Sustainability Appraisal of Development Trends in the Urban Fringe: an MCA Approach

Introduction

'Sustainable Development' or 'Sustainability' dictates the way through which development can be ensured in a balanced and low-impact way. But rapid urbanization along with technological advancement is threatening this issue of 'sustainability' both at local and global scale. Now question has emerged, whether the Earth's resources will be able to meet the demands of a growing human population that has mounting aspirations for consumption and quality of life, while maintaining the rich diversity of the natural environment or biosphere. And, in the case of city or urban development, this issue of sustainability is raising much concern being it the root cause for exploiting the natural resources as well as providing human being with improved amenities and services.

Cities are the engines for economic and social development of a country. This massive agglomeration of population is not only influencing the overall city structure but also causing rapid consumption of environmental resources in the vicinity of the cities; particularly in the fringes. Balanced developments of urban fringes are now a challenging concern for urban planning where the onslaught of urbanization is quite obvious. This is where the issue of sustainability of fringe area development comes about, which is the key focus of this study.

Sustainable development is essentially not only about the environment but rather about the capacity of human society to enact permanent reform in order to safeguard the delicate balance between humans and their natural life support system (Hamm & Muttagi, 1998). For this reason, this study tries to evaluate the issue of sustainability from all of its social, economic and environmental dimensions in the case of fringe area development and searches some policy options that would be necessary to ensure sustainable urban growth. In this way it proposes a framework within which all the aspects of sustainability can be appraised in an integrated way for the particular context of developing countries.

Sustainability/Sustainable Development

The Stockholm Environmental Conference of the United Nations (1972) was the first major meeting of the international community to express grave concern over the deteriorating environment (Hamm & Muttagi, 1998 p.1). In 1987 the Prime Minister of Norway, Gro Harlem Brundtland, launched the book *Our Common Future* that effectively began the era of sustainability. In this report, the Commission offered one of the first definitions of sustainable development as: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987 p.43). In the decade following the publication of the Brundtland Report, over 100 alternate, more detailed definitions of sustainable development, and related term of sustainability, were proposed (Elkington 2002, Murcott 1997). Now, in addition to its political impact, the term rapidly became a new research paradigm in a wide range of disciplines, from the social sciences to biology (Becker, 1997).

Sustainability has come from a global political process that has tried to bring together, simultaneously, the most powerful needs of our time (Newman, 2000):

- the need for **economic development** to overcome poverty,
- the need for **environmental protection** of air, water, soil and biodiversity upon which we all ultimately depend, and
- the need for **social justice and cultural diversity** to enable local communities to express their values in solving these issues.

Thus when the issue of sustainability is referred it will be the simple idea that means the simultaneous achievement of social, economic and environmental sustainability. This concept can be shown as Figure 1.

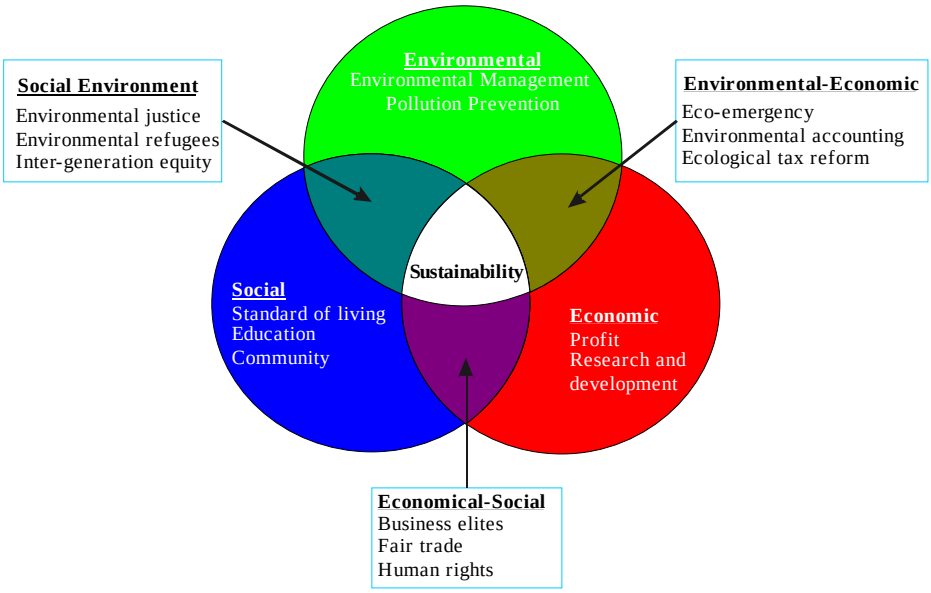


Figure 1: Issues within three spheres of Sustainability (redrawn from Sustainability, 2002)

Sustainability has mostly been defined at the global and national level and only recently has begun to be applied to cities. The principles of sustainability outlined above can be applied to cities though the guidance on how this can be done was not very clear in Agenda 21 or the other UN documents on sustainable development (Newman, 2000). But the initiatives for sustainable city development are going on world wide both at developed and developing countries (UN-Habitat & UNEP, 2001). Significant numbers of sustainability appraisal methods are also there to ensure sustainable development at city level thought the philosophical aspects behind them are diverse.

Sustainability Appraisal: Methods and Techniques

A lot of tools and mechanisms have developed worldwide for appraising sustainability both at local and global scale. Some of them have the option for determining the sustainability level of any development process and some of them have the capability for comparing among alternative policy options or development projects. *SustainabilityA-Test* project team identified following group of tools that may (can) be used in sustainability-related impact assessments in support of policy at various stages of development (Ridder, 2005):

1. Physical assessment tools – tools that assess some physical parameter;
2. Monetary assessment tools – tools that assess some financial/economical parameters;
3. Models – tools that used (computer) model;
4. Scenario analysis – tools with a prospective character;
5. Multi-criteria analysis – tools that help with the consideration of various criteria;
6. Sustainability appraisal tools – tools prescribing how sustainability appraisals could/should be done;
7. Stakeholder analysis tools – tools that aim to involve stakeholders;
8. Transition management – tools that can support transition management.

These tools have lots of variation in their specific methods and techniques, context for application, requirement of data and form of decision making. ‘Physical assessment tools’ for

sustainability appraisal may include Economy wide Material Flow Analysis (MFA), Life Cycle Analysis (LCA), Ecological Footprint (EF), Global Land Use Accounting (GLUA), Total Resource Use Accounting (TRUA) etc. that focus particularly on environmental sustainability impacts due to any policy, project or product. Most of these methods need a mass of reliable data on the particular action or process. 'Monetary based tools' for sustainability appraisal are mostly concerned with economic sustainability issue of a particular policy, plan or project. Cost-Benefit Analysis, Cost Effectiveness Analysis, Environmental Accounting etc. are some monetary based method for economic sustainability appraisal. Integrated Computer Models like Land Use Change (LUC) models, Qualitative System Analysis (QAS), Scenario Building and Planning (SBP) etc. provide some good options for sustainability appraisal in an integrated way that encompass all the spheres of sustainability (i.e. environmental, social and economical) within one appraisal framework. But these also have some limitation regarding their data requirement, complexity in model development procedure, communication ability with policy makers etc.

One of the main constraints for sustainability appraisal is the integration of all the issues of sustainability under one framework that would be able to handle both quantitative and qualitative data on these issues. Multi-Criteria Analysis (as discussed later in the paper) provide such option at different levels of decision making.

In addition to the above mentioned methods, Sustainability Impact Assessment (SIA) (developed for EU), Strategic Environmental Assessment (SEA) etc. are some other methods for sustainability appraisal which are mainly concerned with appraisal of strategic policies. Researches are still going on in this issue of sustainability assessment/appraisal. For example, Beccalli *et al.*, 2001 developed a Decision Support System based on Multi-criteria Analysis for the selection of Urban Sustainability Scenarios. Through this system it develops an Urban Sustainability Index (USI) to appraise sustainability of a development proposal or plan.

After reviewing existing available tools and techniques, this study prepared a sustainability appraisal framework for the particular context of urban fringe of a developing country that can be applied being within the constraints of local levels of developing countries.

The concept of Urban Fringe

The term fringe has been subject to a lot of discussions since the beginning of the 20th century. Many terms synonymous to fringe such as urban fringe, rural urban fringe, sub-urban areas, suburbs, urban periphery and more recently extended metropolitan regions (EMRs) have been used in planning literature. Whatever may be the designation, conceptually, fringe is related to the growth of cities that lies immediately outside the designated urbanizable limits and has strong interaction with present city and bears an urban reflection of on the physical, occupational and demographic characteristics (Sinha, 1997).

Pryor (1968) distinguished 'urban fringe' from 'rural-urban fringe' by narrating 'urban fringe' as, "… that sub-zone that is in context with a contiguous to the central city. Its density of occupied dwellings is higher than the density of occupied dwellings for 'rural-urban fringe' as a whole. It has high proportion of residential, commercial, industrial and vacant land as distinct from farmland."

Sinha (1997) classified fringe into two components- rural (outer) and urban (inner). According to his concept, the outer fringe (rural fringe) is more rural than urban areas whereas inner fringe (urban fringe) is more urban than rural and together may be called rural urban fringe. Sinha's concept can be visualized through figure-2.

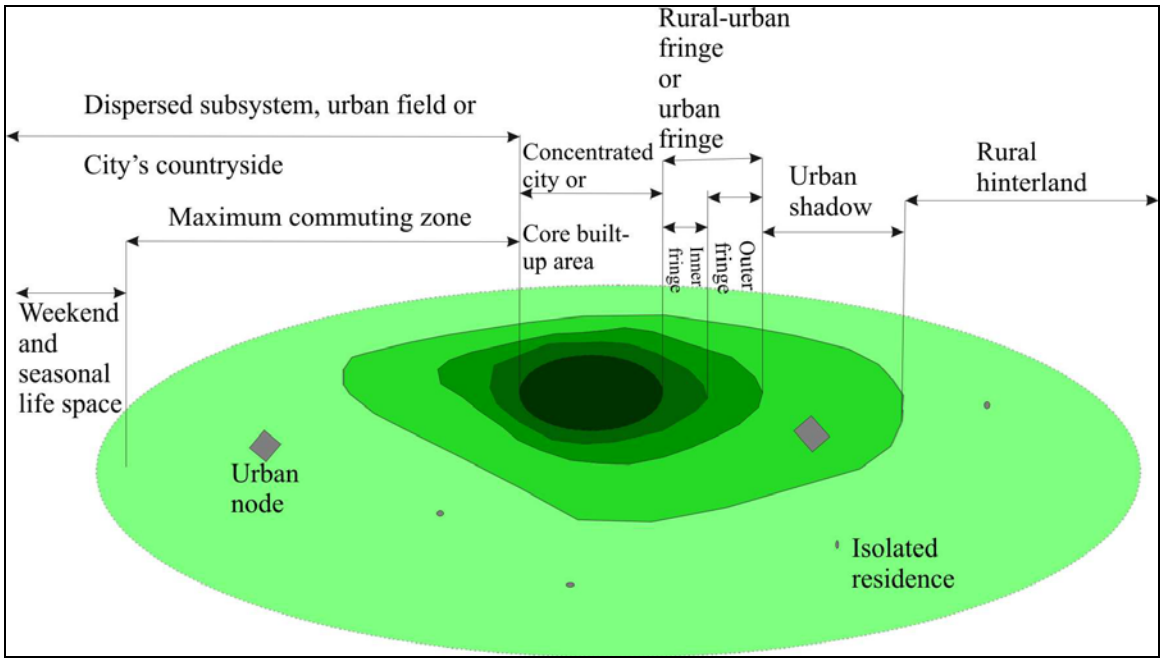


Figure 2: The form of the regional city (redrawn from Bryant et al. 1982)

Problems associated with urban fringe areas

Problems of urban fringe area in developing countries are quite different from that of the developed countries. While most of the developed countries are concerned about sprawl development in their fringes, most of the developing countries deal with the problems of haphazard development of shacks and slums, piecemeal commercial development, intermixes of conforming and non-conforming uses of land coupled with inadequate services and facilities etc in their fringes. Perhaps the most common problem associated with the urban fringe of developing countries is in the realm of inefficiency of land use (Sinha, 1997). The haphazard and arbitrary development of fringe areas devastates rural areas in many ways: it destroy the rural environment once dotted by forests, fields, farmland, and rivers, lakes and ponds; it destroys the agricultural heritage of this area and it changes the economic and cultural character of these areas.

One of the most damaging impacts of fringe area development on natural resources is run-off generated from farms and city streets that carries pollutants and excess sediment into waterways, which degrades water quality and create hazard for ecology of the fringes. Wetlands work as natural sponges that soak up and store rain and runoff. When these wetlands are bulldozed over and asphalted under in the process of development works, water that would have been stopped or slowed is free to flood. This problem is distinct in the case of Dhaka city where unplanned filling of wetlands in the fringes are not only creating localized flood in those areas but also at the inner part of the city.

Objectives of the study

The focus of this study circulated around formulating a sustainability appraisal framework for the context of a typical urban fringe area of a developing country (i.e Bangladesh) and to identify the sustainability level of this area due to present development trends there using this appraisal framework. It also aimed towards identification of policy options that would ensure sustainable development in the study fringe area. In the process of formulating the objectives, it was recognized that being in a developing country, adequate data on the study area would not be available. So, it was a challenge for the study team to formulate a sustainability appraisal framework that won't require extensive data on the study area.

Following sections of this paper discusses on this framework and the result that was generated by applying this framework on the study area.

Methodology of the Study

After reviewing a significant number of methods and techniques, it was decided that Multi-Criteria Analysis (MCA) would be the feasible technique basing on which the sustainability appraisal framework can be formulated. MCA is a decision-making tool developed for complex multi-criteria problems that include qualitative and/or quantitative aspects of the problem in the decision-making process (Mendoza and Macoun, 1999). As discussed earlier Sustainability is a multi-objective issue that need to integrate all the three aspects of Tripple Bottom Line (TBL), i.e. environmental, social and economic aspects. And there would be a group of criteria of these three aspects that need to be evaluated in an integrated framework where different criteria would be given relative importance. MCA is a tool that can help evaluate the relative importance of all criteria involved, and reflect their importance in the final decision-making process (Mendoza and Macoun, 1999). Different types of MCA are also available some of which can be named as Linear Additive Model, Direct Analysis of Performance Matrix, Multi-Attribute Utility Theory, Analytical Hierarchy Process (AHP), Outranking Methods, Fuzzy Set methods etc. Different MCA types need different extent of data and software requirements that can be applied to different decision contexts. For the present study Linear Additive Model was applied due to its flexibility, easy interpretation capability and above all minimum data requirement. In Linear Additive Model, value score of each criterion are multiplied by the weight of that criterion and then all those weighted scores are added together to get an overall value. In this study Analytical Hierarchy Process (AHP) was used to weight different sustainability criteria. Following sections of the paper sequentially describes the framework for sustainability appraisal of development trends in the study fringe area using Linear Additive Model of MCA.

Identification of sustainability criteria

For conducting MCA this study has identified 3 Primary Tier Criteria (PTC), namely Environmental, Social and Economical. Under these PTC, 28 Secondary Tier Criteria (STC) have been identified. The Environmental PTC contains 10 STC, Social PTC contains 9 STC and Economical PTC has got 9 STC. These PTC and STC are listed in Table-1.

Weighting of the criteria by AHP

The Analytic Hierarchy Process (AHP) is a multi-attribute modelling methodology, which was first developed and applied by Saaty (1980). The Analytical Hierarchy Process (AHP) is a systematic method for comparing a list of objectives or alternatives. The basic procedure to carry out the AHP MCA consists of the structuring of a decision problem and selection of criteria, priority setting of the criteria by a pair wise comparison (weighing), a pair wise comparison of options on each criterion (scoring) and obtaining an overall relative score for each option (Ridder, 2005). AHP was applied in this study for weighting the STC. All of the PTC was given with the value of 1 which was distributed among their STC in the form of Sustainability Weight (SW) on the basis of AHP (Table 1). The study team made the pair wise comparison after having extensive visit to the study area. Consistency Ration (CR) of the pair wise comparison was also analyzed to keep the decisions at the acceptable consistency level. An AHP module developed in Microsoft Excel spreadsheet program was used in this process.

Table 1: Primary Tier Criteria (PTC) and Secondary Tier Criteria (STC) with their Sustainability Weight (SW) generated by AHP

PTC	STC	SW
PTC 1 (Environmental Sustainability)	(STC 1-1) Air Pollution	0.077
	(STC 1-2) Loss of wetland	0.189
	(STC 1-3) Water Pollution	0.109
	(STC 1-4) Noise Pollution	0.053
	(STC 1-5) Waste Management	0.109
	(STC 1-6) Agricultural Productivity	0.116
	(STC 1-7) Fisheries Production	0.077
	(STC 1-8) Ground water extraction	0.051
	(STC 1-9) Deforestation	0.076
	(STC 1-10) Sanitation	0.143
	Total	1.000
	Consistency Ratio (CR)	0.045
PTC 2 (Social Sustainability)	(STC 2-1) Public Participation	0.147
	(STC 2-2) Housing Quality	0.074
	(STC 2-3) Education Facility	0.211
	(STC 2-4) Healthcare Facility	0.134
	(STC 2-5) Access to safe drinking water	0.113
	(STC 2-6) Recreational Facility	0.053
	(STC 2-7) Gender equity	0.149
	(STC 2-8)Public security/ crime	0.053
	(STC 2-9) Disaster Management	0.067
	Total	1.000
	Consistency Ratio (CR)	0.025
PTC 3 (Economic Sustainability)	(STC 3-1) Increase of income	0.131
	(STC 3-2) Employment opportunity	0.173
	(STC 3-3) Increase of property value	0.088
	(STC 3-4) Economic equity	0.254
	(STC 3-5) Development of Industries	0.068
	(STC 3-6) Economic return of agricultural products	0.109
	(STC 3-7) Transport Facility	0.078
	(STC 3-8) Electricity Supply	0.052
	(STC 3-9) Gas Supply	0.046
	Total	1.000
	Consistency Ratio (CR)	0.025

Identification of Sustainability Impact Value (SIV) for each criterion

Two sites within the study area were selected for achieving the best result from the analysis. Between these two sites one was in inner fringe area and the other was in outer fringe area. Data and information regarding the selected STC of these two sites were collected both from primary and secondary sources. Based on the selected PTC and STC a close-ended questionnaire was prepared to identify the perception of the local residents regarding the positive or negative change of these criteria within last 10-15 years in the study area. Two focal group meetings were arranged in the sites comprising local political leaders, representatives from different professional and social groups. Equitable presence of all income groups and sexes was also ensured. In these focal group discussions the purpose of the study was duly briefed and how the questionnaire would be filled up was elaborately

shown. The meeting attendees were then asked to answer about the level of change of each criterion as shown in figure-3. 100 questionnaires (50 from each of the focal group discussions) were collected.

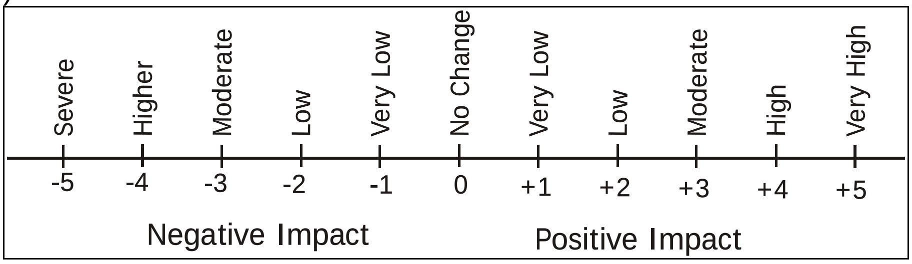


Figure 3: Sustainability Impact Level (SIL) for different STC

Data and information about the STC of the two sample sites were also collected from different secondary sources like newspapers, previous studies, government reports and different documents prepared by local organizations. The criteria, which were not possible to evaluate through questionnaire survey, was assessed through focal group meetings and analysis of secondary data. For calculating Sustainability Impact Value (SIV) of each of the STC from questionnaire survey, following equation was used:

$$SIV_{ji} = \frac{\sum (SIL \times X)}{\sum X} \qquad \text{……………………………… (1)}$$

Here,

SIV_{ji} = Sustainability Impact Value of i-th STC of j-th PTC
SIL = Sustainability Impact Level (SIL) assigned by the respondent
X = No. of respondent

Determination of sustainability level

After providing SW to all of the STC (by AHP), these SWs were then multiplied by SIVs of the respective STC. In this process the following equation was used to calculate Primary Sustainability Level (PSL) of each of the PTC:

$$PSL_j = \frac{\sum_{j=1,i=1}^{n} \left(SW_{ji} \times SIV_{ji} \right)}{\sum_{j=1,i=1}^{n} SW_{ji}} \qquad \text{…………………………………… (2)}$$

Here, PSL_j = Primary Sustainability Level of j-th Primary Tier Criteria (PTC)
SW_{ji} = Sustainability Weight of i-th Secondary Tier Criteria (STC) of j-th Primary Tier Criteria (PTC) (here, $SW_{j1}+SW_{j2}+SW_{j3}$+---------+SW_{jn}=1)
SIV_{ji} = Sustainability Impact Value of i-th STC of j-th PTC
(here $-5 \leq SIV_{ji} \leq +5$)

Identified PSL of the three PTC were then calculated to identify Site Sustainability Level (SSL) of each of the sites using the following equation:

$$SSL = \frac{\sum_{j=1}^{n} (PSL_j \times SSV_j)}{\sum_{j=1}^{n} SSV_j} \qquad \text{…………………………………… (3)}$$

Here, SSL = Site Sustainability Level
PSL_j = Primary Sustainability Level of j-th PTC
SSV_j = Sustainability Significance Value of j-th PTC

Here, Sustainability Significance Value (SSV) for different PTC was applied depending on the relative importance of the PTC on the total sustainability of the area. SSV is an arbitrary value depending on its significance. For this particular study, it was assumed that all the PTC are equally important for the overall sustainability of the fringe area and hence all the SSVs were equally valued (=1).

In this way SSL_1 and SSL_2 were calculated for site-1 (inner fringe) and Sited-2 (outer fringe) respectively. SSLs were then used to identify Generic Sustainability Level (GSL) of the study area according to following equation:

$$GSL = \frac{\sum_{k=1}^{n} (SSL_k \times SSV_k)}{\sum_{k=1}^{n} SSV_k} \qquad \text{.......................................} \quad (4)$$

Here, GSL = Generic Sustainability Level of the study area
SSL_k = Site Sustainability Level of k-th Site
SSV_k = Sustainability Significance Value of k-th site

In this case also, Sustainability Significance Value (SSV) was applied for the two sites based on their relative locational importance on the overall sustainability of fringe area. These SSVs are arbitrary values depending on their significance. In this case, two of the sites were in inner fringe and outer fringe and sustainability of both of these sites were assumed to be equally important for the sustainability of whole fringe area.

About the Study Area

The study area is in the northeastern part of Dhaka city that falls to the east of Uttara (Map-1). It has an area of about 40.69 sq.km (Chowdhury et.al., 2001). It is bounded by the Dhaka-Tongi railway line at the west, the Tongi Khal at the north, the Balu River at the east and the eastern fringe of Dhaka at the south. This area is easily accessible from Mymensingh Road through Uttara. Rivers around this area are also used widely as transport route to communicate here.

Present Development Trends in the Study Area

The study fringe area is experiencing a spontaneous development without much control from the city development authority (i.e. *RAJUK*). As the Detail Area Plan (DAP) under the Dhaka Metropolitan Development Plan (DMDP: 1995-2015, Structure Plan of Dhaka) is yet to be completed for the study area, it is rapidly loosing its natural serenity under the pressure of unplanned infrastructural development both by public and private initiatives. This study has identified some broad development trends that are described as follows:

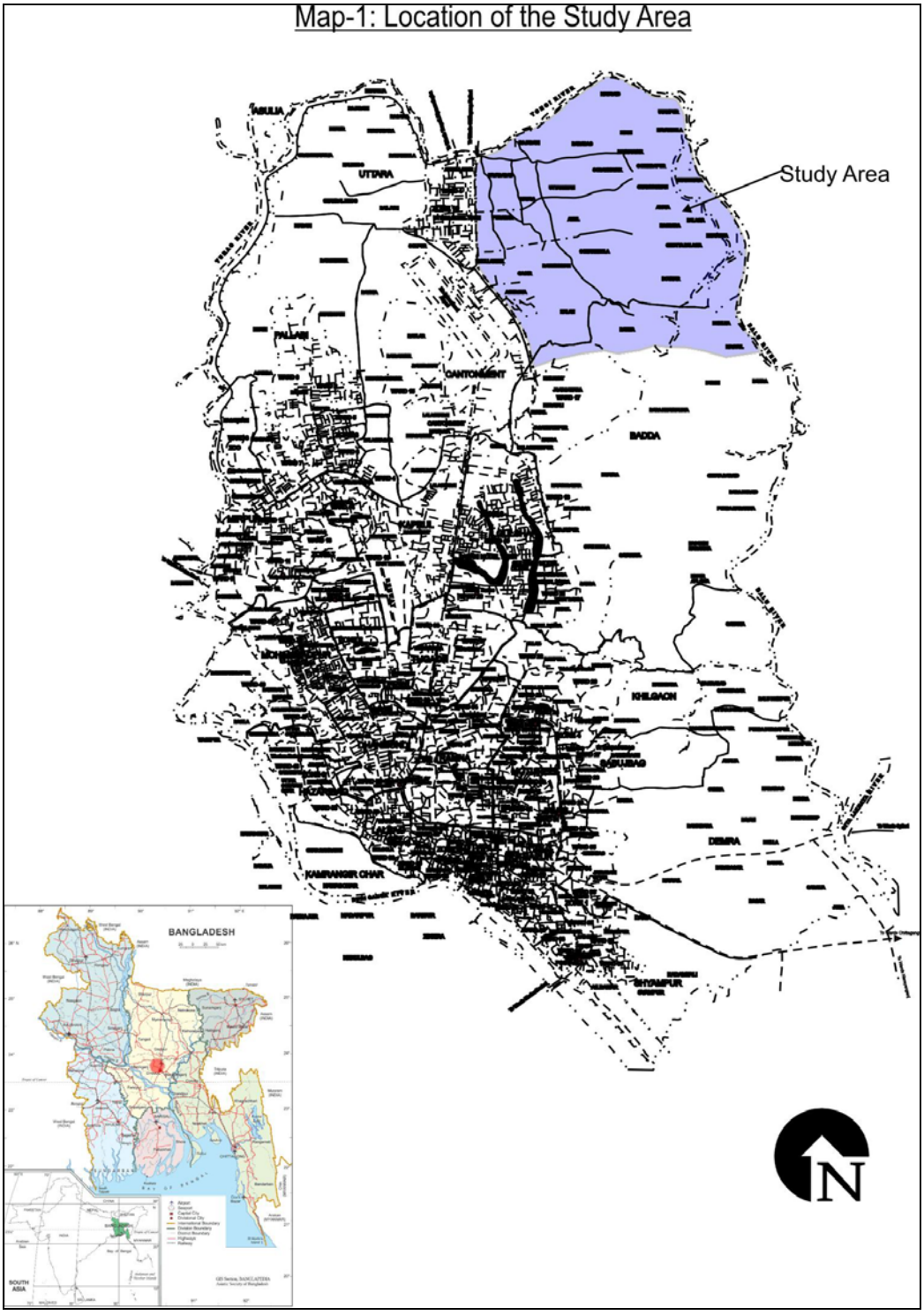
Obstruction to natural flow of water

Obstruction to natural flow of water is one of the major causes for increasing the severity of floods in and around Dhaka city. It was found through field survey in the study area that both public and private development works are causing obstruction to natural flow of water at present there. Some road networks have been developed there without providing adequate opening for flow of water during rainy season.

Real Estate Development

Due to its vicinity to the urban core of Dhaka city, the study area is a lucrative choice for the real estate developers. But, the amount of high land required for any kind of real estate development is not so abundant in this area. As a result, low lands are now being considered

as the potential site for this kind of development. Improved road communications in last few years along with cheaper land price have promoted this trend further.



Increase of land value

Land value in the study area has rapidly increased within last 10 to 15 years. It was found that, in the inner fringe land value has more highly increased than that of the outer fringe. In the inner fringe area land value of high land was around 200,000 tk. to 300,000 tk. (2,900 US$ to 4,300 US$) per *katha* (720 ft^2) in the year 1990-95 which increased to 500,000 tk. to 1,200,000 tk. (7,150 US$ to 17,150 US$) per *katha* presently.

Increase of transport facility

Road transport facility has greatly increased in the study area within last 10-15 years. Most parts of the inner fringe of the area have got easy access to road transport facility. Non-motorized transport (mostly cycle-rickshaw) is the main mode of the transport in this area, although it has some provision of public transport in the form of bus and *tempo*. People of outer fringe area use both road way and waterway as their transport route. During rainy season, native boats become the main mode of transport here.

Provision of utility services and community facilities

As most part of the study area is out of the jurisdiction of Dhaka City Corporation, utility services and community facilities are not so developed here. But previously the situation was much worse as it was revealed through personal interview of the local residents. At present, most part of the study area is under the network of electricity and gas supply. The provision of piped water supply is available only in some parts of the inner fringe area. With increased road transport facility, the people of the study area have got increased access to education and healthcare facilities.

Lack of adequate development control

Development control mechanism is very weak for the study area. Although this area is under the jurisdiction of *RAJUK* (the city development authority), hardly any building owner of the area bother to get their building permission from this development control body. Lack of proper inspection by RAJUK officials in the study area promotes improper and ill-engineered building construction in hazardous locations that not only act as a potential threat for the life of its inhabitants but also causing damage to overall natural environment of the area.

Analysis of the result

Using the sustainability appraisal framework as described earlier, the sustainability level of the study area was identified. At first the level of sustainability of both inner and outer fringe area was identified in the form of Site Sustainability Level (SSL). And on the basis of these levels the overall sustainability level of the study area was identified in the form of Generic Sustainability Level (GSL). Analyzing the Primary Sustainability Level (PSL) of all the PTC, the mostly affected component of sustainability was identified both in inner and outer fringe area. On the basis of the SSLs, the sustainability position of each of the sites can be identified according to Table 2. This table was also consulted to identify the position of the GSL. For example, if the GSL is –2.5 then it can be said that the study area is in a 'Moderately negative sustainability state'.

Table 2: Qualitative Statement on Sustainability based on SSL and GSL

SSL/ GSL	Qualitative statement on Sustainability
–5 to –4	Severely Negative state
–4 to –3	Highly Negative State
–3 to –2	Moderately Negative State
–2 to –1	Low Negative State
–1 to 0	Very Low Negative State
0 to 1	Very Low Positive State
1 to 2	Low Positive State
2 to 3	Moderately Positive State
3 to 4	Highly Positive State
4 to 5	Very High Positive State

Sustainability Level of the Study Area

Figure 4 below shows the Sustainability Impact Value (SIV) of different Secondary Tier Criteria (STC) under the Primary Tier Criteria of Environmental Sustainability (PTC-1). It shows that only STC 1-5 (waste Management) and STC 1-10 (sanitation) of both inner and outer fringe are in a positive state of sustainability although with a very low value of SIV. All the other STC of this PTC are in a negatives state where STC 1-2 (Loss of wetland) is in the worst position, which is followed by STC 1-9 (Deforestation). STC 1-3 (Water Pollution), STC 1-7 (Fisheries Production) and STC 1-8 (Ground water extraction) are also in highly negative state as can be seen from the figure.

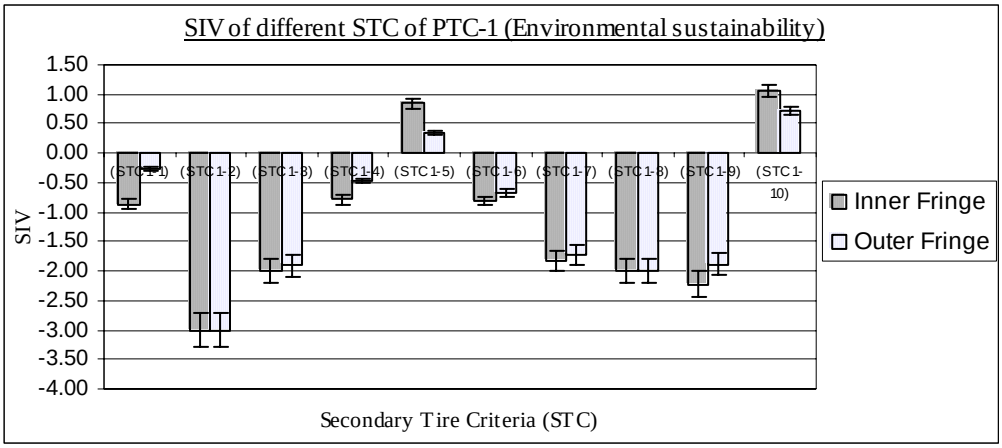


Figure-4 Sustainability Impact Value (SIV) of different STC in PTC-1 (Environmental Sustainability)

Figure 5 shows the Sustainability Impact Value (SIV) of different Secondary Tier Criteria (STC) under the Primary Tier Criteria of Social Sustainability (PTC-2). It shows that both inner and outer fringe is in a positive state of sustainability in terms of Public Participation (STC 2-1), Housing Quality (STC 2-2), Education Facility (STC 2-3), Healthcare Facility (STC 2-4), Access to safe drinking water (STC 2-5) and Gender equity (STC 2-7) although all of them contains a low positive value of SIV. In terms of Recreational Facility (STC 2-6), Public security/crime (STC 2-8) and Disaster Management (STC 2-9) both of the sites are in a negative state of sustainability.

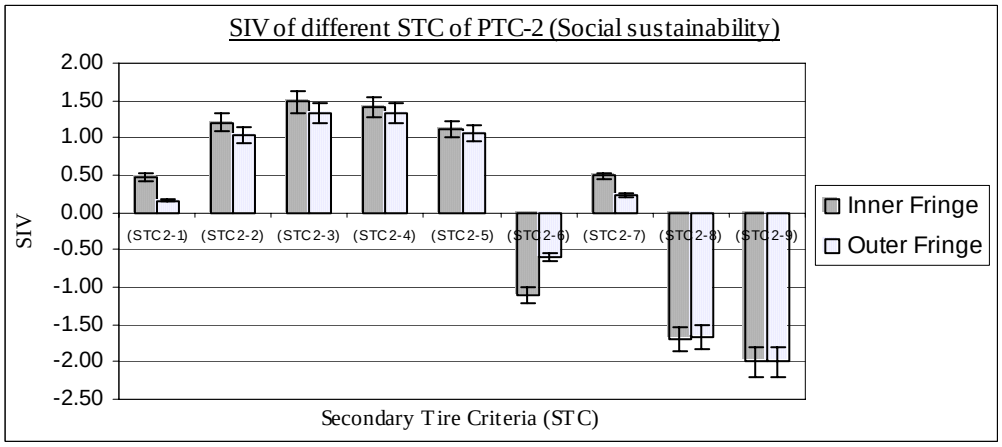


Figure-5: Sustainability Impact Value (SIV) of different STC in PTC-2 (Social Sustainability)

Figure 6 shows the Sustainability Impact Value (SIV) of different Secondary Tier Criteria (STC) under the Primary Tier Criteria of Economic Sustainability (PTC-3). It shows that both inner and outer fringe is in a positive state of sustainability in terms of increase of income

(STC 3-1), employment opportunity (STC 3-2), increase of property value (STC 3-3), development of Industries (STC 3-5), economic return of agricultural products (STC 3-6), transport Facility (STC 3-7), electricity supply (STC 3-8) and gas supply (STC 3-9) although all of them contains a low positive value of SIV. But, in terms of economic equity (STC 3-4) both of the sites are in a highly negative state of sustainability.

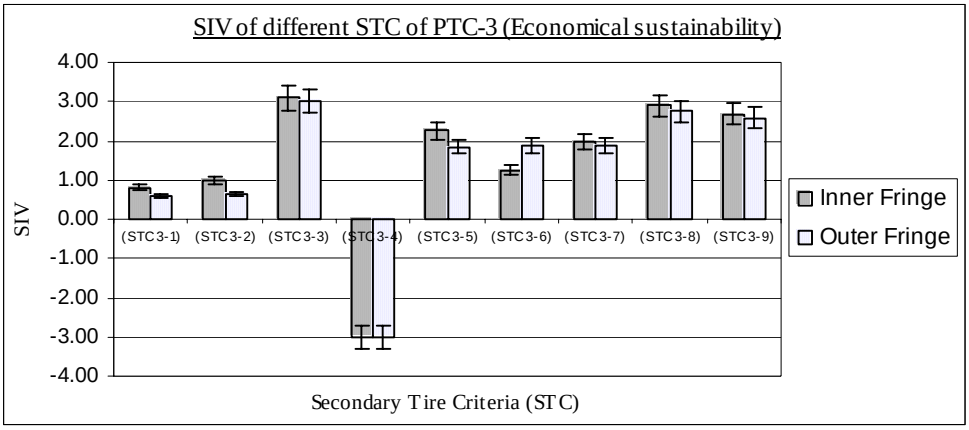


Figure-6: Sustainability Impact Value (SIV) of different STC in PTC-3 (Economic Sustainability)

Primary Sustainability Value (PSV) of different PTC was calculated using Sustainability Impact Value (SIV) of their respective STC according to equation (2). Figure 7 shows the relative position of all the Primary Tier Criteria (PTC) in inner and outer fringe of the study area. Although both of these sites are in very low positive state in terms of social and economical sustainability, it is in a significantly negative state of environmental sustainability. For improving overall sustainability of these sites, this issue of environmental sustainability needs to be addressed adequately.

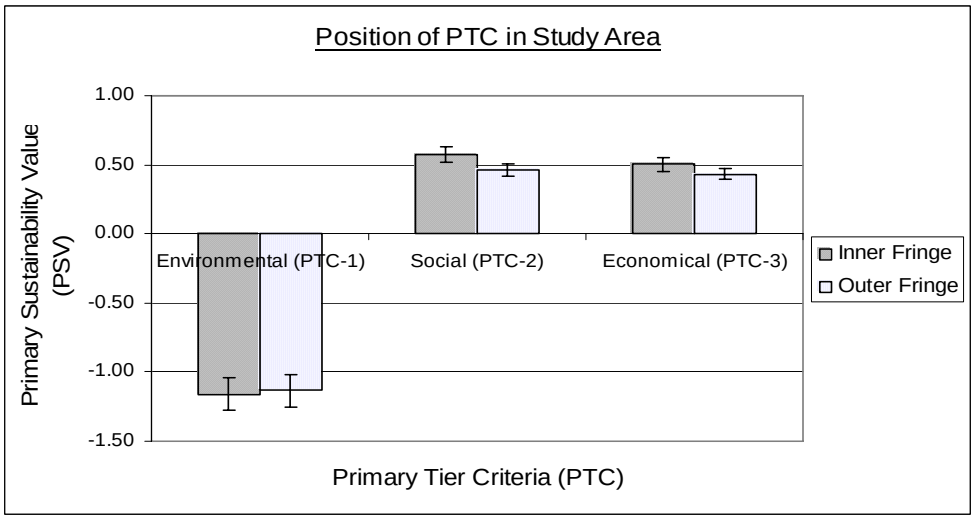


Figure 7: Position of Primary Tier Criteria in the study area

The Site Sustainability Level (SSL) of both inner and outer fringe was calculated using the Primary Sustainability Level (PSL) of all the Primary Tier Criteria (PTC) according to equation (3). It was found that SSL of Site-1 (inner fringe) is –0.026 and Site-2 (outer fringe) is –0.08 which indicate that both of the sites are in a 'very low negative state' of sustainable development (as per table 2).

Generic Sustainability Level (GSL) of the whole study area was calculated by using the Site Sustainability Level (SSL) of the two sites according to equation (4). It was found that, the study area has a GSL value of '-0.053'. It indicates that the study area is in a 'very low negative state' of sustainability in its development process. It means that, if the development

trends of the study area continue in the same manner as it occurred for last 10-15 years, it would proceed further towards an unsustainable situation. For achieving sustainable development in this area, some sensible and planned initiatives need to be taken here. Some recommendations in this regard are discussed in following sections.

Proposals and recommendations

Based on the Generic Sustainability Level (GSL) of the study area and the Primary Sustainability Levels (PSLs) of the components of sustainability, some recommendations were prepared at the end of the study as to how the overall sustainability of the study area can be improved.

Proposals for promoting environmental sustainability

For promotion of environmental sustainability adequate focus should be given on promotion of pollution control mechanism, strengthening of development control measures through Detail Area Planning, Improvement of waste management mechanism and improvement of sanitation situation in the study area.

Proposals for promoting social sustainability

For promotion of social sustainability adequate emphasis should be given on- Strengthening of Local Government bodies, Improvement of community facilities, Promotion of gender equity and Improvement of disaster management mechanism in the study area.

Proposals for promoting economic sustainability

For promotion of economic sustainability proper focus should be given on- measures for poverty reduction, promotion of small industries, improvement of transport facility and improvement of utility services in the study area. Poverty alleviation is one of the prime issues for attaining economic sustainability. Although, the process of urban expansion in the fringes bring economic benefit to a significant portion of upper and middle income people, in some cases the poor have to face the adverse affect of this process.

Conclusion

Environmental Impact Assessment (EIA), Initial Environmental Examination (IEE), Socio-economic Impact Assessment (SIA) etc. are the widely used methods for assessing viability of any development plan or proposal in Bangladesh (and most other developing countries). Although these methods have the ability to efficiently judge and compare the suitability of any project, they are narrowly focused on some limited issues. But, any kind of physical development have some sort of positive or negative impact on the environmental, social and economical aspects which need to be addressed broadly to attain the highest benefit from it. Sustainability assessment would appraise all these aspects of a development proposal with only one mechanism. So, adequate research on this mechanism needs to be conducted to make it more workable at the local level of Bangladesh, which was an initiative of this study.

Initiated by the Brundtland Commission Report (WCED, 1987), the issue of sustainable development or sustainability is generating wider interest among the scholars and policy makers of both developed and developing countries. It is now extensively applied from the issue of global trade to development works at the local level. Although conservation of natural resources is the main focus of this term, it is now widely used to guide the development initiatives encompassing all aspects of human habitat. Assessment of sustainability has now become a widely accepted tool for comparing between alternative development proposals and for determining the viability of the on going ones. It is now accepted that only progression towards sustainability will ensure a livable human habitat on earth. This paper proposes an integrated framework for planners in this way.

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