Classification and Resolving Urban Problems by Means of Fuzzy Approach

F. Habib and A. Shokoohi

***Abstract*—**Urban problems are problems of organized complexity. Thus, many models and scientific methods to resolve urban problems are failed. This study is concerned with proposing of a fuzzy system driven approach for classification and solving urban problems. The proposed study investigated mainly the selection of the inputs and outputs of urban systems for classification of urban problems. In this research, five categories of urban problems, respect to fuzzy system approach had been recognized: control, polytely, optimizing, open and decision making problems. Grounded Theory techniques were then applied to analyze the data and develop new solving method for each category. The findings indicate that the fuzzy system methods are powerful processes and analytic tools for helping planners to resolve urban complex problems. These tools can be successful where as others have failed because both incorporate or address uncertainty and risk; complexity and systems interacting with other systems.

***Keywords*—**Classification, complexity, Fuzzy theory, urban problems.

I. INTRODUCTION

LITTLE research has been carried out in the area of the nature of urban problems [1]. Although many researchers attempt to extract ruling for solving urban problems and they have been relatively successful, but many of their models were failed [2].Cities are complex systems [3]-[5] and lack of sufficient understanding of these complex systems caused many models and scientific methods have been failed to solve urban problems [2]. In an attempt to answer the challenging question as to why models fail, Casti [6],[7] summarized five main reasons by synthesizing the latest development in a vast array of disciplines such as quantum physics, computer science, biology, and mathematics. The following five reasons are what Casti called the surprise-generating mechanism in complex systems:

Unpredictability: Long term prediction is impossible for complex systems. Chance must be treated as an actual cause for many things occurring in the real world.

*Instability: T*he butterfly effect: Small changes in a system may cause large and catastrophic effects.

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Incompatibility: Certain system behaviors defy explanations by rules. There is no prior reason to believe that any of the processes of nature and humans are necessarily rule-based.

Irreducibility: System behaviors cannot be understood by decomposing it into parts. Reductionism and atomistic view will lead to further illusion about reality.

Emergence; Co-evolution: Interactions among system components generate unexpected global system properties not present in any of the subsystems taken individually. Micro level interactions between individual agents and global aggregate level patterns and behaviors mutually reinforce each other. By combining a large amount of new discoveries from numerous scientific frontiers, Casti [7], [8] presented convincing evidence to support these five pervasive characteristics exhibited in both human and physical systems. Geographers have also reported empirical evidences that are consistent with these five surprise-generating mechanisms in both human and environmental systems such as urban system [9]-[13]. System is a set of interacting or interdependent entities, real or abstract, forming an integrated whole [14]. The scientific research field which is engaged in the transdisciplinary study of universal system-based properties of the world is general systems theory [15], systems science and recently systemics [16]. They investigate the abstract properties of the matter and mind, their organization, searching concepts and principles which are independent of the specific domain, independent of their substance, type, or spatial or temporal scales of existence. System modeling is difficult in social sciences because of their system complexities.

A complex system is a system composed of interconnected parts that as a whole exhibit one or more properties (behavior among the possible properties) not obvious from the properties of the individual parts. A system's complexity may be of one of two forms: disorganized complexity and organized complexity. In essence, disorganized complexity is a matter of a very large number of parts, and organized complexity is a matter of the subject system (quite possibly with only a limited number of parts) exhibiting emergent properties [17].

Complex systems are studied by many areas of natural science, mathematics, and social science. The key problems of such systems are difficulties with their formal modeling and simulation. From such perspective, in different research contexts complex systems are defined on the base of their different attributes. At present, the consensus related to one universal definition of complex system does not exist yet [18]. The study of complex systems is bringing new vitality to many areas of science where a more typical reductionism strategy has fallen short. A complex system is therefore often used as a broad term encompassing a research approach to problems in many diverse disciplines [19]-[21]. Scientists often seek simple nonlinear coupling rules which lead to complex phenomena, but this need not be the case. Human societies (and human brains) are complex systems in which neither the components nor the couplings are simple [19].

II. URBAN COMPLEX SYSTEM

According To Chadwick [4], in the urban system, there are many complex combinations of factors and subsystems. He has pointed to the complexity of the real world and human limitations in understanding it and said that, tools such as mathematical theories and models must be used with full consciousness of complexity [4].

Jane Jacobs was the first to propose that the city is an "organized complex system" and is a set of different functions; the city is a living organism composed of complex communication, behavior, multilateral and unforeseen nonlinear features [5]. She insists that urban problems are ‘‘problems of organized complexity’’. Indeed that the city is the example par excellence of organized complexity [3]. She drew her inspiration from Warren Weaver's [17] address to the Rockefeller Foundation in which he suggested that systems could be classified as applicable to three kinds of problem: problems of simplicity, problems of disorganized complexity, and problems of organized complexity [17].

This was also pointed out by Batty [3], who showed, through the Agent Based Models that cities are complex systems. He argued as follows:

> *Systems of cities are no longer thought of as being ‘‘complicated’’ but rather ‘‘complex’’ in that there is always uncertainty about the outcome of processes of changes. This is what we mean by ‘‘complexity’’ [3].*

From a pragmatic perspective, these arguments raise new approach to confront complexity. As Morin [22] and Batty [3] noted, this approach to cities (and many other physical and social systems) is important because it changes our attitude to design and intervention. Moreover, despite the theoretical apparatus that is needed to demonstrate these ideas in measurable terms, this approach is consistent with the way many people feel about the limits of our abilities in management and planning.

This article aims to follow the application of fuzzy systems in the analysis of urban complex problems; classifying urban problems in different criteria and solutions for each category of urban problems with fuzzy approach. In this part of article, authors review definition of urban problem with system approach. A problem is an issue or obstacle which makes it difficult to achieve a desired goal, objective or purpose. It refers to a situation, condition, or issue that is yet unresolved. In a broad sense, a problem exists when an individual becomes aware of a significant difference between what actually is and what is desired. In urban studies an urban problem is difference between an observed condition and a desired condition in a city. Thus urban planning is identifying the actions that might effectively narrow the gap between what-is and what-ought-to-be in a city [23]. For eliminate or reduce the distance between the existing and desired conditions, it is necessary to recognize of complex system constructive elements and the interrelationships between them. Therefore, urban problem, is finding elements of the urban system and relationships between them.

III. NATURE OF URBAN PROBLEMS

Urban planners have reached to this conclusion that urban problems are not simple problems but their nature is complex and intertwined. Rittle and Weber [23] have criticized contemporary urban theories, analyzed problems and expressed complexity of them. The kinds of problems that urban planners deal with, societal problems are inherently different from the problems that scientists and perhaps some classes of engineers deal with. Planning problems are inherently wicked. As distinguished from problems in the natural sciences, which are definable and separable and may have solutions that are findable, the problems of urban planning are ill-defined; and they rely upon elusive political judgment for resolution. Rittel and Webber [23] published a path breaking article defining "Wicked Problems." Especially in the context of Urban Planning, they wrote that Wicked Problems have these defining characteristics:

- There is no definitive formulation of a wicked problem.
- Wicked problems have no stopping rule.
- Solutions to wicked problems are not true-or-false, but good-or-bad.
- There is no immediate and no ultimate test of a solution to a wicked problem.
- Every solution to a wicked problem is a "one-shot operation"; because there is no opportunity to learn by trial-and-error, every attempt counts significantly.
- Wicked problems do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan.
- Every wicked problem is essentially unique.
- Every wicked problem can be considered to be a symptom of another problem.
- The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem's resolution.

- The planner has no right to be wrong (Planners are liable for the consequences of the actions they generate) [1].

Researchers in different fields of science have provided different strategies to solve problems of complex systems [24]-[28]. These strategies have concentrated only on two common organizational coping mechanisms that are routinely applied to wicked problems: *studying* the problem, and *taming* it. The literature is almost silent on the details of solving and taming methods of complex problems. That is, this research attempts to develop a new method for solving urban problems with fuzzy theory for the first time. Zadeh [29] originally suggested a 'fuzzy set theory' to solve problems caused by the crisp approach.

The paper has three parts. First, it reviews the extant literature relevant to systems and complex urban problems. Then the research methodology is presented and data analysis techniques are discussed. Next, the findings are discussed and summarized.

IV. Methodology

A. Grounded Theory

This article study involved Grounded Theory research, a systematic set of procedures to develop an inductively derived theoretical formulation of the reality under investigation [30]. The study used the constant comparative method to arrive at a Grounded Theory of new fuzzy approach formation. The target population for this study consisted of articles, internet sites, focus groups and observations about fuzzy theory applications. Researchers used purposive sampling for study articles sampling. Sample sizes were determined on the basis of theoretical saturation (the point in paper collection when new papers no longer bring additional insights to the research questions).

The first step in developing the Grounded Theory was open coding, the "process of breaking down, examining, comparing, conceptualizing, and categorizing data" [30]. This involved repeatedly reading over articles and examining the researchers' own reactions to the data. Axial coding was the next step, a set of procedures whereby coded data were put back together in new ways by making connections between categories. Integration of concepts, known as selective coding, was the final phase, which was a process of selecting the core category, systematically relating it to other categories, validating those relationships, and filling categories that need further refinement and development. More than one core category emerged, which led to the development of a theory that included solving urban problems with fuzzy logic theory.

B. Fuzzy Theory Applied in the Study

One of the most important cores in Grounded Theory of this research is fuzzy theory. The very basic notion of fuzzy theory is fuzzy sets versus crisp sets. Fuzzy logic was initiated by Zadeh [29]. Basically, Fuzzy Logic is a multi-valued logic that allows intermediate values to be defined between conventional evaluations like true/false, yes/no, high/low, etc. Notions like rather tall or very fast can be formulated mathematically and processed by computers, in order to apply a more human-like way of thinking in the programming of computers [31]. Fuzzy set is an alternative to traditional notions of set membership and logic. This theory proposed making the membership function (or the values False and True) operate over the range of real numbers [0.0, 1.0]. New operations for the calculus of logic were proposed, and showed to be in principle at least a generalization of classic logic. The notion central to fuzzy theory is that truth values (in fuzzy logic) or membership values (in fuzzy sets) are indicated by a value on the range [0, 1], with 0 representing absolute Falseness and 1.0 representing absolute Truth.

In classical sets or systems the elements which have been assigned the number 1 can be interpreted as the elements that are in the set and the elements which have assigned the number 0 as the elements that are not in the set. For example, a mega city is usually defined as a metropolitan area with a total population in excess of 10 million people [32]. So a city can be a metropolitan or not to be. (Respect to its population). This concept is sufficient for many areas of applications, but it can easily be seen, that it lacks in flexibility for some applications like cities ranking. For example in rank-size distribution of cities with Zipf's law, if one ranks the population size of cities in a given country or in the entire world and calculates the natural logarithm of the rank of the city population, the resulting graph will show a remarkable log-linear pattern. As Guerin[33] noted, In the case of city populations, the resulting distribution in a country, region or the world will be characterized by a largest city, with other cities decreasing in size respective to it, initially at a rapid rate and then more slowly. This results in a few large cities and a much larger number of cities orders of magnitude smaller. For example, a rank 3 city would have ⅓ the population of a country's largest city, a rank four city would have ¼ the population of the largest city, and so on. While Zipf's law works well in many cases it tends to not fit the largest cities in many countries. A 2002 study found that, Zipf's Law was rejected for 53 of 73 countries, which is far more than would be expected based on random chance [34]. A 2004 study showed that Zipf's law did not work well for the five largest cities in six countries [35]. In the richer countries, the distribution was flatter than predicted. For instance, the New York Metropolitan area is only 1.3 times the Los Angeles CA. In other countries, the largest city would dominate much more than expected. For instance, Kinshasa in Zaire is more than five time larger than the second largest city.

Why Zipf's Law result is far more than would be expected? Because simple ranking based on crisp sets could not be able to predict easily such complex distributions. From a pragmatic perspective, in the real world the boundaries are fuzzy, but in the classical sets, they are crisp. Another example about fuzzy sets in urban planning is difficulty of the spatial definition of urban areas. Writers such as [36], through an empirical work, find that urban areas have fuzzy boundaries. Further significant literature is the using a fuzzy GIS (Geographic Information System) for site selection of urban services. Analysis results of a fuzzy GIS are better than a traditional GIS in urban areas. Fuzzy GIS analyses can be done by allowing not only the crisp decision Yes/No, but more flexible rules like " fairly low/high". A fuzzy set allows us to define such a notion. The aim is to use fuzzy sets in order to make GIS more 'intelligent' [37]. Although the literature on application of fuzzy in urbanism is very recent but fuzzy systems has emerged as a profitable tool for the controlling and steering of complex systems and industrial processes, as well as for household and entertainment electronics, as well as for other expert systems and applications like the classification of urban areas.

C. Fuzzy Control Systems

The purpose of control is to influence the behavior of a system by changing an input or inputs to that system according to a rule or set of rules that model how the system operates [38].

Classic control theory uses a mathematical model to define a relationship that transforms the desired state (requested) and observed state (measured) of the system into an input or inputs that will alter the future state of that system [39]. For example urban models used to transform urban system to the desired state.

The most common example of a control model is the PID (proportional-integral- derivative) controller. This takes the output of the system and compares it with the desired state of the system. It adjusts the input value based on the difference between the two values according to the (1).

$$\text{Output} = A.e + B.\text{INT}(e)\,dt + C.de/dt \qquad (1)$$

Where, A, B and C are constants, e is the error term, INT (e)dt is the integral of the error over time and de/dt is the change in the error term. The major drawback of this system is that it usually assumes that the system being modeled in linear or at least behaves in some fashion that is a monotonic function. As the complexity of the system increases it becomes more difficult to formulate that mathematical model. Fuzzy control replaces, in the picture above, the role of the mathematical model and replaces it with another that is build from a number of smaller rules that in general only describe a small section of the whole system. The process of inference binds them together to produce the desired outputs [40]. That is, a fuzzy model has replaced the mathematical one. The inputs and outputs of the system have remained unchanged. The Sendai subway is the prototypical example application of fuzzy control. Fuzzy control systems are very simple conceptually. They consist of an input stage, a processing stage, and an output stage. The input stage maps sensor or other inputs, such as switches, thumbwheels, and so on, to the appropriate membership functions and truth values. The processing stage invokes each appropriate rule and generates a result for each, then combines the results of the rules. Finally, the output stage converts the combined result back into a specific control output value [38]. The processing stage is based on a collection of logic rules in the form of IF-THEN statements, where the IF part is called the "antecedent" and the THEN part is called the "consequent". Typical fuzzy control systems have dozens of rules. For example consider a rule for a thermostat: *IF (temperature is "cold") THEN (heater is "high").*

This rule uses the truth value of the "temperature" input, which is some truth value of "cold", to generate a result in the fuzzy set for the "heater" output, which is some value of "high". This result is used with the results of other rules to finally generate the crisp composite output.

As described earlier, general systems theory is the scientific research field which is engaged in the transdisciplinary study of universal system-based properties of the world[15]. So this theory was used to study of urban features in the form of urban planning models. All the purpose of urban Planners is to influence the behavior of an urban system by changing an input or inputs to that system according to a rule or set of rules that model how the system operates. So they use a mathematical model to define a relationship that transforms the desired state (requested) and observed state (measured) of the system into an input or inputs that will alter the future state of that system. But no model of a system will include all features of the real system of concern, and no model of a system must include all entities belonging to a real system of concern. So in this research, a new fuzzy method was developed that classifies urban problems only with assessing inputs and outputs of urban system without recognition of system's inner structure. Classification based on the nature of urban problems has failed and cannot solve them. For example, planners such as Cartwright [41] tried to classify urban problems in some categories then proposed a specific solution for each category but she has acknowledged a need for greater system understanding in this area. Urban complex system is like a black box. Thus, new methods must classify urban problems respect to their system's inputs and outputs without recognition of system's inner structure.

According to Grounded Theory, at the first step data are collected through a variety of methods (papers about using fuzzy method for solving or classifying problems). From the data collected, the key points are marked with a series of codes, which are extracted from the text. The codes are grouped into similar concepts in order to make them more workable. From these concepts, categories of problems are formed, which are the basis for the creation of a new theory for solving problems with fuzzy systems.

V. RESULTS AND DISCUSSION

With using fuzzy systems principles [42] urban problems can be categorized based on inputs and outputs into the followings:

1. Decision Making Problems

Decision making is a process of problem solving which results an action. It is a choice between various ways of getting an end accomplished. Decision making plays an important role in many urban problems. In the urban projects, an option is chose between other alternatives. It is a difficult process due to factors like incomplete and imprecise information, subjectively, linguistics, which tend to be presented in real life situations to lesser or greater degree. This factors indicate that a decision making process takes place in a fuzzy environment. In these problems, input factors are alternatives, goals and constraints. So on, Output factor is a decision. (Fig. 1)

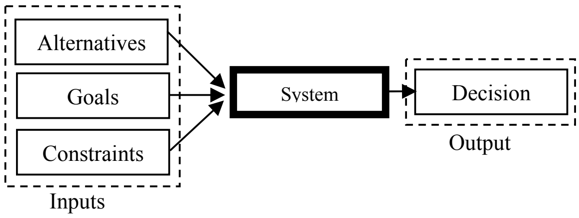

Fig.1 Structure of inputs and outputs in decision making problems system

2. Control Problems

Many problems related to urban systems are control types. In this type of problems, size and type of output factors are affected by the inputs and a feedback regulates the process through input and output (Fig. 2).

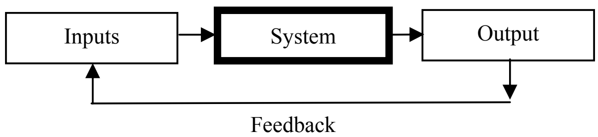

Fig. 2 Structure of inputs and outputs in control problems system

Centers such as traffic control or urban air pollution control center are facing such problems. The purpose of solving these problems is stabilizing and correcting performance of the system. Currently, classic controllers are used in controlling systems. One of the disadvantages of these systems is simplification of the real systems as the form of a mathematical model; classic controllers are designed for the model but fuzzy controllers are designed by combination of if-then rules with experts' experiences (Fig.3).

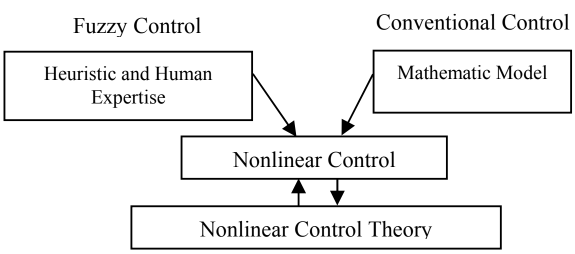

Fig. 3 Fuzzy controller compared with conventional controllers [42]

Therefore, a fuzzy control system could be designed for solving urban control problems.

3. Polytely Problems

Polytely is a Greek word comprised of Poly means many and Telos means Goals or Outcomes [43]. These problems are related to the systems with multiple outputs (Fig.4).

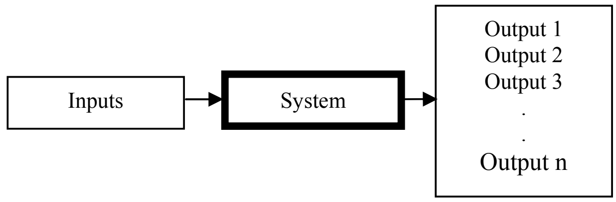

Fig. 4 Structure of inputs and outputs in systems with polytely problems

Polytelies are the most considered problems in urbanism. Since, urban system is an economic, social, climatic, and physical complex system; many urban problems should achieve multiple goals. For example, an urban project not only must provide welfare of citizens but also has to justify the economic and climate adaptation. Analytic Hierarchy Process (AHP) usually is used to solve this type of problems; in this process, problem qualitative parameters are converted to quantitative parameters. Since qualitative parameters are imprecise linguistic variables, use of Fuzzy AHP has better results in solving these problems.

4. Optimization problems

The purpose of these problems is finding best solution among the possible solutions, so several inputs and one output can be seen in these systems (Fig.5).

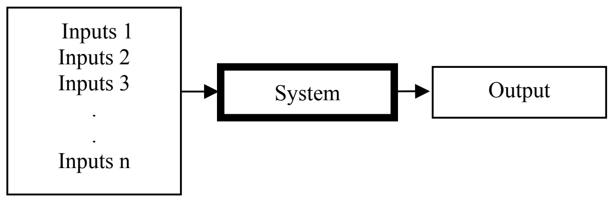

Fig. 5 Structure of inputs and outputs in optimization problems systems

Optimization problems are very similar to decision problems with this difference that inputs are not equal. Evaluation of urban projects is an example of optimization problems. Fuzzy AHP could be used for solve these problems because, they are dealing with uncertainty.

5. Open Problems

These problems are related to systems in which the input is known, but outcomes are unknown (Fig.6).

Fig. 6 Structure of inputs and unknown outputs in open problems system

Open problems can be accurately stated, and have not yet been solved (no solution for them is known). For example, the problem of old urban fabric is an open problem, while not finding an appropriate response to them and still open and others can comment to them. Since outputs in these systems are unknown, these problems are complete and the most complex problems. For analyzing these problems first step is extracting subsystems of them with a Fuzzy Cognitive Map (FCM) then providing solutions for each subsystem.

According to the categories were established, following solutions could be offered:

1. *Decision problems solving method*

There are tow methods for decision making base on fuzzy sets and fuzzy logic. First is the Bellman-Zadeh [44] approach, according to which decision making is defined as intersection of goals and constraints described by fuzzy sets.

Decision making is characterized by selection or choice from alternatives which are available, i.e. they are found or discovered. In the process of decision making, specified goals have to be reached and specified constraints have to be kept. The process of decision making is shown on Fig.7.

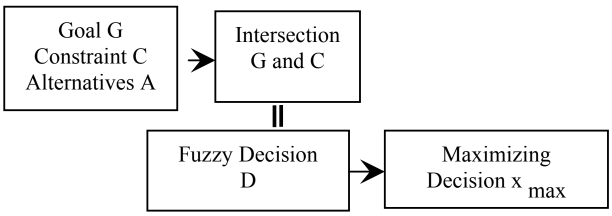

Fig.7 the process of decision making in Bellman-Zadeh Method [44]

The second approach for making decisions combines goals and constraints using fuzzy averaging [45].

2. *Control problems solving method*

Designing a fuzzy controller to solve these problems can be a suitable method. Designing methods of fuzzy controller can be divided into two main categories; one try and error method and next is a theoretical method. In try and error method, sets of fuzzy if-then rules are collected through the following proceedings:

- Using knowledge based on experiences
- Questions are asked from the relevant experts
- Detailed questionnaires that are completed

Then controller based on fuzzy rules is made and finally system is tested.

In theoretical method, structure and parameters of fuzzy controller are designed for stability of urban system [40].

3. *Polytely problems solving method*

Fuzzy AHP method could be used for solving these problems. Classical AHP is a method for ranking decision alternatives and selecting the best one when the decision maker has multiple criteria [46]. It answers the question, “Which one?”. With AHP, the decision maker selects the alternative that best meets his or her decision criteria developing a numerical score to rank each decision alternative based on how well each alternative meets them [47].

In AHP, preferences between alternatives are determined by making pair wise comparisons. In a pair wise comparison, the decision maker examines two alternatives by considering one criterion and indicates a preference. These comparisons are made using a preference scale, which assigns numerical values to different levels of preference [48]. The fuzzy AHP technique can be viewed as an advanced analytical method developed from the traditional AHP. Despite the convenience of AHP in handling both quantitative and qualitative criteria of polytely problems based on judgment of decision makers, fuzziness and vagueness existing in many decision-making problems may contribute to the imprecise judgments of decision makers in conventional AHP approaches [49]. Ozdagoglu [50] has studied the fuzzy AHP which is the extension of Saaty’s theory, has provided evidence that fuzzy AHP shows relatively more sufficient description of these kinds of decision making processes compared to the traditional AHP methods. Thus, this method can be used to solving polytely problems.

4. *Optimization problems solving method*

An optimization process can be defined as a maximization (or minimization) of an objective function. Two popular techniques have been developed for optimization process; they are linear programming and quadratic programming [51].

Differently from the classical optimization methods, the main idea in fuzzy optimization is to optimize objective function and constraints, simultaneously. In order to determine the optimal point (solution point), both objective function and constraints must be characterize by membership functions and they must be linked by a linguistic conjunction: “and” for maximization and “or” for minimization.

The fuzzy optimization by pseudo goal was proposed by Bellman and Zadeh [44] and the main idea is to satisfy a fuzzy objective function and fuzzy constraints that receive the same treatment, i.e., there is no difference among the objective function and constraints. Thus, fuzzy optimization methods can be used to solving these urban problems.

5. *Open problems solving method*

Although these kinds of problems are very complex, but they can converted into the simple problems with Fuzzy Cognitive Maps (FCM). FCMs are very similar to Resolution Maps [1] for solving wicked problems.

In fact, FCM could be regarded as a combination of Fuzzy Logic and Neural Networks. In a graphical illustration FCM seems to be a signed directed graph with feedback, consisting of nodes and weighted arcs.

5. Nodes of the graph stand for the concepts that are used to describe the behavior of the system and they are connected by signed and weighted arcs representing the causal relationships that exist between the concepts (Fig. 8). It must be mentioned that all the values in the graph are fuzzy, so concepts take

values in the range between [0, 1] and the weights of the arcs are in the interval [-1,1]. Observing this graphical representation, it becomes clear which concept influences other concepts showing the interconnections between concepts and it permits updating in the construction of the graph, such as the adding or deleting of an interconnection or a concept.

An FCM consists of nodes-concepts and arcs between concepts. Each concept represents a characteristic of the system; in general it stands for events, actions, goals, values, trends of the system that is modeled as an FCM [52]. FCMs provide the possibility of identifying problem effective factors and express system performance.

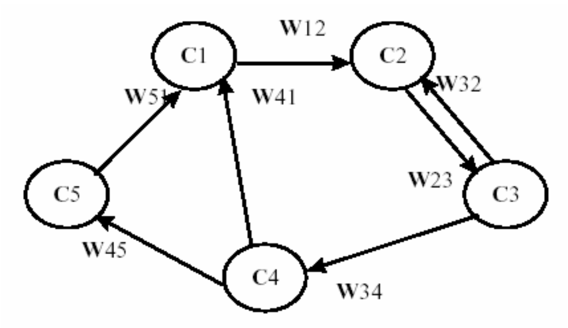

Fig. 8 A simple fuzzy cognitive map (FCM) [52]

VI. CONCLUSION

In this paper, fuzzy solving methods were proposed for urban complex problems. The use of fuzzy system techniques as a method of problem solving for urban issues is innovative. The study has made a contribution to academic knowledge in relation to its fuzzy solving methods in urban problems. The implementation results show that it is useful to classify urban problems and have good results in resolving them. One of the main advantages of this technique is that urban problems can be classified respect to their system's inputs and outputs without recognition of system's inner complex structure. Also, this study has contributed to the acceptance of fuzzy methods in public problem solving, particularly urban wicked problems.

In conclusion, the paper showed that it was possible to categorize urban problems and develop new fuzzy solving methods for them. Urban problems classification with fuzzy approach and their proposed solving methods in this article are shown in Table I.

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TABLE I
TYPES OF URBAN PROBLEMS AND THEIR RELATED FUZZY SOLVING METHODS

Type of Problem (Class)	Fuzzy Solving Method
Decision Making Problems	Fuzzy Decision Making Methods
Control Problems	Fuzzy Controller Designing
Polytely Problems	Fuzzy AHP
Optimization Problems	Fuzzy Optimization Methods
Open Problems	Fuzzy Cognitive Map (FCM)

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