

The role of environmental impact assessment tool in achieving sustainable urban development and its challenges in Iraq

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Abstract

This research will concentrate on an environmental impact assessment tool as one of the tools which has the capability to achievesustainable urban development, andthe kinks which lead to incapablyapplying it in Iraq. This is done by focusing on the most important principles, objectives, and criteria to evaluate the impact of urban projects on our local environment, as well as the mechanisms to achieve best environmental assessment practices to reduce the adverse environmental effects.

From above,and in this research there will be two parts, one of them will concentrate on building an environmental impact assessment matrix for urban projects, depending on the most important environmental factors affecting urban projects in the local Iraqi environmentand their actions. While the other part will extract briefly in a developed modeldepending on the sustainability indicators,the obstacles that face the planner and urban designer in achieving sustainable urban development in Iraq. As aresult, the research emphasizes the importance of considering this matrix (after developing it)one of the main elements of the planning process in Iraq and an active factor to take the necessary precautions to reduce the negative environmental effects and thus achieve the goals of sustainable development.

Keywords: EIA, environmental factors, LEED, sustainable urban development.

Introduction

Our environment in its broadest sense considered the basis content and the essence of dynamic interaction for the presence of life. Indeed, after the global climate changes (due to human activities and rapid urbanization) and accelerated evolution of the concept of sustainability and its international prosperity, the process of assessing the environmental impact has become an urgent need which evolved into a tool to discover the effects of human development and activities on the environment and an expanse for the environmental dimension of knowledge the environmental consequences of the development on sustainability.

Material and Methods

Research objective and methodologies:

This research will focus on two major aspects, firstly by developing an (EIA matrix) depending on the integration between the local environmental factors, and the international LEED-ND rating system which enable the specialists from upgrading urban projects and achieving the goals of sustainable urban development. Secondly, and because the step of developing an environmental impact assessment tool considered too late step comparing with the sustainable urban development accomplishments around the world, the research will identify the most significant challenges which might hinder the activation of this process in Iraq by extrapolating the glitches that are associated with each dimensions of the sustainability indicators.

What is EIA:

According to the European Union's definition which directed and named an environmental impact assessment in 2011, the term refers to the process and procedure that taken to ensure the implication and the protection of the environmental in any individual and urban project before the decisions are taken [1]. In addition, Environmental Impact Assessment (EIA) is the process that analyzes and evaluates the impacts that human activities can have on the environment. Its purpose is to guarantee a sustainable development that is in harmony with human welfare and the conservation of ecosystems. EIA has proven itself to be an effective tool for environmental planning and management. Its application involves the use of attributes to identify and evaluate possible environmental changes caused by a project, construction, or another human activity. Furthermore, it enable the affected community from participating in the decision-making processes. So, EIA is a technical key to incorporating concepts such as the precaution principle and to preventing the loss of natural resources which is evidently the main goal of sustainable development in decision-making. For urban projects, it's defined as the systematic identification and evaluation of the potential impacts (effects) of proposed projects, plans, programs or legislative actions relative to the physical, chemical, biological, cultural and socio-economic components of the environment.

From the above, environmental impact assessment is an organized predicted process through which the forecasting, identification, and description of the environmental impacts of the activities that affecting various urban projects, with the application of an adequate environmental protection procedures to mitigate environmental impacts and to avoid the loss of ecosystems and species that will result in the protection of the environment through the achievement of sustainable urban development (The researcher).

The principles of EIA:

An EIA would be:

- A) Integrative: address different impacts in many projects that could have an environmental impact.
- B) Adaptable: Compare alternatives management techniques to any project.
- C) Enforceable: provide information, monitoring, and feedback procedures for decision-making and analyze specific characteristics to non-experts, as well as experts in the field.
- D) Applicable: Include broad public participation and significant administrative review procedure. (Muthusamy, 2003, p 293).

Development of the EIA through sustainability:

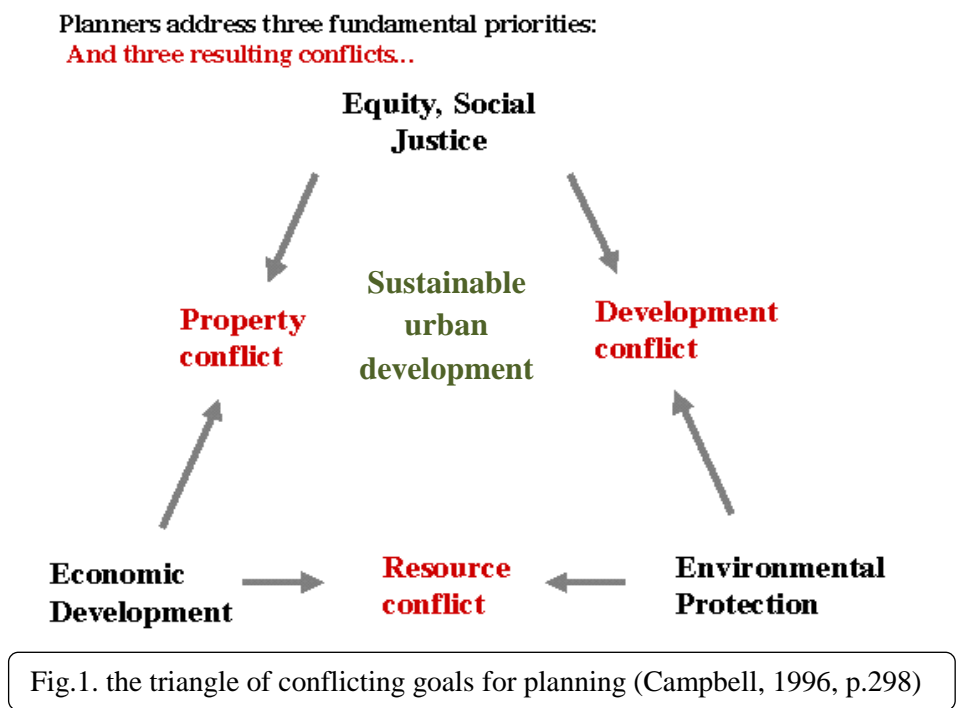
The concept of sustainability derives from the well-known notion of sustainable development, "The development that meets the needs of current generations without compromising the ability of future generations to meet their needs" (WCED, 1987, p.41). However, there is no unanimous consensus on how this definition should be put into practice. Due to the elusiveness of the definition, many theoretical formulations of the concept of sustainability have been proposed, and consequently many versions of sustainability-based decision principles and criteria have been proposed.

Sustainable urban development requires the integration of environmental interests in urban planning. Although various methods of environmental assessment have been developed, planning outcomes are often disappointing due to the environmental neglecting in urban planning, which should take place in multiple areas within multiple policy networks (Stigt & others, 2013, pp.18-19).

"Abroad re-environmental assessment should be applied not only to products and projects, but also to policies and programs, especially major macroeconomic, finance, and sectorial policies that induce significant impacts on the environment" (WCED, 1987, p.222).

The challenge of attaining sustainable urban development is the integration of environmental interests into the urban planning process. Essentially, sustainable urban development entails balancing three conflicting interests: overall economic

growth, social justice, and environmental protection. Schematically, this is represented by Campbell's (1996) well-known "planning triangle" as seen in Fig.1.



The corners of which represent these interests, whereas the sides of the triangle represent the three main conflicts among them: the property conflict between social justice and economic growth, the development conflict between social justice and environmental protection, and the resource conflict between environmental protection and economic growth. Campbell envisaged sustainable urban development to be at the center of the triangle, "a substantive vision of sustainable development".

Results and Discussion

Matrix framework:

In this paper, we will develop a framework for evaluation in a matrix depending on the integration of the most important local environmental Factors with the urban project Actions. The developed framework applied to analyze how sustainability principles are addressed in EIA practice for urban planning. It is possible to identify, describe, and evaluate the environmental impacts stemming from the interaction of the project with environmental factors. This evaluation can be performed by using different methods such as interaction matrixes; and checklists. However the simple matrix is identified by two vertical and horizontal checklists. So, and as a general rule, interaction matrices are the most frequently used method because they are simple to apply, inexpensive, and not time-consuming. Also, matrices are commonly used to organize and present information. Many of the more sophisticated methods and techniques often use matrixes as a starting point for analysis.

Because of that, this paper will use a developed qualitative environmental assessment methodology for the evaluation in a matrix depending on the integration of environmental factors with the project circumstances, activities, and actions which identify the opportunities and constrainsurrounded any project.This matrix is developed from one of the earliest matrix methods that developed by Leopold et al. In a Leopold matrix and its variants, the columns of the matrix correspond to project actions (for example, flow, alteration, and cost. Ext) while the rows represent environmental factors (for example,climate, geo. ext.)¹.The impact associated with the action columns and the environmental condition rows is described in terms of its magnitude and significance. Matrixes require information about both the environmental factors and project activities or actions. The cells of the matrix are filled in using subjective (expert) judgments, or by using extensive databases[2].In the matrix types, the symbolized matrix combines descriptive and numerical scales that grade Impact Importance. The magnitude of the interaction (extensiveness or scale) is described by assigning a value ranging from 1 (for small magnitudes) to 10 (for large magnitudes). The assignment of numerical values is based on an evaluation of available facts and data. Similarly, the scale of importance also ranges from 1 (very low interaction) to 10 (very important interaction). Assignment of numerical values for its importance is based on thesubjective judgments of the interdisciplinary team working on the EIA study.Once theinteractions are identified, Impact Importance is then evaluated by gradinga set of attributes that vary in number, depending on the legal framework of the country and the official guidelines recommended or requiredby the government.

In our paper, we modified and developed this method into a calculation tool multiplying each EnvironmentalFactor column by the Actions row taken in the project, so each intersectionis used to identify possible impacts as seen in Table -1- . The matrix approach is reasonably flexible.The total number of specified actions may increase or decrease depending on the nature and scope of the study andthis is one of the attractive features of the matrix, while the environmental factors are almost constantscame from several previous researches done by the researcher. Technically, the Matrix approach isa valuable tool for explaining impacts by presenting a visual display of the impacted items and their causes. Summing the rows and columns that are designated as having interactions can provide deeper insight and aid further interpretation of the impacts. The matrix can also be employed to identify impacts during various parts of the entire project cycle -construction, operation, and even dismantling phases.

Table -1-
The developed matrix (source: the researcher)

Project Actions that can potentially generate environmental impacts		Susceptible Environmental Factors				
		F1	F2	F3	F4	F5
Actions	A1	F1A1	F2A1	F3A1	F4A1	F5A1
	A2	F1A2	F2A2	F3A2	F4A2	F5A2
	A3	F1A3	F2A3	F3A3	F4A3	F5A3
	
	
	
	Impact	ΣF1A	ΣF2A	ΣF3A	ΣF4A	ΣF5A

The qualitative calculation of Impact Importance is carried out by applying a generic mathematical formula composed of a series of Main and Secondary (or sub) Environmental Factors weights that have been graded by a specialist evaluators. Consequently, the process is rather subjective but in our sequence researches we developed to be more objective by taking samples of specialists’ opinions and put them in analysis computer programs². Eq. (1) is used to calculate or

¹ In our paper we switched the columns with the rows for the variety of project actions and constantly environmental factors.

²For more information about the process of choosing our environmental factors weights you can read the researcher paper “Developing an Environmental Criteria for sustainable urban site selection” which published in" the planner and development journal", 2015.at This paper applied SPSS programby setting weights of the intentional sample of planners

estimate the environmental impact importance. The expression(Imp) stands for the importance of the factor; (Fn.An) refers to the multiplying the constant weight of the environmental factor by the value given to the action if it is related or not related to the certain environmental factor, (n) refers to the number of the environmental column or action row, and (A) represent the project action related to each environmental factor.While the action to be sustainable it has to be related to a very sophisticated studies so the research took LEED – ND actions (without their values) to be an efficient matrix with all the possible sustainable action.Each action will take a value between (1,-1, or zero),(source: the researcher),

- (1 point)If the action related to the environmental factor and used it efficiently.
- (-1 points)If the Action related to the environmental factor but used it inefficiently.
- (Zero points)If the Actionunrelated to the environmental factor.(source: the researcher)

$$\sum \text{Imp.Fn} = \text{fn} (A1+A2+A3+A4.....\text{ext}) \quad \text{Eq. (1) (source: the researcher)}$$

Then we have to transfer it in to 100 percentage to be able to estimate the impact as

$$X = \frac{\sum \text{Imp.Fn} * 100}{\text{Biggest F} * n \text{ of applicable Actions}} \quad \text{Eq. (2)(source: the researcher)}$$

seen in Eq (2), as seen in the EIA matrix below

X represent the total positive impact on the environment (not negative) and here the higher value will be better. So the final assessment of Impact Importance, with n values, is calculated on the basis of the values assigned to the attributes. The numerical result evaluates the impact as:

- Incompatible ($0 \leq X < \%24.F$)
- Critical ($\%25.F \leq X < \%49.F$)
- Compatible ($\%50.F \leq X < \%74.F$)
- Efficient ($X \geq \%75.F$) (source: the researcher)

So, from (50%) it will be certified as a sustainable project with two kind of certification one goes to a (Compatible EIA for sustainability) and the other will take the efficiency. (Source: the researcher)

EIA matrix Source: the researcher		Main Environmental Factors			
		Geo hydrological factor	Climate factor	Topographical	Ecological
		F1 (35)	F2(30)	F3(15)	F4(20)
Actions(LEED STANDARD)	Smart location	A1.F1	A1. F2	A1. F3	A1.f4
	Pattern & Design	A2. F1	A2 F2	A2.F3	A2.f4
	Green infrastructure	A3. F1	A3. F2	A3. F3	A3.f4
	Innovation & Design Process	A4. F1	A4. F2	A4. F3	A4.f4
	Regional Priority	A5 .F1	A5. F2	A5. F3	A5.f4
	Impact	IMP1	IMP2	IMP3	IMP4
	Total Impact (X)	IMP1*100 / Biggest .F value * no. of Actions	IMP2*100 / Biggest .F value * no. of Actions	IMP3*100 / Biggest .F value * no. of Actions	IMP4*100 / Biggest .F value * no. of Actions
	Assessment Criteria	Incompatible ($0 \leq X < \%24.F$) Critical ($\%25.F \leq X < \%49.F$) Compatible ($\%50.F \leq X < \%74.F$) Efficient ($X \geq \%75.F$)			

and environmental affairs specialists in the program and tested degree of confidence and freedom. While the research here considered the next step of the previous paper.

Environmental Factors and Actions:

One of the key components of EIA is providing information regarding the environmental factors of the project area, project characteristics, the identification and evaluation of potential impacts. Moreover, Environmental Factors are basic elements of the physical, biological, social, or economic environment. These are receiving environmental impacts from activities, and can be aggregated into super-components or desegregated into sub-factors. Most methods define a hierarchy of factors (e.g., physical may be split into atmosphere, water, soils, etc. and atmosphere might be split into air quality, meteorology, climate, etc.). For this, the most important environmental factors and sub factors highlighted by specialists and taken into account when choosing a Urban site for a particular use or another include: Geo-hydrological factor, Climatic factor, Topographical factor and Ecological factor and all these factors have sub-factors related to the main environmental factor See Table -2- the sub-environmental factors[3].

Table -2- The environmental and sub environmental Factors and weight (source: The researcher depending on a published previous research analysis)

Main Factors	Geo-Hydrological					Climatic				Topographical		Ecological	
Main weights	35					30				15		20	
Secondary weights	8	7.5	5.5	7	7	7	8	8	7	6.5	8.5	11	9
Sub- Factors	Soil structure	Renewable available energy	Groundwater availability	Groundwater level	Nature of surface water	Renewable available energy	Orientation, shaded efficiency	Thermal comfort	Indoor air quality	Slope level	Surface nature	Biodiversity	Sense of landscape

While the actions of the project are variables depending on the environmental, social, economic, and governmental conflicts that explained later in the research, and here we depended on LEED rating system for neighborhood development that has been developed in 2010. In addition, Talen and others explained the abilities of LEED –ND to become a certification system for many locations and urban projects instead of rated them individually (Talen and others, 2013, p.1, LEED-ND has lots of applications which extended from being an individual rating system to have the initiative for applying urban design principles[4] These Actions go within five categories as seen in Table-3- Source : NEIGHBORHOOD DEVELOPMENT, LEED Rating System Draft, November 2010.

Table-3- Actions in EIA
(Source :NEIGHBORHOOD DEVELOPMENT, LEED Rating System Draft, November 2010)

A. SMART LOCATION & LINKAGE	A.1. Imperiled Species and Ecological Communities Conservation
	A.2. Wetland and Water Body design and Conservation
	A.3. Agricultural Land Conservation
	A.4. Floodplain Avoidance and Steep Slope Protection
	A.5. Preferred Locations
	A.6. Brownfield Redevelopment

	A.7. Locations with Reduced Automobile Dependence
	A.8. Bicycle Network and Storage
	A.9. Housing and Jobs Proximity
B. Project Pattern & Design	A.10. Walkable Streets
	A.11. Compact Development
	A.12. Connected and Open Community
	A.13. Mixed-Use Centers
	A.14. Transit Facilities
	A.15. Access to Civic and Public Space
	A.16. Visitability and Universal Design
	A.17. Community Outreach and Involvement
	A.18. Local Food Production
	A.19. Tree-Lined and Shaded Streets
C. GREEN INFRASTRUCTURE & BUILDINGS	A.20. Certified Green Building
	A.21. Minimum Building Energy Efficiency
	A.22. Minimum Building Water Efficiency
	A.23. Construction Activity Pollution Prevention
	A.24. Landscape Water Use Reduction
	A.25. Existing Building Reuse
	A.26. Historic Resource Preservation and Adaptive Use
	A.27. Minimized Site Disturbance in Design and Construction.
	A.28. Rainwater Management
	A.29. Heat Island Reduction
	A.30. Solar Orientation
	A.31. Wastewater Management
	A.32. Using renewable energy and energy efficiency
	A.33. Recycling infrastructure
A.34. Solid waste management	
A.35. Pollution reduction	
A.36. Insulation heating and cooling	
D. INNOVATION & DESIGN PROCESS	A.37. Innovative design process
E. REGIONAL PRIORITY	A.38. Regional Priority

Applications of EIA arwond the world:

- EIA has clarified its overall effectiveness inthe evaluation of the importance of environmental impacts. This method is more in consonance with the characteristics of the activities and actions as wellas the social, economic, and environmental features of the context inwhich it is applied. Its enhanced objectivity reduces the risk of the manipulation of data by the evaluator and assures that major impacts willnot be unfairly eliminated.
- It has also helpedto determine theneed for additional assessment with one or more of the other tools,depending on the local context.In addition, it is ananalysis workbook -based tool for a more comprehensive and objective assessment, which could bedeveloped to a full environmental impact analysis process.
- It considered a Plan Review (in Checklists or Matrixes) that are based on the same evidence, synthesized into a series of questions to evaluate the content of local comprehensive plan elements

The possibilities of applying EIA in Iraq

Many years ago until now the architects and planners trying to build an environmentalassessment to evaluate the environmental impact of urban projects that could suit to the Iraqi projects, environment, and local climate, and could be considered as a reference to measure sustainable urban development.However, and in practice, achieving sustainable urban development appears to be problematic in Iraq. Since the planners and the developers found after lots of researches as a response to this challenge, and from about the 1970's till now, they found that the environmental impact assessment (EIA) became a routine part of decision-making on projects in the built environment. Along with they discovered that the governments and the NGOs like the World Bank and the United Nations have a powerful role in activating sustainable development in both developed and developing countries and play a significant one in sustaining urban efficiency[5]. Here, and because the Iraqi government take the main responsibility for achieving urban development for its role in

funding, directing, controlling and supervising mechanisms in all or most of the investment projects especially public sector or depending on the joint venture in project administration [6]. The research will take the three priorities (Social justice, economic development, and Environmental protection) from Compbell's conflict triangle and will add the missing corner in this triangle which is (the government role) to see why the urban development process (in Iraq) until now do not have any local environmental impact assessment or any urban criteria which can used as a reference in achieving sustainable urban development in Iraq. So as seen in Fig. 2, the research added the government role and try to see the conflict among the four priorities.

While the main conflict between social justice and economic growth is the property conflict in Compbell's proposal, there is another very important element in Iraq which is the community participation. In most EIA systems public or community participation is considered the cornerstone of the EIA process with the differences in the interaction step of assessing [7]. In Iraq there is a real problem with the social participation and what is considered a community responsibility and response to the environmental issues and in fact there is really resistance to change their habits and live affordably [8]. On the one hand the cost and the economic growth take the top of the priorities in all the development sectors, and, on the other hand, the environment is a government responsibility or that what people believe and behave [9]. In fact, there is a lack and shortage in the educational institutions for the most basic principles of environmental education, as well as this issue has not received the local importance for the public awareness weakness of the seriousness of the problem of depleting the natural environment and its impacts on public health components and the environment [10]. For all these reasons and more the research considered the main conflict in Iraq between social priority and the environmental priority is the social awareness (The researcher).

If we try to figure out what is the main conflict between economic growth and social priority and environmental protection in Iraq, we can simply identify the lack of professionals, practitioners and workers in sustainable business for the lack of sustainable business markets and technologies. Add to this, the deactivation of sustainability role in creating an attractive investment environment and the inadequate funding sources necessary to achieve sustainable human development [6]. From the other hand we (in all the developing countries) not only have always to cope with overseas scientific and technological progresses without any creativity or conserving our local identity, but also each project works independently from its urban surrounding (Urban independency) and faraway from the people participations [7]. For all these reasons, there will be a missing connectivity between our communities' needs and economic growth and for this it has to take the top of the conflicts between economic growth and social priority.

In addition, the investment environment in Iraq isn't far away from the previous indicators, Al- Rawi argued that the economic sector in Iraq has the inclusive characteristic depended on the oil resource only reducing the investment role of the private sector [11]. While there are poor integration and trade interface in the volume of investments through an effective partnership between the countries [12]. In Iraq, we have a leak in accurate information documentation and registration and delay in our urban projects [6]. And one of the main reasons for all these problems is the lack of the good sustainable urban management which considered one of the successful keys⁴ of the good governance that might accelerate the sustainable development [5]. In addition the shortage of the environmental legislations, jurisdictions and regulations in the field of sustainability to all its dimensions [9]. For sure, there are some legislations concerning the environmental protection but they are so general and flexible in the obligations of applying these legislations [9]. Upon checking in, we find more than half of which does not exceed express an opinion, and if the law stipulates in Article -10- First it on the necessity of commitment to the owner of any project before you start created a report to estimate the environmental impact, it did not appoint the competent authority to study and evaluate this report, Is it the Ministry of the environment, or the Council of protect and improve the environment [13]. Here we can find another conflict between the government role concerning the environmental protection which is the decision-making and who is responsible on what (the researcher).

With the lack of coordination among partners of the development process (the financed government, developers (engineers, designers and planners) and the community) for the lack of sharing vision in our planning institutions, and depending on traditional and old delivery tenders (Design-Bid-Build) which depend on delivering any project in separate

³There are many obstacle prevent Iraq country from providing an attractive investment environment like the weak capital accumulation, high unemployment rates, weak exports, weak financial institutions, escape the national capital, weak infrastructure And more [6].

⁴Transparency, participation, good government and sustainable management are the key factors and the most effective indicators of attaining successful governance [5].

phases⁵. here, developers got lost between trusting in investing in the economic market or private sector or trusting the governmental funding and public sector, and for this the research consider the main conflict between social and government is the loss of trust (the researcher).

While the problems of the environment in Iraq and most of the Middle East countries started with the depleting of non-renewable resources and the total dependence on them as an economic basis, reduces the chances to orient the development toward the natural energies as alternatives, and the Fragile and environmentally threatened areas. [6]. Environmental marginalization and lack of understanding the important role played by environmental criteria for the success of sustainable development. The lack of cognitive, scientific integration, and real study in any urban project submitted in Iraq deal effectively with the urban environment factors neither geology nor hydrology factors which need a special dealing especially with the desertification and the depleting of water resources [7]. So the conflict between the economic growth and environmental protection is still the resource depending like Compbell suggested twenty years ago.

From all the above, we can extract the conflicts among the four sides of the sustainable urban development in Iraq as below see Fig. (2):

- Conflict between Economic Development AND Environmental Protection= resource
- Conflict between Economic Development AND Social Priority = Connectivity
- Conflict between Economic Development AND Government Role = Governance
- Conflict between Social Priority AND Environmental Protection= Social awareness
- Conflict between Social Priority AND Government Role= Trust
- Conflict between Environmental Protection AND Government Role= Decision making

(Source: the researcher) See Figure (3) at the end of the research which explaining the conflicts among the sustainability indicators in Iraq in detail.

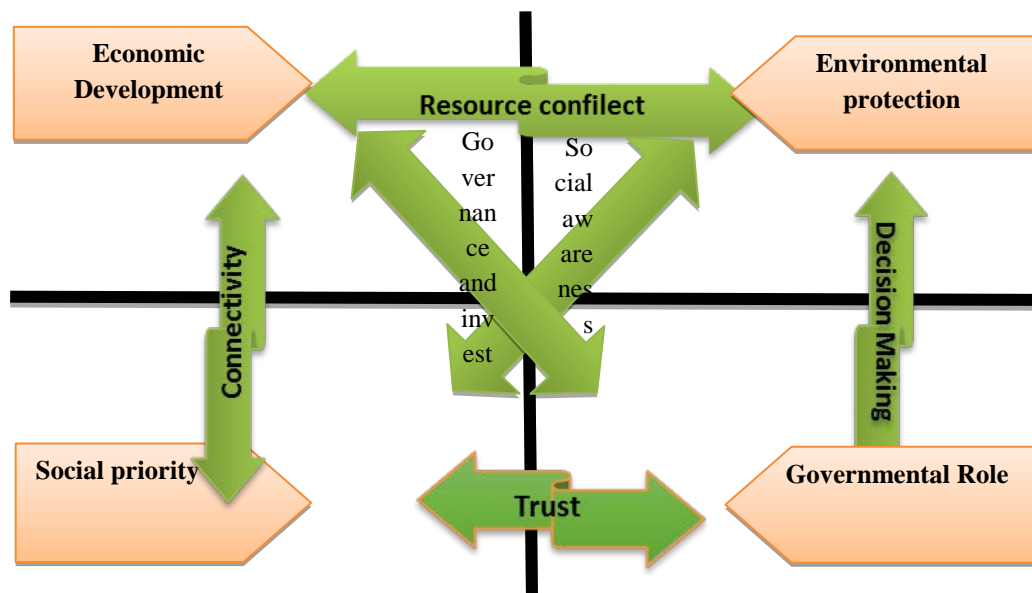


Fig (2) Priorities and conflict of Sustainability in Iraq (source: The researcher analyses)

Conclusion

⁵Design-Bid-Build is an old traditional way to deliver any project which the government contract with several entities to design then construction and delivering which might cause a defect between quality and economy cost. [14].

The world footsteps went towards putting sustainability and Sustainable urban development into practice many decades ago, while Iraq so far lacks to sustainable environmental standards that can developed towards a possible guide for measuring the environmental impactof urban projects.

Environmental impact Assessmentbecame indispensable both on the global or regional levels in reaching sustainable urban projects, with sophisticated solutions and multiple ways starting in the seventies of the last century by checklist untilreaching today to the most complex matrices approved of international criteria , Moreover, its applications extended from the simplest construction projects to the city planning.

Today, In Iraq there are lots of obstacles preventing developing and applying environmental impact Assessment tool varied from the depleting natural resources to the lack of the good investing and governance and the disconnectivity and miss trusting, while the social awareness take another side with the lack of the legislation that make environmental protection mandatory.

Recomandations

From the above, we find the need to develop anIraqi environmental impact assessment starting from developing local environmental standards for sustainable urban development depending on a local environmental standards, down to put this assessment into practice through the evaluation of any new projects to achieve sustainable urban development. This can achieved through the development of the research matrix and make othercomplementary researches in a way that leads to the adoption of standards and principles that lay the dimensions of economic, social, environmental and governmental role in complementary manner. As well as, this research recommends the adoption of this matrix from our ministries and administrations and supports it by conducting a professional team specialist in sustainability to integrate each part in to the local environmental standard in a way that can considered it the basis of selecting sustainable urban project by measuring its contribution toward environment. Moreover, these ministries can support and develop this EIA environmental matrix in a manner that push the development of environmental laws, and jurisdictions and activatetheir roles.

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