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New Attempted Moving Towards Understanding Urban System Behavior

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New Attempted Moving Towards Understanding Urban System Behavior

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Abstract: System is considering useful concept to describe the spatial forms (city, region, etc.). Additionally, diverse fields that undertaking finds it sharpen their understanding and improve their practice.by exploring the literatures in this field; here we argue that there are two forces that effect in urban system behavior: 1st one vertical force the value which changing according to urban rent and another social factor related to place. The 2nd one horizontal force the flow changing according to movement of matter, energy, and information. That may lead to new perspective to see the city as a system and highlight the way for planners to sustain their cities.

Keywords: Urban system, the complexity theory, system behavior, urban forces

1. Introduction

Many attempts that made to relate the theoretical framework of system identification to the human settlement pattern. Yet there is so many done in this field we review this literature in selective way in this paper as a result of the limitless scope of this subject. The complexity of the real world and the city as a part of it make us against unpredictable behavior for city systems evolution with time. So, this paper designed to pass three stages

- 1st the exploration the literatures that consider city as system.
- 2nd re-adjustment with regard to the theoretical framework new understanding for urban system behavior.
- 3rd try to draw conclusions for improvement of understanding the urban system, and for future urban planning practice

2. System terminology development:

The most surely well-known definition of a system is that given by Hall and Fagen [1]According to them, a system is "a set of objects, together with relationships between the objects and between their attributes." So, they define major elements in any system objects, attributes, and relationships.

"Objects: are the parts or components of a system, which are unlimited in variety"

"Attributes are properties of objects"

"Relationships are those that 'tie the system together'." The idea of complexity is not so far from their definition but not in clear way as Stanford Optner [2] "Objects are the parameters of systems : the parameters of systems are input, process, feedback control, and a restriction. Each system parameter may take a variety of value to describe a system state"

"Attributes are the properties of object parameters. A property is an external manifestation of the way in which an object is known, observed, or introduced in a process. Attributes characterize the parameters of systems, making possible the assignment of a value and a dimensional description. The attributes of objects may be altered as a result of system operation."

"Relationships are the bonds that link objects and attributes in the system process. Relationships are postulated among all system elements, among systems and sub-systems, and between two or more sub-systems"

Rapoport's[3] brought the definition into another applied structure for scientific and prescient purposes. According to him, a system is "a portion of the real world which at a given time can be characterized by a given state together with a set of rules and laws that permit the deduction of future states from partial information"

Hall and Fagen's definition emphasize objects while Stanford Optner gives new description for objects as parameters of the system while Rapoport, emphasis on Attributes and relationships. He sees every system can be a portion of the real world.

3. The city as system:

The study of functional and spatial characteristics for system can be found in the real world such as the city which is the focus of the present of this city at a point in time, represent the state of the system while the various hypotheses posited to facilitate an understanding of its operations may be interpreted Conceptualizing as the rules and laws that will enable deductions to be made about the future states of the system. [4]

Cities were first treated formally as systems when General System Theory and Cybernetics came to be applied to the softer social sciences in the 1950s. Ludwig von Bertalanffy (1969) the idea of a general systems theory was gradually fashioned from reflections on the way distinct entities which were clearly collections of lower order elements, organized into a coherent whole, it was encapsulated in the phrase that "the whole is greater than the sum of the parts". It was part of a wave of change in the social sciences which began in the late 19th century as these fields began to emulate the physical sciences, espousing positivist methods which had appeared so successful in building applicable model in represent of the real world.

General system theory provided the generic logic for both the structure and behavior of such systems through various forms of feedback and hierarchical organization while cybernetics represents the 'science of steersman ship' which would enable such systems to move towards explicit goals or targets. [5]

The systems view of planning first arose in the UK in the late 1960s through the work of Brian McLoughlin (1969) and George Chadwick (1971, 1978) They contribute to moving far from the old convention of urban planning practice. The embodiment of this new methodology was to treat settlement as a system that is, as a set of parts associating with each other figure 1. So that settlements are seen as urban systems, urban system can be viewed as a type of methodological control, so organizers can utilize every one of the apparatuses given by cybernetics.
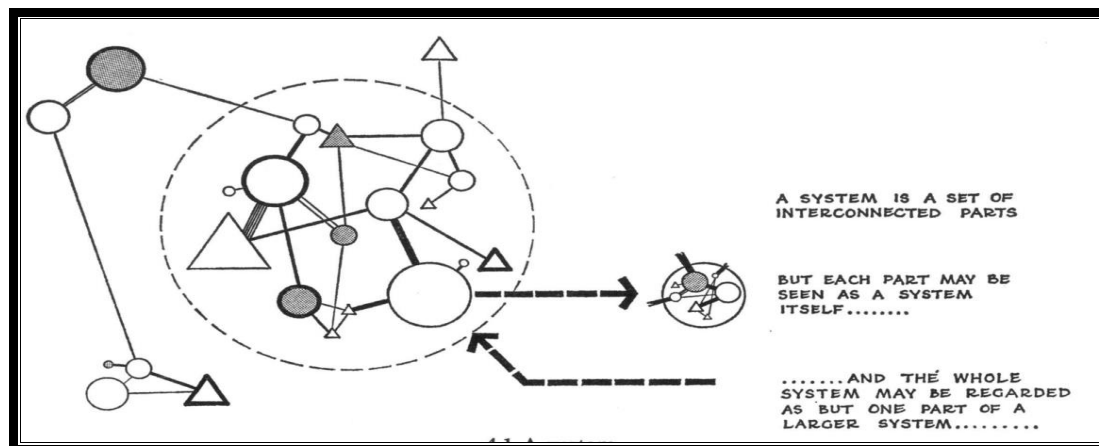
Figure 1. System according to McLoughlin
Ref: McLoughlin, J.B., Urban & regional planning: a systems approach. 1969: Faber and Faber.

To comprehend the connection between the utilization of planning standards and the systems planning theory hypothesis "the system is actuated by a control device which is supplied with information about its actual state compared with the intended state" [6]On urban planning, "the city of course is the system we wish to control, the desired states are expressed in the plan, we measure the actual state at any time by all forms of survey and can thus compare the actual conditions with those intended by the plan"[6] The desired state of a settlement is defined in the planning program. The planning program composes the approaches and activities into objectives, which have a general character, into goals which are more exact and into sub-objectives, which contain guidelines for particular actions [2, 6].

According to McLoughlin working with objectives and sub-objectives in quantitative terms is important, in light of the fact on perspective planners need to predict the future state and, then again, it enables them to quantify the deviation between the real and the planned state whenever. McLoughlin [6] explain the that the term goal and the needs in planning process

"This statement "[i.e. goal] is not capable of providing neither a clear basis for the design of a plan nor an operational basis for its implementation. It lacks the more precise statements of objectives and standards which are needed."

In several examples, McLoughlin presents the use of other planning standards, such as "area of green space per inhabitant" and "area of urban uses per certain distance of the city centre".[6]

That uncovers that systems planning in McLoughlin concepts of urban system have embodied standards norms in its methodology, utilizing them as a tool for convert the general goals into particular arranging actions. The researchers go on to assert that the system approach provides a proper spatial framework for developing an understanding of and a proper attitude toward the working of our cities it provides us with tools for the analysis of urban systems, which is particularly concerned with events in both spatial and temporal dimensions. Provided our definitions are precise, the resolution of these dimensions is facilitated by the use of system analytic techniques.

In order to use some of these concepts, Wilson try to identify the major components of the city system. He categorize these components into "objects, activities, physical Infrastructure land and policy".[7] The "objects" refers the population, the goods and the vehicles in the urban area; activities include residing, production of goods and services and trip-making for the gets

these goods and services. infrastructure refers to the buildings (houses, schools, stores, factories and shops) and at the same time to roads, parking spaces, pipes, electricity and telecommunication lines. Land refers to areas under various land uses while policy refers to the decision-making agencies which affect the volume of other components of the city system. Figure 2.
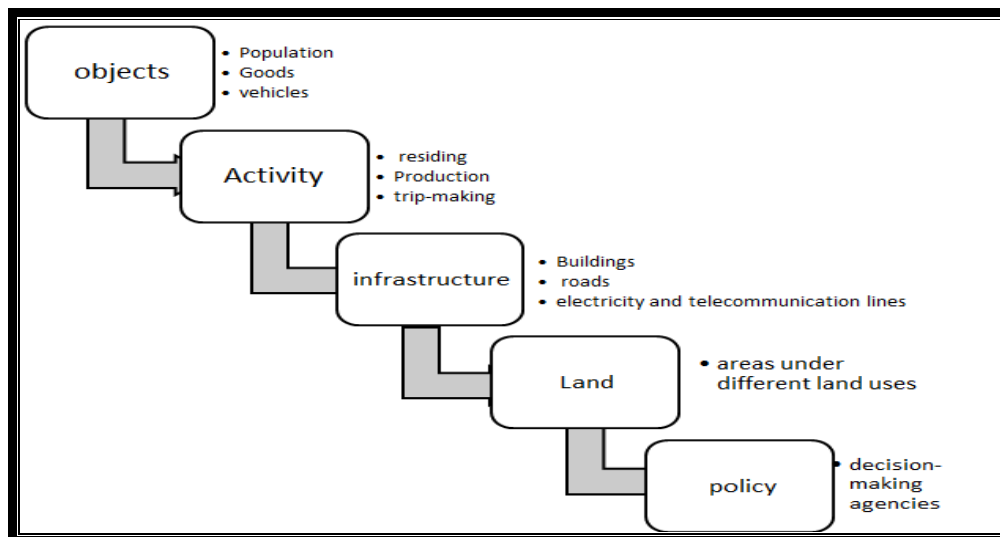
Figure 2. The components of urban system in Wilson categorization
Ref: Wilson, A.G., Forecasting 'planning'. Urban Studies, 1969. 6(3): p. 347-367.

The entities defined above form the first steps in the building of subsystems of interest within the city. The city as a system also involves the definition of interactions, are responsible goals plans land in different uses decisions Land Policy as these for its social, economic and spatial structure. The interactions that determine the economic structure are the monetary and other financial transactions, while the social structure may be seen as determined by flows of information and ideas. The spatial structure on the other hand is dependent on spatial interaction which has its expression in the form of all aspects of human spatial behavior such as the journeys to work, servicer, schools and recreational centers. The volume and direction of these physical trips represent the relationships between the objects of the city system.[4]

Planning is a process of human thought and action; spatial patterns are not the object of planning, they are the objects of a process independent from them. Planning has been too much concerned with the content of plans rather than with the process of planning. So, must of planners concern about the object of the urban system that they deal with less than the process of how they develop and interact as urban forces which this paper will discuss.

4. The complexity of urban system:

We need to see urban areas as complex systems and accept the strategies that exist prof to the hypothesis of such systems the recent works of 30 years ago can be incorporated through the thoughts of what is turning into a typical methodology in numerous fields of science – complexity theory.

It will be contended that there is more potential for urban examiners who can be opened through complexity hypothesis and new interdisciplinary joint effort. Curiously, it tends to be contended that explain of complexity theory is essential substantive field for two reasons as Wilson explain[8]:

"first, because in all the excitement of the new developments in complexity theory, the social sciences have been seriously neglected; secondly, because urban modeling in particular

demonstrates how the ideas of complexity theory can be made to work in a real context." We therefore need a good explain to understand of what complexity theory is about.

It's about how seen cities and regions as a system - simply because they involve a large number of interacting components. Complexity theory can then be thought of as theory about complex systems. Urban and regional analysis can then be seen as concerned with complex spatial systems.[8]

Warren Weaver [9] was first introduced a useful distinction between simple and complex systems. In the scientific context, "simple systems were those describable by a small number of variables; complex systems needed a large number of variables to describe them." He made a further subdivision of complex systems into those of disorganized complexity (chaos) and those of organized complexity. It should now be recognized that a particularly important subset of systems of organized complexity are nonlinear systems.

Wilson [8] try to characterizes the main aspect of complexity theory Figure 3. Nonlinearities can emerge in differentiation of tools: when rates of progress are something besides consistent; the nonlinearities are at the premise of what is intriguing in complex system behavior.in other side, various essential investigative issues related with urban systems solved utilizing strategies for system of disorganized complexity nature. The most fascinating issues, as in most different sciences, are those of systems of organized complexity nature.

He fined that systems of organized complexity are basically that they are comprised of huge quantities of parts and these parts are strongly connected, they each cooperate firmly with various others. Clear examples of systems of sorted out complexity nature are human beings, brains, ecosystems, economies, cities and urban communities. The greater part of these figures complexity nature theories is discussed.

He takes speculations that about understanding systems; and that techniques are essential components in theory assembling. We ought to likewise perceive that most intriguing hypothesis building is worried about process - the nature of progress after some time for the arrangement of intrigue. Scale is especially vital. It is imperative to perceive that there are fascinating (logical) phenomena at every one of these scales - however some of the time there are vital associations between scales. It would then be able to be contended that the strategies which are important in theory working at one scale might be not the same as those for a similar system (or a component of it) at another scale. Essentially, we work with a chain of command of learning about real complex systems.

However, there is another aspect of the methodological tool building which needs to be brought into play here. Most interesting complex systems are very large. So even though some of the mathematics exists in principle, either not enough is known substantively about the system to make mathematical analysis possible, or the system is simply too large for feasible analysis; there are too many variables. This is where another major impact from discoveries of the last 20 years contributes to method: powerful computers. These have meant that many of the problems which are not solvable in analytical mathematical terms can be tackled through computer simulation - generating great understanding and insight. Much of the power derives from the fact that it is possible to combine human intelligence with computing power – and we should not underestimate the impact of computer graphics, developed with the advent of PC cultures, in this context. In many cases, it is easier to work directly with ideas of computer modeling and simulation rather than the more traditional systems of mathematical equations. In the context of urban and regional analysis, these ideas have even manifested themselves in impressive computer games[10].

There is one last element to the methodology of complexity theory: the effective metaphor. This arises from the multidisciplinary power of complexity theory: essentially, in fact, the main concepts are (supradisciplinary). These ideas will allow us to map out (systematically!) in turn the territory of complexity theory and the range of methods which are potentially valuable in systems of interest - in this case, cities and regions. there is a three-stage approach to achieving understanding: the articulation of systems of interest; theory development for that system; and the deployment of appropriate methods to operationalize the theory. The particular and more

specific focus on representation of this knowledge as system models. By adopting a system modeling focus, it might be argued that an essentially functionalist approach is being adopted. That is, the forms of organizations and institutions are taken as given and the emphasis is on the way they function both individually and in relation to each other. It is also necessary to explore the deeper structures and forces which create these particular forms of organization.[8]
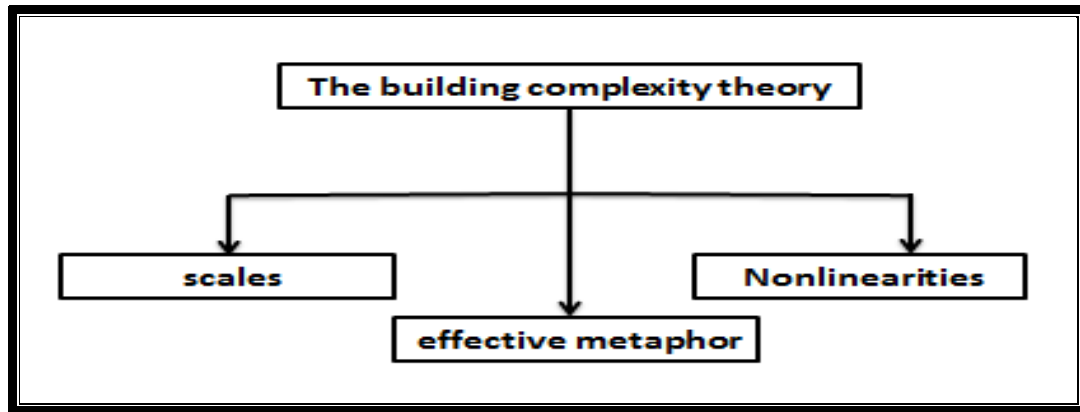
Figure 3. The main aspect of complexity theory

Ref: Weaver, W., Science and complexity, in Facets of systems science. 1991, Springer. p. 449-456

The apparent phenomena of city and regions such as locations and land use pattern are just the surface of deeper complexity in the natural and biological social economical systems that together generate \these patterns. This hidden system is desperate geographically and we can't understand the behavior of these systems without understanding the evolution and dynamics of their spatial development.

The new complexity sciences are rewriting the theory of general systems, linked through interactions which determine the processes of behavior which keep the system in equilibrium and/or move it to new states. Feedback is still central but recently has been more strongly focused on how system elements react to one another through time. Feedback is now largely seen as the way in which these structures are evolved to new states. Relationships between the system elements in terms of their interactions are being enriched using new ideas from networks and their dynamics[11].

The key ideas defined cities as sets of elements or components tied together through sets of interactions. The archetypal structure was fashioned around land use activities with economic and functional linkages between them represented initially in terms of physical movement, traffic. The key idea of feedback, which is the dynamic that holds a general system together, was largely represented in terms of the volume and pattern of these interactions, at a single point in time. Longer term evolution of urban structure was not central to these early conceptions for the focus was largely on how cities functioned as equilibrium structures.

The essence of using a systems model of spatial interaction to test the impact of such changes on city structure is twofold:

- First such a model can show how people might behave.
- Second the slightly longer term effects of flows and values forces the city system models presented here designed to track and predict such order effects [12]

In such a case functional relationship between "vertical" and "horizantal" coordinates of the urban system will have to be identified in terms of its forces.

Applications of physical analogies to social and city systems, particularly ideas about gravitation and potential, had been explored since the mid-19th century under the banner of 'social physics' and as transportation planning formally began in the 1950s, these ideas were

quickly adopted as a basis for transport modeling. Softer approaches in sociology and political science also provided support for the idea of cities as organizational systems while the notion of cybernetics as the basis for management, policy and control of cities was adopted as an important analogy in their planning [2, 6]

The approach characterizes the city as a system in the terms defined above, and to go further to identify what constitutes objects, attributes, relationships, the state, rule and laws of this system. The point is that if a city must be viewed as a system, there is a need for precise and explicit definitions of pertinent concepts. Once this is achieved, it is possible to introduce such ideas as "energy", "temperature", "forces" and "vertical and horizontal coordinates" into our conceptualization. In this way, we shall be at the threshold of utilizing a well-developed body of ideas and techniques in analyzing and understanding social systems in general and urban systems in particular [13]

5. Forces that effect in urban system (Flow-Value relationship):

5.1. Vertical force (value):

The review in literature on place value reveals more attention in uneconomic values that rule the land market and effect in its value. ÜNSAL ÖZDILEK [14] investigates in urban land value and he emphasizes that recent literature don't reuse the same concept in earlier three centuries but provide basic explanatory tools use for urban value models but still that useful in same cases and not so satisfactory in other. Such tools as rule explain thoughts of spatial harmony, homogeneity, and coherence, while the core of the issue is in reality about disequilibrium, dissymmetry, and intermittence. With regards to most developed urban communities where like never before the land market showcase is logically disappear. And the concept of urban value becomes cloudier. The literature of urban valuation has lamentably a specific issue and dubiousness. He explains that one can take any paper on—and additionally identifying with urban land value, and note that reactions to at least one of the accompanying the seven fallowing inquiries:

1) What is the type of land under study?
2) When is the land value being assessed?
3) Where is the land located?
4) Which method of valuation is appropriate?
5) Why care about land value?
6) Who are the actors in the land market?
7) Whatever the explanations, are they enough?

He considers these seven inquiries are the significant for an exact estimation of urban value. The urban land value for him is continues to shape the urban dynamics. While other literatures use other dimensions in valuing urban land not just place measured in economic aspect there is more bonds related to place value Williams and Vaske [15] propose that place value can be identified and measured using a two-dimensional scale of place attachment based on place identity and place dependence. "Place identity refers to the mixture of feelings about specific physical settings"[16]. Place dependence refers to connections based specifically on activities that take place in a setting, reflecting the importance of a place in providing conditions that support an intended use [17]

Early qualitative studies argued that sense of place was dependent on the depth of experience with settings[18] and social relationships with settings. Relph[19] developed an 'insideness' scale which reflected knowledge of the physical details of place, sense of connection with a community, and a personal connection with place. One limitation with these studies is that they have a tendency to emphasize the individualistic dimensions of place.We also recognize other researchers like Dixon &Durrheim[20] consider place attachment as a separate place dimension, to be examined alongside place identity and place dependence But

there some studies they consider place identity and place dependence to be integral components of place attachment.[21]

Many scholars have come to see memory as a social activity, as an expression and active binding force of group identity Whether one refers to 'collective memory', 'social memory', 'public memory', 'historical memory', 'popular memory' or 'cultural memory',[22] most would agree with Edward Said[23] that many "'people now look to this refashioned memory, especially in its collective forms, to give themselves a coherent identity, a national narrative, a place in the world'". This is a key contention, for it suggests that the surging scholarly interest in memory reflects larger, societal changes. Said continues by arguing that the study and concern with memory of a specifically desirable and recoverable past is a specially freighted late twentieth-century phenomenon that has arisen at a time of bewildering change, of unimaginably large and diffuse mass societies, competing nationalisms, and, most important perhaps, the decreasing efficacy of religious, familial, and dynastic bonds. Ours is an age of both rapid social transformation and a search for roots, of time space compression as well as people looking for a past seemingly removed from the unrelenting social-political-economic forces that have come to be called globalization. But Monuments, memorials and museums have proven to be fertile grounds for investigating places of memory[22]

This not considers fewer real values of community image, positive feelings, and reminders of personal memories. These findings, however, must be interpreted with caution because they are dependent upon the sample of residents and the physical conditions. These results suggest the need to promote public awareness of certain benefits of the urban place value.[24] Norberg-Schulz[25] discusses the way in which morphological and cosmic connections are given physical expression in society's dwelling and living. He seeks meaning and symbolic function by understanding the systematic pattern of the settlement. In summary, Norberg-Schulz conceives of people's life world as a basis for orientation and identity.

Conzen[26] argued that, when form after form is added to the surface of the earth, the whole cultural landscape should be seen as an 'objectivation of the spirit' of a society.

Urban values, generated in and by the cultural urbanities spread as "the network of communications ... banks, schools, and factories are built throughout the provinces and urban values are widely adopted.

Cities are "open-system clusters" whose social and cultural ferment is transmitted to the environment of an international society. The over-arching concept of a world-wide environment for systems of cities has been labeled the "value system" which guides and influences social processes.[27]

Geddes provide some aspects that related to place Figure 4 that we should to take in consider if we looking to estimate the comprehensive urban place values , he emphasis on understanding the life as a dynamic process in which we need to raise the understanding of the relation between the nature and culture as main element that form the human physical environment.[28]
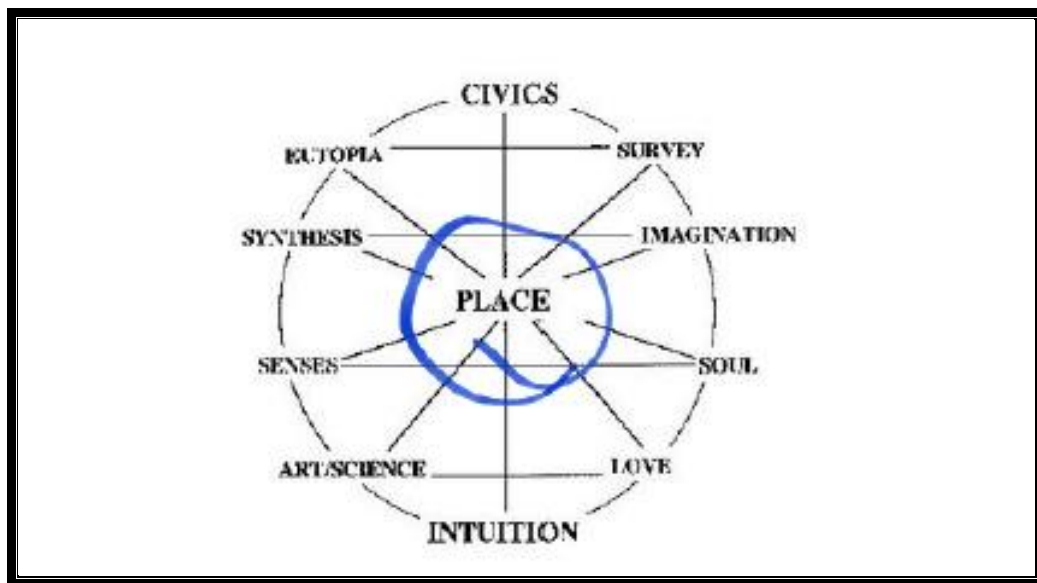
**Figure 4.** Map of how to conceive of and relate to place

Ref. Geddes, P., Cities in evolution. 1949: William and Norgate Limited, London

In fact, we cannot explain the impact of these forces, which are represented by the value of the place itself only economically, there are effects related to place, which greatly affect the components of the urban system and spatial relationships.

5.2. Horizontal forces (flows):

When we talk about urban systems, we mean that we study it as open systems in constant exchange with the surrounding systems. Urban systems exist in relation with the other systems in their environment, and the system open to each other or partially closed so an open system is not isolated from its environment are exchange with other systems its materials or energies or information in regular manner

Chadwick[2] describe the system as a relations between input- process- output and there are flows of energy matter and information through that which can see in simplest way as input-output relationship figure 5.
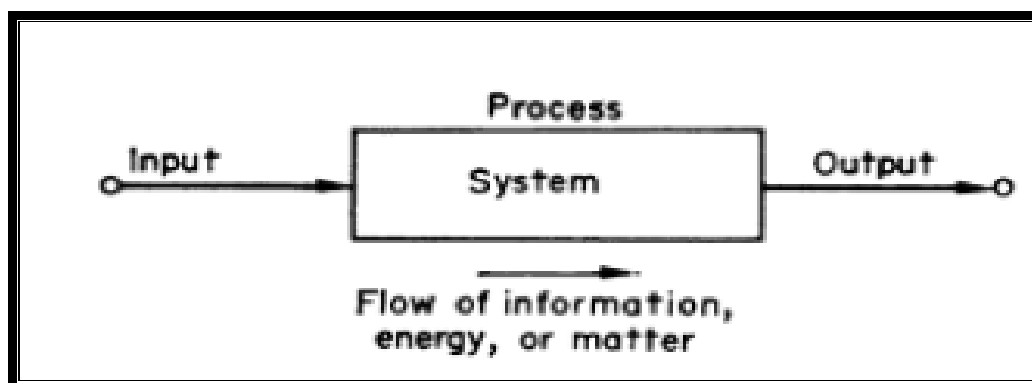
Fig (5) the input-output relationship as Chadwick description

Ref: Chadwick, G., *A systems view of planning: towards a theory of the urban and regional planning process*. 2013: Elsevier.

So, all urban systems are flow systems, for flows of information and/or energy and/or matter make up the relationships which are the heart of any urban system. The basic idea of the flow in systems described by Chadwick [2] "for example a group of people walking through and seeing a landscape, has as its basis a set of flows of information which relate to the flows of matter (people) and to the flows of energy which they and the vegetation around them produce and consume. A set of ideas may be conceptual system, related by the flows of information again, and using flows of energy in the person producing them. The whole man-nature system." The advantages of such approaches would not be confined to consideration of the input and output—or stimulus and response—vectors of the connections between individual persons but could also assist materially in identifying the appropriate environment in which the urban system is set. Since the drawing of the system boundary is always somewhat arbitrary it poses special difficulties for the analyst. "With physical systems the environment is theoretically everything that is not included in the given system. However, since we confine ourselves mostly to a finite number of defined relations between the system and its environment, it is usually advantageous to restrict oneself to the substantial environment, that is, to a limited set of elements which interest us in the environment"[29] [27]. Flows in urban systems as the study of Limtanakool [30] can be characterized by three S-dimensions

The first dimension is <u>the strength of the interactions</u>. The level of integration in a system is a function of "the sum of all flows of some types within the system as a whole". When nodes are intensively related to one another, changes, new ideas, innovations and so forth can be transmitted from one node to the other more readily. The presence of strong interactions between such elements as cities is thus an important building-block of urban systems.

The <u>symmetry dimension</u> can be distilled. The interactions between cities can range from completely asymmetrical (that is, a unidirectional relationship) to fully symmetrical (that is, a bidirectional relationship with the flows in both directions being equally large) Asymmetrical interactions are characteristic of interactions in a fully monocentric system; the most important city (or cities) containing the most and the more specialized functions receive flows from less important cities, but do not send flows in return. In this case, the asymmetrical interaction indicates a dependent relationship between the two nodes. In contrast, the symmetrical interactions are characteristic of interactions in a fully polycentric system, where nodes function as complements to other nodes to which they are connected. The third dimension refers to the structure of the system. <u>The structures of urban systems</u> can range from a hierarchical structure, as in a fully monocentric system, to a non-hierarchical structure, as in a fully polycentric system. Non-hierarchical structures are characterized by the "diffusion of impulses through the system in horizontal, diagonal, reciprocal and other directions, rather than downward in a hierarchical manner.[31]

Flows in all its types represent the relationship of the system with its surrounding in the input-output relationship, which affects the value of the system. Therefore, these flows are horizontal forces that influence the place and determine the shape and structure of the urban place and its relationship to other urban systems.

6. Conclusions:

In this paper, because of the difficulties that face the understanding interrelationships of complex urban systems, we tried to dematerialize this relationship in the form of horizontal (flow) and vertical (value) forces, which through their interaction with each other produces the urban physical form which is the result of the interaction of different systems and forces to produce this urban form. Through the our examination of previous studies that concern with the behavior of the system, we can come up with a general classification in analysis of the urban system, it has a special structure and this structure change over time and have unique behavior according to the variables and forces affecting in its environment, and as a result the urban system will change in to new form or to new situations, but our attempt to understand the

behavior of the urban systems After studying many studies in this field , we can say that there is no adequate theory or model to describes the behavior and structure of urban systems. The apparent environment of these systems is an expression of deeper environments and more complex relationships that need to be more discussed about their motives and the forces that influence them.

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