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Urban Growth Carriers; An Alternative Policy for Urban Growth Management in Iran[1]

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ABSTRACT: Like other developing countries, Iranian cities are growing and expanding physically at a high speed. For about five decades, the only policy of the urban development plans in the field of urban growth management has been definition of the Urban Growth Boundary (U.G.B.) which is still used without any major modifications. Despite the slight evidences indicating the ineffectiveness of the current policy, there has not been any assured and agreed alternative yet. Today, the waves of new urbanism and other modern paradigms have urged temptations of making fundamental changes in the definition of urban growth boundary. Through an analytic framework, this research investigates the effectiveness of some of the most basic carriers of urban growth in 11 sample cities (each of them introducing one type of Iranian cities). The results of this analysis will illustrate a new vision- a native one - for alternative policies of urban growth management in Iranian cities.

Keywords: *Urban growth, Urban growth management, Urban growth boundary (U.G.B.), Growth Carriers, City edge, Weight of the inductive effect index.*

INTRODUCTION

The Iranian urban system including a couple of major cities (e.g. Tehran, Meshed, Isfahan, Tabriz and Shiraz) and plenty of cities still are the attraction cores for population and expansion (Hashemi, 2002, 10-16; Mohammadzade Titganlu, 2003, 34-45). Basic changes in socio-economic and political institutions in Iran have led to a 60% increase in urban population during four decades (1957- 1979). During this period, the number of cities has increased three times and the urban population has doubled. (Kamrava, 2001, 77-78). The common features of this growth include city expansion along the gateway corridors, formation of peripheral urban villages, a chaotic composition of disjointed zones, legitimacy of underdevelopment, damages to the environment and natural resources, debarment of realization of predicted densities in urban development plans, abandoned and undeveloped lands inside the urban areas (Saeednia, 1996; Hashemi, 2002).

Since about five decades ago, defining the Urban Growth Boundary (U.G.B) has come into the consideration of (central) government and urban management. All through these years and despite the clear evidences indicating the ineffectiveness of urban growth limiting lines, this policy is still used without any major modifications. For example, a brief survey on seven Iranian cities reveals that up to 3-26% of the cities expansion during the implementation of urban development plans have occurred outside of the approved limits. On the contrary, 10-40% of the area within the limits is left unconstructed. (Mashhudi, 2002).

This article is due to investigate current mechanism of defining Urban Growth Boundary and answer the following key question: "Which of the two global patterns of circular (peripheral) growth or development along the transit corridors illustrates the process of expansion of Iranian cities?" The outcomes of this research could be applicable if it could introduce and illustrate the effects of elements/factors which urban growth has shaped around them (urban growth carriers) and should be taken into consideration by new mechanisms of urban growth management.

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Literature Review

Urban growth and physical expansion come with functional changes under influence of push and pull factors. Yet enabling factors like public transportation intensify this growth (Fischler, 2005, 437-439). During the years, the attitudes based on Euclidean geometry have showed to be ineffective and have been substituted by the irregular and composite growth patterns (Hough, 1992, 30). Since last century theorization of spatial nature of urban growth has been affected directly and indirectly by diversified urban patterns and the discussions over the optimal city size. Furthermore, the broad debates over the optimal city size have not reached to any clear preferences yet (Zebardast, 2005). According to Duany and Plater- Zyberk (1988), during the past century the urban growth has followed three models of Urban Boundary, Rural Boundary and Transit Oriented Development (T.O.D). The first model based on teachings of Ebenezer Howard has been trying to draw a continuous line around the city and transfer the urban growth to satellite cities. The second model based on the teachings of Benton MacKaye allowed the urban growth along the permitted corridors and forming the traditional neighborhoods development (T.N.D). Defining the detached nodes of development, the third model established by Peter Calthrope and Douglas Kelburgh tries to regulate the peripheral regions around the city through a Transect (Duany & Plater-Zyberk, 1998). From a different perspective, two dominant paradigms can be found in directing the urban growth in the modern world. The first one is European paradigm following the urban growth management through the Urban Growth Boundary (U.G.B, mostly restrictions due to peripheral expansion through the green belts). Beside its origin (Europe), this viewpoint has supporters in other countries. Definitions like Urban Service Limit, Urban Limit Line, Development Policy Area, Urbanized Circles and Designed Growth Areas are derived from this look (A. Bollens, 2005, 475-476). Oppositely, the American paradigm originated from new urbanism and specifically smart growth, recognizes the peripheral dispersal as an inherent reality of the modern city. To deal with sprawl and decentralization of the cities, the American paradigm relying on compactness and transit oriented development has focused on preservation of areas in vicinity of the cities to make a balance in the continual fight and rivalry between inside and outside of the cities (Trancik, 1986, 63; Duany et al., 2000: Gillham, 2002, 289: Walters & et al., 2004, 28; Loeb, 2008). To a large extent, the fundamental difference between these two paradigms originates from difference between public/private ownership and commitment of Europe to traditional urban form and lack of commitment of Americans to it. Although the preference of European paradigm to American one is interpreted as a help to realization of compact city, beside the orthodox supporters, this notion faces ardent opponents as well (especially among the supporters of Sustainable Development) who question its environmental advantages and its cost-benefit balance (Frey, 1999, 331-332; Tods, 2005, 94). Recent researches reveal that although sprawls have been traditional concerns of American urban planners, European cities are facing the same problem (Kasanko et al., 2006; Anas et al., 2008). It seems that the incidents happening in the origins of both paradigms have been the same and that is only the name which is different; Urban Sprawl or Growth (Bento, F. Francoet al., 2006).

Urban Growth Management in Iran

The urban growth system in Iran has evolved through four periods: (Raees Dana, 2001; Hashemi, 2002; Mashhudi, 2002; Sabeti, 2002; Ahmad Akhundi et al., 2008).

1922- 1942: Construction of ring road around major cities and introduction of service limits for cities.

1942- 1967: expeditious and fast growth of cities in lack of supervision, zoning of lands inside and outside of service limits, lack of permission and capability of municipalities in takeover and ownership of barren and unused lands in the vicinity of urban areas.

1967- 1978: Obligation of municipalities due to definition of the periphery of the cities (outside of U.G.B) and provision of master plans.

The comprehensive plan of Tehran was one of the first urban plans of Iran approved in 1968. Defining an (legal) urban service limit, it determined a 25 year old scope as well. In its worst option, this scope was interpreted as a necessity for a full development within 25 years.

1978 till now: continuation of the former process and successive increase of the former city limits during the revision of urban master plans. The distinction between this period and the former one was more sprawled cities due to increase of immigration caused by 1979 Iranian revolution and Iran-Iraq war. Moreover, this period coincided with the stronger and broader presence of metropolitans within Iranian urban system. Legal definitions have added to the complexity of the urban growth in Iran. The urban development plans define the cities within a "certain limit" or as a "building mass with a condensed population" or "confined within an approved limit". This attitude makes problems in two ways; non-realization of anticipated population in urban development plans - based on anticipation of future urban population and the direction of urban growth; it decreases the efficiency of the city tangibly. Furthermore, according to these definitions, the problems of the city would be disjointed from its vicinities definitely when the urban development plans have to locate many of the major activities and infrastructures outside of the cities (Saeednia, 1996, 34). Also, the multiplicity of the legal definitions has caused many ambiguities. Although the legal approvals of 2006 tried to unify and brief the different definitions and limiting them to two definitions of "city limits" and "city boundary" and omit the obscurities and ambiguities, still relying on the traditional mechanisms is problem-causing.

On the other hand, the Iranian country divisions and definitions it provides on the city (having homogenous texture with at least 10 thousands of population), and the administrational-political

look to the cities – instead of a thorough research on the city as a complicated economic complex- have rarely contributed to the interaction between the cities and the peripheral habitats (Saeednia, 1996, p. 35: Raees Dana, 2001, pp. 20-21). Probably the most challenging complexity is confusion and uncertainty of authority and action domain of the urban and territorial management institutions (municipalities, counties and governorships). For instance, plenty of urban villages within the limits of a city beside the governance dispersion (because of divergence caused by ample of small and independent municipalities especially within the metropolitans) can be mentioned (Kazemian, 1998, pp. 63-66: Ahmad Akhundi,et al., 2008, pp. 14-16).

Methodology

Because of complex, meta-problematic and combined nature of growth, there are many emphases by specialists indicating the impossibility of comprehensive urban growth analysis based on system analysis, mathematic patters and models based on mathematics (Batty & Torrens, 2001). New concepts like self-organization, emergence, and analysis within fractals, chaos, fuzzy logics and models based on complexity theory including Cellular Automata Modeling, Multi Agent Modeling and Neural Network Modeling are some instances. Though, there is a relative consensus over incomprehensiveness and indecisiveness of these analytic models (Cheng, 2003).

The approach of the analysis - In addition to spatial factors, various issues such as socioeconomic structure, decision makers (agents, developers and owners), decisions (objectives, strategies and policies) and systems (land subdivision and legal procedures) affect urban growth (Cheng, 2003). Extent of issue and reality of influence factor of all spatial and non-spatial factors on urban growth ultimately appearing physically have put focus of this research on temporal-spatial changes (analysis of spatial-temporal urban growth). The visual aspects of most of basic data of the research, inadequacy of quantitative data, and inefficiency of agreed and relatively proved mathematical models have defined the analysis and interpretation method of this research as visual. Depending on the quantifying of the data, the quantitative analytical tools are used as well in G.I.S.

Operational Definitions;

1. City edge -To define the city limits in any time profile (based on the visual interpretation of aerial photos and or satellite images) the conventional definition of "City edge" is employed. "City edge" is the visual and distinctive limit of more urbanized zones from less urbanized regions – when it ousts the definition of "city". Distinction between urban and non-urban spots is implemented through visual interpretation of raster images and relying on three factors of probability, density and intensity. Accumulation of constructed elements (visible buildings, roads, urban infrastructure and land development) represents more urbanized. Conventionally, city edge is approximate, fuzzy and non-linear.

2. Weight of the inductive effect index -An index has been defined to pave the way for providing a functional alternative for policy making and provision of a comprehensive tool for the urban growth management. The preliminary monitoring helped forming a hypothesis indicating that urban growth is affected by proximity of former city edge, urban growth boundary (U.G.B) in urban development plans and corridors branched from city. Review of each of the above three factors- which in a way are assumed as growth carriers- are taken into consideration by this research. Proof for dominancy of former city edge effect on city growth is an annular and laminated expansion. At the same time, dominance effect of gateway corridors reveals that for its development, city is formed based on Transit Oriented Development (T.O.D.). Dominance of approved U.G.B. demonstrates that despite its role in urban development plans – illustrating final limit of the city in the horizon of the plan- this boundary has turned to a strong factor in absorbing and stimulating urban growth and to some extent to urban sprawl. Therefore, an index defined as the "weight of the inductive effect index" reviews effect of stimulation of each of the aforementioned factors - former city edge, urban growth boundary, gateway corridors. According the Gravity Model, each pixel of urban growth affiliates a proximity weight toward each of the three growth carriers. If the inductive weight of three carriers in each of the grown pixels of the city could be compared with each other, it would divulge which of the inductive effect affects more strongly on the growth current or in other words, the urban growth is influenced by which of the factors. This analysis is implemented by the help of G.I.S (as in figure 1).

Case studies - Among Iranian scholars, the commitment or non-commitment to the different tools of urban growth management in various groups of cities always has been a challenging issue. For that reason, the evaluations have taken place considering the different groups of the cities to reveal the possible fundamental differences. It is necessary to mention that the difference of urban growth in metropolises and small cities are absolutely obvious. But in this research the objective has been discovering the functional difference of the current and future policies in different groups of the cities.The diversity of climatic zoning, city size, and spatial structure of city-periphery relationship, classify Iranian cities in different categories morphologically. Climatically, Iran consists of four zones; hot and dry, cold and mountainous, hot and humid, temperate and humid. From population point of view, spatial planning policies classify Iranian cities in five groups; small (less than 50 thousands), medium small (between 50 thousands and 100 thousands), medium large (between 100 thousands and 250 thousands), intermediate large (between 250 thousands and 500 thousands), large and very large (between 500 thousands and 2 millions). The city-periphery relationship is classified into three groups; metropolitans (concentrated mother city

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and peripheral area), singular city (a city in a relatively void environment and distinguishable from space around) and cluster/chain cities (aggregation of relatively same level, neighboring and linear cities). Similar to most of developing countries, lack or inadequacy of data resources (especially related to the past), and the relative priority of review of some categories, have put nine urban categories as the objectives of this research. For each category and out of 108 cities, one city was selected benefitting a more appropriate data condition. Regarding the special conditions of metropolises, the sample of these groups has been picked apart from the size and the climate. At the same time, in the case of cluster/chain cities in temperate and humid climates, two cities have been researched (as in table 1).

Data -Accessibility to an aerial photo or satellite image of the city and peripheries in past and recent years, having at least one urban development plan, the least criteria to be called a model city, revision of urban development plans, having a defined periphery, having a regional or city master plan beside all the other complementary documents have been of the priority conditions for the case selection.
Along with the selection of case study, the growth process of the cities in different spans of time and the successive changes of the approved urban growth limits in urban development plans (U.G.B) were monitored.

Monitoring- According to accessible data from sample cities, the city growth is researched in one (or outmost two) period(s). The beginning of each period is the time of the closest accessible document on the status of city edge at the time of compiling the urban development plans. The end of research time is the status of city edge in the horizon of urban development plans. Thus, in each period of research, three layers of primary city edge, the final city edge (urbanized area) and the approved urban growth (U.G.B.) during that period would be present. Since there is a possibility that the urban development plans have had a wrong conception about the existing city edge, in this research and according the existing documents (the most recent ones or the closest time to the current time) the city edge has been defined once again (as in Figes. 2 &3).

Evaluation and Discussions

Since the classification variables of the cities are qualitative and follow a non-normal distribution of statistical population, the nonparametric tests are used in this analysis.
The polarity generated by the approved U.G.B. has stimulated the urbanization (more sprawls) along the line which according the urban development plans the urban areas were supposed to change to non-urban zones. This stimulation strongly conflicts with the basic definitions of U.G.B. In addition, the evaluations reveal that despite the conditional assumption due to the difference in urbanized areas in different cities, this difference is not tangible and it seems that the differences among the categories mostly affects the growth process and annexation. To a considerable extent, this inference challenges the viewpoints of those specialists who appraise the current urban growth management through a different classification of Iranian cities (as in table 2). The Kruskal Wallis Test has been applied to examine the weight of inductive effect of the growth carriers. The significance of the inductive effect of the growth carriers (former city edge, U.G.B. and gateway corridors) on the urbanized areas equals to sig=0.27. Thus, despite dependence of city growth to the triple carriers, their effects on city growth are relatively even. The relative even effect of growth carriers on urbanized areas is a conclusion of the evaluation. The relative evenness of the inductive effect of the former city edge and gateway corridors, have added to the urbanized areas of cities in two forms of peripheral (annular) growth and along the transit corridors. As a result, the development approaches based on T.N.D cannot be considered necessarily in line with the U.G.B reality of Iranian cities (as in table 2). In the same time, the significance of the growth effects of different categories of cities (size, climate and city-periphery relationship) does not prove the dominance of the effects by city size, climate, or the city-periphery relationship (as in tables 3-6).

CONCLUSION

Adoption of a new and efficient mechanism which based on this reality that each spot of the city inherently can have a primary potential of annexation to the city), is the first revision priority among the tools of urban development management of Iranian cities. This new mechanism should take the reality of more urbanized peripheral regions around the former edges and along the transit corridors into consideration. Based upon that, neither the European paradigm (limiting the city peripheries) nor the American approach (channelizing the growth along the transportation corridors) can define management tool of urban growth in Iran. This new approach is against the current negative paradigm which excludes parts of the peripheral zones from the annexation process without any logical justification. Probably, the cost-benefit of urbanization of new regions is strongest and most effective reality in annexation or not annexation of these regions to urbanized areas. Therefore, this new mechanism should monitor this cost-benefit constantly and not temporarily (and not just in certain periods). Thus, U.G.B is fluid, flexible and based on changeable trends. It seems that more than urban growth process fitting into the conventional U.G.B (the way it is occurring in the policies of current urban development management) that is the urban growth mechanism which should get in harmony with reality of urban growth process.

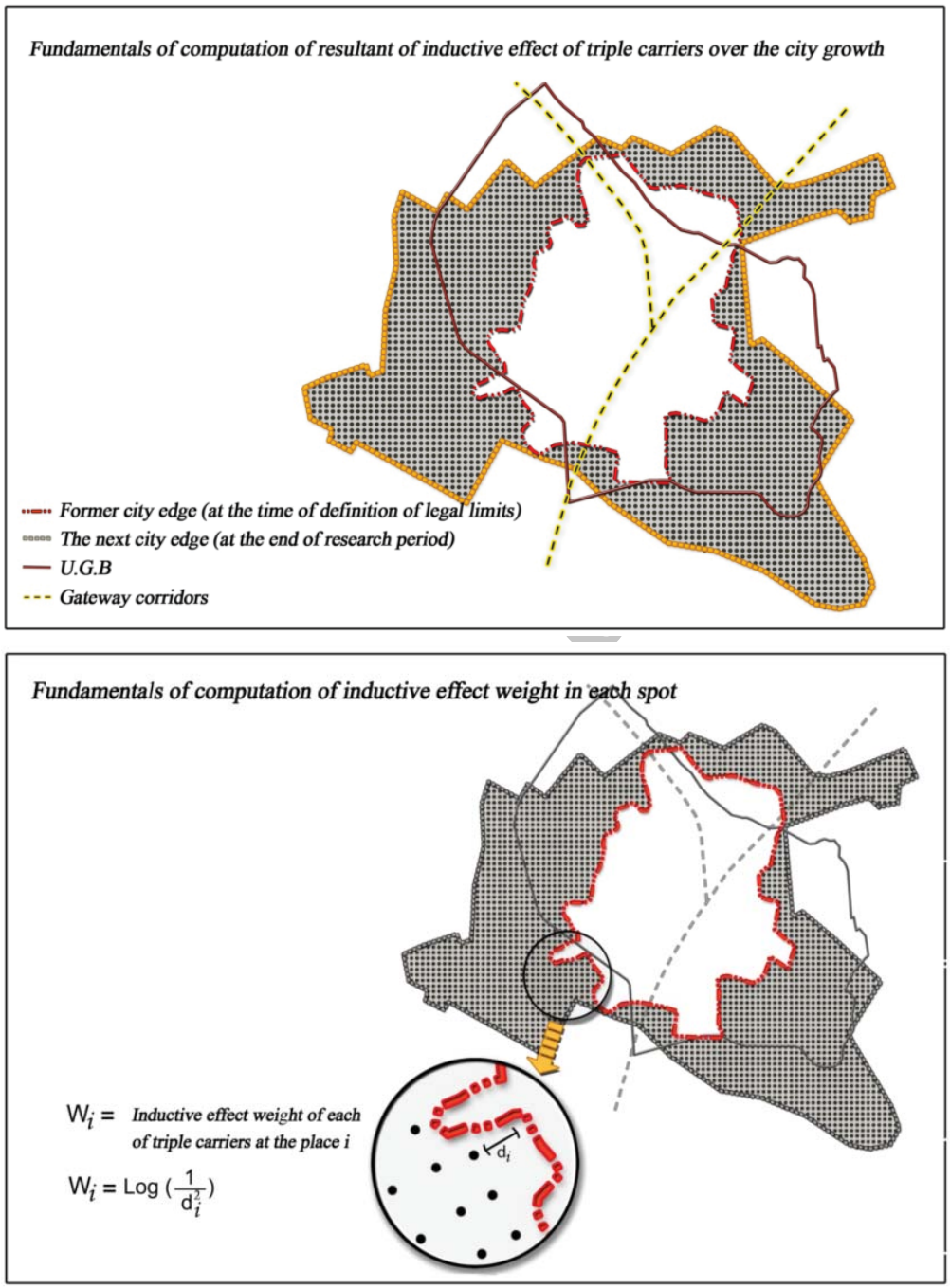

Figure. 1: Fundamentals of computation of inductive effect weight of growth carriers

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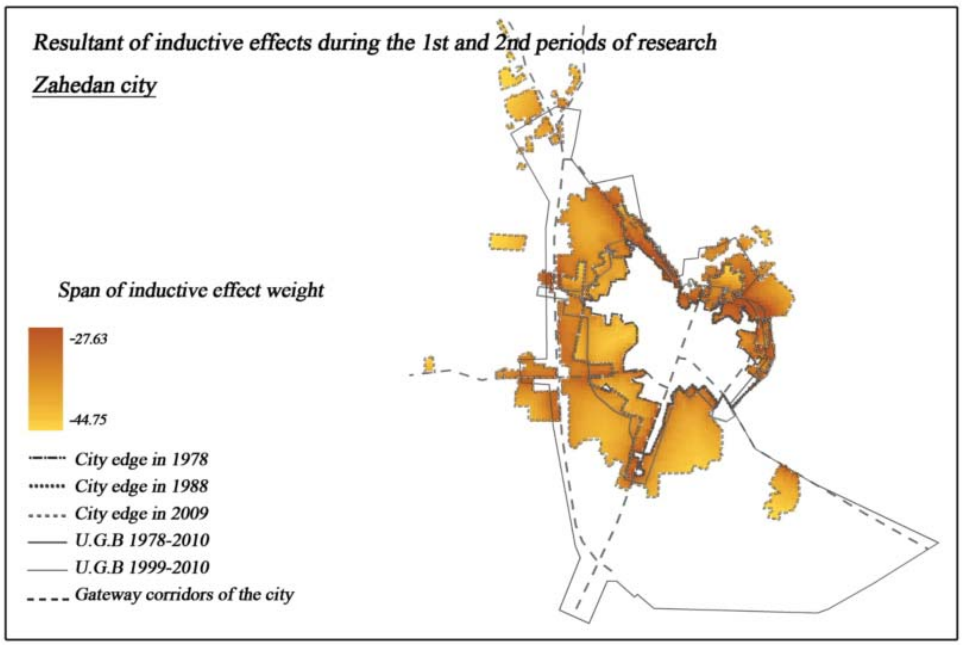

Figure. 2: Study of urban growth (case study- Zahedan: 1978-2009)

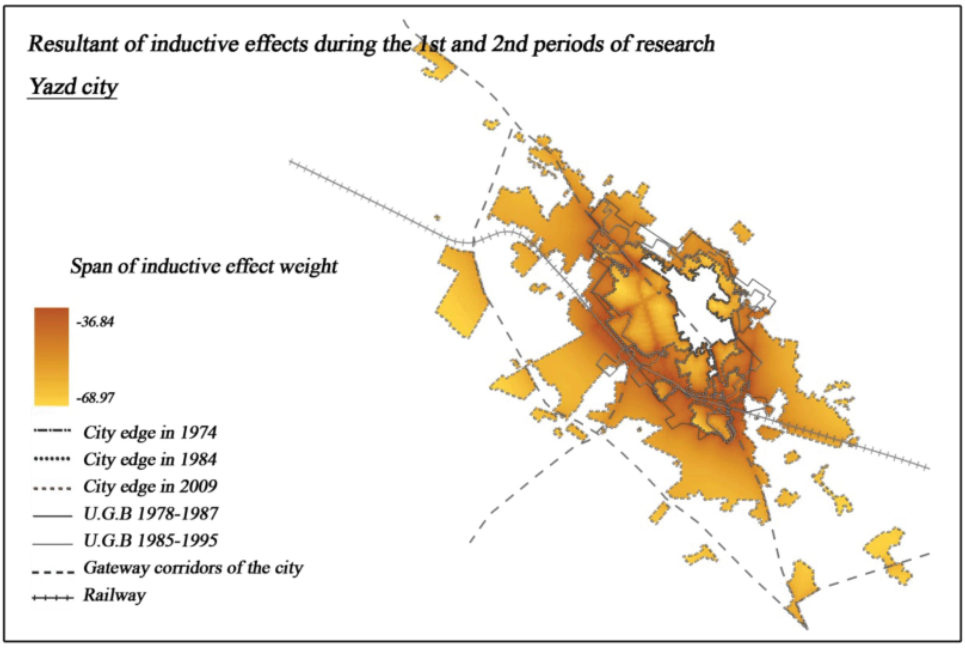

Figure. 3: Study of urban growth (case study- Yazd: 1974-2009)

Table 1: Classification of case studies and study periods

City-periphery relationship	City size	Climate	Case study	study period	Area of primary urban zone (ha)	Area of the final urbanized zone (at the end of study period)	Area of approved U.G.B (ha)
Singular	Medium (small & large)	Hot and dry	Birjand	1st period 1986-2002	1115.05	1698.57	1657.35
				2nd period 2002-2009	1698.57	3931.70	2398.17
		Mountainous and cold	Yassuj	1st period 1989-2002	1015.35	1030.39	1691.83
				2nd period 2002-2009	1030.39	1804.53	1795.07
		Temperate and humid	Babol	1st period 1990-2001	498.74	825.54	1017.57
				2nd period 2001-2009	825.54	2827.91	1290.90
		Hot and humid	Bushehr	1st period 1984-2009	578.72	1863.95	366.46
	Medium large	Hot and dry	Yazd	1st period 1974-1984	984.50	3719.57	4665.91
				2nd period 1984-2009	3719.57	15033.88	6010.58
	Large and very large		Zahedan	1st period 1978-1988	930.13	1558.91	1687.47
				2nd period 1988-2009	1558.91	3364.77	1558.91
Cluster (chain)	Medium (small &large)	Temperate and humid	Lahidjan	1st period 1994-2004	502.29	675.35	1094.83
				2nd period 2004-2009	675.35	2143.18	1094.83
			Langerood	1st period 1978-1995	126.63	309.46	264.32
				2nd period 1995-2009	309.46	1324.69	932.16
Metropolitan			Meshed	1st period 1967-2000	2503.89	26960.9	10706.5
				2nd period	26960.9	44016.69	15131.6

Table 2: Dominance of inductive effects of the triple carriers on the selected cities growth

City-periphery relationship	City size	Climate	Case studies	Dominance of inductive effect of growth carriers (percentage of expanded area during the entire research periods)							Total
				Primary edge, U.G.B , Gateway corridors	U.G.B & Gateway corridors	Primary edge & Gateway corridors	Primary edge & U.G.B	Primary edge	U.G.B	Gateway corridors	
Singular	Medium (small & large)	Hot & dry	Birjand	1.65	2.93	1.13	12.93	38.95	22.18	20.23	100
		Cold & mountainous	Yassuj	1.64	5.63	4.93	8.22	43.66	9.15	26.76	100
		Temperate & humid	Babol	1.87	7.27	5.62	5.07	14.76	37.00	28.41	100
		Hot & humid	Bushehr	2.38	0.37	7.33	22.34	25.64	9.52	32.42	100
	small	Hot & dry	Tabas	-	-	7.10	-	53.20	-	39.71	100
	Medium large		Yazd	1.02	6.60	2.26	4.72	22.19	31.94	31.29	100
	Large and very large		Zahdedan	1.56	4.93	11.84	4.03	38.40	19.82	19.41	100
Cluster (chain)	Medium (small & large)	Temperate & humid	Lahidjan	0.74	1.73	2.47	21.51	37.82	24.72	11.00	100
			Langrood	1.82	10.60	4.97	8.44	23.01	32.78	18.38	100
metropolitan			Meshed	0.08	2.92	1.20	0.62	22.01	100	39.86	100

Table 3: Significance level of the inductive effect of the growth carriers in different cities with different relation with the peripheries

	U.G.B	Primary edge	Primary edge & U.G.B	Primary edge & Gateway corridors	U.G.B & Gateway corridors	Primary edge, U.G.B , Gateway corridors	Gateway corridors
Chi-Square	2.486	1.706	2.735	1.706	.468	1.527	5.891
df	2	2	2	2	2	2	2
Asymp. Sig.	.289	.426	.255	.426	.792	.466	.053

Table 4: Significance level of the inductive effect of the growth carriers in cities with different sizes
Test Statistics (a,b)

	U.G.B	Primary edge	Primary edge & U.G.B	Primary edge & Gateway corridors	U.G.B & Gateway corridors	Primary edge, U.G.B , Gateway corridors	Gateway corridors
Chi-Square	2.525	2.525	5.891	.927	2.735	4.208	2.026
df	2	2	2	2	2	2	2
Asymp. Sig.	.283	.283	.053	.629	.255	.122	.363

Table 5: Significance level of the inductive effect of the growth carriers in cities with different climates

	U.G.B	Primary edge	Primary edge & U.G.B	Primary edge & Gateway corridors	U.G.B & Gateway corridors	Primary edge, U.G.B , Gateway corridors	Gateway corridors
Chi-Square	3.409	2.109	4.418	2.218	2.545	3.827	3.627
df	3	3	3	3	3	3	3
Asymp. Sig.	.333	.550	.220	.528	.467	.281	.305

Table 6: Significance level of the effect of growth carriers

	The inductive effect of the primary edge	The inductive effect of gateway corridors	The inductive effect of U.G.B
City size	0.283	0.363	0.283
City-periphery relationship	0.426	0.530	0.289
Climate	0.550	0.305	0.333

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