J. Basic. Appl. Sci. Res., 2(5)4861-4870, 2012

ISSN 2090-4304
Journal of Basic and Applied Scientific Research
www.textroad.com

Land Use Change and its Implications on the Spatial Structure of City, the Case of Rasht, Iran

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ABSTRACT

This paper aims to analyze urban land use change over a 10-year period (1997-2006) in a relatively large city in the north of Iran. The main data employed in this study has been obtained from the official documents of the secretary of the official board responsible for urban land use change within the cities. The study is focused on the official land use change within the built-up areas of the City of Rasht. The analysis was undertaken mainly with the use of correlation coefficient and mapping techniques. The results indicate that: during 1997-2006, the overall demand for land use change has been increased significantly. While the residential and commercial activities have been the main recipients, public services such as green space, education and sport land-uses have faced with the biggest encroachments. The average size for each transformation has been declined and changes in the land use pattern are correlated to the housing development and land value.
Keywords: land use change, urban development, housing construction, master plan, Rasht.

INTRODUCTION

The ongoing process of rapid urban growth in Iran over the past four decades has led to a noticeable change in the structure of cities. Between 1966 and 2006 the number of cities tripled and the urbanization level increased from 38% to 68%. One of the main characteristics of such growth has been the concentration of population in large cities. To mention, the cities over 100 thousands has reached from 11 to 76 and cities over 500 thousands increased from 2 to 12 (SCI, 2007). Such a rapid growth has resulted in the considerable physical expansion and change in the internal structure of many cities. To manage the rapid growth, the provision and implementation of modern urban plans have been exercised since late 1960s in Iran; however, the speed of development, particularly in large cities has forced the modification of most official plans to respond to the needs of rapid urban development.

Local plans in Iran, as required by the *Planning Act of 1972,* are intended to be the major regulative tool for directing and molding urban development (Ministry of Housing and Urban Development, 1972, 83). The city development plan mainly is composed of Master and Comprehensive plans. While the Master plan usually specifies the permitted land uses in particular zones, the comprehensive plan designate land uses and site layout more specifically and reflect ongoing decisions.

Issuing a permit for an urban project requires that the submitted development plan to be in accord with the comprehensive plan of the city, otherwise an amendment must be approved for its land use before the permit to be issued. The decision for land use change is decided in an official board called Commission Act Five (CAF). The decisions made by this legal institute have served as the main source of data for the purpose of measuring the degree to which the structure of study area has been affected over the past years.

The main objective of this paper is, therefore, to analyze the characteristics of land use change in the city of Rasht over a 10 year period (1997-2006) and its implications on the spatial structural of the city and the way it has affected the quality of urban life in this city. The assumption underlying the analysis in this paper is that the recent land use changes in Iranian cities is heavily market oriented through which higher value lands have gained more than lower value lands during the study period.

This paper has five main parts. The first section outlines the existing literature on land use change. The second section introduces the study area and explains about the data and methodology. The third section presents the result and analyzes the trend of land use amendment within the boundaries of city plan and analyzes the underlying factors of land use change in Rasht. The fourth part presents the spatial implication of the land use change in the study area and finally the fifth or concluding section draws together the main findings.

LITERATURE REVIEW

Urbanization is one of the major driving forces contributing to land use change and requires an increasing amount of land and other resources (Yokohari et al., 2000). It is most likely that urban and regional development will remain as a key issue for the foreseeable future, particularly in developing countries (Wu, Zhang & Shen, 2011). Decreasing the arable lands and increasing built up areas are the inevitable results of

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rapid urbanization in many places (Yi, Chao-Fua, and Ke, 2011; Xiao, Wei & Yin 2011; Tan, 2005; Cohen, 2004; OECD 1997). The land consumption by urban areas is often characterized by fragmented or dispersed developments, (Darla, 2005) transformation of agricultural landscapes (Su, 2011), mono-functional and low-density land uses (Squires, 2002; Torrens and Alberti, 2000; Couch, et al., 2005) which displays the typical features of veritable urban sprawl (Zanganeh, 2011; Nuissl, et al., 2009).

The optimization of land resource allocation, particularly for urban construction, is vital to improved welfare and effective land policy and control over the use of land are important from the viewpoint of urban efficiency. To maximize the potential of urban for the public good, it is imperative for the state to intervene in the supply, allocation and pricing of the land (Misrat, 1986). It is perhaps for this reason that land-use controls are exercised under the authority of town-planning legislation enacted at the state level. Nevertheless, Misrat mentions that the lack of coordination between various agencies involved in land development is common in all cases, even though in each case development authorities have been created to integrate and guide all activities related to land development

As a complex phenomenon, the causes of land use change include personal choice, legislation, government policies and plans (Yuzhe, Xiaoling and Liyin, 2011; Nick, and Kwang, 2001), decisions of developers or transportation entrepreneurs, the nature of the land itself, or the availability of technology to develop the land (Hill, 1989, p. vii). Holdgate (1993) refers to population increase, rise in resource utilization and expansion of urban spaces as major factors affecting land use change. Jantz, Goetz, and Shelley (2004), have explored the potential impact of different regional management policy scenarios on land use change in recent years. In this respect, Sims and Schuetz (2009) also refer to the significant role of local governments in the United States in decisions regarding land use change.

From economic point of view, in an empirical study on the role of land prices in the decision to change land use in Chicago region, Munneke (2005) found that the probability of land use change increases as the expected price in a use other than the parcel's current use increases relative to its price in its current use

Lambin and Geist (2007) summarize the causes of land use change into direct and indirect categories. Direct causes explain how and why local land uses are modified directly by humans, while indirect causes explain the broader context and fundamental forces underpinning these local actions. In general, direct causes operate at the local level (households or communities) and indirect causes originate from regional (districts, provinces, or country) or even global levels, though complex interplays between these levels of organization are common. Indirect causes also tend to be complex, formed by interactions of social, political, economic, demographic, technological, cultural, and biophysical variables. Some local-scale factors are endogenous to decision makers and are therefore under local control. However, indirect causes are usually exogenous (originate externally) to the local communities managing land and are thus uncontrollable by these communities. In general, indirect causes tend to operate more diffusely often by altering one or more direct causes.

Though the impact of rapid urban development and land use change on the environment and particularly agricultural lands have extensively been examined (e.g. Nuissl et al, 2009; Henning, 2007; OECD 1997; Du, Ottens, & Sliuzas, 2010; Li, et al., 2010; Xian, Crane & Su, 2007; Banderia, et al, 2011) Few studies have been performed on the spatial implications of land use change within the built up areas of cities (e.g. Ademola, and Takashi, 2007; Batisani, and Yarnal, 2009). Looking from this perspective, this article examines the trend of land use change within the built up areas of Rasht in the north of Iran during a 10-year period and tries to explore the spatial impact of land use transformation in this city.

MATERIALS AND METHODS

The main data employed in this study has been obtained from the official documents of the secretary of CAF in the city of Rasht. The study includes both land use and density changes within the built-up areas of Rasht. Two sets of data were utilized in the research. First, all the applications for land use change that included 3165 files were reviewed to find out the general trend of activity change and the emerging pattern of urban land use pattern in the city of Rasht during the 10-year period. Each file included information about the type of request for land use change and the decision made by the CAF on the requests. The second set of data comprised a sample of 380 files (out of 3165 reviewed files) for detailed analysis of the land use change and its spatial implication in the city.

The main research method in the study is descriptive and analytic. For the first set of data, the statistical methods of correlation coefficient and regression analysis were used to distinguish the situation and underlying factors of the land use change in the study area. For the second set of data, a spatial analysis was done to indicate the distribution of land use change within the city and the way it affects the internal structure of the city as well as its implication on the quality of urban life in the study area.

During the recent years, because of the shortage of vacant lands in many cities, the demand for land use change within the built-up area has been increased. The land use change in this research referred to both activity and density changes within the city boundary. This article is going to examine the details of recent land use change for different activities within the city of Rasht over a 10-year period from 1997 to 2006.

Study area

Situated in the north of Iran with 340 km distance from Tehran, Rasht is the largest population centre in the southern shores of Caspian Sea. Its known history dates back to the Safavid era in 17th century during which it became as a transport and trade centre that connected Iran to Russia and Europe, and was therefore entitled the "Gate of Europe". In the last quarter of the 19th century, Rasht was one of the earliest industrial sites, prominently in fields such as fishing, caviar production, construction and textiles (HUDOG, 2007).

As the centre of Guilan province, Rasht has been the main industrial city among the cities situated in the southern shores of Caspian Sea during the past decades. Like the other large cities in Iran, Rasht has been faced with a rapid growth in the second half of the 20th century. The population of the city was increased from 109 thousands in 1956 to 557 thousands in 2006 (MPOGP, 2007) and to over 600 thousands in 2011 (MPOGP, 2011). During the past two decades, because of an increase in car ownership rate and the surge of rural-urban exodus, the city has expanded substantially to the surrounding lands. In its first master plan in 1972, the total developed area in Rasht was 1072 ha which increased to 8118 ha in 2005 (HUDOG, 2007). Because of this expansion, a considerable amount of agricultural lands in the urban fringe have been disappeared and the city has expanded rapidly. In addition to the transformation of agricultural lands to urban areas, there has been also a noticeable change in the composition of implementing urban land use plan over the past years which is discussed in detail in this study. Fig. 1 shows the location of Rasht, the centre of Guilan Province in the north of Iran.

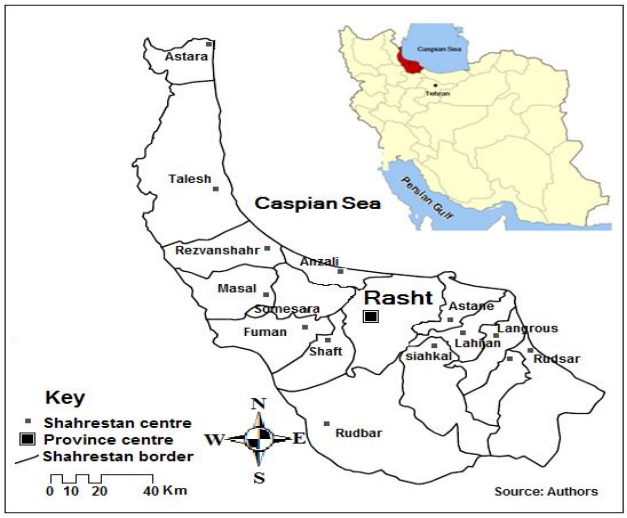

Fig.1 The location of study area in the north of Iran

RESULTS

The overall land use change

During the 1997-2006, a total of 3165 requests for land use change were reviewed by CAF of Rasht from which 1798 cases (56.8%) were accepted, 871 cases (27.5%) were rejected and 496 cases (15.7%) were deferred for further consideration. Because of the varying construction activities particularly residential developments, the volume of demand for land use change differed substantially from 102 cases in 1997 to 582 in 2003. From 1798 approved requests, 1009 cases (56%) were related to land use change and 789 cases (44%) about density increase. In contrast with the general increasing trend in the number of requests, the average size of changed lots was decreased. As a result, a total of 88 ha from urban activities were transformed into other uses than what master plan had specified of which about 70% were upgraded, 7.5% downgraded and 22.5 % changed into the similar uses.

The volume of activity change in Rasht during 1997-2006 period has been illustrated in Fig. 1. Three types of changes for 16 categories of land uses are shown in the graph including the recipient land uses, the encroached land uses and the net change. Among the recipient land uses, residential, office and commercial activities with 45.1, 9.7 and 9.5 ha respectively had the most gains while higher education and green space with 0.4 and zero ha had the smallest gains. In contrast, green space, sport and industrial activities with 16.5, 12.1 and 11.6 ha had the biggest encroachment while the commercial-residential activities had the smallest encroachment. The difference between the recipient and encroached land uses comprises the net change which in the case of Rasht, residential land use with 34 ha alone include 63% of all net gains in the city. After residential use, commercial, office, recreational and commercial-residential activities with 9, 4.3, 3.6 and 2.3 ha respectively were the only activities with net gain. On the other hand, the remaining 11 uses had negative net change or net loss. Among them, green space, industrial and educational activities with 16.5, 11.6 and 9.1 ha had the most negative net change or net loss (Fig. 2).

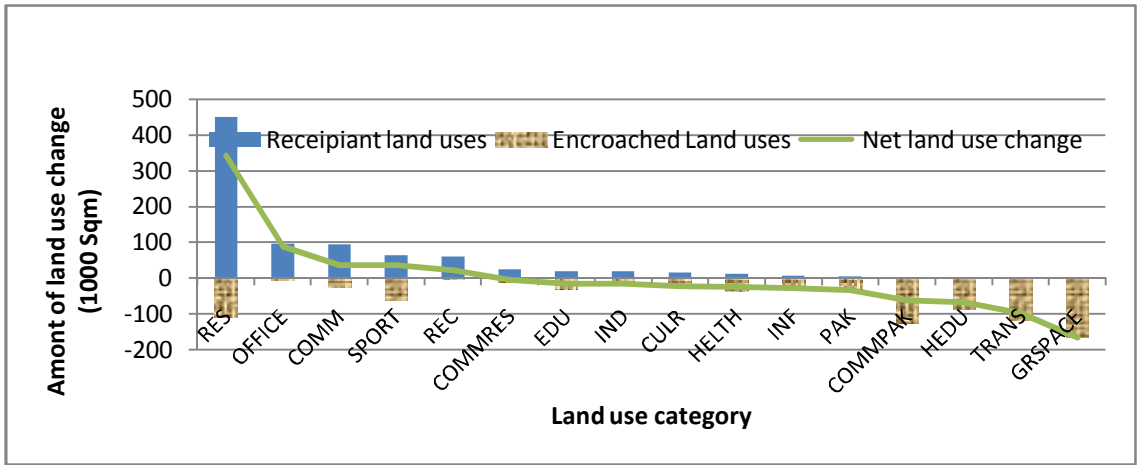

Fig. 2 Urban land use change pattern in Rasht (1997 and 2006)
Source: adopted from the documents of the secretariat of CAF, Rasht

Land use changes among activities

Even though in Fig. 2 the overall land use transformation for different categories in the City of Rasht has been illustrated, however, it is important to know how the land use change has occurred among the different activities. In order to have a better understanding of the future trend, we need to know what kinds of activities and in what capacity have been transformed to what? In this respect, Table 1 shows how the land use changes have taken place within the different activities in the City of Rasht. The data in Table1 has been arranged in columns and rows. While the columns show the amount of gained lands for each category from other uses, the rows indicate the amount of land encroached (lost) in each category to other uses. In the last four rows, the total gained lands, the number of categories from which land has been gained, total land use transformation and the net change for each category has been calculated. The last two columns in the right also show the total area of lost land for each use and the number of categories to which lands have been lost.

Table 1 Transition matrix of urban land uses among different activities in Rasht, Iran (1997-2006) (1000 Sqm)

		Recipient land uses																	
	Land uses	Residential	Office	Commercial	Sport	Recreation	Com-residential	Educational	Religious	Transportation	Health	Infrastructures	Parking	Industrial	Com-parking	Higher education	Green space	Total lost	***NDLL*** **
Encroached land uses	Res	0	29	41	17	0.9	4.6	10	1		1.6	2.4	0.7		1.9			110	11
	Office	19	0	33		0.4	0.1	1.4										54	5
	Comm	4.1		0							1.4							5.5	2
	Sport	69	46	3	0			1.9			1			1.4				122	6
	Rec	25		0.1		0												25	2
	Comm-rec	0.1	0.6	1		0.2	0				0.5							2.4	5
	Edu	79	5.3		1		2.2	0	3.5							0.8		91	6
	Cul	21					6.1	0.5	0			2.3						30	4
	Trans	29		1						0			2					32	3
	Health	7	6.5	0.8	22						0							36	4
	Infr	11										0						11	1
	Prk	28		2.3					7.2				0	1.4				39	4
	Indust	37		4.7		60				15				0				117	4
	Com-Prk	4.4		1.3	0.5		3.2	6			1.2				0			17	6
	H. edu				23											0		23	1
	Grspace	118	11	7.6	0.9		9.5	1	4.4		7.1	1.6	2.7	2.1			0	165	11
	Total gain	452	97	96	64	62	26	21	16	15	13	6.2	5.4	4.9	1.9	0.8	0	880	
	NOGL	14	6	11	6	4	7	6	4	1	5	3	3	3	1	1			
	Tot transform	562	151	102	186	87	28.4	112	46	47	49	17.2	44.4	122	18.9	23.8	165		
	Net Change	341.6	44	90.3	-57.9	-14.2	23.4	-70.4	-14.2	-17	-24	-4.6	-34	-112	-14.7	-21.7	-165		

RES= Residential; COMM= Commercial-residential; REC= recreation; COMRES=Commercial; EDU=Education; CULR= cultural; Trans= transportation; Inf= infrastructure; Prk=Parking; Ind=Industrial; Comprk= Commercial Residential; Higher education; Grspace= Green space; *NOGL*= Number of the origin of gained land use; *NDLL*= Number of the destination of lost land uses
Source: adopted from the documents of the CAF (Guilan Province)

Based on Table 1, the residential land use with 56.2 ha had the biggest amount of transformation among the others. It has gained 45.2 ha from 14 activities, lost only 11 ha to 11 activities and as a result has had 34.2 ha of net gain. On the opposite side, we have the green space with total transformation of 16.5 ha from which it had no gain, but lost 16.5 ha to 11 activities and as a result, has had 16.5 ha of net loss. Table 1 also shows that after residential land use, sport, green space, office, industrial, educational and commercial activities respectively have had the biggest amount of transformation. However, in terms of net change only residential, commercial, office and commercial-residential activities were benefitted from land use transformation, possibly, because of their higher land value. On the other hand, the remaining 11 activities faced with net loss, perhaps, as a result of lower land value. Among the lost activities, green space, industrial, educational and sports land uses confronted with the biggest loss which can be related to their relative lower values among the other activities.

The pattern of land use change in Rasht also indicates a gradual shift in the urban activities in which higher value lands such as residential and commercial activities have been gaining, while the lower value lands which mostly are related to public services such as green space, educational, industrial and sports activities have been losing their shares in the urban zoning. Other public services like recreation, transportation, health, infrastructures, religious and parking also have been losing their status within the city. If we put this losing status of public services beside the recent policy for density increase in urban areas in the country, we can realize why land use pattern in Rasht is polarizing in favor of certain activities.

Density change

As stated earlier, the second aspect of land use change in Rasht is density change which mainly is related to increase in the residential uses. In order to maintain a certain level of living quality in urban areas, usually city plans define a density limit for different parts of the city. Based on Planning Act in Iran, any density raise in urban land use map requires official approval by CAF. During the 1997 and 2006, the CAF of Guilan province approved over 93692 square meters (m^2) of density increase for the City. While the average annual density increase over the study period was 9300 m^2, it varied between the years. For instance, 2002 and 2003 with 16 and 17 thousands m^2 had the highest density increase, while 1998 and 1999 with 2 and 3 thousands m^2 had the smallest density increase.

For the most part of past two decades, generally there has been a hot housing market in Iran particularly in larger urban areas. Due to the shortage of vacant lands in many cities, the density limits set by master plan was released under the name of "density selling" regulation which began at the end of 1980s in Tehran and later spread throughout the country. This regulation welcomed by developers as well as municipalities because both benefitted from that. While the developers considerably increased their profit from the added value of developed lands, in essence, it has been the main income source for most municipalities during the recent years.

Because of the profitable market, there has been a substantial housing construction in the City of Rasht over the past years (MPOGP, 2008; Azimi, 2004). As a result, there has been a high demand of density increase in the city. Perhaps, that is why we see a significant relationship between the density increase and housing development indicators in Rasht as it is shown in Table 2. The Table shows that with the growth of residential development, the amount of land use density has risen. Based on the data illustrated in Table 2, the correlation between density increase with three variables including the number of issued building permits and the number of residential units at 0.05 level are *(r=0.65)*, *(r=0.74)* respectively and with the floor area for issued permits at 0.01 level is *(r=0.8)*.

The causes of land Use change in Rasht

More often, land use change is brought about by a combination of causes (Edmonds & Kyle, 1998). An attempt was made to identify the influencing factors and their associations with the land use change pattern in Rasht. In general, the causal factors, to a great extent, could be related to the situation of housing development in the post Iran-Iraq war era in the country. The main factors examined here include the number of issued building permits, number of residential units, the average floor number, the total and average floor area of the issued permits, the floor area of residential units and the permitted density increase (Table 2).

Table 2 Land use change and correlated factors within the boundaries of master plan in Rasht (1997-2006)

Year	No of land use change request	No of approved requests	Ratio of accepted requests	Average land use change per request (m^2)	Total volume of annul land use change	Accepted density increase (m2)	No of building permits issued	No of residential unit	Average floor for per permit	Total floor area of issued permits (m^2)	Average floor area per building permit (m^2)	Average floor area per residential unit (m^2)	Rent price (m^2)
1997	102	90	88.2	1523	137091	4644	1211	2980	2.5	399537	329.9	134.1	3975
1998	173	115	66.5	1660	190911	2263	1298	4080	3.1	427300	329.2	104.7	4868
1999	193	131	67.9	479.9	62863	3418	1218	4270	3.5	462796	380.0	108.4	5993
2000	227	120	52.9	840.4	100844	7096	1167	4411	3.8	467036	400.2	105.9	6574
2001	318	177	55.7	671.4	118846	12970	1236	5229	4.2	591770	478.8	113.2	7654
2002	570	291	51.1	179	52096	16773	1817	9048	5.0	914363	503.2	101.1	9903
2003	583	283	48.5	36.8	10411	17033	2223	11766	5.3	1140465	513.0	96.9	15233
2004	353	174	49.3	75.8	13193	7665	1193	6106	5.1	610434	511.7	100.0	14898
2005	291	176	60.5	474.2	83465	6775	1071	4191	3.9	466537	435.6	111.3	17959
2006	355	241	67.9	458.2	110426	15055	1173	4373	3.7	539879	460.3	123.5	21924
Total	3165	1798			880146	93692	13607	56454	4.1	6020120	442.4	106.6	
Ave.	316.5	180	56.8	640	88015	9369	1361	5645		602012			10898

Source: SCI (1997-2007)

As stated earlier, from 1997 to 2006 as a result of 1997 cases of approved requests by CAF, a total of 88 ha of urban lands were transformed within the boundaries of master plan in Rasht. During this period, the average land use change per (accepted) request was 640 sqm which varied substantially over the period. The average lots differed from 36 sqm in 2003 to 1660 sqm in 1998 which could be related to the situation of development projects in the city over the past years. This variation, perhaps, corresponds to the fewer but large scale residential development projects carried out mainly during the 1990s and more but small scale housing or commercial development/redevelopment projects mostly constructed in the older parts of the city in the following years.

Table 3 presents the correlations between land-use change and related factors in Rasht. Based on this Table, the land use change request (column 1) is significantly correlated with the number of building permits and residential units (column 7 & 8) with (*r=0.79*) and (*r=0.92*) respectively. We can also observe a significant correlation between the number of approved requests and the building permits and residential units with (*r=0.72*) and (*r=0.82*). Other housing development indicators also reveal strong relationship with the land use change as we can see the correlation between the number of land use change requests with the average floor (column 9) is (*r=0.89*) and with the total floor area for issued permits (column 10) is (*r=0.93)* and the average floor area for issued permits (column 11) is (*r=0.88*). The same significant relationship also exist between the number of approved request with columns 9, 10 and 11 with (*r= 0.78, 0.86* and *0.83)* respectively.

Table 3 Pearson correlation between land use change and related factors

	Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1	NR	-												
2	NAR	.965**	-											
3	RAR	-.725*	-.581	-										
4	AvACH	-.788**	-.756*	.714*	-									
5	TotACH	-.683*	-.586	.618	.912**	-								
6	ADI	.887**	.921**	-.515	-.653*	-.470	-							
7	NBPI	.793**	.717*	-.438	-.417	-.491	.650*	-						
8	NRU	.919**	.822**	-.675*	-.659*	-.688*	.740*	.943**	-					
9	AvFAPBP	.894**	.780**	-.897**	-.871**	-.823**	.694*	.620	.844**	-				
10	TotFAIP	.934**	.859**	-.625	-.660*	-.669*	.804**	.944**	.992**	.822**	-			
11	AvFAPP	.876**	.831**	-.782**	-.899**	-.765**	.816**	.479	.724*	.934**	.740*	-		
12	AvFAPRP	-.578	-.408	.868**	.526	.540	-.212	-.513	-.661*	-.754*	-.573	-.500	-	
13	Rent Price	.522	.630	-.324	-.640*	-.442	.533	.091	.278	.466	.312	.631	-.078	-

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

NR = No of requests; NAR= No of approved requests; RAR= Ratio of accepted requests; AvACH= Average area of Change; TotACH= Total volume of change; ADI= Accepted density Increase; NBPI= No of building permit issued; NRU= No of residential unit; AvFAPBP= Average floor per building permit; TotFAIP= Total floor area of issued permit; AvFAPP= Average Floor area per Permit; AvFAPRP= Average Floor area per Residential Permit; RP= Rent price

The post Iran-Iraq war era and the economic situation of the country could, perhaps, linked to the way land use changes have occurred in most Iranian cities. End of the war brought the attention of urban authorities to focus on many problems which had been suppressed during the war among them housing shortage, perhaps, was one of the most important issues. The main strategy to cope with this problem was allowing density increase for housing construction within the existing city boundaries. Under the mounting pressure of housing demand, the tendency for housing development especially redevelopment of old houses increased. This process first began in Tehran at the end of 1980s and early 1990s and spread to the other cities. The gradual improvement in the post war economy in Iran led to the provision of fiscal support for real estate developers and home buyers as well, which revived housing market in urban area. The result was an increasing demand for housing construction in most of the cities especially in large urban areas. This process for Rasht began around mid 90s and it intensified until the housing market saturated around 2004. During the seven years from 1997 to 2003, we can see an increasing trend in all of the indicators of residential development. After 2004, although because of the saturation of housing market, some decline was observed in housing development, it bounced back in the final year of the study period.

The spatial implications of land use change in Rasht

The impact of geographical location on the distribution of activities is a long established discussion in geography. To examine the spatial implications of recent land use changes in Rasht, samples of reviewed documents were studied. From 1798 accepted requests by CAF, 380 samples (about 20% of the statistical population) were randomly selected. To show the spatial distribution of samples, they were plotted on the city map based on their addresses (Fig. 3). Due to the concentration of most economic activities in the city centre, the relationship between distance from city centre and land use change was tested. The result indicated a significant inverse relationship of (r = -0.7) which implies the influence of city centre on the land use change. The location of bazaar, financial institutions, most offices and several well-off residential districts in the nearby have kept the land price high in this part of the city and, perhaps, this is one of the main factors for most redevelopments carried out around the city centre. As Fig. 3 indicates, except for the area where traditional bazaar in located, most of the land use change are happening within a radius of about 1.5 Km from the city centre as well as in the newly developed higher class residential district of Golsar in the north of city centre.

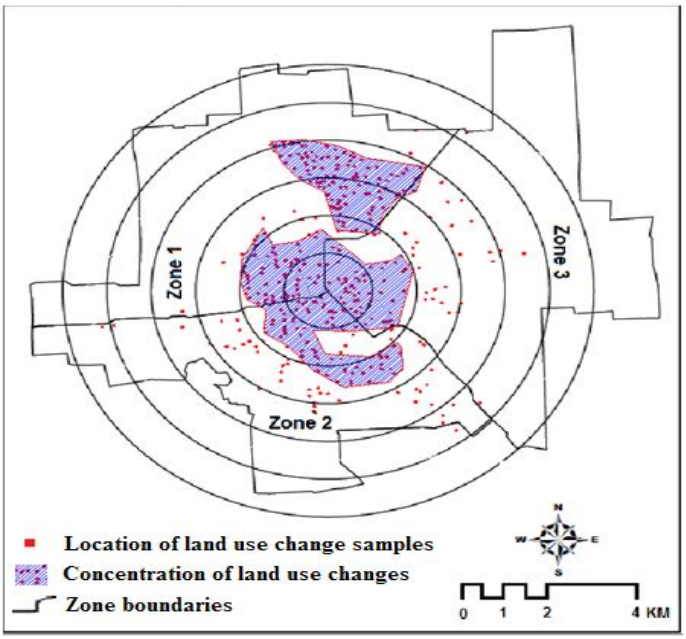

Fig. 3 Distribution of sample land use changes in Rash, Iran (1997-2006)

Another causal factor which was tested for land use change was land value. Previous studies indicate that higher value urban lands have been more prone to change than those with lower value Munneke, 2005; Hu, et al. 2012; Magliocca, et al., 2012). In order to evaluate the role of land value on urban land use change in the city of Rasht, existed data on land transactions for commercial and residential activities at 63 districts was collected and utilized in this study. The available data contained minimum and maximum land prices based on which the average land value also was calculated for both categories. Then, the coefficient correlation was calculated between the land use change and all sets of land values. The result indicated that at 0.01 level, a significant correlation exists between the land use change and land value as followed: with maximum price of commercial lands *(r= 0.50)*; with minimum commercial land price *(r=0.55)*, with average commercial land

price (r=0.53), with maximum residential price *(r=0.50)*. The relationship between land use change and minimum residential price at 0.05 level was also significant *(r=0.37)*.

In Fig. 4 we can see the geographical distribution of samples of land use change and the land value transactions at district level over the study period. Since the most land use changes have occurred for residential uses, the land price map is only shown for this use. As Fig. 4 illustrates, most of the land use changes have occurred in districts where the value of land is higher. These two variables are also in close relation with the distance from city centre.

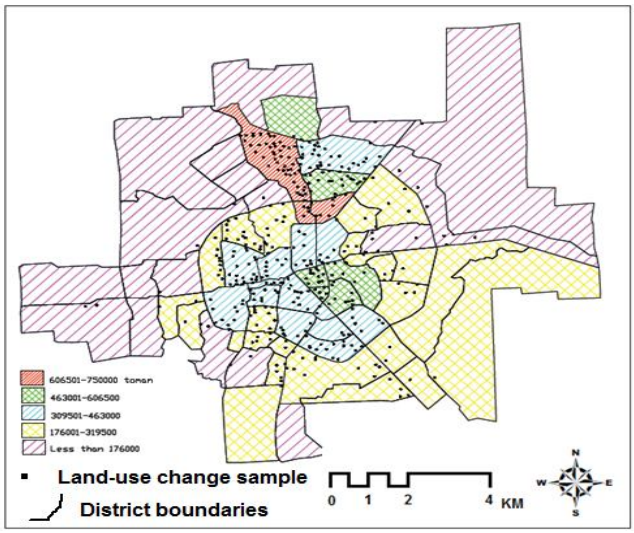

Fig. 4 Relationship between land value and land use change in Rasht, (1997-2006)

DISCUSSION AND CONCLUSION

This paper analyzed urban land use change and its impact on public services in the City of Rasht. Due to the extent of urban development and redevelopments over the past years and the inefficiency of official plan, the demand for land use change has been increased. Findings of this study indicated that with increase in the number of request for land use change, the average size of changed lots has been declined. The tendency of most changes were from lower value land uses such as green space, education and parking spaces towards higher value uses like residential, commercial and office uses. Through the change process, while only five types of land uses (out of 16) had net gain, eleven of them faced net loss. One important point to mention here is that gained land uses included mainly higher land value and private based activities such as residential, commercial and office uses, while most of the net loss land uses contained activities related to public services like green space, sport, education, health and religious uses.

One of the main factors correlated to urban land use change in Rasht was the volume of new developments in the city. We found a significant relationship between the number of demands for land use change and annual building and built area permit issued for residential purpose. We realized that land or housing market fluctuation play an important role in the volume of development in Rasht which in turn affects the volume of urban land use change. Analysis of the impact of land use change on density in the study area revealed that with an increase in the number of land use change and decrease in the average lot size, there has been an increase in residential density permission.

Analysis of urban development in Rasht shows that along with population growth and increase in residential construction, the tendency towards land use change has been increased. One important point is that this transformation has favored mainly residential land use as well as commercial and office activities. In contrast, most of the public land uses such as green space, sport, education, health, transportation and parking activities have been negatively affected. The continuation of this process will negatively influence the quality of urban life in the future, if the increased population do not have adequate access to public services and shared spaces.

It is quite logical that with the development of residential area, the commercial and business activities grow too. However, along with population increase, activities related to public services should be increased too. The case study of Rasht indicates that the recent residential development and increase in construction density, is not a balanced one and does not bring harmony to other urban activities. If the rapid population growth in large cities coincides with the decrease in public services, the quality of urban life will be declined. This is the case at present situation for the city of Rasht and, probably, most other large cities in Iran and needs to be modified.

Therefore, it is recommended that urban authorities should seriously consider the consequence of existing land use change trend. They should bring a balance between private and public activities. The present situation certainly occurs under existing situation of land economy in urban area through which people try to maximize their profits, however, there should be a new development control policy such as effective property tax, land use change regulations and incentives for investment in public services which could lead to balanced urban activities and better urban life in the future.

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