The introduction of sustainability indicators of Iranian new town: A practical municipal level approach

Mahsa Faramarzi Asli[1], Seyed Majid Mofidi Shemirani[2], Mohammad Amin Khojasteh Ghamari[3]

[1.] Department of Art and Architecture, Science and Research Branch Tehran; Islamic Azad University; Iran.
[2.] Department of Art and Architecture, Science and Research Branch Tehran; Islamic Azad University; Iran
[3.] Department of Art and Architecture Islamic Azad University of Tabriz and payame noor university; Iran
arch_khojasteh@yahoo.com

Abstract: One of the main reasons of in sustainability of city development in Iran is that almost planners and mayors could not have created a connection trough different dimensions of the city. Sustainability indicators are evaluation tools of cities operation that these indicators are applicable in life environmental, economical, social fields. Purpose of this article is offering a framework including the description of wide specter of indicators, with regard to the operation of environmental sustainability indicators. For having a common framework of sustainable indicators for neo cities of Iran, we create a charter in America and Australia. So, according to the documents and library related studies and comparative method of study, we will study some samples of sustainable cities. Results of this article are as follow: Introduction of sustainability indicators for codification of sustainability indicators of Iran neo cities.

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Introduction

In dynamic systems like, human societies, sustainability is considered as a subject of balance during the times (Dahl.1995, 15-17). Sustainability is an item that cannot be easily standardized. In relation to the sustainable development Wheeler expresses:" Sustainable development is the one that improves the long-lasting ecological and social health of the cities and towns" (Weeler.1998, 436).

Because of several problems like: non-assigning the exact legal positions of the neo-cities, non-defining the sources for providing the expenses, non-cooperation of different organizations, lack of built over facilities and non-programming of the decision makers and mayors regarding to the sustainability, neo-cities of Iran tends toward instability. Trough considered purposes and comparison of these cities, it can be expressed that: "most of the neo-cities of Iran has not yet achieved their goals and disordering condition that dominates over the neo-cities of Iran is a good evident for this claim (Shieh, 1385, p: 151). Sustainability indicators of cities are important tools for evaluating the operation of cities and also they applicable in the environmental life, economical and social fields. Espangerberg believes that "using the indicators for creating a tool is considered a guide in policies of sustainable development (includes controlling the criteria and relations and their results in general scale)" (Spangenberg, et.al 2002, 61–77).

Most of developed countries apply a series of indicators for achieving their goals and measuring their own success and for communicating; they adopt the result of adopted plans on their citizens. If we assume that public institution cannot design the necessary strategy for sustainable development without having knowledge (Ronchi, et.al), we can apply the indicators of environment and sustainable development for improving decision making about the environmental subjects under a condition through unclear variances. (Levy et.al 2000, 79-86) and also for having a shared frame of city sustainable development indicators, we can create a charter of sustainble indicators in cities. Indicators are considered important members in total evaluation of sustainable development. General principles of this evaluation were introduced in Bellagio conference in Italy in 1996 (Hardi Peter, Zdan, Terrence John, 1997). First series of indicators were published in 90 decade, before the summit of Rio de Janeiro.

In fact working on indicators had been started at the last decade of eighty in Organization for Economic Co-operation and development (OECD) and was continuing in some countries. One of these countries was Canada. The nation work program on indicators through focus on environmental indicators started in 1989. America and Australia were those countries that had a lot of activities in regard to sustainability and evaluation of most institutions. Limitation of activity of these organizations was very

extended and different projects were adopted in small and big scales. The most important institutions in America and Australia those were active in the field of sustainable development indicators: Sustainable Arizona Resource and Education Council, Energy and Sustainability Office, City of Berkeley, Boulder City/Boulder Valley Sustainability Indicators Project, City of Seattle, Office of Sustainability & Environment, Brisbane City Council - Clean and Green city, City of Gosnells Sustainable Development Initiative (Hardi Peter, Zdan, Terrence John, 1997)

According to the offered environmental indicators by mentioned organizations, steps can be taken for offering procedures for codification of sustainability indicators for neo-cities of Iran and improving the environmental and body situations. The purpose of this article is offering a framework that includes describing a wide spectrum of adopted action in sustainable development cities in America and Australia and offering procedures for codification of environmental indicators of neo-cities of Iran, with regard to the operation of environmental sustainability indicators in developed cities.

Materials and Methods

A quick look on sustainable developments

In order to access a total evaluation of sustainability, we analyzed the sustainable development cities of America and Australia. In this method, we use careful review of the literature and taking them. The cities under study are similar to Iran's cities in terms of climatic variety.

Comparison of cities is based on the area-based framework.

Present research is a case-control study in which 14 cities of America and Australia have been studied in terms of climatic similarities. It is important to know that these countries are considered as pioneers in discussion of sustainability in the world. According to the theory of Whorton and Morgan sustainability indicators "is some experiments of sustainability and reflector of vital order for economical, social and environmental life health of a society within different generations" (Whorton and Morgn 1975 , Clark and Wilson , 1994). According this definition it can be said that studying the sustainability indicators in sustainable development cities is an efficient step for getting a program for a sustainable development society.

Every of 14 chosen regions is in harmony with nature .With regard to common purposes and different points of these samples it can be said that in spite of the appearance differences these patterns are moving in a shared growing direction which their purposes are protection of environmental life. So in spite of the kind of the encounter of every plan with climatic, economical, social, body conditions and existing energy sources in that region and more important than all, the way of life criteria according to native qualities and conditions dominating each region of the world can be different and also can be used in the form of a raw and primary patterns in designing the life residences and residential lots in neo-cities of Iran. In choosing samples of the study it has been attempted to be chosen with different climatic condition to get different indicators.

Concordance analysis

For studying the cities, we study them in the environmental field and regulate the results in the intentioned framework. It is worth mentioning that every sample with regard to its special conditions and existing problems have the sustainability indicators in that pivot and less samples have related indicators in all fields of sustainability.

Samples under sustainability

Mawson Lakes, Teviot Downs, Nathanvale, Beddington, Subi Centro, Christie Walk, New RoseHill, Austin, Boulder, Chattanooga, Metrodade, Chittenden, phoenix, and Portland.

Chosen samples are according to city scale so some of them are based on regional scale. So study of cities in environmental fields and according to key concepts is in this field. These concepts are introduced as dimensions of environmental sustainability in this article: land use, City transportation network, Ecology, Energy and Recycling and Green architectural. Its results are regulated in related tables.

With regard to the following tables it can be said that:

Environments Indicators of sustainable cities

Through studying the mentioned samples, cities sustainability indicators can be studied in different dimensions and introduced. As it can be seen in the table, the sustainable development cities according to environmental and native conditions of the region have their own special indicators and it can be said that special dimensions of every city have been studied in city development. However, sustainability has multidimensional concepts and a city is called sustainable development that is whole dimensionally sustainable development; because of not being so, every city is sustainable development through special aspect and its indicators have been introduced in that field.

In Mawson Lakes, sustainability was studied through environmental dimension and in the environmental field was under attention through energy aspect and recycling materials and green architectural; so most of the indicators are in the fields of energy and recycling materials. In the region of Teviot Downs was under attention in terms of land efficiency, energy, material and green architectural.

In region of Nathanvale is the environmental indicators in ecological field; this is because of the special conditions of the region and its special nature. It can be said that in Beddington region environmental sustainability has been studied through all dimensions and in all fields there are sustainability indicators. Subi Centro region has been under attention in terms of land use, transportation, ecology and green architectural and redundancy. Indicators have been used in environmental dimension. Also in terms of being all-aspected it's in a high level. Sustainability in Christie walk in environmental dimension has been studied through energy and recycling and green architectural aspects. The reason of not studying other aspects of the project, is its scale that is more in the level of residual series; so the aspects of transportation and land efficiency is not seen in this project. New RoseHill has been paid attention in terms of recycling and green architectural, in a way that green house gases have been reduced 80 ton a year. It seems that studying the sustainability in terms of these aspects needs fewer expenses and through easy actions can take the steps in direction of sustainability. In Austin city in Texas, the environmental sustainability in the fields of transportation and energy and recycling and green architectural had been under attention. In this city energy indicators and recycling are more under attention. In Boulder Colorado environmental programming has been adopted in relation to the land use, energy and recycling, ecology and green architectural. Codification of indicators is more seen in relation to reducing the air pollution and recycling. Chattanooga and Hamilton county shows that most of the sustainability programs had been in environmental fields and in relation to the ecology, redundancy indicators are seen. In Chittenden in Vermont region the Indicators ecology and energy and recycling are seen. In this region less environmental sustainability indicators have been used and just protection of the region was under attention. In Metro- dade county in Florida, the main purpose of sustainability programs is in the fields of land use, ecology, green architectural and it seems that in the field of energy, its necessary that programming of sustainability to be adopted. Phoenix in Arizona, the main purpose of sustainability programs are in the fields of, energy and recycling and green architectural and in relation to energy and recycling materials, there are more indicators. In the city of Portland in Oregon, the main purposes of sustainability programs are in the fields of land use, energy and recycling and green architectural. There are more indicators in relation to green architectural and in the fields of energy there are no sustainability indicators. If cities based on sustainability aspects of our environment, Sustainability indicators in relation to land use, transportation, ecology, energy, and recycling and green architecture, according to tables 1, 2, 3, 4, 5 as they please consider below:

Table 1: Land use sustainability indicators

No.	City	Sustainability indicators of land efficiency
1	Mawson Lakes	----------
2	Teviot Downs	*offering documents based on the way of structure in stages of selling the land. *suitable road-makings for the region in direction of protection of the region
3	Nathanvale	----------
4	Beddington	*mass expansion model for reducing the pedestrian courses, roads and built over. *place finding of the road in a way that cars move without interfering the pedestrians. *using the natural form of the site
5	Subi Centro	*expanding the central square of the sub co that have been the main principles of expansion. has reduced the commuting of cars. *using designing system through considering the water and creating open spaces. *in city programming of Sub co the residual, trading regions and open spaces with and in relation with together are supposed to offer us a society with mixed fluor efficiency. * designing the local through the plant covering. *designing the special efficiencies.
6	Christie Walk	----------
7	New RoseHill	----------
8	Austin	----------
9	Boulder	*some politics related to supporting the transportation.
10	Chattanooga	----------
11	Chittenden	----------
12	Metro-dade	*controlling the growth and city transportation.
13	phoenix	----------
14	Portland	*expansion of the growing boundary through keeping the present growing line and increasing the crowd of population in these boundaries.

Table 2: Transportation Sustainability indicators

Row	City	Sustainability indicators of transportation
1	Mawson Lakes	----------
2	Teviot Downs	----------
3	Nathanvale	----------
4	Beddington	*good public transportation network in the region. *designing and basing the politic of public transportation for reducing personal transportation. *considering the trading and official spaces in city expansion parts for reducing the distance of transportation. *considering the coffee shops and other welfare facilities in expansion regions for reducing the transportation. *setting an expansion with average mass for reducing the built overs and road-makings. * Place-finding of the roads around the site convenient moving for cars and creating a friendly central core.
5	Subi Centro	*using the bicycle and pedestrian transportation network noticeably is another kind of commuting. *caring the parking space of the cars in street. *encouraging the pedestrians and bicycle riders through creating a convenient bicycle and pedestrian network. *designing the streets in a way that encourages for low speed, safety and available for all the people. *improving situation of the roads their width through created spaces for parking. *rail road line metro station in a way that an underground station rail road tunnel are placed in the center of this project .metro relates the northern and southern areas through expanded areas.
6	Christie Walk	----------
7	New RoseHill	*T-direction for close connection of all houses with city center.
8	Austin	*using the electrical transport means. *reducing the use of gas-burner transportation means.
9	Boulder	----------
10	Chattanooga	----------
11	Chittenden	*protection of natural situation of the region and environment through a total process. *protection of the life sources of the region.
12	Metro-dade	----------
13	phoenix	----------
14	Portland	----------

Table 3: Ecological Sustainability Indicators

Row	City	Ecological Sustainability Indicators
1	Mawson Lakes	----------
2	Teviot Downs	*recognition of the animal fossils and protection of native plants of the region for creating half-rural and cultivating spaces. *assigning the dimensions of moving corridors for moving the animals.
3	Nathanvale	*recognition of necessary managements of the region, like: management of the thicket burning. *recognition of the efficiencies before the history of farming region and patterns of land erosion. *creation of moving corridors in the region for moving the animals. *reviving the plant covering in water following direction through creating piped channels.
4	Beddington	*increasing the life variety of the region through creating green roof, public, farming and cultivation spaces.
5	Subi Centro	*reviving and restructuring 80 hectors of industrial lands. *picking up the products through rain water for categorizing plants. *Urban Green Space
6	Christie Walk	----------
7	New RoseHill	----------
8	Austin	----------
9	Boulder	*supporting the natural areas and wild life residuals around city.
10	Chattanooga	*using lands(studies three dimensional computerized modeling of the ponds, little pools, existing lands and entertaining use of them ,existence of extentioning species, dangers, cultural cases and historical sources in these water areas. *system of green direction (connecting the parks, directions, highness and lowness of a rounding lands.
11	Chittenden	*Protection of natural conditions and regional environments through the general processes. * Protection of life sources of the region.
12	Metro-dade	*wild life management.
13	phoenix	*saving the deserts.

Table 4: Energy and Recycling Sustainability Indicators

Row	City	Energy and Recycling Sustainability Indicators
1	Mawson Lakes	*Management of water losing through DLL commission. *management of water flood (DLL commission). *educational programs related to saving water. *recycling the sewage for uses except drinking (irrigating the park, washing the cars, toilet tanks). of aware green spaces. *solar water heating in all houses for providing hot consuming water. *automatic lights of the yard.
2	Teviot Downs	*management of water and prevention of losing water. *management of sewage for not absorbing the mineral materials of soil through sewage (that hurts the plant covering).
3	Nathanvale	----------
4	Beddington	*use of material with less potential energy that destroys the nature. *providing a recycling store for all the residual spaces. *attention to construction waste sewage. *using the tanks with small capacity in the toilet and facilities with efficiencies of reducing water consumption and fixers in buildings. *using the water consumption measuring set. *using porous tiles in the parking floor for taking in water. *storing the water of rain and using it in toilet tanks. *using the green roof for taking in water of rain and reducing the flood. *insulating the building for preventing the heat transmitting. *using materials with high heat capacity, in a way that gains the solar heat and transmits it inside the space. *using glasses with high efficiency. *Using high-quality materials and suitable fixers. *using cast iron windows to prevent the transmission of cold weather. *using the energy renewing technology for ventilating the region include: -Mass life system CHP (combination of energy and heat) -solar cells for providing fuel energy (fossil) *using material with high energy capacity for regulating the inner heat of the building when the heat increases.
5	Subi Centro	----------
6	Christie Walk	*using the photovoltaic sheets in the building. *providing water of buildings through solar energy. *using water recycling system and low-quality water in toilet tank and irrigating the yard. *using underground tank for storing the low-quality water
7	New RoseHill	*insulating the ceiling holes through insulation batt. *using glasses with aluminum frames and low E program for reducing the heat transmission. *water recycling system. *using the new energy production technology in residual regions.
8	Austin	*establishing the powerhouse of Metan gas. *program of taking the expense for more rubbishes. *cleaning the sea water and seaside. *technical helps to local companies for reducing and protection of commercial water. *program of reducing the consumption of irrigating water. *inspecting the water consumption degree of houses and informing for reducing the consumption.
9	Boulder	*providing necessary things for recycling paper.
10	Chattanooga	*using lands (studies three dimensional computerized modeling of the ponds, little pools, existing lands and entertaining use of them, existence of extentioning species, dangers, cultural cases and historical sources in these water areas). *green direction system (relates parks, directions, lowness and highness of arounding lands).
11	Chittenden	*offering new projects related to energy.
12	Metro-dade	----------
13	phoenix	*storing the thermal energy. *efficient programs in energy output. *installing photovoltaic cells. *program of promoting the cold making system. *encouraging programs in transportation and using bicycle. *saving water through program of water division in irrigating.
14	Portland	*stopping the use of containers having polyester foam *reducing the 50 percent of urban solid loses till 2000.

Table 5: Green architecture, sustainability indicators

Row	City	Sustainability indicators of green architectural
1	Mawson Lakes	*directing the buildings toward the light of north. *spreading the glass in appearance of the building. *using the trees that offer shad in summer and prevents light passing in winter.
2	Teviot Downs	*keeping the environmental life condition.
3	Nathanvale	----------
4	Beddington	*using the natural form of the site. *choosing the material that their sources are not further than 60 kilometers. *using natural, recyclable and reviving materials. *using materials that are less allergic. *weather harmony. *directing the buildings in a way that gets sunlight in the winter and keeps it out in summer. *natural efficient ventilation.
5	Subi Centro	----------
6	Christie Walk	*designing through natural factors.
7	New RoseHill	*designing the building in a way that directions of the windows are convenient for using the natural ventilation. *edged roofs for creating shade. *using the materials of the region, like: lumbers of the region's jungles. *using the ceiling fans for natural ventilation. *using green concrete (60% recyclable) for concreting the directions of bicycles and pedestrians. *used materials in construction should be recyclable.
8	Austin	*constructing green space.
9	Boulder	*management of loses and prevention of pollution. * Controlling the water quality through educational programs of pollution test.
10	Chattanooga	----------
11	Chittenden	----------
12	Metro-dad e	*reducing the dioxide carbon.
13	phoenix	*reducing loses and recycling the trashes. *reducing loses and green road programs. *prevention of pollution through burning the trashes.
14	Portland	*prevention of air pollution through programming in transportation field. *attempts for reducing the pollution through helping the local societies for changing into fuel. *increasing knowledge of the people about urban polluters and storm waters.

Result and Discussion

In this article the attempt has been for describing and evaluating the sustainability indicators of America, Australia to adaptation them with neo-cities of Iran Pattern of the sustainable development city can be manifested in forms of history, culture; economic of the region. Codification of sustainability indicators is considered one of the main strategy of sustainable development. According to the figure 1, we conclude that less than 50% of the residuals have studied the land use. It seems that sustainability indicators of land use has been less under attention against their importance. Also this figure shows that Beddington city with the most privilege is the most sustainable development city according to the sustainability indicators of land use. Subi Centro is in the second place and Teviot Downs is in the third position and Portland, Metro-dade, Boulder cities are of the same rank.

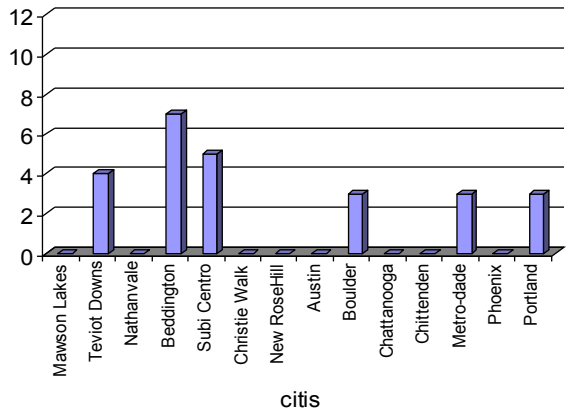

Figure 1: Indicators of sustainable land use in the America and Australian cities

According to the figure 2, we conclude that just about 35 percent of cities studied the sustainable development transportation that is a low percentage .This figure, shows that Bedding ton city is in the first position in terms of transportation and Teviot Downs, New RoseHill and Austin are respectively in second, third and fourth position.

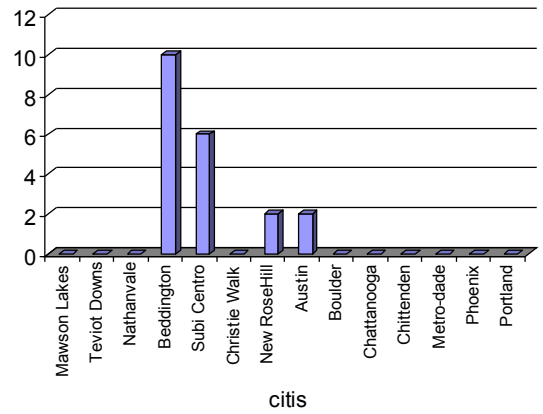

Figure 2: Indicators of sustainable transport in the America and Australian cities

The figure 3 shows that according to the ecological sustainability indicators, Chattanooga with grade of 18 is in the first position and Chittenden with grade of 14 is in the second position and Subi Centro and Teviot Downs are in the third position and phoenix, Boulder and finally Metro-dade and Bedding ton are in the next positions. It seems that most of the cities have been studied in terms of the ecological sustainability Indicators are more applicable through them.

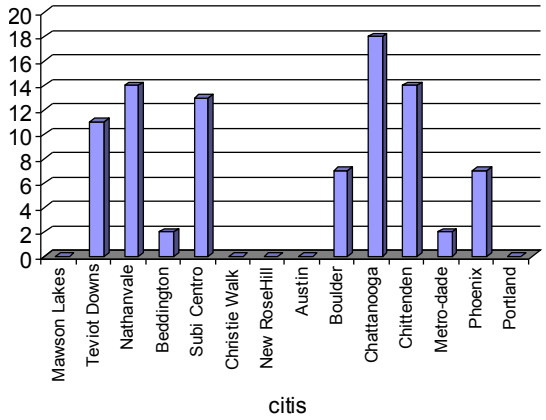

Figure 3: Indicators of ecological sustainability in the America and Australian cities

According to the figure4 we conclude that just 20% of the cities do not have the energy and recycling indicators. In this study, Beddington with the most privilege is in the first position and respectively Mawsonlakes with 28 privileges is in the second position and phoenix with privilege of 26 is in the third position and Austin with 24 privilege is in the fourth position, then respectively Christwalk, Chattanooga Teviot Downs, Portland, Boulder, Chittenden are in the next positions.

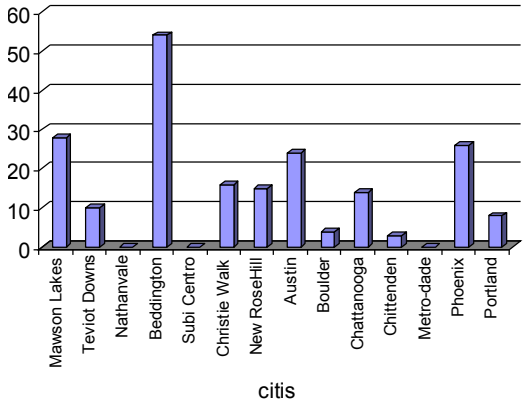

Figure 4: Indicators of energy sustainability and recycling in the America and Australian cities

Trough studying the figure5 it can be said that Beddington with 25 privilege is in the first position .New RoseHill with 22 privilege is in the second position, Portland with 18 privilege is in the third position and then Mawsonlake, Metro-dade, phoenix and Subi Centro are respectively in the next positions. Trough this explanation, it can be concluded that just less percentage of cities that have no green architecture sustainability indicators have not been studied.

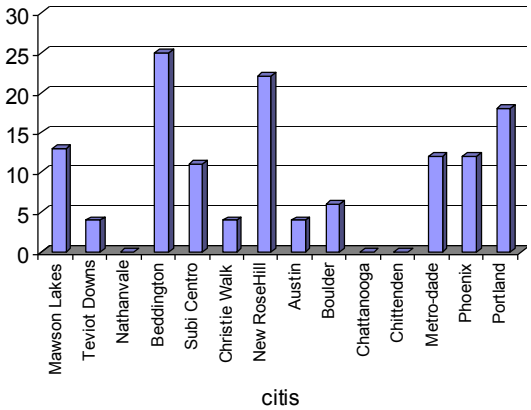

Figure5: Indicators of green architecture sustainable in the America and Australian cities

Conclusion

It can be said that studying the environmental sustainability indicators, is an efficient way for procedures for codification of environmental indicators framework for neo-cities of Iran. According to this research sustainability indicators of Energy and Recycling and Green Architecture.have the most effect on

city sustainability and are considered as the main subjects in the environmental sustainability. Factor Ecology is the second factor in sustainability and indicators of Land use is third factor and transportation as fourth factor in city sustainability has less effect in comparison to other areas in the field of sustainability. Also this shows that in codification of the framework based on areas in environmental field for neo-cities of Iran, the main fact is studying that through offering related indicators in this field can take efficient steps to offer a suitable way in direction to sustainability of neo-cities of Iran.

Corresponding Author:
Dr.Mahsa Faramarzi Asli
Department of Art and Architecture, Science and Research Branch Tehran; Islamic Azad University; Iran.

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