life; that of life support, technology support, and exploratory support. Categorization and taxonomy are important here, as the resulting model seeks functional simplification. These layers are composed of relatively homogeneous, sorted and ordered components, the product of earlier phases of sorting and cataloguing of human life [without the market or State]. Each layer is configured and sorted according to a particular function, that of life, technology, and exploration. Each of its layers is an articulation of a specific logic.

Here, the habitat service system (Read: city) operates through connected classification and taxonomy, not only providing an order but, beyond that, establishing an ontology: categories, attributes and subcategories are created and, in doing so, they create their very object of intervention. Here, reality is thought of as an integrated organizational language and applied stack-a popular way of conceptualizing protocols, data formats and software amongst engineers-ensures that each layer [of the stack] handles the same base information simultaneously, but at different levels of abstraction. Extrapolating 'stack thinking' to the city means that, in a highly hierarchical fashion, different urban systems (such as health, transport, energy or waste) are modelled and understood in the same way (Read: are operationalized together). (Marvin, 2017: 95)

The city is, in essence, subject to a form of modularization and categorization according to a set of predefined [human and ecological] criteria that are then reflected in the realization of a global habitat software and hardware (hybrid) system. In order to integrate city organization, standardization, modularization and classification are fundamental processes. Therein, city planning analysis is the process of breaking down the city into a multiplicity of objects and components.

A service bus is a scheme used in computing, software, and spacecraft development to refer to a transferring interface between mutually interacting components. There are two core service buses to the city, one an information bus (with a particular focus on decisioning) and the other a material [service] bus. These buses represent the core, center or platform around which the wider ecosystem is organized. Within the total ecology of the city there is a form of interlayering of networks, interfaces and data integration that are assembled and operated together in a [decision] control system positioned within the layers of the city. Thus, the city may be viewed, decomposed, as a series of event rules, a set of semantic models, and a set of work-flows that are supported by indicators, directives, and alerts.

The information system of the city uses analytics (data analytics, predictive systems, modelling and simulation) that are based on a set of societal standards for habitat service systems. The analytics generated by habitat data are then related to a set of visualizations, such as dashboards for current operations and future possible operations (i.e., planning). Data integration and gateways for flow control occur along a information service bus and within the information system itself, which brings into existence a real-time, real-world visualization (Read: model) of the operation (or, potential operation) of the system. This visualization can be viewed from several core perspectives, including that of the support services themselves, the software therein, and the hardware therein. Such a holistic view of the habitat as an integrated information and spatial (Read: material) system, where everything is a data point, allows for flexibility, efficiency, and optimization of the planning and operation of the environment for all inhabitants.

Within the city (Read: habitat service system) network, there is the ability to access data globally, as well as the need for modularity, interoperability, and transferability across [service] systems and cities. An yet, each city within the network is also a customized package of sub-services (or, sub-customizations of service) depending upon the unique circumstances of individual cities. Local issues enter the global city information network in the form of data. Therein, by combining data sets, cities may be reconfigured in a multiplicity of ways. Therein, cities maintain a central processing system (or, central processing unit, CPU) as part of their information support service, which processes not only local city information, but distributed information pertaining to the global city network, which from an information viewpoint is known as, the societal information system. The societal information system works on comprehensive design solutions that may be applied to any city in the network. This process of disaggregation is made possible by reconfiguring the components of the city into data blocks that can later on be worked with, recombined or reprocessed. The city is viewed, like the society itself, as an information system (an assemblage of data), which may be disassembled into its constituent parts as defined by the categories of any human-based habitat service system, and then unproblematically re-assembled into new more desirable configurations and flows. Therein, [habitat service] operational processes can be analyzed as data packages and reconfigured in a variety of custom ways. (Marvin, 2017: 98-99) This technique is sometimes given the term 'digitalization'; and, the logical computation of a digital (information) system for a city/habitat is often called, 'habitat computational logic' (a.k.a., city computational logic). Whereupon, the total logic of said environment for a operating system for the global habitat (a.k.a., habitat operating system or city operating system. In a global, technologically developed community-type society, computational logics have become ubiquitous, pervading every aspect of life.

> **INSIGHT:** *A comprehensive habitat systems approach recognizes that the fabric of the natural world, from human biology to the Earthly biosphere, to the electromagnetically gravitational arrangement of the universe itself, is one huge synergistically connected system, fully interlinked. Human cells connect to form organs, organs connect to form bodies, and since bodies cannot live without the Earthly resources of food, air, water and shelter, organisms are intrinsically connected to the Earth in each moment of breath.*

9.1 Societal access platforms

A.k.a., Mapping habitat service systems.

All societal-based platforms must account for a material system. When producing anything, access to objects must be accounted for. Access is necessary and two dimensional concept. Firstly, there is access to a team or working group through a contribution-based structure, and then, there is access to goods and service (without force of trade). Access can be accounted for many types of surveys including demand surveys, resource surveys, contribution surveys, etc. In the market, access is considered through the cost of a sale. In the State, access is acquired through authority. Humans require access to objects and information, which are composed into services. In a market, access is controlled by price, and the concept itself is mixed with "rights" (given by authority) and "property" (purchased in the market). In a community-type society, access

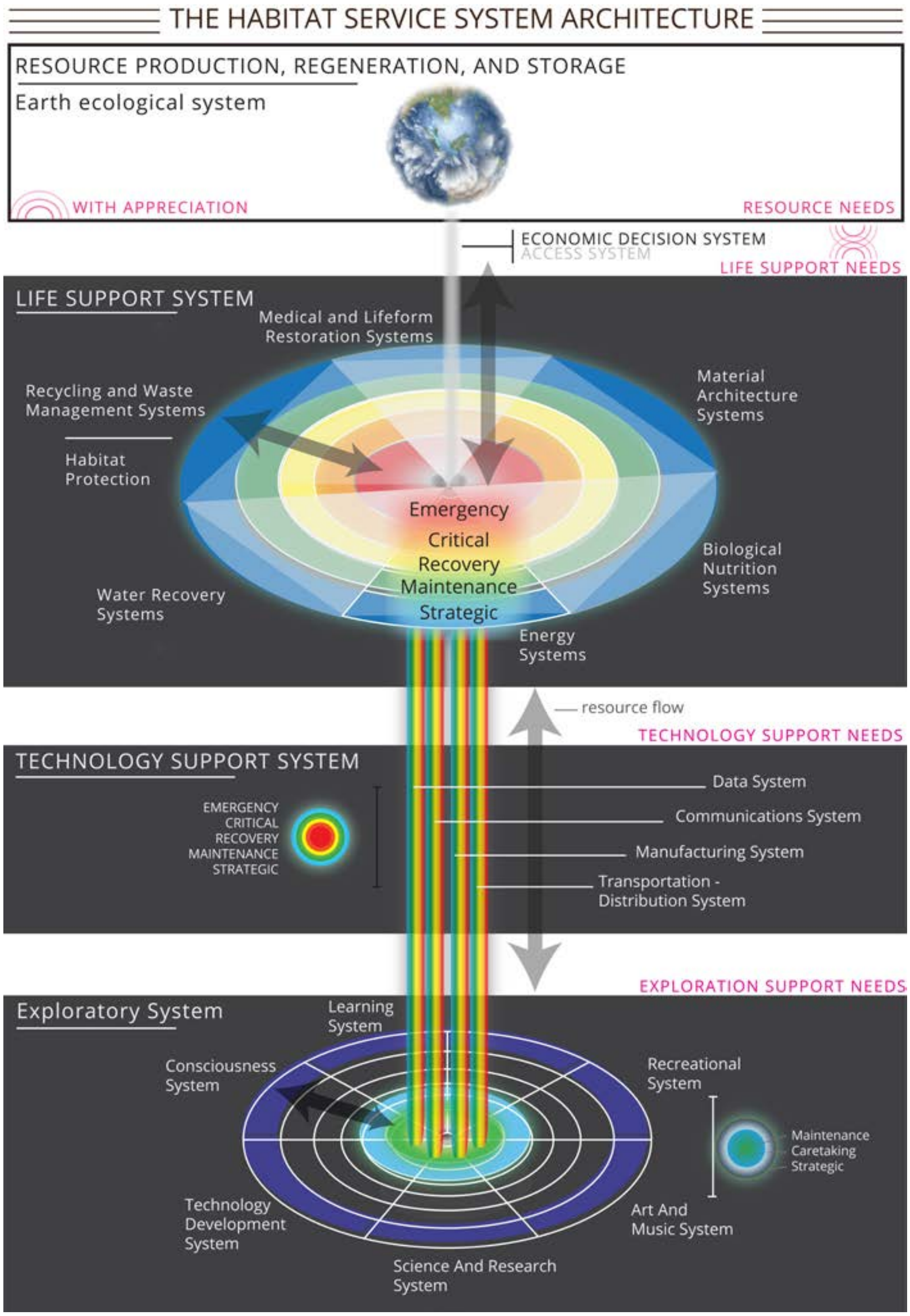

Figure 15. *The Habitat Service System Decomposed Layered Reference Model.*

refers to demands and other issues for service that are accessible to users. Ultimately, the goal is to have access to that which optimally meets user requirements (human needs) given that which is available at the time of access. In a community-type society, access centers and integrated transportation systems distribute products. Services are integrated, often modularly, into the infrastructure of the environment in order to optimize efficiency and produce a higher quality experience of access [to services] by a user. With sufficient technical knowledge and ability it is possible to apply automation technologies to increase the efficiency by which access occurs. Automation technologies can free individuals for access to opportunities they might otherwise not have had. Automation technologies can also make access to services, such as medical and informational more safe, reliable, and faster.

9.2 The habitat system states

> **NOTE:** *In nature, a 'structure' is a responding service. And herein also, the habitat service system is structurally designed as responding services (i.e., a service that responds appropriately to human need).*

In systems thinking the state of a system is a complete description of the system in terms of its condition, its parameters, its dynamics, values and variables, at a particular moment in time. This domain represents the formalized, existent structure of the community (the one actually operating or previously operating).

The Real World Community information system maintains a record of every known state of every system in the habitat. This includes both a model of the natural world, and a 'state model' of each service system. For every current habitat state, there is a past state that may or may not have been recorded, and there is a future state depicted by the solution to some material (habitat) decision inquiry.

There are three possible types of state for which the information system must account:

1. The **current state** of each habitat system (*quantitative* and *qualitative*).
2. The **past states** of each system of the habitat are identified as elements of the habitat's history (*quantitative* and *qualitative*).
3. The **future planned, predicted, and simulated states** that identify potential states as well as the next selected incremental state (*probabilistic*).

The 'past' represents a record of former re-structured iterations of the environmental habitat. A 'past state' represents a model of the prior state-dynamics of information, energy and services in our total environment.

The 'current state' space represents the current re-structured iteration of our environmental habitat -- the current state dynamic of information, energy and services (Read: the responding flow of resources) in the our total environment.

Individuals in community naturally seek the iterative improvement of their service system's trajectory toward greater states of human fulfillment. In other words, in community, our intention is to cooperatively create progressively more informed and fulfilling states of our habitat.

> **NOTE:** *It is useful to know where we have been so that we can intelligently design where we are going. Further, it is useful to simulate where we are going so that our likelihood of a safe arrival is more certain.*

9.3 A unified information system

An information system is a fundamental element of a socio-technical society, because it interconnects four fundamental environments: the social and technical spaces as well as the digital (virtual) and material environments, and formalized through signals and language systems allows different actors to interact with coherency and precision. These connections are important in the production of useful projects, designs, possibilities, and simulations that are likely to generate a stable and predictable environment [for human fulfillment]. By viewing society as an information system, it is possible to formalize intentions, perceptions, and physical space in a useful and intelligent manner.

Through a unified information model it is possible to fully account for the material environment, in particular, composition and location. When composition is accounted for, then it is possible can compute various functions of the same materials. With a referential database of materials and functions it is possible to identify probable service configurations - exploring probabilistically the way in which material resources can be transformed into productive goods and services, and then back into their basic material constituents, following a sustainable cycle. Humanity can then design different material configurations of its environment and simulate their engineered experience for optimal resolution of the current habitat.

9.4 A service system

> *A.k.a., A productive contribution system, a production system, a socio-economic system, an access [contribution] system, production, etc.*

Everything which has been technically constructed into the habitat may be said to have been engineered and integrated into that which is most often referred to as a "habitat service system". Service needs become engineering requirements for a specific **states** and **resource positions** of the material system. In its base form, a service is a process of doing something for and with others -- for human fulfillment and with an Intersystem Team contributing through a Contribution Service System. The primary productions of this Contribution Service System are a Societal Specification Standard and an operating Habitat Service System(s) based on the societal standard. The Habitat Service System is the first societal=level produced [material] service system.

A society necessarily includes material platforms for service. Society is a socio-technical system that must account for service in order for fulfillment to have meaning. Service is an enabling element in society; it enables productive, organized, repeatable, and motivated effort. Service can be accounted for through user and habitat surveys. In the market, service is sold. In the State, service is duty. In a community-type society, services are accounted for, contributed to, and operationalized. Cities are localized service systems. Services are operated by contributors for users. All services require information and objects, and

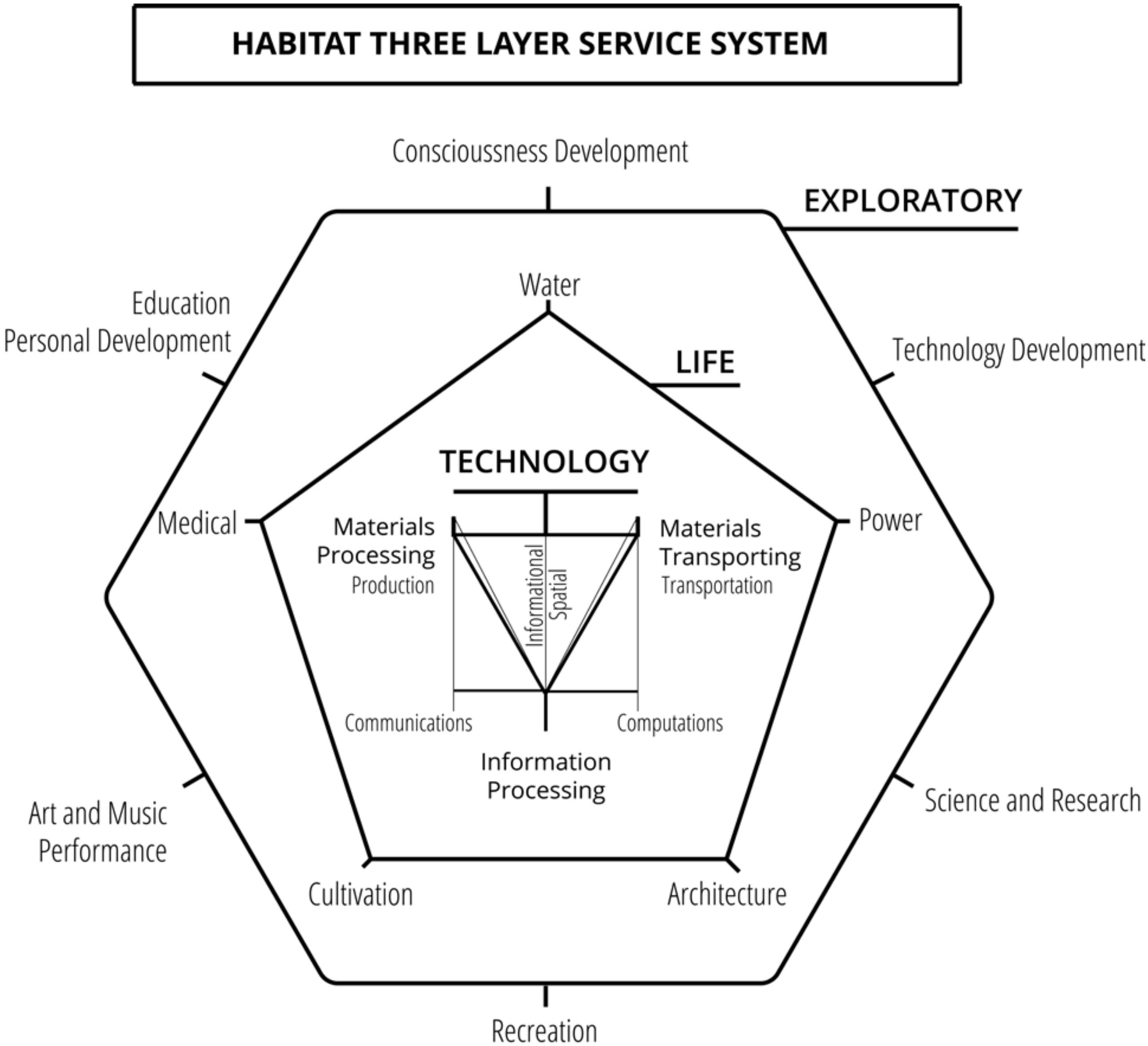

Figure 16. *This diagram shows a habitat service system's primary system classifications. Herein, the three axiomatic (fundamental) systems of a habitat service system (city) are: Life Support, Technology Support, and Exploratory Support. The sub-systems of each of these primary systems are identified: 5 Life sub-systems, 6 Exploratory sub-systems, and 4 Technology sub-system. These are the habitat service systems to which resources and effort can be allocated. It should be noted here that in its operation, by means of a contributing habitat service team, all habitat work is completed through InterSystem access coordination.*

therein, sufficient information and objects to result in a continuation of the service and satisfied users.

A service system is a complex socio-technical system. A service system is a configuration of technology and organizational networks designed to transform resources into objects that are delivered as services [through contribution] that satisfy the needs and preferences of their users. Needs are essential, of which the top level material categories are:

1. Life support needs are provided by a life support system.
2. Technology support needs are provided by a technology support system.
3. Exploratory needs are supported by an exploratory support system.

NOTE: *Societal service systems are socio-technical systems that have engineering requirements and performance requirements.*

Preferences (wants) are not essential and relate to the transformation of resources and environments that involve subjective preference. These are voted on, and votes are processed within a value inquiry processes which facilitates the design of the newly to be resolved habitat service system state.

The emphasis is placed on the co-operative characteristic of the act of service. Service is defined as the application of skills (knowledge and tools) to the benefit of others, suggesting that service is a agreement, commitment, and action between an individual (in the community) who is also a user (in the community) that has as a beneficial/useful result, thus meeting the Social System Standard value condition of 'Contribution'.

NOTE: *A service system is more broadly labeled as a service. In other words a service system that serves a population is a service itself (i.e., it is recursive).*

In a task-based systems oriented sense, service involves at least two entities, one applying competence [at completing tasks/objectives] and another integrating the applied competences with other resources ("value-co-creation") and determining benefit. These interacting entities may be called, service systems (or, a service system). In other words, the idea of a service system involves two entities with the following inputs, processes, and outputs:

1. [Contributor] The serving entity, doing tasks with objectives, apply effort and resources. The serving entity accounts for requirements.
2. [User] The serviced entity, receiving the benefit of applied competence, and realizing a fulfillment benefit. The service entity accounts for needs.

A service system is thus a system of interacting and interdependent parts (people, and shared resources, technologies, organizations, and information) that is oriented to accept contributions by meeting the needs of the same population; by servicing fulfillment through human service contribution. A Habitat Service System's construction and operation requires an Intersystem (inter-/mulit-disciplinary) approach. Service interactions occur within environments. In a community-type society, the habitat is the location in which most service interactions occur. The habitat may be sub-divided into local habitat service systems (Local HSS).

Here, service is of actual social and material value to everyone. In order to be of actual social and material value, service is realized through the value condition of 'cooperation' (a stabilizing value in the Value System detailed in the Social System) within macro-decisioning and macro-coordination. In this sense, the material service system is an extension of a human contribution-based service system; because, the humans contribute so that habitat service fulfillment continues through socio-technical [habitat] service systems.

Broadly speaking, service is the application of resources, including individual human resources (competences, skills, and knowledge) and shared phsyical and informational resources, to operate systems and make changes to systems that have fulfillment (Read:

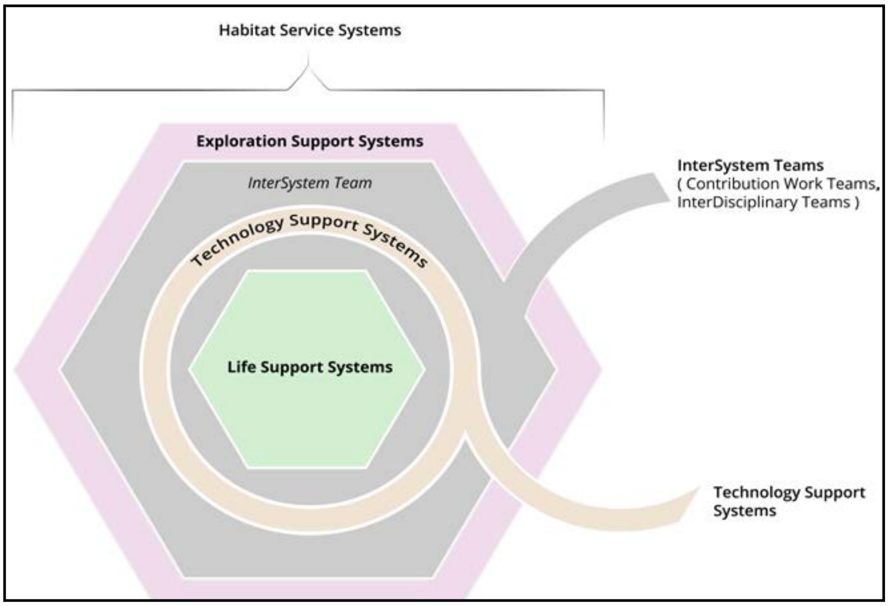

Figure 17. *The integration of technology into a habitat service platform for human fulfillment, involving (at least) life and exploration support.*

beneficial) objectives (i.e., "value") for another (system). Value is improvement in a system, or the fulfillment of an individual, as determined by a decision system or by the system's ability to fit an environment.

Service systems are made up of resources included within activities. The two primary resource types/activities are:

1. **Operant resources** that perform actions on other resources.
   A. Operant resources can act on other resources (including other operant resources) to create change.
2. **Operand resources** that are operated on.

NOTE: *Without an operant resource there is no service system.*

Determining which resources are operand and which are operant depends on the position and orientation of the system deciding it. A physical tool, such as a "hydraulic press", is an operant resource for the service production system, because in this case it that creates tablets out of a powdered chemical. In this case, the tablet is an operant resource, because it is used to clean dishes in a dishwasher. Additionally, the "hydraulic press" may be the operand resource for a member of the InterSystem Team or an [automated] habitat service sub-system (e.g., factory production service robot). Operant resources act on operand resources from the resolution iof a deciding service system.

Note here that human contribution is an operant resource and individuals must act to apply operand resource through, at the very least, a proposal for contribution that is agreed upon and committed to, and which leads to the fulfillment of all. A service system is a configuration of resources, and so, it is also a type of resource itself. In fact, it may be an operand resource for another service system. For example, life support is part of the habitat service system. (Spohrer et al., 2008)

Note here that the ability to share the supply of (i.e., "pool") resources across a set of combined service systems is an essential component of community operation. A cooperative of using contributors agree to share common resources, commonly produced and used tools, and common information to meet a set of fulfillment objectives defined as service system requirements. Sharing is advantageous for the overall service system.

It is possible to decide the engineering of and evaluation of a service system; and, this process is generally called, "utility". A service system that doesn't have utility is not useful to its users.

The worldview of [common] service-dominant logic stands in sharp contrast to the worldview of the property-dominant logic of the early 21st century, as it holds service - the application of competences and resources for benefit of others - rather than property by means of competition (predation), to be the fundamental basis of economic operation. Within the service-oriented worldview, it is suggested the axiomatic material abstraction is the service system, which is a configuration of people, technologies, information, and other resources that interact to create mutual fulfillment. When this happens at the city level, within a habitat(s), it is reasonably labeled a, habitat service system. Herein, humans contribute, necessarily, to the existence and persistence of a [habitat] service system.

As a system, the habitat service system may be decomposed to a set of primary habitat service sub-systems, each of which meets a unique primary category need of the population (e.g., life, technology, exploratory). In this context, the organizational view of a service system is sometimes known as service system mapping (although it has many other names).

Note here that many systems can be viewed as service systems, including families, cities, and working groups, among many others.

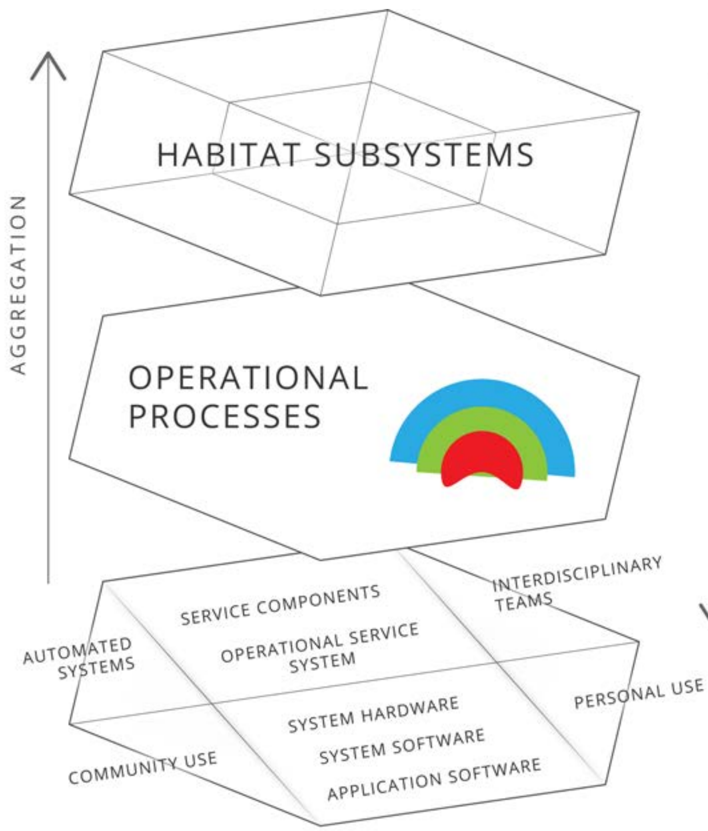

Figure 18. *High-level aggregation/decomposition layering of the Habitat Service Support System.*

9.5 Service system carrying capacity

NOTE: *Population problems have a horrible way of resolving themselves.*

Carrying capacity is a term that relates to the primary service systems in the habitat. Each service system has a capacity determined by its inputs, process, and outputs. The outputs of each service system are calculated to sufficiently fulfill the population, while providing a storage buffer for safety. For example, all cities will be designed with a buffer capacity for housing. Therein, something akin to 3-5% (*an estimate, accurate figures to be determined by decisioning*) of the dwelling will remain unoccupied. This allows for:

1. Expansion of the population,
2. Always available housing alternatives; and
3. Possible emergency housing in case of a disaster.

One might imagine 100% capacity as the most effective strategy for occupation of a locale, but in the context of survival in a larger ecology, a buffering strategy for occupation and usage of a service system is most efficient. Buffering means that there is a lessening or moderating of the impact of something. The buffering part of each service system provides access to resources and other materials in case of an unaccounted for demand or incident. When the precautionary principle is applied to habitat service functionality, then it means to have enough of something so that you have another one if the first one breaks or if more are immediately needed.

Businesses in the market prefer to operate their systems as close to full capacity (i.e., "peak capacity") as possible to maximize their revenues. In community, we design for service and ecological capacity, and we operate within that set capacity threshold with a buffer for risk. In community, there is no incentive to operate at peak capacity. Instead, service operations in community fluctuate directly with demand and participation - they are designed by the user, for the user.

It is also relevant to point out here that populations may actually begin migration within the city network, which may seasonally shift the population sizes of various community-cities.

Any service system may be reconfigured for a new function and capacity.

Allowing expansion sounds like a contradiction to total city design. We can duplicate cities, but to have them undergo expansion may be poor design and not even possible in a sustainable system.

In order to determine a structure's functional capacity, the following must be known (What is the functional capacity of a structure?):

1. What is the material composition of a structure?
2. What is its engineered configuration?
3. What is the functionality that it encodes?
4. What are the structure's interdependencies?
5. What is the affect of the structure on its environment?

9.6 Common habitat services

A.k.a., Common habitat service accounting.

Common habitat-type city services found in most cities in the early 21st century include, but are not limited to (note: this is a simplified list and is not intended to be a complete list of all services):

1. **Residential services:**
   A. Accommodation (a.k.a., housing).
   B. Eating and drinking.
   C. Clothing and accessories.
   D. Household and office supplies.
2. **Energy and power services:**
   A. Heating, ventilation and cooling (HVAC).
   B. Electricity.
   C. Water pressure.
3. **Cultivation services:**
   A. Food cultivation.
   B. Non-food materials cultivation (e.g., fiber and fuel).
   C. Nature and beauty (greenscapes).
4. **Food services:**
   A. Food preparation.
   B. Food storage.
   C. Food delivery.
   D. Food dining.
   E. Food cycling.
5. **Medical services:**
   A. Emergency medical care.
   B. Medical safety services.
   C. Medicines production.
   D. Life stage care.
6. **Waste removal services:**
   A. Waste separation.
   B. Waste removal.
   C. Waste processing and disposal.
7. **Construction/materialization services**
   A. Production (including extractive).
   B. Recycling.
   C. Maintenance and repair.
8. **Information services**
   A. Computing services.
   B. Data storage services.
   C. Software services.
9. **Education services:**
   A. Learning services.
   B. University services.
10. **Communications services.**
   A. Internet services.

11. **Production services:**
    A. Light production.
    B. Medium production.
    C. Heavy production.
12. **Transportation and distribution services:**
    A. Vehicle transport (including vehicles, stations, and infrastructure; road and rail).
    B. Walking transport infrastructure.
    C. Materials transport/distribution.
    D. Electrical transport/distribution.
    E. Materials storage.
    F. Access centers
13. **Recreational and creative expression services:**
    A. Bodies of water.
    B. Landscape features.
    C. Outdoor pursuits.
    D. Sports and entertainment.
    E. Sports complex.
    F. Art and music.
    G. Venues, stage and screen.
    H. Quite and contemplation pursuits.
    I. Botanical and zoological cultivation attractions.
14. **Science and research services.**
    A. Experimental research services.
15. **Technological development services.**
    A. Hardware development services
    B. Software development services.

City services in the market-State that are absent and/or replaced by community-type services include, but are not limited to:

1. **Commercial services (a.k.a., profit services):**
    A. Advertising and marketing.
    B. Consultancies.
    C. Contract services.
    D. Employment and career agencies (a.k.a., hire services).
    E. Financial services.
    F. Gambling (a.k.a., betting).
    G. Legal services (a.k.a., legal council, lawyers).
    H. Property services.
    I. Property storage services.
    J. Insurance services.
    K. Retail services (i.e., stores; e.g., grocery, drug,

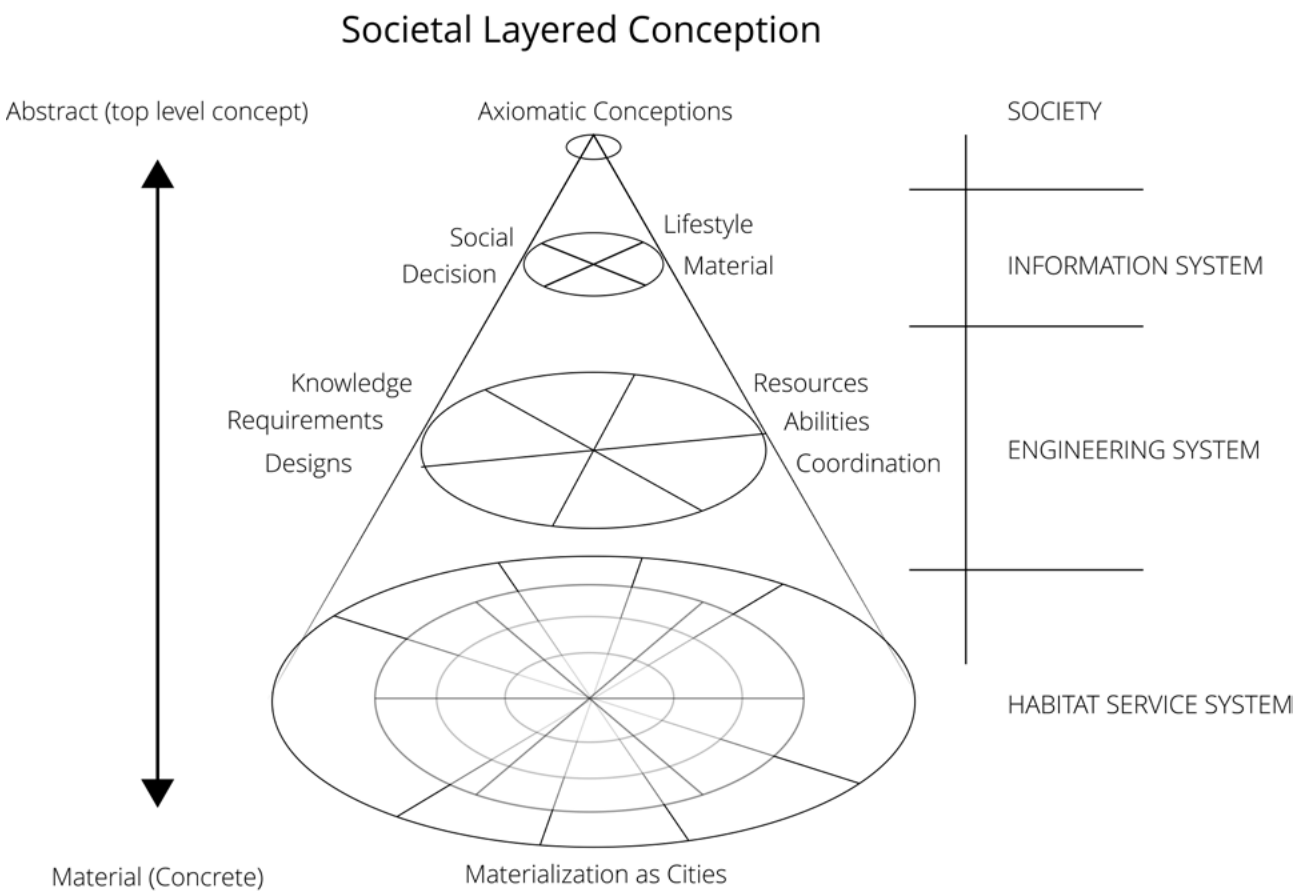

Figure 19. *The materialization of a society as a unified whole composed of a set of systems/dimensions representative of data (information processing), teamwork (the human effort), and physicality (the habitat operating system).*

clothing, convenience, technology, etc.).

L. Trade services (i.e., transaction services between a resident and a non-resident).

M. Private school services.

2. **Governmental services (a.k.a., State services):**
    A. Political services (a.k.a., politicians).
    B. Policing services.
    C. Court services.
    D. Prison services.
    E. Tax services.
    F. Military services.
    G. Public school services.

10 The service-oriented architecture of a habitat service system

INSIGHT: *In any architecture, energy can be spatially and temporally positioned within that architecture in a variety of ways. For example, oil, coal, natural gas, and nuclear are highly centralized providers of energy [as electricity]. Solar, wind, and to a lesser extent hydro, geo-thermal, and biomass, can be localised and provide the energy requirements of a community that seeks electrical generation at a distributed level. In either case, the energy derived therefrom could be laterally decentralized [in time and space] into a series of backup batteries.*

The Habitat Service System is an integrated system for servicing the fulfillment of the material needs, wants, and preferences of individuals in the community. This type of an integrated service system is also sometimes known as an “functionally integrated city system”; yet, it might be otherwise referred to as an “functionally integrated habitat system”. It is designed as a total “functional service platform” for the community in harmony with nature, existing within and through the habitat -- it is a part of the ecological habitat that we have formally and technologically redesigned to service our needs in a manner that is technically functional and commonly fulfilling.

When a group of people are living within the same community and sharing resources, the systems that support their lives together must be identified, operated, and optimized for the community’s very survival.

A basic consideration in the design of habitat service systems is that of dividing work (as effort and services) into reasonable and prioritized tasks and activities (as time and spatial differentiation), while giving simultaneous attention to coordinating these activities and unifying their organization into a meaningful whole (as integration) so that the system can adapt and re-orient where said response is desired.

The Habitat Service System is principally divided into four service sub-systems. These systems are connected to one another within the larger and more encompassing Real World Community information model. In their layered portrayal, they are seen with the decision system running through each of their layers. Each service architecture functions to fulfill a particular category of need (in a temporal and spatial manner). Each system in the habitat involves the nesting of subsystems that must operate together for the overall system to work effectively. The habitat is divided into services to users (concept), operational processes for production (concept), a physical habitat (object).

The core service-oriented functions of a habitat are (i.e., the habitat services are):

1. Life support (core intersystem team).
2. Technical support sub-composed of information & material (core intersystem team).
3. Exploratory support (core intersystem team).

The habitat's operational processes (for each habitat service system) are:

1. **Planning** (the project plan, strategic preservation processes):
   A. Planning standards.
   B. Planning habitats.
2. **Operating** (the service itself, including maintenance):
   A. Operating services (a.k.a., standard operations).
   B. Maintenance services (and re-configuring services; a.k.a., maintenance operations).
3. **Incident operations** (special operations):
   A. Recovery services (a.k.a., recovery operations).
   B. Critical incident services (a.k.a., critical incident operations).
   C. Emergency (a.k.a., emergency incident operations).

10.1 The simplified view of the habitat service sub-system

A habitat is the ecosystem we are dependent on, which we design in nature, and live in. Individual habitats are organized based on three primary service support systems: Life, Technology, and Exploratory. Life is life support, technology is technology support, and exploratory is exploratory support. This is similar to the way NASA organizes the service support systems of spaceships.

Firstly, the human needs can be mapped generally to three systems (and placed in a table where there are also measuring criteria, such as confidence, feeling, uncertainty, etc.):

1. B = Biospheric life (axiomatic materials).
   A. For example: Land, air, climate, sunlight, and an ecology.
2. S = Socio-technical (human hookup).
   A. For example: Socialization, affection, beautification, residentation, habitation, standardization, decision, contribution, education, leisure, common access, etc.
3. H = Habitational (ecological service hookup).
   A. For example: Life support, cultivation support, medical support, information technology support, etc.

The four global habitat service systems (a.k.a., socio-technological productions; the functional parameters of a habitat/city "hookup") are:

1. **The Resource Production, Regeneration and Storage System (planetary biosphere, ecological service support system)** - provides for the community's resource needs - the natural phenomenological environment, the planetary lifeground. Strategic preservation of the lifeground is a requirement for the continuation of all other service support systems. This is the planetary system itself.
2. **The Life Support (LS) System (LSS)** - provides for the community's life support needs. This system might be equivocated with the idea of "needs". Provides for material life support functions; the life support platform. This is the life-sustaining platform, including necessary infrastructure, for a population. This could be considered a social infrastructural system with a dedicated life function. The standard Life Support Service sub-systems are:
   A. Architecture system.
      1. Clothing system.
   B. Water system (a.k.a., water processing system).
   C. Atmospherics system (a.k.a., atmospherics/climactics processing system).
   D. Power system (a.k.a., energy system).
   E. Medical system (a.k.a., lifeform restoration system).
   F. Cultivation system.
      1. Nutrition/food system.
   G. Habitat defense system.
3. **The Technology Support (TS) System (TSS)** - provides for the community's technology support needs. This system might be equivocated with the idea of "wants". Proves for technology support functions; the technology support platform. The is the technical infrastructural system for a population. Note that this system is also sometimes called, the Infrastructure Support System (ISS). This system forms the basic infrastructure of the life and technology support systems. The standard Life Support Service sub-systems are:
   A. Information system (a.k.a., computer system, data system, data and information system, information storage and processing system).
   B. Production system (a.k.a., production and recycling system, materialization system).
      1. This includes materials recycling and waste services. This includes a mineral extraction system (a.k.a., mining system, mineral extraction processing).
   C. Transportation and distribution system.
   D. Communication system (a.k.a., signaling system, Internet system).
4. **The Exploratory Support (ES) System (ESS)** -

provides for the community's exploration (and therein, discovery, self-/social-development, and recreational) needs. This system might be equivocated with the idea of "preferences". Provides for self and social exploration functions; the exploration support platform. This is the self- and social-development platform, including necessary infrastructure, for a population. This could be considered a social infrastructural system with a dedicated exploration function. The standard exploratory support service sub-systems are:

A. Science and research system.
B. Technology development system.
C. Learning system (education system).
D. Recreational exploration system.
E. Consciousness exploration system.
F. Creative expression system (a.k.a., art and music system).

NOTE: *All habitat service systems provide the economic function of fulfilling human needs.*

Each of these systems represents a functional service, a platform, that has been separated out to meet the [frequency] needs of humanity using resources from the common environment. Essentially, these service systems differentiate the different functions that control the 'phenotypic expression' (to use a term from genetics) of a community. Fundamentally, a functional approach allows for the identification of root concerns and the implementation of systemic solutions. Here, each service produces something useful to other services and/or final users. The question then becomes, What is the demand by all sectors of the habitat for the product(s) of any given habitat service? What is the target demand that production ought to meet?

The primary four functional service systems are each sub-composed of a further set of functional sub-systems. These subsystems exist to meet the ongoing and delineated functional requirements of each of the four primary categories of need (Read: ecological services have needs, and humans have life, technology, and exploratory support needs). These sub-service systems fulfill needs by generating [responsive] access to technical production services. Wherein, for instance, the Life Support System is sub-composed of six systems, each of which transfers energy and resources into a particular category of good or service designed to meet the ongoing functional life support needs of individuals in the community. Essentially, these service sub-systems sustain the functioning of the community and are permanent structural elements of the Habitat system. They exist as long as our need for them exists.

All service systems act independently as well as interdependently - they follow dynamic, distributed systems principles - they are centralized and decentralized. It is inaccurate to label them as centralized *or* decentralized, as one or the other. Most issues involve a spectrum of subsystem requirements, and therefore, necessitate the involvement of distributed multi-system effort (i.e., multiple systems acting together to meet a need or accomplish a purpose).

Each sub-system may be seen not only as an area of service, but also an area of inquiry. As such, the word "science" is sometimes appended to the end of the name of each system. For example, "water recovery sciences" or "biological health sciences", and so forth.

NOTE: *Habitat service subsystems have standard operating procedures (SOPs). Lke all socio-technical systems that operate for coordinating human need fulfillment, there are standards, and therein, operating procedures.*

In concern to measurement of the community system as a whole:

1. These functional processing systems are a measure of the technical efficiency of the community.
2. The alignment of these systems with the community's current understandings and technological development is a measurement (indirectly) of the technological age of the community
3. The functioning of these systems are [in part] a measure of the technical resiliency and health of the community.

Issues of greater urgency and those of a strategic nature are more likely to involve multiple system interdependencies, and are sought resolution through an interdisciplinary systems approach (i.e., a systematic solution orientation). In particular, "urgent" issues have the potential of impacting the stability of service systems, and therefore, they require rapid response and a high degree of systems-level coordination. Similarly, "strategic issues" involve the planning of future states of a the total habitat system, and therefore, coordination among systems is relevant. "Operations and maintenance" issues assume a more direct and targeted approach by individual sub-systems, and they have fewer interdependencies; although, it does occur that some maintenance issues involve multiple systems.

The Life Support and Technology Support Systems represent the Habitat's core service systems. The Exploratory Service System is one of the four primary Habitat systems, but it is not a "core system"; it is a secondary system because it relies on outputs of the two core systems to maintain its existence. The Exploratory system exists because:

1. The critical life support needs of individuals in the community are sufficiently fulfilled (i.e., the Life Support System is functionally operational), and
2. The Technology Support Service System's is functioning at a sufficient threshold to then begin

meeting the needs of the Exploratory Service System optimally (i.e., The Technology Support System is functionally fully operational, because it is optimally meeting the needs of both life support service and the exploratory support service).

Thus, exploratory system issues are prioritized after the critical requirements of the Life Support and Technology Support Systems, for if they fail then every system "downstream" will fail also.

Here, functional community design relates an individual organisms resilience to the resiliency of the community as the ability resist illness, the ability to resist injury, the ability repair, the ability to reproduce, to have movement, to generate energy, and to direct energy into a functional state rather than just lose energy to the universe.

10.1.1 The Resource Production, Regeneration And Storage System

A.k.a., The natural environmental domain, the world, the planet, the ecological service support system, the life-ground, the Earth's ecological system, the ecology, the biosphere.

Necessarily, a society must construct in, and account for, its environment, continuously. The Resource Production, Regeneration, and Storage System is the natural [planetary and solar] environment; it is the world that creates (or "has created") all of the resources humanity has access to; it provides for humanity's resource needs, including the production, regeneration, recycling, and storage of resources. The natural environment is the material basis for human survival and socio-economic (socio-technical) development; it is the environment from which humanity acquires resources, discovers knowledge, and into which the material systems of a society (i.e., the habitat service systems) are produced and integrated. Fundamentally, the natural world provides for humanity's resource needs and life experience.

This is the natural substructure of society, without which the rest of the structure could not be built. It consists of a land and its resources, including but not limited to: meteorological characteristics, topographical features, minerals, fauna, and flora. The planet is ultimately where all resources that humanity has temporarily accessed return to, after they are used, or when access is no longer required. The products that humanity produces from the planet's resources will eventually decay and be recycled. Physical life requires resources from the environment for its development and continuance. Therein, there is no life without death.

The Earth and the services that it provides represent a common [life]ground for all of humankind, and all present symbiotic life. Hence, to simply treat the natural environment as a physics lab is folly, potentially beyond repair, and is the ultimate form of irresponsibility. Planetary resources are finite, and it is important to be responsible (and efficient) in their use. Technological systems can facilitate and optimize this system. For example, a building can store harvested resources, and production technologies can increase the nutrition content and yield of a harvest.

10.1.1.1 The wild

A.k.a., Wildlife habitats, nature outside human habitation.

The "wild" involves, natural preserves and ecological corridors between cities. In the wild, outside the perimeter of the local habitat service systems, there are many different types of activities that take place, including but not limited to:

1. Care-taking of nature preserves and wild ecological corridors.
2. Continued holistic cultivation.
3. Seed acquisition.
4. Firewood.
5. Ecological corridors.
6. Learning and exploration centers.
7. Recreation centers.
8. Mining.
9. Potentially unsafe scientific research.

10.1.1.2 The network of cities

A.k.a., The network of habitats.

Cities (habitats) in a community-type society generally do no expand indefinitely. The base economic element of any Earth organisms economic survival is food. In a community network of cities. Cities are bordered by restorative pastoral cultivation and natural preserves. A holistic cultivation system separates one local habitat from another, providing cultivation and soil restoration services for the distributed network of cities. In community, cities are master-planned and scientifically-/contributory(democratically)-decided in an integrated manner, and therein, provide for the needs and services of the local and networked population. Community-type cities are typically considered to be total-/integrated-city designs, where city construction and operation are considered together locally for the local population, and within a network of resources, contributions, and intentions; wherein, most community cities produce almost everything they consume.

NOTE: *It is possible for integrated community cities to be any number of different shapes, technical levels, and biological to mineral fixed construction ratios.*

10.1.2 The Life Support System (LSS)

A.k.a., Life support or life system (LS), life support service system, life service support system, life sustaining system, life-support system, life system, environmental control system and life *support (ECLSS).*

This Life Support System exists to meet the functional life support needs of the community. The life support system is further divided into subsystems representing the essential service categories (or functional processing categories) for the direct support of human life within a habitat. Effectively, life support refers to the vital service functions (and their outputs) for sustaining human life. These systems provide services and products for which everyone in the community has a life-need. In other words, everyone in the community has a direct bio-psycho-social primal need for the outputs, and other technically service productions available through each of these subsystems. Each one of these core functional processes (or subsystems) is required for life stability and is a possible point of resiliency failure for a habitat (i.e., is somewhere that a community can fall out of the state of resiliency).

Individuals will always have a need for food, water and shelter. They will always have a need for the production of energy. They will always have a need for medical care and the recycling of waste in their ecology. These life support needs are critically common. Every habitat service system needs at least these systems on a continuous basis - these are components of a core habitat service system.

The Life Support System maintains the idea of 'social assurance' as the basis of community resiliency and true economic "security" -- that the systems that compose the habitat may be accessed in such a way that the lifeground is preserved and humanity's life needs are fulfilled.

The subsystems of the Life Support System are:

1. **Architectural service system (a.k.a., architectural building service)** - the building environment and all clothing services. All the activities and objects associated with architectural buildings and [architectural] clothing. The architectural system could include the clothing service system if the architecture system was labeled and classified as the "sheltering architecture service system".
2. **Clothing service system (a.k.a., architectural clothing service)** - the clothing services in the habitat. Note here that all clothing is architecture, but the clothing service system may be a separate primary category and not categorized under the architectural service system.
   A. All the activities and objects associated with clothing.
3. **Water service system (a.k.a., water and atmospheric processing service system, water cycling system, hydrological services)** - the hydrological services in the habitat.
   A. All the activities and objects associated with water. The water service system may include other liquids.
4. **Atmospheric service system (a.k.a., atmospheric processing service system)** - the atmospheric services in the habitat.
   A. All the activities and objects associated with atmospherics. The atmospheric service system may include gas mixtures other than air.
5. **Power service system (a.k.a., energy service, energy-power system, energy system)** - the power production services for the habitat.
   A. All the activities and objects associated with power production.
6. **Cultivation service system (a.k.a., agricultural nutrition and textile service, biological extraction)** - the cultivation of organisms for their biological material resources. The cultivation service materials production, aesthetics, ecological service support and organismal diversity, and includes pet services. The cultivation system could include the food service system if the cultivation system was labeled and classified as the "cultivation and nutrition service system", together.
   A. All the activities and objects associated with cultivation of food, fuel, and organic textiles (fiber). Note that food service may be under the cultivation system, or it may be a separate system.
7. **Food service system (a.k.a., nutrition service)** - the production and clearance of food and food medicines. Note here that all nutrition (except minerals) comes from cultivation, and hence, the nutrition service system could be its own primary category, or it may be categorized under the cultivation service system.
   A. All the activities and objects associated with food and some ingested medicines.
8. **Mineral service system (a.k.a., mineral extraction service, mining service, mineral extraction and processing service system)** - the acquisition and production of minerals for direct human and production system usage. Minerals are a requirement for all production, and some minerals are necessary energy resources for power production. Note that the mineral extraction and processing service may not necessarily be categorized here under life support, and may instead be categorized under technology support > production support system. Here, production would be classified as the "production and mining" service.
   A. All the activities and objects associated with mineral production.
9. **Medical service system (a.k.a., life-form restoration)** - the treatment of issues with the

physical body of organisms.
   A. All the activities and objects associated with medicines and medical practices.
10. **Reproduction service system (a.k.a., nurturing service system)** - the tools and information necessary to reproduce healthy offspring and to raise and nurture healthy children. Here, there are reproduction and family-child nurturing support services.
   A. All the activities and objects associated with reproductive and childhood nurturing practices.
11. **Defense service system (a.k.a., military services, habitat defense service system, defense intelligence service)** - the tools and information to defend a population and habitat from aggression and/or harm (e.g., asteroid, fire, etc.).
   A. All the activities and objects associated with defense of the population and habitat assets. Species stay free by being able to defend themselves. There are likely few free societies that do not have the ability to defend themselves.

10.1.2.1 Survival

A.k.a., Safety, security.

In the wild, in a true survival-based situation, there is an ordering to human efforts toward need fulfillment. The prioritization of tasks for survival in a survival situation is (i.e., in order of importance in a survival situation are the following objective-task-outcomes):

1. **Shelter** (from the biospheric elements).
2. **Water** (to drink).
3. **Fire** (for warmth and cooking).
4. **Food** (to eat).

These are the original four survival needs for which humanity can produce technologies that function toward improving those conditions necessary for survival.

> **NOTE:** *Many in early 21st century society have become ignorant to what it takes to survive and thrive together on this planet. Our actions, at the incremental level, can generate a greater likelihood of suffering for all others. Today we are becoming far more aware and realize that we are all connected in our lifestyles and materializations on this planet. We are all connected; the boundaries that we may perceive do not exist. We need symbiotic relationships, particularly between our individual selves.*

Responding to an uncontrolled fire (uncontrolled combustion situation) is the highest priority in the [decision] system; it involves life and the survival of all habitat system assets. First responders to fires are part of a fire-medical InterSystem sub-team. All first responding teams fire and medical trained InterSystem personnel. It is important to clarify here that an uncontrolled fire is not a service or need; it is not the power service system, and it is not the defense system; it is an undesirable event, a risk that is handled when realized with an emergency incident prioritization response; because it concerns everyone's survival. In other words, there is no uncontrolled fire service system in the habitat service system; instead, there is an InterSystem team trained to respond to emergency situations, some of which involve fires, and they do so with incident response prioritization of resources and services.

10.1.2.2 Defense

All living species have a defense [mechanism]. The common defense mechanisms of animals include claws, teeth, camouflage, poison, mimicry, and limb detachment. Plants use defense chemicals and sometimes thorns to defend themselves from predation. Defense is the expression of force and/or passive protection to counteract incoming force, intentional or not.

As with any defensive system it can be a best friend or worst enemy. The human biological immune system is a good example of this. The immune system can protect from disease. However, if there is nothing to defend against and the defense system wants to be active, then it might start attacking the human organism itself. In medicine, such behavior is casually called “innocent bystander activity” wherein the immune system begins creating inflammatory diseases like autoimmunity, allergies, and neuropathy -- it is trying to do battle against a feigned enemy that doesn’t really exist, and in doing so, harms the functioning of the organism.

There are several interrelated ways to prevent the triggering of self-/social-harm in the context of defense:

1. By redesigning the structure of the system with an improved understanding of how to limit the regeneration of conflict between engineered structures and other structures in the ecological habitat [by learning from mistakes and correcting].
2. By redesigning the structure so the triggers of conflict are not present.
3. By removing the “offender”.
4. By “cooling” the system (i.e., behaving in a way that avoids inflammation while stimulating healthy behaviors). In other words, the defense system of our habitat service architecture needs to be of a particular [emergent] structural design so that we aren’t unwittingly harmed by it.
5. By facilitating the evolution of consciousness through the techniques of self-development.
6. By individually releasing trauma.

At the habitat scale, there are a variety of risks that could trigger the necessity for defensive action, including but not limited to:

1. Astrological risks - risks associated with astronomical events, celestial bodies, or cosmic phenomena.
   A. An incoming asteroid / meteorite.
   B. A solar flare.
2. Conflict of belief/ideological risks - risks related to ideological or religious tensions
   A. An assault (i.e., attack and violence) by individuals or groups with harmful intentions, requiring defensive measures to protect the habitat and its residents.

10.1.3 The Technology Support System (TSS)

A.k.a., Technology support or technology system (TS), technology support service system, technology service support system, infrastructural support system, resource support, resource-support system.

The Technology Support System functions to meet the technology support needs of the community. Technology is the application of scientific knowledge for practical, socially identifiable purposes. The Technology Service Support System acts as a conduit for information, energy and resources as they move through habitat. The technical optimization of their flow generates a greater potential for the extension of ourselves into our environment (i.e., they extend our functions). Both individuals as well as other systems in the Habitat System have a need for technological support services. This support system is also sometimes known as resource support services, because it is where resource come from and return to. For instance, production acquires physical resources, after information resources resolves a decision, and then, produces assemblies from those resources that become part of life support and exploratory support service sub-systems; wherein, the life and exploratory services themselves integrate.

At a basic level, an advanced socio-technical society requires two types of technical production support:

1. **Material assembly (mechanisms)** - as a set of mechanical/object causes and effects.
2. **Software assembly (programs)** - as a set of data/concept instructions.

NOTE: F*rom a materials cyclic perspective, it could be viewed that all technological support systems are a sub-unit of the production service system.*

The subsystems of the Technology Support System are:

1. **The production service system (a.k.a., materialization system, production and recycling service system, materials cycling, technical production and recycling, materials cycling and waste management/coordination)** - the system that produces technologies and cycles all material objects. This system involves product cycles (i.e., production units, construction units, fabrication units, and technology cycling), including: manufacturing, fabrication,, construction, re-cycling, up-cycling, and waste coordination (Read: de-cycling). Note here that the mineral extraction and mineral processing service may be categorized primarily here, under the production system, or categorized under life support. Additionally, waste removal services could be seen as part of life support or as part of the production system, as their primary system categorization. City/habitat construction technologies go under this category. Here, there are operational production systems. Production is where materials, techniques, power, and labor time mix to assemble, operate, and disassemble service-objects.
   A. All the activities required to acquire materials, produce technologies, construct cities, and cycle materials. This system involves materialization/production processes. This system may also include the extraction of mineral materials and is linked with the cultivation of non-nutritive materials.
2. **The information service system (a.k.a., computation system, information technology system, information storage and processing, data and informational computation system, information intelligence system)** - the data storage and computational information processing system. Here, there are operational computers and applied mathematical engineering to store, retrieve, and change data, and execute code.
   A. All the activities and technologies required to process data (information) including computing technology and software systems. This system involves data/computation processes.
3. **The communication service system (a.k.a., signals system, signals and communications system, messaging system, telecommunications)** - the reception, production, and processing of all signals and communications using hardware and software. Here, there are operational signaling systems, inclusive of computers and mathematical engineering.
   A. All the activities and technologies required to communicate including communications technology and software systems. This system involves signals/communications processes.
4. **The transportation and distribution service**

system (a.k.a., transportation and distribution, transport and material distribution) - the system that transports, stores, and facilitates access to all objects around the material environment. Here, there are operational transportation systems.

A. All the activities and technologies required to transport and distribute materials. This system involves transportation/distribution processes. All access centers (where people go to browse and pickup products) are part of the transportation and distribution system. Typically, transportation has to do with the movement of objects (or, people), and distribution has to do with where and/or how the objects are delivered (e.g., are they accessed by people at a central location, or are they delivered to an architectural address). This also includes packaging and storage locations for objects.

10.1.4 The Exploratory Support System (ESS)

A.k.a., Exploratory support or exploratory system (ES), exploratory support service system, exploratory service support system, exploration support system.

The Exploratory Support System functions to meet the exploration requirements of the population. Herein, exploration includes, but is not limited to discovery, expression, and self-development activities. The Exploratory Support System is aimed at providing the services and products to facilitate exploration of the world and of one's own higher potentials.

CLARIFICATION: *Exploration is the act (or actions) of searching, discovering, developing, and/or expressing.*

Humans have desires beyond basic needs. If this were not true then there would be no inventors, designers, no exploration and creativity. The Life Support and Technology Support Systems together allow for the stable existence of the Exploratory System. Although the Exploratory System is a separate system, it relies in great part on services from the Technology and Life Support Systems to operate.

The Exploratory Support System is composed at a high-level of the following sub-systems:

1. **Science and research service system (a.k.a., scientific research and discovery system, science and research exploration services, experimental sciences)** - all the activities and technologies associated discovering and integrating new factual information about real-world phenomena (a.k.a., reality) via research and experimentation, with some certainty level.
2. **Technology development service system (a.k.a., engineering, applied sciences, technology exploration services, technology research and development)** - all the activities and technologies associated with the engineered development of new technologies, including hardware and software. Technological development is an exploratory working group and InterSystem team that develops technologies.
3. **Education service system (a.k.a., learning system, learning service system, education service, education exploration service)** - all the activities and technologies associated with the learning and becoming educated.
4. **Recreation service system (a.k.a., recreational system, physical play service)** - all the activities and technologies associated with recreation, relaxation and play. Physical play activities. May include entertainment reception.
5. **Creative expression service system (a.k.a., art and music system, art and music exploration system, art and music service system)** - all the activities and technologies associated with expressing oneself artistically, content expressive flow, and content expressed reception. May include entertainment production.
6. **Consciousness service system (a.k.a., consciousness exploration system, consciousness development system, consciousness service system)** - all the activities and technologies associated with resources and processes associated with the study of and exploration of consciousness (including religious and spiritual services and activities).

10.1.5 The Decision Support System (DSS)

The Decision Support Service System runs throughout the whole habitat. The Decision Support System functions to meet the decision requirements of the population (in concern to habitat design, construction, operation, and material cycling. The decision support system designs and designs and operationalizes the master plans of habitats, and the habitat network (where resources and contribution are shared) as a whole. The decision support system combines calculation with human research, human engineering, and human [need and preference] requirements input. The results of decisions are modifications to the master plans to which the habitat team personnel, as technicians, provide services to the local populations. Decisioning is an integrated and systematic process in community that transparently completes a inquiry resolution protocol, the solution to which includes a set of value-alignment problem-solutions, and statistical calculation.

The protocol (including: human involvement, value processes, and calculation) produces a new master plan to the habitat, and simultaneously, the whole habitat network. By societal engineering in this contributorily planned and projected way, it is possible to optimize human community values of freedom (openness), justice (fairness), and efficiency (of duty and of inclusivity).

10.2 The habitat service system's primary operational processes / operational phases

The sub-systems of the primary four service systems maintain an operating structure that involves the operational processes of *integration and planning*, *operations* and *maintenance, and incident response*. 'Operational processes' define the primary tasks (or activities) that must be performed to ensure the stability and continuity of the whole Habitat Service System.

The three operational processes are:

1. **Strategic preservation planning (a.k.a., master planning, strategic planning and preservation, strategic decisioning, strategic societal engineering, standard and decision working group operations)** - the process of integrating goals, values and new understandings into the design of future socio-technical productions (a.k.a., goods and services). This operational process involves strategic decision planning, decisioning, master planning, and standards development. A society with a purpose must develop and follow a set of blueprints (a.k.a., plans). Strategic preservation planning ensures that needed goods and services are strategically accessible via planning. All habitat and information system master planning fits within this operational process. This operational process phase includes the development of plans and procedures for societal construction, operation, and incident response. This plan development (a.k.a., planning) process typically integrates various disciplines, such as urban planning, resource coordination, standards development, and risk assessment, to ensure the effective fulfillment of human requirements and sustainable preservation of assets, infrastructure, or natural resources.
2. **Operations and maintenance (a.k.a., continuity operations, service continuity, maintenance and operations, M&O, O&M, habitat team operations)** - the comprehensive set of processes and activities associated with the operations and maintenance of assets, infrastructure, and facilities. Operations encompass the day-to-day processes and procedures required to ensure the efficient and optimized functioning/performance of systems so that they provide goods and services as planned. Maintenance is focused on the systematic preservation and upkeep of assets, including preventive, predictive, and corrective measures to sustain functionality and longevity while minimizing downtime and disruptions. Together, habitat operations and maintenance processes ensure the continuation of systems which provide for individual access to products and services. Operations and maintenance occur in accordance with standards and plans.
3. **Incident response (a.k.a., emergency response, incident handling, emergency operations, incident operations, disaster operations)** - a systematic approach to handling and mitigating incidents or unforeseen disruptions in an organized, efficient, and coordinated manner. It involves the identification, containment, eradication, and recovery from incidents to minimize damage, reduce downtime, and safeguard assets. Incident response procedures encompass planning, preparation, detection, response, and recovery, often with the goal of maintaining operational continuity and preserving the integrity of people, systems and data. This process often involves a dedicated team, protocols, and tools to swiftly and effectively address incidents. Incident response is the process of responding to malfunctions and other [potentially harmful] incidents within the habitat. Incident response is essentially the critical resolution of a point of identified failure in a system. Highly reactive issues are urgent and they have the potential to impact the integrity, availability and transparency of systems. This operational process includes processes involved in the recovery from malfunctions and other incidents.
   A. InterSystem incident/emergency response is a response to harm to people and the services and assets that are required to meet their needs and keep them safe.
      1. An incident with (emergency to) assets: The habitat service emergency response mode, where a service fails in some way and incident response is sent to handle the incident with the affected service(s). Each habitat service could potentially have an emergency occur to its service.
      2. An incident with (emergency to) people: The medical service emergency response mode, where any individual can have a medical emergency occur to their body.

B. In general, there are three incident response sub-processes/phases, each with a set of associated activities:
   1. **The emergency phase** - is the initial response to an incident or crisis when immediate actions are taken to assess the situation, contain the incident, and safeguard lives and assets. It is characterized by rapid decision-taking (often based on pre-set protocols), communication, and mobilization of resources to address the immediate impact of the incident. The emergency phase comes into effect right after, for example: a fire starts, a person is injured, a machine fails, etc.
      i. Key activities: During the emergency phase, activities may include incident detection, alerting, evacuation, first aid, deploying emergency services, stabilizing to prevent further failure, and implementing crisis communication plans.
   2. **The critical phase** - follows the emergency phase and involves managing the incident with a focus on stabilization and recovery. It includes assessing the full extent of the damage, prioritizing response efforts, and implementing strategies to regain control over the situation. This phase aims to prevent further harm and facilitate the transition to recovery.
      i. Key activities: Critical phase activities encompass damage assessment, resource allocation, incident containment, setting up incident command structures, and implementing response plans specific to the incident type.
   3. **The recovery phase** - occurs after the emergency and critical phases and focuses on returning the affected environment to a state of normalcy. It encompasses activities aimed at restoring infrastructure, services, and the community's overall well-being. The recovery phase can be a long-term process that continues well after the incident is under control.
      i. Key activities: Activities during the recovery phase include restoring damaged infrastructure, providing assistance to affected individuals, conducting post-incident analysis, implementing resilience measures, and planning for future incidents.

Each habitat service support system is composed of the same three operational processes. The operational processes generate actions that provide for the community's purpose, orientation, requirements, and needs. A system process can be decomposed into several sub-processes, which have their own attributes, but also contribute to achieving the goal or purpose of the super-process. The analysis of system processes typically includes the mapping of processes and sub-processes down to an activity and task level, including a description of the "constructor entities" as well. Each operational process can be subdivided into its base activity and task level, which are interrelated within a comprehensive, real world information system.

The 3 material process phases of a habitat service system:

1. **Developing standards for the use of materials (i.e., material organization/planning, strategic organization of materials):** Develop the information system upon which all material activities are founded.
2. **Moving of materials (i.e., material transportation):** Logistics service system processes - move it, distribute it, and return it.
3. **Using of materials (i.e., material operations):** Life, technology, and exploratory service system processes - use it.
4. **Cycling of materials (i.e., waste coordination):** Appropriate re-cycle, up-cycle and/or dispose of materials after they are used.

All of the above systems-level tasks are planned for through a decision system, and carried out by [inter-] systems teams who have demonstrated experience, or are being mentored by those who have demonstrated experience.

> **NOTE:** *The operation of a service function necessarily takes up material space and time.*

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TABLES

Table 49. City > Ontology: *Smart city ontology within a community-type society.*

Smart								City		
Structure		Functions		Focus		Semiotics		Stakeholders		Outcomes
Information Technology		Sense		Life		Data		Users		Values (e.g., sustainability, resilience, etc.)
Projects		Monitor		Technological		Information		Teams		Quality-of-life / Well-being
Teams		Process		Exploration		Knowledge				Fulfillment
Processes	[to]	Translate	+	Resources	+		[by/from/to]		[for]	Flourishing
Procedures		Communicate		Access						Flow
				Social						
				Decision						
				Lifestyle						
				Material						

Table 50. Habitat Service System > SubSystems: *Habitat service system tiers.*

First Tier System	Second Tier Systems (Subsystems)	Third Tier Systems (Subsystems)	Fourth Tier Systems (Operational Processes)	Activities & Tasks
The Habitat System	**Resource Production, Regeneration And Resource Storage; Life Support System; Technology Support System; Facility/ Exploration System**	**Shelter/Architecture; Power/Energy; Nutrition; Water/Atmospherics; Medical; Recycling & Waste Management; Data Processing; Communications; Manufacturing; Transportation & Distribution; Recreational; Art & Music; Science And Research; Technology Development; Consciousness; Learning**	**Strategic Planning And Preservation; Operations & Maintenance; Incident Response**	**Not Identified In This Table**

TABLES

Table 51. Habitat Service System > Sectors: *The Habitat Service Systems and their secondary sub-systems. This table layout of the service systems (i.e., their aggregation) allows for, or otherwise facilitates, economic calculation. Life, technology, and exploratory services all have a final user demand. Life and Technology services have an intermediate demand, and two exploratory services of Scientific Discovery and Technology Development, also have an intermediate demand. To have an intermediate demand means to require something necessary for production of the final demand by the user.*

Top-level Habitat Aggregated Service Systems	Secondary-Level Habitat Aggregated Service Systems	Service Platform Tasks	Service Platform Resource Compositions and Allocations
NEEDS	DEMANDS	OPERATIONS	RESOURCES
Life Support Service System	Architectural service	...	...
Life Support Service System	Water service	...	...
Life Support Service System	Cultivation Service	...	...
Life Support Service System	Power Service	...	...
Life Support Service System	Medical Service	...	...
Technology Support Service System	Information Service *(Storage and Processing)*	...	...
Technology Support Service System	Communications Service *(Devices and Protocols)*	...	...
Technology Support Service System	Transportation Service *(Machines and Protocols)*	...	...
Technology Support Service System	Materialization Service *(Machines and Protocols)*	...	...
Exploratory Support Service System	Scientific Discovery Service	...	...
Exploratory Support Service System	Technology Development Service	...	...
Exploratory Support Service System	Learning Service	...	...
Exploratory Support Service System	Recreation Service	...	...
Exploratory Support Service System	Art & Music Service	...	...
Exploratory Support Service System	Consciousness Service	...	...

Habitat Service System Master Planning

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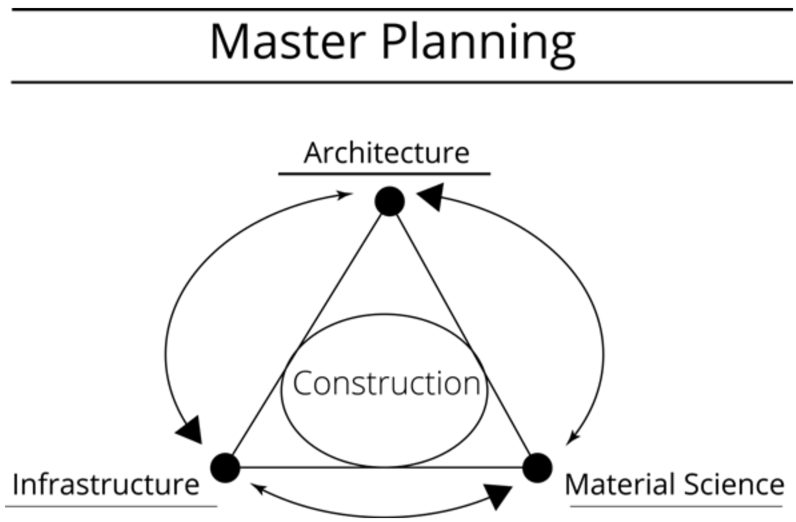
Abstract

A planning approach is required in order to construct in alignment with the need fulfillment of all of humanity. Human fulfillment can be planned and optimized through master planning (i.e., planning the next iteration of the material environment in a unified and cooperative manner). It is possible to plan out a habitat service system network composed of many individual habitats where services are designed and operate to meet human need. Master planning is the method of developing, operating, and modifying a real-world environment. Master planning optimizes the flow of information and materials throughout the material environment. Master planning is essential for developing habitats/cities in community. A master plan is a dynamic, long-term planning documentation set. A masterplan (masterplan) is developed and operate for the whole network of habitats, with a masterplan existing for each individual habitat and the network as a whole. Everyone in the network can see the masterplan. In a way, the term masterplanning is simply another term for systems development, and in the material system, the system under development is a habitat service system network. Material master plans necessarily include an accounting of the material system (land, resources, etc.) as well as habitat service solutions (life, technology, and exploratory).

Graphical Abstract

Figure 20. *Construction of anything in the material environment comes through [master] planning. Master planning of a habitat involves architecture [as a service], infrastructure [as a service], and material sciences [as a service]. In order to master plan the construction of a habitat, all three of these elements must be considered.*



1 Master planning a habitat

A.k.a., Habitat master planning, city master planning, planning habitat changes, habitat change plan.

The master planning of resources for a [state] of the habitat involves many sub-plans and solutions. For example, architectural life-support service plans ensure that architectural services are planned for within the decisioning for a material/habitat service system. The planning of the new state of the habitat service in general, and the architectural sub-system in particular requires an adequately informed and coordinated [master] plan. Master plans are material state change processes (i.e., plans that allow for changes to the state of the material, habitat service system. In other words, master planning is the process of creating a plan that will intentionally modify the material state of the material/habitat service system. Master planning merges the human experience [of needs] and science [knowledge] to realize the visions of individuals among society. Simply put, master planning is a process (framework) for how a location can change [its state]. Optimally experienced habitat service systems (cities) are brought into, and sustained in, existence due to the decision to integrate master plans (i.e., the integration of master plans into societal decisioning). Any given master-plan describes and explains the materially engineered configuration of the system; as well as, the conditions for access to resources, composed into socio-technical service support systems that include humans and technology. The fundamental production technology for socio-technical human need fulfillment is that of a habitat service system.

Local habitat service systems are customized by their inhabitants and what is possible, given the resources and contributions available. The buildings, landscapes, and other services are, in a way, like reflections of the people who manifest them. Their design and appearance give an indication of the occupiers' personality and characteristics. They are a reflection of their integration and realisation, as well as their individuality and sociality. Master-plans define long-term socio-technical development for specific built objects and sites. For architecture, master-plans include considerations related to current and future infrastructure, site development, site circulation, and spatial relationships. A master plan may establish the process for staged implementation over time, and adaptation in the future.

A given project for a habitat service system includes at a basic level:

1. Plans (master service and object plans).
2. Materiality (visible and invisible; resources).
3. People (teams).

It is important to clarify here that it is outputs of Decision System inquiry process that results in planned state changes to the habitat environment. The state of the habitat service system is changed based upon a unified and controlled master-decision planning system. Each service and object within the habitat service system needs to be planned and appropriately accounted for.

Before master planning a habitat, it is essential to consider the whole stakeholder unit, which consists of at least the following:

1. User has residence in:
    A. House/dwelling, in
        1. Habitat, in
            i. Regional habitat network.
2. User has family and friends resident in a habitat.
    A. By user relationship:
        1. Family is most proximal a user.
        2. Friends are second most proximal a user.
        3. Neighbours are third most proximal a user.
    B. By location to the user's dwelling:
        1. Most proximal (under one house roof).
        2. Under apartment roof.
        3. Within dwelling sector.
        4. Within habitat and regional habitat network.

Note that this habitat configuration of usership is repeated throughout the community habitat network.

1.1 A habitat master plan

There are two types of master documents decided upon within the societal information system that produce any given master plan:

1. **A unified [master] standard** from which all local habitat master plans are specified.
    A. Currently active standard.
    B. Draft standard.
2. **A set of local habitat [master] plans** from which all local habitat service operations are specified.
    A. Currently active master plan for the habitat (i.e., for the state of the habitat service system).
    B. Decision working group, next master plan. These are issue-design-decision "packages" that represent possible changes to a local habitat service system for which they represent.

Master planning involves at least the following deliverable formats:

1. Map deliverables.
2. Table (spreadsheets and list) deliverables.
3. Drawings (models) deliverables.
4. Written (text) deliverables.
5. Simulation deliverables.
6. Calculations.
7. Executions of information and physical work.

Master planning involves the following categories of information:

1. Plans.
2. Materials [list].
3. Tools and equipment [list].
4. Processes [list].
   A. Tasks and activities [list].
5. Time and labor (human effort).
6. Coordination and scheduling.
7. Operating and maintenance.
8. Permitting and licensing (market-State code).
9. Habitat agreements, including when and how often the master-plan is modified.

Primary elements to account for on a masterplan for a landscape include, but may not be limited to:

1. Soil.
2. Water.
3. Animals and plants (cultivation system).
4. Productions (the built and infrastructural assemblies representing multiple habitat services).

Habitats themselves are laid out through a control system composed of a hierarchy (order) of architectural-engineering functions and units:

1. The built system of a habitat is composed of functional units: People in society reside in habitats.
   A. Function: Society.
   B. Unit: Habitat.
   C. Relative description: a laid out perimeter.
2. Services in habitats are separated into sectors.
   A. Function: Services.
   B. Unit: Sectors.
   C. Relative description: between blocks/sectors of enclosures separated by some pathway (forming a transport layout).
3. Buildings are enclosures for extending functioning.
   A. Function: Buildings.
   B. Unit: Enclosure.
   C. Relative description: between enclosures proximal one another.
4. Rooms provide area (volume) for specific functions.
   A. Function: Specific Functions.
   B. Unit: Rooms.
   C. Relative description: within the enclosure.
5. In-fill technologies meet specific sub-functions.
   A. Function: In-fill (specific sub-functions).
   B. Unit: Technologies.
6. Habitats have a path[ing] sector [service] for transport between rooms, between buildings (in a sector), between sectors (in a habitat), and between habitats.
   A. Function: Transport (a habitat technology support service).
   B. Unit: Paths.
   C. Relative description: the pathway layout within the perimeter.

Humans are a population occupying space. The space a group of humans occupies over a unit of area is called, "social density". Technically, "social density" refers to the degree of contact and interaction among individuals within a social group or community, usually within a specific physical or digital space. It is a measure of how closely people are connected or clustered together within a given area or network. Social density can have significant implications for social dynamics and behavior, and it is essential to account for in the strategic design of a habitat.

A more broken-down view of the levels of change in society in the context of the presence of social density are (as required flexibility):

1. Global [common heritage] habitat network.
2. Regional habitat network.
   A. Local region of global habitat network.
3. Local habitat (a.k.a., city, urban location).
4. Local sector (a.k.a., zone, block; habitat service sectors).
5. Structure (i.e., foundation, load bearing elements, and shell).
6. Skin (a.k.a., exterior surfaces, facades).
7. Service inputs (a.k.a., infrastructure, utilities).
8. Space plan (a.k.a., interior layout, rooms).
9. Technologies (a.k.a., fittings, fixtures, appliances, in-fill).

The different layers of a habitat (and therein, buildings), have different rates of change, and a master-plan ought to account for that. The complete separation of different layers in building construction can help to increase the lifespan of the building, and also, strategically economize resources. The different levels of the built environment can be fit into a rate-of-change table. This rate of architectural change table can be associated with the cyclical master planning of changes to agreements at each level of the scale. Here, the rate-of-change variable is classified as "flexibility". A more flexible layer can be changed/adapted within a fewer number of years, and a more flexible building/area has inner partitions and façade elements that are not fixed/load-bearing (can easily be changed and rearranged to accommodate new uses while the structural framework is maintained).

Table 52. Habitat Service System > Master-Plan Timing: *Table shows the layers of a habitat master plan, provides a description for each, and gives an example rate-of-change ("flexibility") value for each (Estaji, 2017).*

Layer	Description	Flexibility
Earth	Global habitat service network	Continuous, eternal
Site	Actual landscape location	Continuous, eternal
Habitat regional network	Geographical setting	3-5 years
Local habitat	City, urban location	3-5 years
Local sector	Zone, block	3-5 years
Fixed structures	Foundation and load bearing elements	~50 years
Skin	Exterior surfaces, facades	3-5 years
Services	Electricity, HVAC, water	5-15 years
Space plan	Interior layout, rooms	Flexible
Production space plan	Fixed year means of production (produces services)	3-5 years
Dynamic space plan	Flexible inter-year means of production (is service itself)	Scheduled
Technologies	Fittings, fixtures, in-fill, finishings, furnishings	Flexible

1.2 Account for habitat life-cycle analyses

Life-cycle analyses for habitational products and services used by (potential) residents is required.

The master planning of usage involves the following data product life-phase data sets:

1. **Survey: Surveying to understand demand and availability:** All surveys and assessments must be present.
   A. The plan, including tools, resources, skills, and people, to fully survey for what is needed from, and what is available for, the system (in the real- and digital-world).
2. **Design:** Architectural-engineering to produce a full solution from design-specification.
   A. The plan, including tools, resources, skills, and people, to fully imagine (engineer) the system in the digital-world.
3. **Assemble:** Constructing to produce a fully realized system; involves the components to make something operational [as planned in the architectural-engineering plan].
   A. The plan, including tools, resources, skills, and people, to fully construct the system in the real-world.
4. **Dis-assemble:** De-constructing to produce rarified material resources; involves the components to disassemble something [as planned in the architectural-engineering plan].
   A. The plan, including tools, resources, skills, and people, to fully disassemble the system in the real-world.

Habitation products and services are accessed in the following known ways:

1. Primarily within the perimeter of habitats networked within a regional and globally positioned network of transportation and usage of common heritage resources (i.e., the positioning).
2. Contribution-type access to the production systems for local habitats.
   A. Some production systems are located in habitats, and others are located in production clusters in nature.
3. Final habitat products for personal and common user usage.
   A. Personal dwelling access (a "home"), personal access items, and common habitat service access.

Then, considering the full life-cycle of a product (e.g., a cyclically master-planned habitat) can help measure the benefits of changes that might appear?

Habitats (and the global network of habitats/cities) could be designed based on:

1. Human needs.
2. Community objectives.
3. Locally customized preferences.
4. Available global resources (physical and informational).
5. Available contribution.
6. Available education.
7. Available residency.
8. Available habitat service team operations.

1.3 Account for habitat dwelling carrying capacity

It is possible to designed with a buffer capacity for housing. Therein, something akin to 5-15% of the dwelling could remain unoccupied. This allows for:

1. Temporary expansion of the population (as in the case of visitation).
2. Always available housing alternatives.
3. Possible emergency housing in case of a disaster.

1.4 Account for habitat sector parameters

It is essential to identify the sector (a.k.a., zones) parameters of habitats (cities) in a community configuration of society in order to calculate an economic plan:

1. The functional [habitat] service sector parameters (functional zoning requirements):
   A. Ecological services.
   B. Life support services.
   C. Technology support services.
   D. Exploratory support services.
2. The non-functional [habitat] lifestyle parameters (non-functional life phases zoning):
   A. Education *(education phase)*.
      1. Family and friend nurturing operation.
      2. Learning support service operation.
   B. Production-operation *(contribution phase)*.
      1. Habitat production and operational activities.
      2. Resource collection and heavy productions.
   C. Leisure *(leisure phase).*
      1. Leisure activities for all life phases in a habitat.
      2. Leisure habitats (for those in the leisure phase of life).
3. The non-functional [habitat] objective parameters (non-functional user requirements):
   A. Walkability.
   B. Transportability.
   C. Availability of daylight and sunlight.
   D. Access to wind and views.
   E. Aesthetic quality (view).
   F. Metadata and statistical calculation transparency.
   G. Etc.
4. The possible building typologies.
   A. Open-to-built ratios:
      1. Floor area ratio (FAR).
      2. Gross floor area (GFA).
   B. Building height.
5. The possible space occupancies.
6. The social density.

In a habitat divided into distinct sectors, the distribution and organization of space are influenced by multiple key factors. These elements not only define the physical layout but also impact the functionality, livability, and sustainability of the whole habitat. These factors are:

1. **Total number of sectors:** This figure represents the overall segmentation within the habitat, indicating the scale and complexity of its division into distinct areas or zones, each potentially serving different purposes or housing different communities. Indicates the segmentation of the habitat, showing its scale and complexity.
2. **Number of sectors in a specific circular (and number of circulars; or, number of rows and columns):** This detail specifies how many sectors are included within a particular circular or ringed area of the habitat, often relevant in designs where the habitat is organized concentrically. This organization can help in understanding the spatial layout and planning logic of the habitat, especially in terms of accessibility and distribution of resources and services. Highlights the organization within circular zones, important for spatial planning and distribution.
3. **Ratio of built environment to green [soil] environment:** This metric reflects the balance between constructed spaces (such as buildings and infrastructure) and natural or green spaces (like parks, gardens, and undeveloped land) within a sector. It is crucial for assessing the environmental sustainability and livability of the sector.
4. **Density of buildings in a sector:** This refers to the concentration of buildings within a sector, often measured as the number of buildings per unit area, or just "built area" to total area. It provides insight into how closely packed the infrastructure is, impacting aspects such as population density, accessibility, and the overall urban or rural character of the sector.
5. **Population density per sector:** The number of individuals residing within a sector, or using a sector, per unit area, per time of day/month/year impacting resource needs and social dynamics.
6. **Type of land use:** Categorizes sectors by their primary function (residential, commercial, industrial, recreational), informing infrastructure and service requirements.
7. **Transportation and accessibility:** Evaluates the connectivity between sectors, including transport availability and walkability, essential for human mobility and object transit.
8. **Habitat services (a.k.a., habitat service systems):** Identifies the availability and distribution of habitat services (e.g., life, water, power, technology, etc.) across sectors, key for livability and well-being.
9. **Production activities:** Describes the main economic [decision] functions and productions (Read: industries) present in each sector, essential for contribution (employment) and the habitat operations (i.e., for economic vitality).
10. **Decision inquiry activities:** Examines how sectors coordinate resources like water, energy, and waste, critical for human fulfillment, human values and standards.
11. **Environmental quality:** Assesses air and water quality, greenery, and pollution levels within sectors, indicating environmental health and living conditions.
12. **Urban and green aesthetic form and design:** The current master plan, considering the aesthetic design of sectors, including building architecture,

green-space, and urban layout, affecting the habitat's character, attributes, felt sensation, and functionality.

A habitat, divided into sectors, has Ratio of built environment in the sector to green environment.

1. Density of buildings in the sector.
2. Number of sectors total.
3. Number of sectors in a specific circular.

1.5 Account for habitat master-plan evaluation criteria

A system design and building delivery process is goal oriented and can be represented by a basic system model with the goal of achieving universal design performance criteria for the built system:

1. **Goals (G)** - Herein, user goals are conceptually linked to the elements in the system that are described in the following items. Subgoals (Gs) for achieving system quality can be related to the basic system through modified evaluators (Es), outcomes (Os), and performance (Ps). Thereby, the outcomes becomes the subgoals (Gs) of the subsystem with respective criteria (Cs), evaluators (Es), and performance of the subsystem (Ps). The total outcome of the combined basic and subsystems is then perceived (P) and assessed (C) as in the basic system.
   A. **Performance evaluation criteria (C)** - derived from the user's goals, standards and criteria for the system type. Universal design performance is tested or evaluated against these criteria by comparing them with actual performance.
   B. **Evaluator (E)** - refers to such activities as planning, programming, designing, constructing, activating, occupying, and evaluating a system (e.g., environment, building, etc.).
   C. **Outcome system/object (O)** - represents the objective, physically measurable characteristics of the system (e.g., environment, building, etc.) under evaluation. This includes but is not limited to its physical dimensions, lighting levels, thermal performance, etc.
2. **Actual performance (P)** - refers to the performance as observed, measured, and perceived by those using, occupying or assessing the system (e.g., environment, building, etc.), including the subjective responses of users/occupants and objective measures of the system.

A built system can be designed and developed by a process that includes a set of development phases, and therein, analytical feedback loops that present a set of evaluation criteria for each phase:

1. **Continuous feedback** into the next design and building cycle
2. **Continuous system performance evaluation** (e.g., building performance): A qualitative and quantitative measurement that represents the outcome of the system delivery cycle, as well as system performance during its life cycle.
3. **Development cycle (development phases)**
   Note: Each of the following phases has internal reviews and feedback loops. Each phase is connected with its respective knowledge. This knowledge is contained in system (e.g., building) type-specific data--bases, as well as global knowledge and the literature in general.
   A. **Planning (phase 1):** A strategic plan that establishes medium- and long-term needs of an organization through needs analysis (and market analysis), which in turn is based on the purpose (mission), goals, and possibly, objectives.
   B. **Programming (phase 2)**: A process leading to the statement of an architectural problem and the requirements to be met in offering a solution. Programming is the search for sufficient information to clarify, to understand, and to state the architectural problem. Note that programming is problem seeking and design is problem solving.
   C. **Design (phase 3):**The steps of schematic design, design development, working drawings, simulations, and construction documents.
   D. **Construction/fabrication (phase 4):** The steps of construction and quality control to ensure design and contractual compliance.
   E. **Occupation/usage (phase 5):** The steps of moving in and starting up the system (e.g., facility/building). The steps of turning on and utilizing the system (equipment/technology). This includes, but is not limited to fine-tuning of the system (e.g., facility, technology) and its occupants/usage to achieve optimal functioning.
   F. **Recycling (phase 6):** The building or technology may be remodeled for a different function, or this phase may constitute the end of the useful life of a system (e.g., building), where the building is decommissioned and removed from the site. In cases where construction and demolition waste reduction practices are in place, building materials with the potential for re-use will be sorted and recycled into new products. At this point, hazardous materials, such as chemicals are removed in order to reconstitute the site for new purposes.

4. **Analytical feedback loops (for each phase)**
   Note: Human needs analysis - identification and analysis of all human needs for service.
   A. **Effectiveness review (Loop 1):** Outcomes of strategic planning are reviewed in relation to issue categories, including but not limited to: site, technology, efficiency, effectiveness, flexibility (modularity), adaptive re-use, initial capital cost, operating and maintenance cost, costs of replacement and recycling at end of the useful life. For the market, this includes: cost estimates and budgeting.
   B. **Program review (Loop 2):** Outcomes include a comprehensive documentation of the program review involving the user (client), the programmer (InterSystem Team), and representatives of the actual occupant groups (user/client).
   C. **Design review (Loop 3)**: Evaluative loops in the form of design review or troubleshooting. The development of knowledge-based and computer-aided design (CAD) techniques that make it possible to apply evaluations during the design phase. This allows designers to consider the effects of design decisions from various perspectives, while it is not too late to make modifications to the design.
   D. **Post-construction evaluation (Loop 4)**: An evaluation of the construction/fabrication, including an inspection that results in a checklist ("punch list"). A "punch list" lists items that need to be completed prior to acceptance and occupation of the system (e.g., building or technology).
   E. **Post-occupation evaluation, POE / post-startup evaluation (Loop 5):** An evaluation of the system's (e.g., building or technology) performance. Feedback over time is provided on what works in the system (e.g., facility) and what does not. This evaluation can be used to identify issues and problems in the performance of occupied buildings and further suggest ways to solve these problems. This evaluation is ideally carried out in regular intervals, that is, in two- to five-year cycles, especially in organizations with reoccurring system/building programs.

1.6 Account for dwelling in a habitat

A.k.a., Account for a home in community, account for a house in a habitat.

Cities and towns (a.k.a., habitats) are the "home" of all aspects of human life and of all human technologies: water supply, energy, transportation, health, education, and all other public services and private activities. Adding human need fulfillment and societal information integration to the value chain of all these socio-technical systems reveals a unified and harmonious way that humanity may live well together on a beautiful and resilient planet. Herein, the proximal "home" of any human is their "dwelling", where they share close/proximal life with family and friend members. In community, like in the market-State (in general), dwellings are personal access (similar to, but different than, "private property"). Both personal access and private property access engage rules of "proximal engagement". These rules relate to the self-authorization of another's access to that which is personal access designated to one, or to a family. Following rules of proximal engagement facilitates trust among members of society, and over time. Violation of personal access rules (similar to, private property rules) may have serious habitat access consequences (e.g., arrest) in both a community and a market-State society.

A dwelling/house is a building ("spatial" system) to meet the user's needs and provide space for the family activities; at the same time, it must facilitate interaction and communication with other family members, friends and guests, and must not disturb neighbours. A home "dwelling" is a place for living from birth to death, and must cover all human life-development phases; while other kinds of buildings typically deal with a smaller number of the phases, or are not places of personal access. A house is a place for personal-access human activities during days and nights in all years, and at any time. Note here that a house is personal access (in community) and private/rental property in the market-State.

A dwelling is a building interface designed for "unique" personal access and fulfillment by an InterSystem habitat service network of endpoints (e.g., water taps, electricity, appliances, etc.). Like all buildings, dwellings must be caretaken. The caretaking (cleaning) of dwellings (i.e., service association) extends from:

1. **Self-service**, through to
2. **Full-service** (leisure).

In community, like in the market-State, there are two basic categories of dwelling:

1. **A personal dwelling** (a.k.a., residence, domicile, personal access dwelling, etc.) - is someone's home, house.
2. **A common dwelling** (a.k.a., visitor dwelling, common access dwellings, temporary rental, temporary stay home, hotel, motel, etc.) - is where people visit temporarily. Temporary stay dwellings (a.k.a., visitor homes, common-access dwellings) are for individuals to stay temporarily. These dwellings typically have agreements against most customizations; because, they only host users temporarily. Of course, there is flexibility here, and some common-access dwelling services will provide

for customization of the common-access dwelling, to a degree, before some scheduled user's arrival (as a service).

In community, adaptations to dwellings may occur through:

1. An architectural service InterSystem operational habitat team that makes the change (issue dependent), or
   A. This is an issue dependent action. For example,
      1. If the user needs a utility changed, or a significant modification made, then the InterSystem team is accountable for making the change (per cyclical master-plan agreement).
      2. If the user prefers to change aesthetic preference options (e.g., put up holiday decorations), then, unless there is a disability present, this type of issue is not an InterSystem team accountability.
2. The dwelling's family unit may acquire the tools and resources, and make the change oneself, if self-work is the choice (change dependent).
   A. This is a change dependent action. For example,
      1. If the user needs a utility change that could affect current and future user safety, then the InterSystem team is accountable for monitoring.
      2. If the user prefers a utility change that is excessive in (decision system pre-decided) use of resources, then the InterSystem team is accountable for investigating and restoring from violation.

A personal dwelling must accommodate the personal access needs of one or more individuals in a family, accounting for:

1. The family size.
   A. Individual
   B. Couple.
   C. Friends.
   D. Generational family.
   E. Multi-generational family.
2. The family proximity.
   A. In one house.
   B. In one apartment complex.
   C. In one dwelling sector.
   D. In one habitat.

Summarily, it must account for:

1. The family structure.
2. The family under one roof.
3. The family under some given area (sector, local habitat, regional habitat network).

A home (dwelling) is a place for human activities during days and nights in all years. The wide variety of human activities, as well as a wide range of times spent in the house, emphasizes:

1. The necessity of flexibility in housing design.
2. The necessity of beauty, intuitiveness, and efficiency in design.

NOTE: *A dwelling that lacks both of the characteristic is likely to be more of a stressor than a restorative and uplifting personal environment.*

It is possible to divide the human life into life-phases of development, and the house is a place for living through these life phases, from birth to the end of life; while, other kinds of building deal with a smaller number of the life phases and are not for sleeping or for solely personal access. A flexible spatial home configuration can cover the needs of all phases, for people in different phases of their life, in parallel.

The house requires a flexible spatial configuration that is flexibly able to respond to changes, such as seasonal climatic changes (physical flexibility), aesthetic style changes throughout the year, and changes in family size and family structure (social flexibility). Flexibility in the dwelling building is more important than flexibility in other types of buildings around a habitat. Homes are proximal personal access and can change with the changing moods of the occupant(s), and their life-phases. The wide variety of human activities, as well as a wide-range of times spent in the house emphasizes the necessity of flexibility in home design (for daily, weekly, seasonally, and yearly through habitat master planning cycles). Lifetime homes are flexible and adaptable to their users' (self, family and friends) needs and preferences over time; they are thoughtfully designed to create and encourage a good quality of living environment, given what is known and physically available. From raising small children, to coping with illness, to relaxing and working, to doing fitness and games, or dealing with reduced mobility in later life; lifetime appropriate homes make daily living more intuitive and natural, and reduce stress and conflict throughout the global community. (Estaji, 2014;2017; 2018)

Typically, dwellings have features that in only minutes can be adjusted, added, or removed as needed to suit the occupants. Personal dwellings are typically highly customizable and easy to adapt to the changing lifestyle requirements of the occupants. An "adaptable" dwelling unit is a dwelling unit designed and constructed to facilitate future modification; to adjust to changing need and preference patterns, both social and technological.

It is possible to build houses, home complexes (multi-family dwellings), and whole dwelling sectors of a habitat, to physically grow and adapt, and to meet changing families and lifestyles. Through strategic planning of architecture within an iterative, resident customized master-planning cycle, it is possible to economically meet the habitat>dwelling needs of everyone.

2 Master planning: State interface

A.k.a., Master plan land usage regulation, politics, authority-governed decisions about cities.

A master [city] plan is a statutory land use plan that determines development and is reviewed every some number of years. In the market-State, master plans are statutory documents that show permissible land use and density for developments (market property development and/or State property development). Herein, zoning refers to laws (a.k.a., regulations, ordinances, code, etc.) that govern/control how real property can and cannot be used in certain geographic territorial areas. State and local governments use zoning laws to regulate the uses of land within their borders. Zoning laws are made by branches of local government, municipal corporations, or a county department, and in special cases, they are made by federal State branches of government. Within a zoned territory, there are specific regulations on how a property owner and/or the State can use the land within a zone. A land use zone is a classification that establishes the type of development that is allowed or not allowed in a particular location. A land use zone is a geographic area that has (or, will have) materialized features that define its function. Effectively, cities mark out plots of land for development, and this decisioning process is called "zoning", wherein, the [legal] activity type decidedly allowed is called the "zone type"

Generally, local governments have a large degree of autonomy to control land use within their jurisdictions. Local governments have a large degree of autonomy to control land use within their jurisdictions. States typically grant them the authority to pass laws (ordinances and regulations) as long as they do not conflict superordinate State laws. States typically grant them the authority to pass ordinances and regulations as long as they do not conflict with other laws. Furthermore, all States give municipalities the power to enact zoning regulations. Zoning laws are almost always enacted and enforced by local authorities, and not State-wide or nationwide authorities (except in special cases). City governments, town governments, village governments and the like are merely functions of the State. State and local governments have the power to regulate land use for the health, safety, welfare, and the market positioning of their people.

In some jurisdictions it is possible to petition to change zoning via a written application. The applicant presents their case with the zoning board or planning commission. A hearing will occur where the petitioner presents their case and the board decides whether to accept or reject the case. Here, a "zone" ("sector") is a set of rules about what can and cannot happen within a given area of a city/habitat.

A land-use zone is an area of land used for the same purpose, having the same common rules for usage.

There are two/three different types of land use zoning in the State:

1. **Single-use zoning** - Land can only be used for a single land user function/service. For example, it can only be used for residential.
2. **Multi-use zoning (a.k.a., mixed-use zoning)** - Land can be used for more than one land usage function/service. For example, it can only be used for residential and commercial.
   A. Mixed-use land.
   B. Mixed-use buildings
   C. Mixed-use spaces.
3. **State-use zoning** - Land can only be used for State functions.

In a community-type society, the [land usage] zones are the habitat service systems with their functional sub-systems:

1. Life support (i.e., medical, power, architecture, cultivation, water, ...).
2. Technology support (i.e., transportation, production, computation, ...).
3. Exploratory support (i.e., learning, science, entertainment, recreation, ...).

> **NOTE:** *In community, there is local and distributed access to objects and services through master-planned and team-operated habitats..*

Community zoning includes the process of designing the impact a sub-organization of habitat has on its surrounding area. It necessitates identifying the core (and/or sub-) function(s) of every integrated sector (zone) of an integrated habitat. Each zoning district may also be described by listing the measurable limits of noise, smoke, odor, glare, vibration, etc., that would be permitted for any operation in that particular district. Of most importance is that the uses of a zone are written out in a master-plan.

An example of zoning design is identifying the impact that production industries have on their surrounding areas. Wherein, light production and heavy production may be identified as categories by the amount of measurable impact the production has on its surroundings. Light production is normal to have within the bounds of a city; because, it has insignificant impact. Heavy production is typically done outside of city bounds, in wild nature. Note that with additional safety measures heavy production can sometimes occur within cities too.

Industrial zoning (a.k.a., production zoning) is tied to (city/habitat production), manufacturing and fabrication (commercial services in the market) refers to personal and common products therein. The "industrial" zones (a.k.a., production zones) are unique in the habitat in that they produce and recycle habitat service objects, which can create more noise and a temporary degradation of the local environmental quality factors. Production zones are likely to have more heavy traffic, generate more vibrations and sound, and degrade atmospheric and soil conditions. In this context, "light", "medium", and "heavy" are distinguishing categories of output along a spectrum of potential externalizing environmental outputs of a production zone:

1. Light industrial zoning (light production; internal habitat zoning) - light local manufacturing of locally sold products.
2. Medium industrial zoning (medium production; transition habitat zoning) - may mean a transition period, when heavy production (a major construction zone) is transitioning to interior city light industrial production.
3. Heavy industrial zoning (heavy production; exterior habitat zoning) - heavy intermediary manufacturing of global sold products. For example, airports, mining operations, power plants, chemical plants, and construction zones (city production itself).

States interface with master planning in several key ways, through (i.e., in the market-State, the typical land [zoning] usage classifications are):

1. **Zoning codes (a.k.a., zoning permits, zoning permit regulations, zoning ordinances, zoning standards, etc.)** - land usage regulations, land use allowances. Zoning codes are local regulations that determine land and/water use and development within a State "authority" territory. Zoning is a series of laws that determine how land is used and what is allowed to be built on a particular piece of property. Zoning code applies different rules to different types of properties. A zoning permit is a document that gives the holder permission to construct a new building or make usage changes to an existing building. Zoning codes are legally enforceable, and violating these regulations can result in fines and/or penalties. Zoning laws and zoning permits were created by the State to regulate land uses for a purpose. In the market-State, there is at least the following types of zoning (note in the early 21st century, personal family car parking storage is typically also required for each zone, because that is the primary method of transportation used for local commuting):
   A. **Residential zoning (i.e., residential zone, dwelling zone, residential dwellings)** - location[ing] of dwellings.
      1. Single-family - fully detached, semi-detached, a row house or a town-home. A single-family home is a single housekeeping unit that is not part of a multiple-family dwelling. In the

market, the house-keeping unit for single-family homes is either that the dwelling contains all the cleaning tools the dwellers clean, or a business service is employed to keep tools and clean. In community, it may be the dwellers or a habitat service team.

2. Multi-family - apartments. Note that row houses and townhomes may also be called multi-family dwellings. Multifamily dwelling means a structure that contains more than one separate residential dwelling unit, which is used or occupied, or is intended to be used or occupied, in whole or in part, as the home or residence of one or more persons. In the market, the house-keeping unit for single-family homes is either that the dwelling contains most the cleaning tools (because some must be shared, e.g., trash collection), or a business service is employed to keep tools and clean. In community, it may be the dwellers or a habitat service team.
3. Mixed residential commercial building - dwelling upstairs, and commercial organizations downstairs.

B. **Commercial zoning** - trading organizations require offices, warehouses, distribution points, and customer access points. In community, there is an integrated habitat production-access system. Location[ing of market] commercial and commodities sales. Note here that this zone does not exist in a community-configuration of habitat. Commercial (financial may be separate, or not, from retail stores):
   1. Retail points (user access point).
   2. Service points (including warehouse and distribution).
   3. Offices for an organization's personnel to do information-type work together.
   4. Financial.

C. **Industrial zoning (production zoning)** - refers to land that permits the manufacturing of industrial products, factories, power plants, warehouses, and other uses that are important to that area's economy. A production zone (industrial zone) is a place to do physical production work together. In community, all habitat production services go here:
   1. **Light industrial zones (light production zones)** - low noise and pollution, often indoors. Light production (light manufacturing) - light production does not produce significantly dangerous waste flows (that must be diluted in the ecology) and or does not create an environmental disturbance for the habitat population. Light production is generally localized within habitats themselves.
   2. **Heavy industrial zones (heavy production zones)** - high noise and pollution, often a mix of indoor and outdoor work. Heavy production (heavy manufacturing) - heavy production produces waste flows that may be potentially harmful (may need to be diluted in the ecology or for other safety issues) and/or creates environmental disturbances that are not desirable for a habitat population (e.g., noise). Heavy production is generally localized outside of integrated habitat service systems for comfort and safety.

D. Other industrial:
   1. **Agricultural** (including plants, animals, both, and other).
   2. **Recreational**.
   3. **Transportation** (including technical transportation pathway, transportation access points, and parking).
   4. **Computational** (including buildings for housing physical computational systems).
   5. **Power.**
   6. **Medical.**
   7. **Etc.**

E. **Natural forest preserve zone** - intended as a nature reserve of trees and other landscape artifacts and can't be touched by human labor.
   1. Preservation/reserve (nature preserve, may allow human access and activities within, or may not).

F. **Mixed zoning** - some ratio-ed mixture of the above A through C types of access.

G. **State/governmental** - military security (including policy zones, defense zones, parks and museums, etc.) - State controlled zone.

H. Public use (some public function).

2. **Building codes (a.k.a., building permits, building permit regulations, building regulations, building ordinances, building laws, building standards, etc.)** - building design regulations. Building code is applied to all properties equally. A building code is a set of regulations that govern the design, construction and modification of buildings and other structures in the jurisdiction. Zoning codes are legally enforceable, and violating these regulations can result in fines and/or penalties. Zoning laws and zoning permits were created by the State to regulate commerce, safety, and users. Such permits are required for building structures, including ponds and dams. Note that in many cases, permits to build structures represent a safety check. The potential to damage watersheds

and ecosystem is very high when constructing ponds, dams, and other architecture.

A. **A "permit"** is a "license", is a permission ("privilege") by an authority, to legally start construction of a project and/or operate something on a property; it allows work to be performed on a property. Permits make actions transparent and ensure code compliance, and are a source of income for the State. A "permit" is essentially a form of State permission to do something, a "privilege". A "permit" is an approval to start work. Within the territory of most States, to start most architectural work without a permit is a violation of State law and will likely be punished after inspectors perform an inspection that reveals the violation.
   1. Depending upon the particulars of a given State, a permit could be required for any change, and for the construction and operation of any system, on a piece of land/territory. Permits may be required for any change to buildings, technologies, or landscape. For simple example,
      i. The number of buildings that can be built on a plot of land.
      ii. The size of the building(s) that can be built on a plot of land (minimum and maximum).
      iii. The number of floors a building can have.
      iv. May include air circulation, materials application, fire extinguishing, air circulation, gas detection, pond construction, gas layout, etc.

B. **The "code"** states the regulation of what is permissible. "Code" is a set of regulatory, enforceable statements.

C. **The "ordinance"** states the penalty for violation. An "ordinance" is a local law or decree adopted by a municipality or local government and includes a penalty for mis-behavior. A zoning "ordinance" is a law with State enforceable penalties and consequence for not following it.

D. **Common types of permits (code, regulation) include:**
   1. **Residentially zoned building codes, ordinances, and permits** - residential building and zoning rules (a.k.a., regulations). For example, a zoning requirement that bedrooms need to have a window with natural light.
   2. **Commercially zoned building codes, ordinances, and permits** - commercial building rules/regulations.
   3. **Industrially zoned building codes, ordinances, and permits** - industrial building rules/regulations specific to some form of industry, production (this includes special technical buildings, such as hospitals).
   4. **Natural forest preserve codes, ordinances, and permits** - building codes for what can be built on a natural forest preserve (e.g., path, bench, bathroom, tunnel, bridge, etc.).

3. **Inspection and enforcement (a.k.a., zoning and building policing, code enforcement, inspecting, and/or assurance)** - policing/assurance to ensure codes (rules) are followed, and violations are punished. Inspectors monitor compliance with the regulations set by the State (i.e., by management, by politicians, by administrators, by scientists, by engineers, etc.). Police are the prototypical law inspector and law enforcer in the market-State. There are also city technology inspectors (e.g., A.C. installation inspectors, building inspectors), taxation collection inspectors (Internal Revenue Service, IRS), travel and transportation inspectors (Customs Inspection), etc.

> **CLARIFICATION:** *In community, there are habitats that provide habitat services (a.k.a., productions), therein. In other words, there is production to produce and re-produce habitats as a configuration of services (a.k.a., industrial productions) composed of resources and human labor, and developed for human need fulfillment and ecological restoration. Notice how in community there is a non-commercial relationship between user and producer (a.k.a., industry).*

A master plan is a project document ("policy") that expresses intent. It may, or may not, be an enforceable document. In the market-State, a master-plan is not law; law is code, code is rules, rules are instructions, instructions are our choice. Conversely, in community, a master-plan in conjunction with a set of standards inform societal operations; herein, it may be possible to call "master-plans" law. A restorative justice master plan would be the prototypical law, but there would also be plans for each of the integrated habitat service systems. It could be said that in community, the results of the decision system are the "law".

> **NOTE:** *In the context of habitat master plans, in community, these are decision system deliverables.*

2.1 Market-State master planning method

> *A.k.a., Market-State urban planning, market-State master plan decisioning.*

Market-State master plans are based on local and global human competition (trade) of scarce resources positioned within State economic jurisdictions. Herein, what is acceptable is highly subjective. It is subjective to individual want, to commercial interests, and to authority-over-others. This approach produces a sub-optimal plan for the local populations of humans and the global ecology. The result of this approach to material decisioning is a property tradeable habitat (composed of “rights” to materiality and information). Neighborhoods in the market-State are frequently zoned to keep people of similar wealth together. Also, the zoning of residential neighborhoods can be used to control the influence of votes in a democracy.

Generally, local governments have a large degree of autonomy to control land use within their jurisdictions. States typically grant them the authority to pass ordinances and regulations as long as they do not conflict with other laws. Furthermore, all states give municipalities the power to enact zoning regulations.

Market property areas include:

1. Individual property [“rights” and beliefs].
   A. Citizen property [“rights” and beliefs].
2. Business property [“rights” and beliefs].
   A. Economic property [“rights” and beliefs].
3. State property [“rights” and beliefs].
   A. Ecological property [“rights” and beliefs].

The significant questions about zoning under market-State and community conditions are:

1. What is the decisioning that goes into the positioning of the totality of these zones on the landscape under market-State conditions?
2. In the market-State, is zoning done by urban planners who produce deliverables that relate more to political positions and financial analyses than human needs?
3. In the market, are zones on a landscape decided based upon the context of ownership, property, trade, and regulation?
4. Under community conditions, how might the master zone/sector plan for a city/habitat be different than under market-State conditions, if there is no residential, commercial, or industrial property?
5. In community, is zoning related to the product of a unified habitat service system for global human need fulfillment through common heritage resources and human contribution.?
6. In community, are zones on the landscape positioned based upon an integrated engineering proposal for locally optimized human need fulfillment, constructed and operated by habitat teams?

2.1.1 Market-State urban [code] planning and [code] enforcement method

In general, State law is the foundation for local urban planning. There are a mixture of organizations that decide what is and isn't permissible in concern to urban master planning, these include, but may not be limited to:

1. **Housing and development boards (a.k.a., housing board, development committee, etc.)** - a statutory board under a ministry or State department responsible for the housing. Typically, a housing board is tasked to plan and carry out the construction or upgrading of any building, clear slums, manage and maintain the estates and buildings that it owns, and to provide loans to people to buy land or public housing. The board may also carry out land reclamation works and handles the infrastructure for Singapore's national resource stockpiles.
2. **City council (a.k.a., legislative board of a city)** - a statutory council of the State that adopts the local general plan, zoning, and subdivision ordinances.
3. **Board of supervisors (a.k.a., legislative board of a county)** - a statutory board of the State that adopts zoning, subdivision and other ordinances to regulate land uses and to carry out the policies of its general plan.
4. **Enforcement after code violation (of district authority rules)** - In concern to code violations, the authority may drive around and seek to observe violations. The general public, neighbours, and laborers can also report violations. Violators are usually given hearings, and then fines (i.e., a penalty task). Depending upon the specifics of the authority and its rules, those penalties may lead to time in jail.

NOTE: *When a housing board (city council, etc.) becomes a commodity, then entire cities are built for short-term profit. The sheer necessity to house people can lead to quickly built housing that was only designed for basic survival, fabricated quickly, and at a good profit margin.*

Separating an area of land into functional sectors [for legitimate users] is necessary socio-technical decision task. It is not only a market-State activity, but a societal engineering consideration/activity in general. Individuals zoning in the market-State are highly likely going to take market-State values, requirements, and solutions, and apply them to the allowed usages of land. In community, a community-based information system is highly likely going to take community values, requirements, and solutions, and apply them to the allowed usages of land. Zoning codes in the market-State are frequently, even unintentionally, be designed to perpetuate the market-State status quo, and therein, socio-economic class division. The market-State, the zoning code method is informed through the involvement of commerce and authority. Zoning codes can influence society's configuration of socio-technical relationships in the following ways, including but not limited to:

1. **Economic colonization:** Zoning the territory of another to exploit their resources and their expense.
2. **Economic segregation:** Zoning can lead to economic segregation by designating specific areas for specific societal[-need of] land uses, such as residential, commercial, or industrial. This can influence property values and the distribution of wealth within a community.
   A. Property values: Zoning can influence property values by restricting or encouraging certain types of development. This can impact the market's influence on property values and contribute to class division.
3. **Housing affordability:** Zoning codes can impact housing affordability by regulating the following two variables that can affect the availability of affordable housing options for different socio-economic classes.:
   A. The type and density of housing allowed in different areas.
   B. Redevelopment rules for certain neighborhoods, displacing lower-income residents who can't afford the change.
   C. Taxation changes (e.g., area owner, income, and purchase tax increases/decreases. Taxation can be used to force specific tiered income owners out of an area, and/or
4. **Access to amenities:** Zoning can determine access to amenities like parks, schools, and public transportation, medical care (etc.), which can be unevenly distributed within a community and contribute to socio-economic disparities. Access to decisioning about future amenities can be used to raise the property values of some over others.
5. **Regulatory capture:** In many cases of zoning in the market-State, zoning decisions are influenced by special commercial [for-profit] interests or powerful stakeholders, potentially reinforcing the status quo and market-State class division, in order to maintain their position.

2.1.2 State zoning methods (master plan land usage regulations)

A.k.a., Authority zoning, State authorized location usage, landed property usage, local/district authority rules, land board rules, zoning rules, zoning codes, bylaws, home owner association laws (HOA), property owners association (POA) rules, condo association rules, residential association rules, residents association rules, common interest development rules, property owners group rules, etc.

There are a hierarchy of market-State organizations that create rules governing all aspects of the built environment. A zoning ordinance is the law; it is a set of "authority" given rules for behaviors and structures in a geographic area. Codes, rules, and laws, regulates land use, including but not limited to: building form, placement, size, spacing, parcel area, width, depth, etc. Because an ordinance is law, it includes consequences for violations. Consequences can be a civil infraction such as: ticket and fines, or, criminal charges and injunctions. All of which are meant to, or will, eventually induce pain.

The most common zoning methods in the market-State are:

1. **Market sectorization** - in general, the market is sectorized into two domains:
   A. Socio-economic trade cycle:
      1. Employee (laborer).
      2. Employer (industry & the State).
      3. Consumer (resident).
   B. Production:
      1. Residentation.
      2. Commercialization.
      3. Industrialization.
      4. Agricultural Cultivation.
      5. State Operation.
2. **Euclidian zoning (a.k.a., single-use zoning; single zoning code)** - is zoning based on single usage. It is characterized by the segregation of land uses into specified geographic districts and dimensional standards stipulating limitations on development activity within each type of district. Commonly defined single-use zones include: residential, mixed residential-commercial, commercial, industrial and spatial (e. g. power plants, sports complexes, airports, shopping malls etc.). Each category can have a number of sub-categories, for example, within the commercial category there may be separate zones for small-retail, large retail, office use, lodging and others, while industrial may be subdivided into heavy manufacturing, light assembly and warehouse uses.
3. **Performance zoning (a.k.a., effects-based planning; performance-based code)** - is zoning based on a material or human property. Examples of performance zoning include: number of units (i.e., material property), usage (human-material property), walkability (human-material property),

privacy and visibility (human-material property), and diversity quota (i.e., human property). This includes standards like the Leadership in Energy and Environmental Design (LEED), solar shading code, and other such standards. Performance requirements become part of planning demands and decisions.
4. **Lobbying zoning** - financially wealthy corporations lobby States to acquire access to land for their corporation/business, who grant then the ownership rights after some sort of financial payment (bribe, kickback, etc.) or other inducement.
5. **Incentive zoning (incentivization code)** - is intended to provide a reward-based system to encourage development that meets established population and/or authorities urban development goals. Typically, the method establishes a base level of limitations and a reward scale to entice developers to incorporate the desired development criteria.
6. **"Form-based" zoning** - occurs where States regulate not the type of land use, but the form that land use may take.
7. **Conservation area zoning** - occurs where States want to protect some area from harm and/or change. Conservation areas are typically natural ecological areas, but can be buildings and other architecture.

State "authority" organization with authority-over-overs include:

1. National-State level authorities.
2. Local-State level authorities.
3. Local-Municipality level authorities.

After zoning of land takes place, it may be purchased, either:

1. Through private sellers.
2. Through a government land sale program.
   A. It is Architectural-Construction developers or industry that typically buy this land.

Property therein may be purchased as:

1. **Freehold** - can be handed down to the next generation. The common understanding is that freehold properties can be held indefinitely by the buyer.
2. **Leasehold** - lease hold means that at then of a set number of years, the owner (i.e., the State, or a private entity), will take the property back. Normal leaseholds are 99 years. Generally, 99-year leasehold properties will revert back to the State after the tenure ends. The common understanding is that the property is available for 99 years, whereupon the State takes it back, allowing for significant re-zoning if appropriate.

Individual zones [within a State territory] are separated into groups of "lots" that are traded in the market-State for employer-employee-consumer usage/access: residential, commerce, industrial, and State usage functions. Zoning codes (landed property usage rules) can relate to any possible habitat location factor. Zoning codes in the market-State generally include factors such as: use of area, size of area, signage, parking, fences, setbacks, aesthetics, paint color, illumination, minimum building size, maximum building size, numbers of floors, lot coverage, floor to area ratio (ration of the lot to the total building floor space), area for nature preserve, sports equipment (e.g., basketball hoops), type of power options, exterior design, interior design, etc. For example, an authority may state that basketball nets are not allowed or that all bedrooms need to have a window with natural light.

Most often territory in the market-State is zoned so that it is most easily sellable. In the market-State, land is sold for development and operation within a market-State operational sector (e.g., State usage, commerce, industrial production, home residentation, and agricultural cultivation).

> **IMPORTANT:** *In the market-State, the State governmental zoning board/authority cares whether land can be sold, and what the taxes on the land will be.*

2.2 Community zoning method

> *A.k.a., Habitat service sectorizing method, community master habitat plan sector decisioning.*

Zoning sector plans (a.k.a., as functional service sectors) are an essential component of master plans, as they create the macro-locations of function. In a community-configuration of society, there is collaborative decisioning for the construction and operation of a materially built environment based on community standards. The Plan is based on local and global human fulfillment using known available resources positioned within habitat services. Herein, what is acceptable is the individual experience of human need fulfillment; the plan accounts for the material human demands for life, technology, and exploratory support. This approach produces optimal plans for local populations of humans and the global ecology. This plan uses open source standards. The result of this approach to material decisioning is a shared habitat (composed of common heritage resources). Decisions are based on a comprehensive visualization of human need fulfillment in conjunction with value-oriented solutions. Community values, objectives, and requirements become material habitat projects with by-law customization of local aesthetics and services. Community understandings ensure the drive for improvement of human quality-of-life and ecological regeneration. Herein, plans are proposals, until they are selected, whereupon they become executed operations, protocols and guidelines, followed by habitat operations team members. These team members follow and take decisions based on a unified set of societal information standards that have resulted from integration of understandings over generations of time. Human need fulfillment indicators are the measure to which habitat plans and operations are assessed. Critically, such a framework would ensure that measurement of environmental [resource access] quality is more reflective of human local [community-oriented] aspirations, and based on a process that fosters more participative habitat construction, and meets real-world human well-being objectives.

Community zoning is part of the process of master solution plan decisioning:

1. Issue inquiry.
   A. All issues require area in a habitat in order for the issue to be resolved; all issues are processed in physical habitat sectors.
2. Solution services (parallel decision inquiry) for design and access to habitat sectors:
   A. Performance metrics (performance requirements in master plan).
      1. Are fulfillment performance expectation being met?
      2. Are human fulfillment requirements part of decision planning?
   B. Master plan habitat sectorizing/zoning, based on master plan decisioning (a.k.a. a community decision system):
      1. Agreements ("bylaws") form habitat criteria.
      2. Local agreement of schedule.
      3. Parallel value [objective] inquiry and synthesis master planning of socio-technical habitat.

Accurate and sufficient information and its transparency play a critical role in a habitat's design and performance. Requirements/performance-based design can be understood as an approach to design a habitat that meets measurable and predictable performance requirements regarding human fulfillment. By adhering to human requirements and the results of economic calculation, the design solution becomes optimal and objective, which aligns it with community. This approach is based on the existence of a space of solutions that comply with performance requirements, and therein, a protocol that resolves design decisions to a single next master-plan selection (or, sub-master-plan therein). Contribution to visual design, engineering, project coordination, and local demand identification, together, create a habitat where human fulfillment may be optimized.

In community, a habitat master plan represents an integration of human fulfillment, habitat function, and material reality. Habitat service system elements (life, technology, and exploratory) should be accounted for in the design and selection of zones, circulars, and other material access locations.

Any given habitat will have some ratio of the following habitat service sub-systems:

1. Life support.
2. Technology support
3. Exploratory support.

Any given habitat will have some ratio of the following access categories (access zones):

1. Personal access areas (typically, personal dwellings).
2. Common access areas.
3. Contribution/Team access areas (including team work and production areas).

At the habitat-scale, any given habitat service system may cover in area:

1. A whole sector (fixed or scheduled).
2. Only a specific building(s) or land area in a sector (fixed or scheduled).
3. Only a specific room(s) in a building or on land area in a sector (fixed or scheduled).

2.3 Simplified comparison between market-State and community zoning

Cities in community are each an integrated habitat service system unto themselves, with each of the life, technology, and exploratory service support systems active continuously. The sectors of a local-city system are functionally divided [in a master plan] into the three service support platforms in community (i.e., life, technology, and exploratory). Cities in community exist within a regional (national) and global habitat service system that accounts for the life, technology, and exploratory [resource requiring] services, as necessary for every individual. The market-State zones according to the industrial market (i.e., State, residential, industrial, commerce, agriculture, and mixed), and not according to human habitat service support need (i.e., life, technology, and exploratory). Community creates individually customized total-/integrated-city systems with a master planned final perimeter. In other words, community cities are zoned per fixed [master plan] habitat services. And, market-State cities are zoned per market-State services.

Zoning in the market-State is organic and sprawl is expected. There is no sprawl in community. Cities in community are separated into a unified, and habitat service sectored, structure. Cities in the market-State are separated into taxable or wild reservation sectors, the pattern of which may be repeated over the landscape continuously without stop (i.e., without a final-set perimeter). Cities in community are typically not compacted into expandable city blocks (e.g., square blocks, octagonal blocks, etc.), but instead, fit into a sectorized final master plan (with an outer perimeter).

In community, landed locations are zoned based upon free access to three habitat service systems, and their sub-systems. In the market-State, landed locations are zoned based on property and the market-based industries of the State, residential, commerce, industrial, and agriculture. Simply, community cities are zoned (sectorized) per a habitat service support system master planned [in the decision system] by local en-habitats in coordination with a global decision accounting and solution system. Cities in the market-State are zoned based upon market-State conditions, as well as group and power-individual biases.

3 Master planning: Market interface

A.k.a., Market master planning interface, business master plan.

Market-based master plans are all about business development and business growth; they are about profit, because all businesses in the market must make a profit, or they do not survive. Profit is the major influence on plans in the market. In other words, plans under market conditions seek to arrange the material environment (including objects and people) in such a way that profit can be made. Market-based infrastructure is influenced by many factors, the most fundamental of which is the size and use of selling space and its relationship to traffic circulation and parking .

> **NOTE:** *There is also master planning for the material environment without business, through donation to a city or university. Privately wealthy individuals and organization also donate to fund various architectural and related projects (e.g., a monument, a university dorm, etc.). These funders frequently design the deliverable themselves and/or have veto rights over deliverable's master plan.*

Market master plans are called business plans, and they include at a high-level - objects/services, finances, and contracts:

1. **Object/service specific questions** for a business plan include**:**
   A. What is being sold?
   B. To whom is it being sold?
   C. How will it be sold?
   D. What is the object/service design and development plan?
   E. What is the plan to get people to buy the object/service?
2. **Finance (money) specific questions** for a business plan, identify the:
   A. **Total currency available now** (i.e., capacity for action in the market-State; budget).
   B. **Total inflow of cash** (inflow of currency, input cash flow).
      1. **Funding from sources other than sales** (business funding plan).
      2. **Selling of the objects/services** (business sales plan).
         i. **Projected income (revenue projection)** - multiplying total estimated sales in quantity by sales price of each item.
   C. **Total outflow of currency as cost of doing business** (expenses, output cash flow).
      1. **Employee costs** (labor fees, including

managers, technicians, and attorneys).
   2. **Material and machine input costs** (production fees).
   3. **State costs** (taxes, State fees).
3. **Contract (agreement) specific questions** for a business plan, identify the:
   A. **Contracts** (identification of accountability; legality).
      1. Agreements (written relationship accountabilities and financial trades).

The procurement (acquisition) of services and systems from the market necessitates finances (money) and financial documentation:

1. **Bid tabulations** - the recording of Bids and bidding data submitted in response to a Bid Solicitation for purposes of comparison, analysis and record keeping.
2. **Purchase orders (a.k.a., proposals)** - Purchase orders are documents sent from a buyer to a supplier (seller) with a request for an order. A proposal is an project description sent from someone who seeks resolution of an issue and the agreement of a specific population.
3. **Vendor information (a.k.a., seller information)** - all information about the seller.
4. **Receipt for *procured system*** - identification of the purchase (sale/purchase) of some thing.
5. **Inspection of *procured system*** - process by which the buyer (or some regulatory body) assures that the purchased item is as expected.
6. **Dispute mediation (a.k.a., contracts and law)** - process by which the buyer disputes the sale and/or what was expected to be delivered.

The complete documentation set also includes:

1. **Acquisition (procurement) proposals** - a description of what is needed and what is to be done with the acquired resources.
2. **Accounting reports** - a financial statement consists of:
   A. **Balance sheet** - tells the user the financial status of assets and liabilities by a given date.
   B. **Earnings statement (profit and loss)** - tells the user the financial status by Income Less Direct (job) costs, and Indirect (overhead) costs = profit, or loss.
3. **Contract negotiations:**
   A. Estimate scope of services.
   B. Estimate time, costs, and profit.
   C. Determine method of compensation:
      1. Percent of construction cost.
      2. Lump sum.
      3. Hourly rates.
      4. Hourly rates with maximum "upset" ("not to exceed")
4. **Contract checklist** (note: everything must be put in writing):
   A. Detail scope of work, no interpretation necessary.
   B. Responsibilities of both parties.
   C. Monthly/weekly/daily progress payments.
   D. Interest penalty on overdue payments.
   E. Limit length of construction administration phase.
   F. Construction cost estimating responsibilities.
   G. For cost-reimbursable contracts, specify provisional overhead rate (changes year to year).
   H. Retainer, applied to fee but not to costs.
   I. Date of agreement, and time limit on contract.
   J. Approval of work:
      1. Who
      2. When
      3. Where
   K. Ways to terminate contract, both parties.
   L. For changes in scope, bilateral agreement and an equitable adjustment in fee.
   M. Court arbitration remedies and who pays legal fees.
   N. Signature and date by both parties
   O. Limits on liability.
   P. Time limit on offer.

4 Master planning: Local population relationships

A.k.a., Local communications plan.

Relationship master planning involves engagement with the local population. Positive working relationships must be developed with the local and surrounding populations to ensure a successful habitat construction and persistent operation.

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The Auravana Project exists to co-create the emergence of a community-type society through the openly shared development and operation of a information standard, from which is expressed a network of integrated city systems, within which purposefully driven individuals are fulfilled in their development toward a higher potential life experience for themselves and all others. Significant project deliverables include: a societal specification standard and a highly automated, tradeless habitat service operation, which together orient humanity toward fulfillment, wellbeing, and sustainability. The Auravana Project societal standard provides the full specification and explanation for a community-type of society.

This publication is the Material System for a community-type society. A material system describes the organized structuring of a material environment; the material structuring of community. This material system standard identifies the structures, technologies, and other processes constructed and operated in a material environment, and into a planetary ecology. A material system encodes and expresses our resolved decisions. When a decision resolves into action, that action is specified to occur in the material system. Here, behavior influences the environment, and in turn, the environment influences behavior. The coherent integration and open visualization of the material systems is important if creations are to maintain the highest level of fulfillment for all individuals. This standard represents the encoding of decisions into an environment forming lifestyles within a habitat service system. This specification accounts for the makeup of the material environment. The visualization and simulation of humanity's connected material integrations is essential for maintaining a set of complex, fulfillment-oriented material constructions. As such, the material system details what has been, what is, and what could be constructed [from our information model] into our environment. This specification depicts, through language and symbols, visualization, and simulation, a material environment consisting of a planetary ecology and an embedded network of integrated city systems. For anything that is to be constructed in the material system, there is a written part, a drawing part, and a simulation part, which is also how the material system is sub-divided.

Fundamentally, this standard facilitates individual humans in becoming more aware of who they really are.

All volumes in the societal standard:

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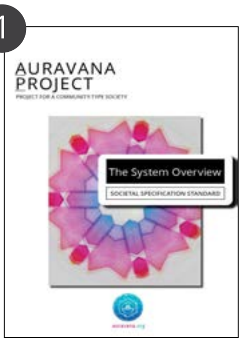

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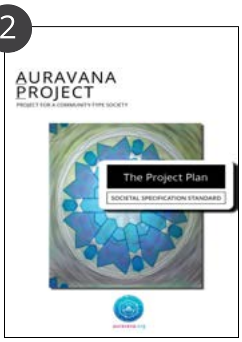

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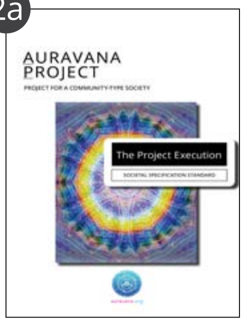

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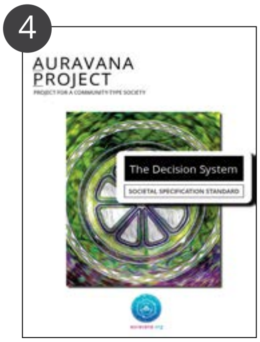

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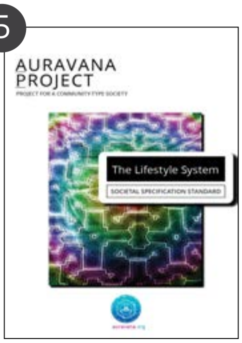

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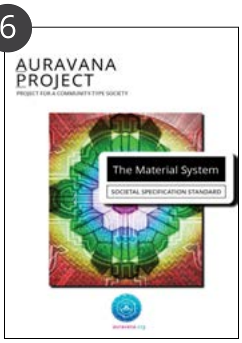

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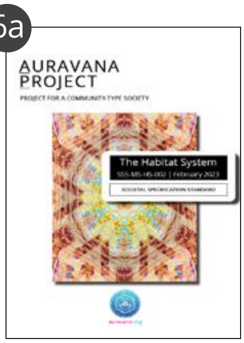

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