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Araştırma Makalesi / Research Article

Rapid Cumulative Impact Assessment for Land Use Planning in Dhaka City

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Abstract

In this study, the quantity of the cumulative impact assessment has been classified by the potential response of Valued environmental components (VEC) to pressures and resiliency, recoverability and compensability of them. In addition, the significance of the cumulative impacts of developments and projects over VECs' future conditions has been assessed. It can be concluded that the anthropogenic interventions to be carried out to protect or develop Dhaka City with the goal of protecting the area in the context of the land use plan will increase negative impacts over VECs in the area. However, it can be argued that clearing the land around flooding zones and fault lines out of settlements to preserve the natural habitat of the region will yield more sustainable outcomes. Strengthening and increasing monitoring activities in the area and imposing sanctions on violators of environmental protection laws properly, by privatizing them would strengthen cumulative impact management in Dhaka City. This study tries to provide suggestions regarding land use planning to reduce cumulative impacts resulting from the failure of previously adopted policies or targeted projects but not implemented land use plans. Individual sponsors, planning team, government and stakeholders have to fully comprehend encountered cumulative impacts and risks, and make effort to develop consistent management strategies to mitigate risks.

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Dakka Şehrinde Arazi Kullanım Planlaması için Hızlı Kümülatif Etki Değerlendirmesi

Öz

Bu çalışmada, kümülatif etki değerlendirmesinin miktarı, değerli çevresel bileşenlerin (VEC) baskılara karşı potansiyel tepkisine, bunların esnekliklerine, geri kazanılabilirliğine ve telafi edilebilirliğine göre sınıflandırılmıştır. Ayrıca, gelişme ve projelerin kümülatif etkilerinin değerli çevresel bileşenlerin gelecekteki koşulları üzerindeki önemi değerlendirilmiştir. Arazi kullanım planlaması kapsamında bölgenin korunması amacıyla Dhaka Şehri'nin korunması veya geliştirilmesi için yapılan antropojenik müdahalelerin, bölgedeki değerli çevresel bileşenler üzerindeki olumsuz etkileri arttıracağı sonucuna varılabilir. Ancak, bölgenin doğal yaşam alanını korumak için taşkın bölgeleri ve fay hatlarının etrafındaki arazilerin yerleşim yerlerinden arındırılmasının daha sürdürülebilir sonuçlar doğuracağı söylenebilir. Bölgedeki izleme faaliyetlerinin güçlendirilmesi ve arttırılması ve çevre koruma yasalarını ihlal edenlere ceza yaptırımların doğru şekilde uygulanması Dakka Şehrinde kümülatif etki yönetimini güçlendirecektir. Bu çalışma, daha önce benimsenen politikaların veya hedeflenen projelerin başarısızlığının neden olduğu ancak uygulanmayan arazi kullanım planlarından kaynaklanan kümülatif etkileri azaltmak için arazi kullanım planlamasına ilişkin öneriler sunmaktadır. Bireysel finansörler, planlama ekibi, hükümet ve paydaşlar, karşılaşılan kümülatif etkileri ve riskleri tam olarak anlamalı ve riskleri azaltmak için tutarlı yönetim stratejileri geliştirmek için çaba göstermelidir.

Anahtar kelimeler: *Çevresel bileşenler, Kümülatif etki değerlendirmesi, Arazi kullanımı, Dakka şehri*

1. Introduction

Valued environmental components (VECs) are defined as fundamental elements of the physical, biological or socio-economic environment, including the air, water, soil, terrain, vegetation, wildlife, fish, birds and land use that may be affected by a proposed project. Valued environmental components are affected by different external natural and social stressors and pressures. In an RCIA (Rapid Cumulative Impact Assessment), impacts are measured not in terms of the intensity of the stress added by projects but in terms of the VEC response and, ultimately, any significant changes to its condition.

1.2. Objective

The main objective of this study is to classify the cumulative impacts on VECs by potential response of VECs to pressures and recoverability and compensability of them. So, the 6-step methodology for conducting RCIA for land use planning in Dhaka City was used.

2. Material and Method

An RCIA study may utilize different methods to analyze cumulative impacts on VECs and their responses to these impacts properly. One of the methods that can be combined with an RCIA study is GIS-based land use analysis. The 6-step methodology proposed by IFC is used for conducting RCIA for land use planning for Dhaka City. The methodology is defining as the study area, identifying VECs as well as all developments and stressors affecting them, present conditions of VECs, recommended projects to save the VECs, severity of the cumulative impacts from projects over the VECs and significance of the cumulative impacts over VECs' future conditions.

3. Discussion and Findings

3.1. Defining Spatial and Temporal Boundaries

The study area contains Dhaka City that comprises ten regions in total (Figure 1). The period for which the cumulative impacts of various developments have been assessed is from 2016 to 2035 (RAJUK, 2015).

To assess the significance of the cumulative impacts over VECs' future conditions in Dhaka city, the magnitude of the cumulative impact potentials have been classified by taking the elements such as the potential response of VECs to pressure as well as their recoverability, compensability and preventability of the impacts into consideration. In order to do so, first, VECs have been defined within the context of spatial and temporal boundaries, and each VEC was given a letter from A to W. In a similar way, possible developments (possible land use plans) have also been defined within the context of temporal boundary and each development was given a specific name from Project-1 to Project-11. After that, impacts have been

classified in accordance with their severity. In classification, the number of impacts over the project and severity of them were given the utmost importance. Finally, significance of the cumulative impacts over VECs' future conditions has been assessed.

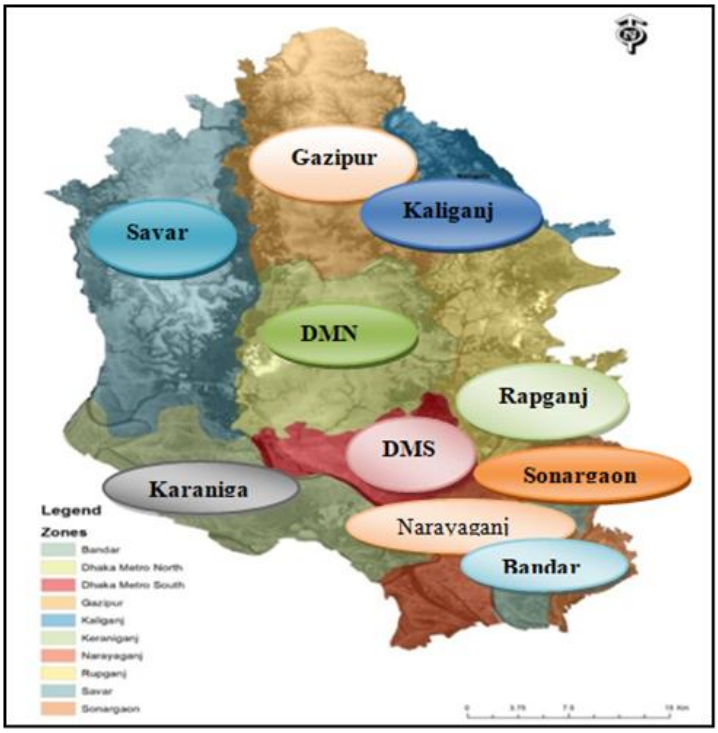

Figure 1. Districts of Dhaka City

3.2. Identifying VECs as well as all Developments and External Natural Stressors Affecting Them

Identifying external natural and social stressors, potentially affected VECs, potentially affected human structures and values, and existing cumulative impacts as natural or social elements of pressure over VECs have all been taken in to consideration. External natural and social stressors and pressures over VECs for Dhaka City are given in Table 1.

3.3. Determining Present Conditions of VECs

Present conditions of VECs in Dhaka City and risk assessment for the existing conditions are presented in Table 2. Each of these has been determined on the basis of the observational findings from environmental survey activities, studies, World Bank Reports, previous plans and various documents prepared by official bodies.

Table 1. VECs evaluated in RCIA for land use planning (Dhaka City)

External Natural and Social Stressors	Vecs	External Natural and Social Pressures Over Vecs
Air Emissions	Urban Population Around Highways / Wildlife Areas Under the Impact of Industrial Facilities / Agricultural Products / Forest Vegetation / Areas Orchards	Meteorological Conditions, Old Technologies, Lack of Monitoring, Unfiltered Chimneys
Noise	Settlements / Urban Population /	Population Density, Traffic, Construction Materials
Land Use and Soil Pollution	Agriculture Areas / Marshes and Peatlands / Wetlands / Stream Bed	Groundwater Overuse, Unsanitary Disposal and Wastewater Discharge
Biodiversity And Habitat	Biodiversity Areas / Bird Sanctuaries / Flyway of Migratory Birds	Seasonal Excesses
Natural Resources	Parks/ Forests / Water Sources	Excessive Use of Groundwater
Ground Water Pollution	Ground Water Quantity	Excessive Groundwater Use, Wastewater Discharge, Unsanitary Disposal Areas, Lack of Interception Canals in Industrial Zones, Industrial Zones Where Infiltration Is Not Possible
Drinking Water Quality	Groundwater Quality and Quantity /Surface Water	Pressure Over Groundwater Quality
Wastewater And Sewage	Wildlife/ Aquatic Fauna	Seasonal Excesses Resulting from Deficiency of Separate Sewerage System
Solid Waste Management	Urban Population/ Wildlife/Ground Water/Surface Water	Topographic Limits, Practice of Traditional Approaches to Waste Management, Need for Awareness-Rising, Poor Provision of Operations Concordant with The Waste Hierarchy
Land and Excavation Management	Wetlands /Streambeds	Illegal Settlements, Sandy Soil Structure Which Does Not Allow the Excavated Soil to Be Used as A Filling Material
Smell	Settlements Around Some Industrial Facilities	Use Of Old Technology, Lack of Green-Fields/Open-Fields
Floods	/Wildlife/Agricultural Land	Topographic Conditions and Seasonal Excesses, Encroachment and Filling of Drainage Zone
Seismic Movements and Other Natural Disasters	Urban Areas and Population	Geological Formation, Structures Built on Fault Lines
Landscaping and Recreation	Natural Habitat	Unauthorized Settlements
Social and Economic Environment	Life Quality/Recreational Real Properties/Economy	

Table 2. Present conditions of VECs in Dhaka City

Valued Social and Ecosystem Components	Risk Assessment for the Existing Conditions		
	Low	**Medium**	**High**
Settlements / urban population around highway transport corridor			✓
Wildlife areas under the impact of industrial facilities			✓
Agricultural land / products			✓
Forest vegetation / areas / Orchards / Marshes and peatlands / Wetlands / Streambeds / Biodiversity areas			✓
Bird Sanctuaries / Flyway of migratory birds / National parks		✓	
Water resources / Groundwater quality / quantity			✓
Surface waters / Aquatic fauna			✓
Buildings / industrial facilities within inundation area			✓
Natural habitat / Life quality			✓
Recreational areas / Real properties		✓	

3.4. Assessing Cumulative Impacts

Recommended projects addressed in the tables below have been developed on the basis of the findings obtained during research in this study. Possible developments (possible land use plans)

have also been defined within the context of temporal boundary and each development was given a specific name from Project-1 to Project-11. Recommended projects and developments are given below:

Project-1: Relocation of the settlements within the potentially inundated areas.
Project-2: Relocation of the industrial facilities within potential inundation area or developing free trade zones for these facilities.
Project-3: Developing new attraction and urban centers for the management of population density.
Project-4: Determining education, R&D, IT campuses.
Project-5: Increasing the natural ground level of some areas below sea level or within inundation area.
Project-6: Innovative construction techniques and land use on the land with the stability problem.
Project-7: Filling of marshes, peatlands and irrigated farmlands.
Project-8: Construction of new waste collection centers to increase solid waste management capacity.
Project-9: Planning of waste collection systems in accordance with the waste hierarchy along with recycling, recovery and waste incineration facilities.
Project-10: Burying energy transmission pipelines underground.
Project-11: Carrying out urban renewal projects within the 1 km corridor around the fault lines.
*(D): Drivers

Adverse impacts of the developments (indicated as projects) expected to take place in the study area are given below:

Project -1:
Adverse Impacts: Emission of combustion gases, acoustic emission, dust, vibration, solid waste generation, Degradation of the soil, liquefaction, degradation of the existing structure, impacts of road construction on soil / Demolition waste / Excavation waste / Non-hazardous and hazardous wastes / Use of arable land for construction / Wastewater accumulated in foundation pits.
Project -2,3 and 4:
Adverse Impacts: Combustion of gases, dust, vibration, solid waste / Contamination of pollutants into ground water / liquefaction / Degradation of the stratigraphic structure, soil erosion / Spread of water filled with materials / Penetration of leachate into soil/ the land puts pressure on VECs during the operation process / emission problems and socioeconomic problems.
Project -5:
Adverse Impacts: Emission of combustion gases / vibration, solid waste / Contamination of pollutants / Sediment accumulation.
Project -6:
Adverse Impacts: Contamination of pollutants into groundwater / Spread and penetration of pollutants / Spread of water filled with materials like cement etc.
Project -7:

Adverse Impacts: Degradation of the natural drainage structures / Reduction of carbon sinks / Depletion of the aquatic fauna / Degradation of the surface and groundwater quality / Depletion of groundwater.

Project -8:

Adverse Impacts: Since groundwater level is not very deep, Exhaust gases, smells, dust / Methane and carbon dioxide gas emissions from waste storage sites.

Project -9 and 10:

Adverse Impacts: Exhaust gases / ash / Boilers / Carbon monoxide, Hydrogen chloride, Hydrogen fluoride, Sox, NOx, PCDD/F, Dust, Mercury.

Project -11:

Indirect Impacts of all projects: New highways and railways construction/ Dust, NOx, benzo[a]pyrene emissions, resulting from the combustion of fuels / Fuel leaks / Noise / Health risks and environmental degradation / Waste discharge on the roadsides, Interventions into water and nitrogen cycle / Temporary land-grabbing practices / quality soil loss.

3.5. Importance of Cumulative Impacts over the VECs in Dhaka City

In order to determine the significance of cumulative impacts on the future conditions of the VECs, the potential response of VECs to pressure as well as their resilience, self-recovery capacity and recoverability have been evaluated, and potential cumulative impacts have been classified in accordance with their severity. This classification is based on the potential impacts of some selected developments (possible land use plans) on the land-use-related VECs in the study area. Table 3 has been organized as simple as possible to make it more understandable even for policy implementers and other stakeholders possessing only very basic technical knowledge regarding the methodology adopted in this study. Table 3 shows the severity of the cumulative impacts resulting from some selected projects/developments over the VECs in the study area.

Table 3. Severity of the cumulative impacts from projects over the VECs

Developments* / VECs	Project -1	Project-2	Project -3	Project-4	Project -5	Project -6	Project -7	Project -8	Project -9	Project -10	Project -11	Existing Impact	TCIP**
A.	0	2	1	0	2	2	0	2	1	2	3	3	
B.	0	1	1	0	1	0	2	2	1	0	0	2	
C.	1	0	1	0	1	0	1	0	0	2	0	3	
D.	0	0	0	0	1	0	1	0	0	0	0	3	
E.	0	0	0	0	1	0	1	0	0	0	0	2	
F.	0	0	0	0	0	0	5	1	0	0	0	3	
G.	0	0	0	0	0	0	5	1	0	0	0	3	
H.	0	0	0	0	0	0	3	0	0	0	0	4	
İ.	1	1	1	0	1	0	3	2	0	0	0	3	
J.	0	0	0	0	0	0	3	1	0	0	0	1	
K.	0	0	0	0	0	0	3	0	0	0	0	0	
L.	0	0	0	0	0	0	1	0	0	0	0	0	
M.	1	1	1	0	1	0	4	1	0	0	0	3	
N.	0	1	0	0	2	0	3	1	0	0	1	3	
O.	1	1	0	0	1	0	2	1	1	1	1	3	
P.	0	0	0	0	0	0	4	0	0	0	0	4	
R.	0	0	0	0	0	0	0	0	0	0	0	1	
S.	1	0	1	0	1	0	3	0	1	0	0	2	
T.	1	1	0	0	1	0	1	1	0	1	2	4	
U.	0	0	1	0	0	0	0	2	0	0	0	3	
V.	1	2	0	0	0	1	0	3	1	0	1	2	
W.	2	3	3	1	3	2	1	1	1	4	3	3	

* (0): No cumulative impact alone;
(1): Very low cumulative impact;
(2): Low cumulative impact;
(3): Medium cumulative impact;
(4): High cumulative impact;
(5): Very high cumulative impact;
**TCIP: Total Cumulative Impact Potential

None (0-4)	Low (5-9)	Medium (10-14)	High (+15)

3.6. Assessing the significance of the cumulative impacts over VECs' predicted future conditions, and managing the cumulative impacts

In this step, the significance of the cumulative impacts over VECs' future conditions has been assessed and the existing individual and cumulative impacts have been taken into consideration. The results are as follows:

4. Results and Recommendations

When the selected developments are compared and the existing individual and cumulative impacts are taken into consideration, it can be concluded that the anthropogenic interventions to be carried out with the goal of protecting or developing Dhaka City in the context of the land use plan will further increase these negative impacts. Considering the main environmental threats within the context of land use, it can be argued that clearing the land around flooding zones and fault lines out of settlements to preserve natural the habitat of the region may yield more sustainable outcomes from both economic and environmental perspectives compared to taking structural measures regarding land use to protect the land. On the other hand, extending the implementation of developments over a period of time might play a positive role in minimizing cumulative effects by ensuring that the similar pollutants and pressures won't repetitively affect the same receptors/VECs. Strengthening the monitoring mechanisms, imposing sanctions on violators of environmental protection laws properly, and increasing monitoring activities by privatizing them would strengthen cumulative impact management in Dhaka City. It should not be ignored that land use plans are being prepared in a state where cumulative impacts already exist. The most important aim must be to make environmental improvements and to facilitate urban and socio-economic developments.

This study tries to provide suggestions regarding land use planning to reduce cumulative impacts resulting from the failure of previously adopted policies or targeted but not implemented land use plans. The problems encountered are very complex and involve a large number of parameters. The requirements for the solution far exceed the capabilities of a single Project developer. Hence, individual sponsors, planning team, government of Bangladesh and stakeholders have to fully comprehend encountered cumulative impacts and risks, and make maximum effort to develop consistent management strategies to mitigate them. More importantly, it has to be realized that no matter what mitigation strategies will be developed, an active involvement of government of Bangladesh will be required to implement them properly and effectively. While elaborating on the current problems, experts from different disciplines should evaluate the

economic system, socio-economic goals, energy system, communication system, transport system, flood management, disaster and emergency management, waste and sewage system, water supply system, education and culture system and so on of the city altogether.

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