

MULTI-CRITERIA EXPERT BASED ANALYSIS FOR RANKING THE URBAN GENTRIFICATION DRIVERS IN DEVELOPING COUNTRIES

Soheil Sabri¹ and Ahris Yaakup²

Department of Urban & Regional Planning

Faculty of Built Environment

University of Technology Malaysia

¹PhD Student, SSoheil2@siswa.utm.my

²Professor, PhD, b-haris@utm.my

ABSTRACT

More than 40 years have passed since the term “gentrification” was coined by Ruth Glass (Torrens & Nara, 2007). Originating from Britain, gentrification has become popular concept in developed countries and much research has been conducted in the US, Europe, Canada and Australia since the 1970s on gentrification of the inner cities (Bounds & Mourris, 2008; Hamnett, 1991). Research was also conducted in some premier cities of developing world such as Mexico, Istanbul, Ankara and Seoul (Ha, 2004; Ergun, 2004; Guzey, 2006; Jones & Varley, 1999). Most of the gentrification researchers come to the point that appearance of the already formulated origins of gentrification are time and place-specific (Guzey, 2006), as this urban phenomenon through an evolutionary process found different aspects and drivers. The reason is that through its evolution from late 1950s different preconditions have brought different logics and outcomes in different geographies. Thus it is worth to threat gentrification as a complex phenomenon by sophisticated tools to examine the ideas and hypotheses behind it. In this research it is intended to use the analytical network process (ANP) integrated with GIS to figure out the gentrification drivers in Kuala Lumpur inner city and rank them according to their influence. This would provide a decision support system as tool par excellence for exploring the expert idea based on time and place. Besides, the methodology will foster the future works on modeling and simulating the behaviors of gentrification in developing countries that have not been applied hitherto.

Keywords: Urban Gentrification, Developing Countries, Analytical Network Process, Decision Support Systems.

1. INTRODUCTION

Gentrification as one of complex urban behaviors has enjoyed the spotlight as a topic of academic inquiry in economics, politics, and sociology for about four decades (Torrens & Nara, 2007). Much research has been conducted in developed countries like US, Europe and Australia (Smith, 1979, 1996; Hamnett, 1991; Wyly & Hammel, 2004; Bounds and Morris, 2005). Two mainstream ideas predominate in the geographical literature: Humanistic and Marxist approaches. Hamnett (1991) summarizes the

distinction between the two in terms of the difference between “ the liberal humanists who stress the key role of choice, culture, consumption and consumer demand, and the structural Marxist who stress the role of capital, class, production and supply (Torrens and Nara, 2007).

The character of gentrification has changed dramatically in past two decades (Bounds and Morris, 2005). Several inter-related factors lay behind this transformation, including economic restructuring, state intervention in the development of brown field sites using principally the housing demand of new middle class, the rent gap of rust belt zones, and the windfall profits of private developers who restructure and redevelop inner-city areas.

Chris Hamnett (1991) outlines five reasons that gentrification attracted a widespread interest among academic as well as policy makers and authorities:

1. Gentrification has provided a novel and interesting urban phenomenon for geographers and sociologists to investigate.
2. Gentrification poses a major challenge to the traditional theories of residential location and social structure.
3. Gentrification is a political and policy-relevant issue as it is concerned with regeneration at the cost of displacement.
4. Gentrification has been seen as constituting a major ‘leading edge’ of contemporary metropolitan restructuring.
5. Gentrification represents one of the key theoretical and ideological battlegrounds in urban geography.

lees et al. (2008) added three other reasons to Hamnett’s to prove that over recent decades we are still experiencing the gentrification and even in other places than first world cities. These are mostly the exogenous factors which going to change considerably the urban climate in terms of social and physical pattern.

6. Gentrification is the leading edge of neoliberal urbanism.
7. Gentrification has gone global and is intertwined with processes of globalization.

8. Gentrification is no longer confined to the inner city or to First World metropolises.

The ambiguity nature of gentrification and the complex interdependencies of its components make the academics and researchers to take use of more sophisticated and state-of-the-art methods. Agent-Based Modeling can be introduced as such; this is widespread because of the capability of analyzing and modeling the interdependencies of the complex phenomena, as what we are considering in gentrification modeling. The second reason is that we are beginning to take a more realistic view of the highly complex systems like economic markets which are traditionally relied on the notions of perfect markets, homogenous agents, and long-run equilibrium. Third, data are becoming organized into databases at finer levels of granularity. Micro-data can now support micro-simulations. The vast varieties of scale observation in gentrification literature suggested the need for micro-simulation in order to investigation the trend of process in neighborhood scale. The forth and most important reason is that computational power is advancing rapidly. Large-scale micro-simulation models can be computed now (Macal & North, 2005). This not have not been plausible just a couple years ago.

According to time and place-dependence nature of urban phenomena, we have to decide which criteria are most appropriate to take into consideration in modeling and simulating. There are varieties of techniques for analytical thinking and planning. These are considered as tools for better decision making that can be addressed as Fuzzy, Delphi, AHP, ANP and so forth. The last two techniques are introduced by Saaty in 1970s and 1980s respectively. It seems that from first application of AHP technique in "Sudan Transport Study" to latest applications of ANP in "Conflict between China and Taiwan" and "U.S. Response to North Korean Nuclear Treat" these methodologies of decision making brought sound power to help the planners and decision makers. Obviously the integration of the AHP or ANP with modeling and computational techniques is likely to provide the rational outcomes.

In this paper we are going to highlight the importance of analytical decision making and using of Analytic Network Process in defining the most important

gentrification drivers in Kuala Lumpur City Centre that would feed up the future process of Agent-Based modeling.

The remainder of paper explores the topics are raised in this introduction in some more detail, the section two is consisted of two parts: In first part we will describe the agent based modeling requirements for Gentrification process and its compatibility with GIS that can be used as fundamental for second part. part two explains the analytical decision making and using ANP for defining the most suitable criteria in modeling and simulating the gentrification process in Kuala Lumpur City Centre through the quantitative approach. Lastly, in section three we will discuss about the outcomes of the methodology is used and some strategies for future work on modeling and simulating of Gentrification.

2. METHODOLOGY

2.1. Agent-Based Modeling and Simulation

Agent-based Modeling and Simulation (ABMS) is a new modeling paradigm and is one of the most practical developments in modeling since the invention of relational databases (Macal & North, 2005). From a practical modeling view, the agents are considered to have certain characteristics:

- An agent is identifiable, a discrete individual with a set of characteristics and rules governing its behaviors and decision-making capability. Agents are self-contained. The discreteness requirement means that an agent has a boundary and one can determine whether something is part of an agent, is not part of an agent, or is a shared characteristic.
- The position of an agent is defined, and in the environment that is living has interaction with other agents. This interaction is based on protocols such as communication protocols and the capability to respond to the environment. The traits of other agents can be recognized and distinguished by the other agents.
- An agent has goals to achieve with respect to its behaviors. This can be regarded as goal-directed characteristic of agent.
- An agent can function independently in its environment (Autonomous), and its dealing with the other agents (self-directed), at least over a limited range of situations.

- An agent is flexible, and has the ability to learn and adapt its behaviors over time based on experience. This requires some form of memory. An agent may have rules that modify its rules of behavior (Macal & North, 2005).

Thomas Schelling is recognized with developing the first social agent-based simulation in which agents represent people and agent interactions represent a socially relevant process (Macal & North, 2005). Schelling applied notions of cellular automata to study housing segregation patterns. He posed the question, "is it possible to get highly segregated settlement patterns even if most individuals are, in fact, color-blind?" The Schelling model demonstrated that ghettos can develop spontaneously. Interpreted more generally, Schelling showed that patterns can emerge that are not necessarily implied or even consistent with the objectives of the individual agents. This was an important observation that spurred interest and gave direction to the field of ABMS.

The first gentrification model was developed by David O'Sullivan (2002) which was based on Cellular Automata (the simplest way to illustrate the basic ideas of agent-based modeling and simulation). O'Sullivan represented the consumption explanation of the cause of gentrification in a preliminary and exploratory research (O'Sullivan, 2002). He considered the Rent Gap theory of Neil Smith (1979) and suggested the potential ground rent as a neighborhood phenomenon, rather than a fundamental characteristic of individual parcel. In contrast, the capitalized ground rent, according to him, was strongly dependent on individual building characteristics of parcel cells. Therefore, in this framework O'Sullivan presented the relationship of 'local' (parcel scale) and 'global' (neighborhood scale) model parameters by notion of CA characteristic. The states of the cells were defined based on occupation status and the decision of owner to sell or rent the property. Figure 2 shows the assumptions of O'Sullivan which are implemented in CA model of gentrification using voronoi polygon tessellation (O'Sullivan, 2002).

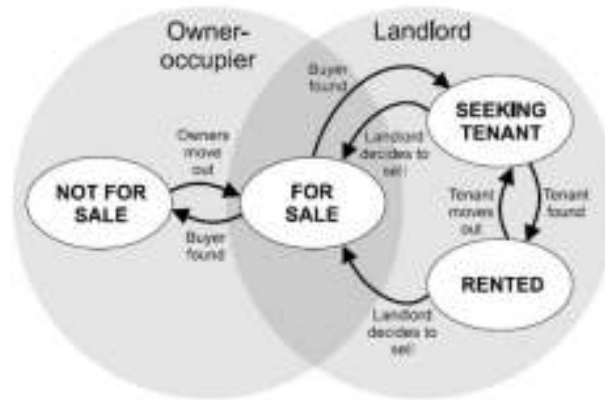


Figure 1. Location discrete states and the allowed state transitions. The relationship of these states to property tenure is also shown
 Source: (O'Sullivan, 2002)

According to O'Sullivan this spatial resolution has simplified data assumptions that make it impossible capture the precise categories of potential and capitalized ground rent. Therefore, new concepts of gentrification require a holistic approach rather than one dimensional study.

Paul Torrens and Atsushi Nara (2007) tried to combine the fixed agents and mobile agents to explore both explanations of gentrification in Salt Lake city, United States. The state variables are indeed more than any other attempt that has been down in modeling and simulating urban gentrification. But the complex nature of gentrification obviously needs more state variables and an organization of endogenous factors as well as exogenous. In their research Torrens and Nara (2007) considered the household as the mobile agent and "Market, Property and FixedLand" as fixed agent (Torrens & Nara, 2007). This type of modeling that is regarded as Hybrid model of fixed and mobile automata seems that can provide the most variables of complex process of gentrification. The question in this research is that how do they give the weights in their hedonic function and what is the ration behind these weights to increase or reduce the relative importance of the other factors. Besides, how the criteria proposed for such weighting were evaluated. Certainly there is a need to some supportive methods to achieve more realistic outcomes.

The other research was done by Lidia Diapi and Paula Bolchi (2007) in Milan. They also same as O'Sullivan focused on Rent Gap theory and examined the fixed and mobile agents through their behavioral rules. This research was an integration of Multi-Agent Systems (MAS) and Cellular Automata (CA) like the one Torrens and Nara

suggested. The conciliation of two sides of gentrification theories were not considered again and the Smith's Rent gap was regarded as "most influential and path breaking contribution" (Diappi & Bolchi, 2007). This is quite different with the new explanations of gentrification by Lees and her colleagues in their recent contribution of gentrification process (Lees, Slater, & Wyly, 2008).

The most recent research on modeling gentrification is performed by Jeremy Jackson et al. (2008) in Boston. They used agent-based modeling (ABM) approach to simulate residential dynamics based on simple decision-making rules. They considered the production explanation of gentrification (Jackson, Forest, & Sengupta, 2008). The introduction of new creative class as the mobile agents are considerable, they took into account the decision rules and transformations of college students as new gentrifiers and compared this creative group by young professionals as well as non-professional and elderly people. In this research they were going to find "How land rent surface can be used by the agents within the simulation interface?" there can be seen new factors comparing with previous studies which are "communication" and "memory" for agents that are regarded as influential factors for social transformation as well as land rent ratio. Four factors along with the above mentioned factors were defined and combined to form the decision-making framework for the agents. These are occupation, distance to commercial, existence of one similar neighborhood and affordability. The question is that how these factors are evaluated and what are their weights in social transformation. Certainly, these factors as the main criteria for agent behavior have different effects. So there is a strong need to evaluate and bring the real weight of each factor according to time and place that they are going to be used. Almost in all above mentioned experiences the lack of proper criteria definition or evaluation for gentrification process can be investigated. This is our problematic in the process of modeling gentrification.

In next section the effectiveness of multi-criteria decision making based on ANP method will be discussed as an appropriate tool for support of agent-based modeling in future works.

2.2. Analytic Network Process (ANP)

The Analytic Network Process (ANP) is the most comprehensive framework for the analysis of societal, governmental and corporate decisions that is available today to the decision-maker (Saaty R. W., 2003). ANP provides a way to input judgments and measurements to derive ratio scale priorities for the distribution of influence among the factors and groups of factors in the gentrification. The well-known decision theory, the Analytic Hierarchy Process (AHP) is a special case of the ANP. Both the AHP and the ANP derive ratio scale priorities by making paired comparisons of elements on a common property or criterion. According to saaty (2006) AHP is conceptually easy to use; however its strict hierarchical structure cannot handle the complexities of many real world problems (Saaty & Vargas, 2006) especially the urban phenomena which have many dependencies. As a solution, Saaty proposed the ANP, the general form of the AHP. The ANP represents a decision making problem as a network of criteria and alternatives (all called elements), grouped into clusters (figure 2).

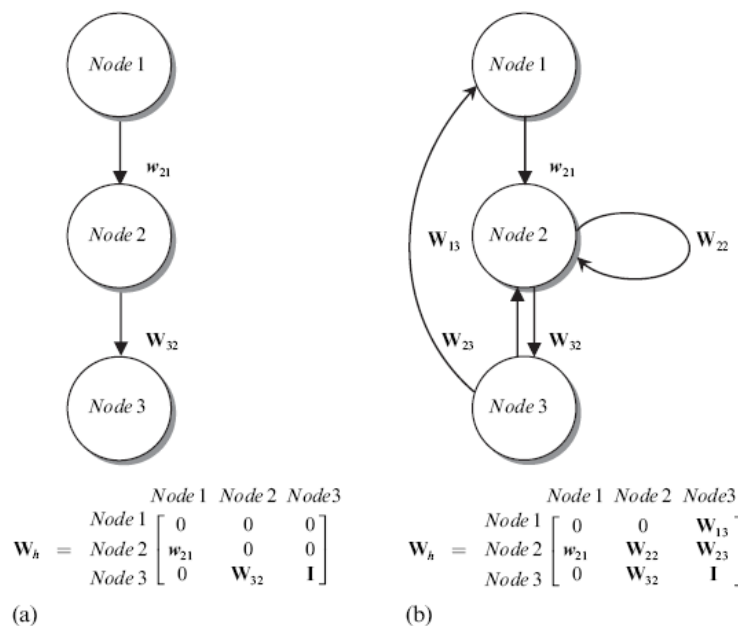


Figure 2. (a) A linear Hierarchy process (b) A Nonlinear Network

Source: (Wey & Wu, 2008)

It allows one to include all the factors and criteria, tangible and intangible those have bearing on making a best decision. The Analytic Network Process allows both

interaction and feedback within clusters of elements (inner dependence) and between clusters (outer dependence). Such feedback best captures the complex effects of interplay in human society, especially when risk and uncertainty are involved. There are varieties of experiences showing the integration of ANP with the other planning methods to support the decision making. This is because of the ANP power to product the most reliable priorities comparing to the other methods (Pourebrahim Abadi, 2008; Demirtas & Üstün, 2008; Wu, Munir Sukoco, Li, & Chen, 2008; Wey & Wu, 2008).

In gentrification process the calculation of priorities by ANP can be the most important part, which is considered in this study to provide the most appropriate factors for gentrification modeling.

a. Case study

Based on the objective of this research that was raised from the lack of criteria evaluation in previous attempts in simulation of gentrification process Two hypotheses are introduced (Jackson, Forest, & Sengupta, 2008; Torrens & Nara, 2007; Diappi & Bolchi, 2007; O'Sullivan, 2002).

- I. It is assumed that the political-economic reasons have more influence on driving the gentrification phenomenon in Kuala Lumpur City Centre.
- II. It is assumed that Kuala Lumpur is following the global economic and political restructuring that leads to experience the new urban phenomena like segregation, urban sprawl, gentrification and so forth.

The above mentioned hypotheses are going to achieve the objective of this study and are supported by the literature review about urban gentrification in both developed and developing countries. There are main questions in order to scrutinize the hypotheses raised in this study:

1. What are the indicators of urban gentrification in city centre of Kuala Lumpur?
2. What is the role of political influence comparing with economic and social criteria in gentrification process of Kuala Lumpur city centre?

3. What will happen to future social context of Kuala Lumpur city centre based on proposed plans like Kuala Lumpur Structural Plan 2020 and the other local plans?

The population target in this research were the expert people who can be found mostly in government departments and agencies, institutions of higher education, professional bodies, non-governmental organizations (NGOs), community associations, political parties and individuals who have appropriate information according to their experience or studies regarding to subject.

The case study area as mentioned above is the City Centre of Kuala Lumpur as one of six strategic zones defined in Kuala Lumpur Structure Plan 2020 (KLSP 2020) with the area of 1,813 hectare. The city centre is the centre of focus in KLSP 2020 (CHKL, 2004) in terms of residential, commercial, entertainment and educational functions. The sampling type is Non-probability sampling which is chosen according to the nature of subject. In this research the subject dictates the respondent group to be the expert people that have knowledge and experience about the gentrification phenomenon. Because there is a small specialized population that can appropriately provide the information and give the relevant answer to questions. This is known as “judgment sampling method” or “purposed method” that is going to apply for data collection from three groups.

First group is comprised of administrative bodies in government departments, the second group consisted of the expert board in government departments and the third group includes high professional academic fellow. The data collection method has been done in an In-depth interview through a closed questionnaire. This method of data collection was chosen again according to especial nature of topic and the strong need to collect complex information from interviewer. It seems that a discussion with the interviewer about the gentrification subject can make more confidence that the answers are achieved based on highly understanding of this urban phenomenon.

The disadvantage of Non-probability sampling method is its weakness in generalizing the information obtained. Obviously, the respondents can have

influence on the result of survey. Different groups' opinion may bring different results. But according to Schreuder et al (2001), there are many situations that some data are perceived to be useful even when not collected in a statistical or probabilistic manner (Schreuder, Gregoire, & Weyer, 2001). The study of gentrification can be categorized as such.

A combination of two methods of probability and Non-probability also can be useful, because in most cases when the response rate in probability approach does not suite the research requirements, the sampling method turns to non-probability approach (Doherty, 1994). Therefore, the proposed groups and sampling among them is mostly same as disproportional stratified sampling. For data collection method also the combination of closed questions and In-depth interview can guaranty the survey that the most appropriate answer is obtained from respondents.

b. Results

The criteria provided in table 1, are extracted based on literature about the gentrification in developed and developing countries.

Table 1. The criteria evaluation for study on gentrification in KLCC

Proposed criteria	Indicator
Migration	Out-Migration
	In-Migration
Employees Residential Area	Outside City Centre
	Inside City Centre
Desirability of Area for Previous Residents	Outsiders
	Insiders
Government Intervention	Direct
	Indirect
Developers	Major Developers
	Minor Developers

Individual Preferences for lifestyle	
Social Composition	Similarity of Ethnic groups
Beneficiary for Political Parties	Remaining
	Displacing
Preference of Owners	Remaining in Area
	Selling the Property
	Renting the Property
Accessibility	To work
	To services and facilities
	To education
Globalization	Politic
	Economic
	Property
	Environmental Issues
Government Policies	Federal
	State
Planning Concepts	General Concepts
	National and local Planning Schemes

Certainly the defined criteria and indicators inside each one are not the entire criteria that can affect the social transformation of KLCC. But according to responses the above mentioned criteria are the most appropriate ones for this research.

Implementing the ANP method, conveys almost the similar weight for criteria defined in Gentrification process in KLCC and doesn't show a meaningful difference. Table 2, demonstrates the ranking that is outcome of this method.

Table 2. The criteria ranking for study on gentrification in KLCC implementing the ANP Technique

Criteria	weight
economic	16.40%
Institutional	17.68%
Political	17.09%
Environmental	17.09%
Physical	14.70%
Social	16.95%
economic	16.40%

Certainly each indicator inside criteria has priority that can support the modeling and simulating process.

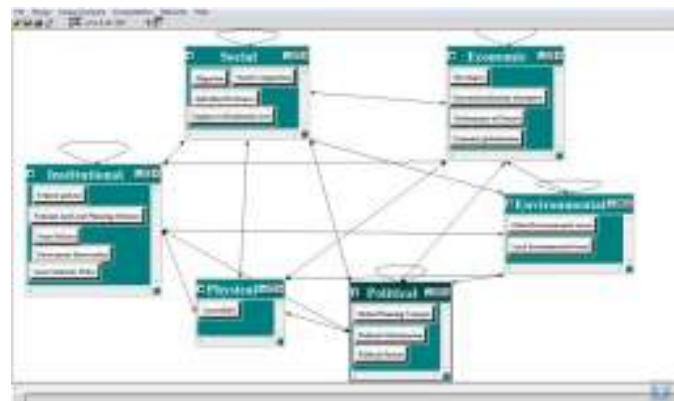


Figure 3. Structure of Clusters and criteria in ANP in SuperDecisions

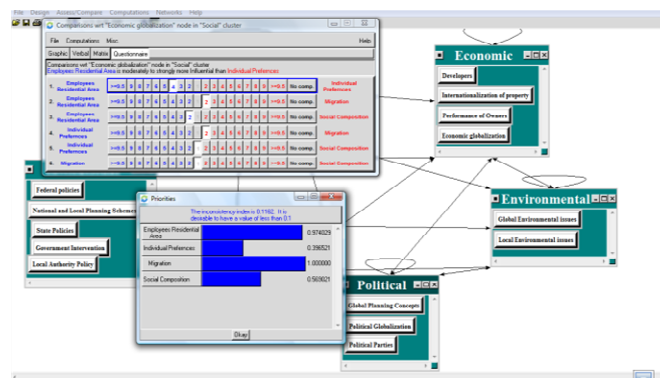


Figure 4. Priority of criteria in each cluster

3. CONCLUSION

The development of gentrification phenomenon was briefly introduced in this paper and the necessity of using sophisticated tools was explained which agent-based modeling is regarded as one of excellent methods to explore the complexity of this urban phenomenon. The integration of Cellular Automata (CA) and Multi-Agent Systems (MAS) is the best technique that is examined by Torrens and Nara (2007) and experienced in some extends by Diapi and Bolchi (2007). Voronoi polygon Tesselation is used by Jackson (2008) and O’Sullivan (2002) to develop the most proper raster surface, using GIS capabilities could provide sound facility for their experiment.

Ultimately, it seems that the raster structure is the best context that is compatible with automata concept.

Reviewing the previous experiences that are mostly performed recently, the lack of criteria evaluation was investigated. It is believed that criteria evaluation can better feed the modeling and simulation practice to achieve the most real outcome. Analytical Network Process is introduced in this regard and the evaluation of gentrification drivers in Kuala Lumpur City Centre is demonstrated in this paper that can provide the suitable data to carry out the study by modeling practice.

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