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Role of Urban Transformation and Environmental Design in Social Sustainability - A Case of Indore City

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Abstract— **City dwellers experience urban transformation through time that gradually or in a rapid evolution expose the development of the city and its architecture. The research explores this transformation through the views of dwellers and analyses them. This research paper analyses how architecture and environmental design can predominantly effect both growth and decline of Social Sustainability in the commercial capital and fast growing city of a state.**

Researcher's aim is to analyze the level of Social Sustainability which persists along with the Urban Transformation faced and Environmental Design adopted in four distinguished locations of Indore city. The four areas are identified according to their social status. The researcher wishes to identify that process of Urban Transformation and Environmental Design can make Social Sustainability better or worse despite of having citizens of similar background. The paper is an effort for creating consciousness among designers of urban environment focusing upon their role as a social human being towards society.

The study comprises of ground observations and analysis of questionnaire, regarding Urban Transformation, Environmental Design and Social Sustainability. The questionnaire is weighed in five point Likert scale. Later the results are subjected to statistical analysis for testing the hypotheses.

Index Terms— **Environmental Design, Integration, Safety, Social Sustainability Urbanization, Urban Transformation,**

I. INTRODUCTION

URBAN TRANSFORMATION

The term Urban Transformation has been coined because, the city and its urban fabric do not remain same, it is dynamically changing and mutating into new forms. Urban fabric can best be described as conglomeration of greater and smaller urban concentrations that live in one organism. [11]

Growth and decline support each other because house hold, business and economy keep on moving without interruption, from one location to another looking for 'good life' and economic and potential appreciation. [1]

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To get more profit, output or pleasure, urban actors interweave the strands of urban structure together which take care of urbanization process and either plan new settings or renew old pockets for reuse [17]. As any alteration in cell's genetic constitution affects the inherited characteristic in future generation thus bringing a shift in the mechanism of heredity. Same is with the city, a small change in psychology and morphology of it, effects the city as a whole. [13]

SOCIAL SUSTAINABILITY

Adopting sustainability understands the interconnections among economy, society and environment. It implies to using methods, systems and materials that will not deplete resources or harm natural cycle. [16]

As addressed in the UNU Global Seminar – Kanazawa Session 2001. Social Sustainability focuses on the development of human being in all areas. It includes safety, security, employment, economic, social and health conditions of human beings within bearing capacity of planet earth.

Urban Social Sustainability is the term which denotes a city having improved quality of life including ecological, cultural, political, institutional, social and economic components without leaving behind a burden on future generations.

ENVIRONMENTAL DESIGN

The use of land represents the common consensus favored image of a dense, over-lapping layered urban centre which is reminiscent of medieval cities.[10]. Apart from being organizer of space and language, Environmental Design is a power of identity.

There is a need of research in the planning field which stresses on human beings' natural health, mental fitness and physical well-being. All these human conditions are affected by the surrounding which in turn can be enhanced or deteriorated by the way Environmental Design has been done.[18]

The surrounding environment is created by the buildings, street arrangement, public facilities and other outdoor spaces, which together or individually influence the Social Sustainability. [15]

II. RESEARCH DESIGN & OBJECTIVE

A. Methods

Literature survey showed various theories which can form basis of methods adopted by the researcher. Jane Jacobs, 1961[8] advocated that the surrounding environment is created by the buildings, street arrangement, public facilities and other outdoor spaces, which together or individually influence the opportunity of crime and the level of fear of

crime [15]. Urban Transformation, Social Sustainability and Environmental Design of Indore city as a whole and in four locations of Indore are analyzed. Community is socially sustainable when it is safe; the citizens perceive it to be safe and when the others also consider it to be safe. [4] All these theories from a base line for evaluation, considering all the theories and planning approach, objectives for the research have been formulated and then evaluated by questioning various respondents.

B. Approach Used

Approach proposed by Nes A V and Rueb, L[14] coined that human behavior takes place in space and the spatial layout of the environment providing various opportunities for people interaction. The interaction between people can create safe and unsafe communities which are a foundational part of society welfare.

CPTED(Crime Prevention Through environmental Design) the term coined in 1971 by C Ray Jeffrey refers to design solutions in enhancing Social Sustainability. It argues that most crime events are linked with the opportunities created by Environmental Design. [3]

C. Description of Measure

Researcher used the measures of Urban Transformation given by Milojevic, 2012 [12] which are as follows:

(1) Population
(2) Policy
(3) Economy
(4) Architectural and Urban Planning
(5) Legislation

Review of various experts' view adds on to the six parameters of Social Sustainability, which are utilized in the research, they are:

1) Basic Needs
2) Safety
3) Health
4) Gender Equality
5) Participation
6) Justice and Welfare

Researcher used the measures of Environmental Design given by Cozen, P.M (2002), which are as follows:

1) Territorial Reinforcement
2) Milieu and Accessibility
3)Activity and Image
4)Natural Surveillance

Measurement is done on a scale. The scale is based on the above parameters. Questionnaire has been developed taking these parameters as the basis.

D. Research Gaps

None of the previous research has conducted an empirical study and based measurement of all the above parameters on any type of scale. Thus researcher has developed own scale of Likert type based five points for measurement.

E. Measurement of Questionnaire

The current study is conclusive in nature. The measuring questions as placed above are then subjected to Multiple Regression and Structure Equation Modeling.

Environmental Design has been evaluated through various variables under the above mentioned indicators, then their moderating impact on Social Sustainability have been tested through statistical program, identifying nature of 4 location of Indore city; Studying relationship between Urban Transformation and Social Sustainability with moderating affect of Environmental Design.

III. OBJECTIVE

To study impact of Urban Transformation and Environmental Design on Social Sustainability.

The hypothesis for the objective is as below:

- **Hypothesis:** Social Sustainability is not related to Urban Transformation and Environmental Design.

The above hypothesis is tested by regression analysis. The assumption here is that Social Sustainability is dependent on Urban Transformation and Environmental Design. Simple regression analysis of linear type was carried out. The SPSS 21 outcomes by using enter method of relationship analysis suggest that:

(i) For model 1, when Social Sustainability is the dependent variable and Urban Transformation is Independent variable, R square value is 0.819. This means about 81.9% of the variation is Social Sustainability is explained by Urban Transformation. The regression equation appears to be very useful since the value of R square is close to 1.

Model Summary

Model	Change Statistics					Durbin-Watson
	R Square Change	F Change	df1	df2	Sig. F Change	
1	.819	1436.095	1	318	.000	.887

a. Predictors: (Constant), UT

b. Dependent Variable: SSFINAL

Table 1

(ii) For Model no. 2, Social Sustainability is Dependent Variable, EDT (Environmental Design for Territorial Reinforcement) is predictor or Independent variable along with Urban Transformation as prior existing variable.

Environmental Design for Territorial Reinforcement is introduced, R^2 change is .855, which means about 85.5% of the variation in Social Sustainability is explained by Environmental Design for Territorial Reinforcement, also the regression equation appears to be very useful for making Environmental Design for Territorial Reinforcement predictions since the value of R square is close to 1 i.e 0.855. The Fisher test and ANOVA analysis at 95% of confidence limit shows that F value was 1436.095 with Social Sustainability and dependent variable and Urban Transformation as Independent variable, after introduction of Environmental Design for Territorial Reinforcement Environmental Design for Territorial Reinforcement, the F value has become 933.500 at total degree of freedom of 319. The value reported is 0.000. The magnitude of significance value is less than 0.05. This reflects that linear relationship exists between the variables. The co-efficient of the regression as calculated by SPSS reflects that constant value is 1.269 and co-efficient of Urban Transformation has reduced from 1.231 to 0.830 due to introduction of Environmental Design for Territorial Reinforcement, meaning Environmental Design for Territorial Reinforcement has considerable impact on Social Sustainability; from the regression equation.

Social Sustainability = 1.269 + 0.830 UT (Urban Transformation) + 0.199EDT (Environmental Design for Territorial Reinforcement)

Model Summary

Model	Change Statistics					Durbin-Watson
	R Square Change	F Change	df1	df2	Sig. F Change	
1	.855[a]	933.500	2	317	.000	.832

a. Predictors: (Constant), EDT, UT

b. Dependent Variable: SSFINAL

Table 2

(iii) The Model no. 3, Social Sustainability being dependent variable, EDN (Environmental Design for Natural Surveillance) as Independent variable is introduced along with pre-existing independent variables - Urban Transformation and Environmental Design for Territorial Reinforcement.

As Environmental Design for Natural Surveillance is introduced R^2 change is 0.886 which means about 88.6% of the variation in Social Sustainability is explained by Environmental Design for Natural Surveillance, also the regression equation appears to be very useful for making predictions as the value of R2 is close to 1, i.e 0.886

The Fischer Test and ANOVA analysis at 95% of confidence limit shows that with Urban Transformation and Environmental Design for Territorial Reinforcement as predictors, F value was 933.50, after introduction of Environmental Design for Natural Surveillance as one more predictor (Independent Variable) along with Urban Transformation and Environmental Design for Territorial Reinforcement; the F value is 818.098 at total degree of freedom 319. The significance value reported is 0.000. The magnitude of significance value is less than 0.05, This reflects that linear relationship exists between the variables. The co-efficient of the regression as calculated by SPSS reflects that when Environmental Design for Natural Surveillance is introduced, the value of constant is 1.291,co-efficient of Urban Transformation is 0.636, co-efficient of Environmental Design for Natural Surveillance is 0.270.

From these co-efficient, regression equation is,

SS (Social Sustainability) = 1.291 + 0.636 UT (Urban Transformation) + 0.270EDN (Environmental Design for Natural Surveillance) - 0.015EDT (Environmental Design for Territorial Reinforcement).

The relationship as expressed by the values is very significant as small change in Environmental Design for Natural Surveillance will bring out larger change in Social Sustainability. Thus it proves that Environmental Design for Natural Surveillance has significant effect on Social Sustainability.

Model Summary

Model	Change Statistics					Durbin-Watson
	R Square Change	F Change	df1	df2	Sig. F Change	
1	.886[a]	1229.996	2	317	.000	1.010

a. Predictors: (Constant), EDN, UT

b. Dependent Variable: SSFINAL

Table 3

(iv) For Model no. 4, Social Sustainability as Dependent variable, EDA (Environmental Design for Activity and Image) as Independent variable introduced along with pre-existing independent variables - Urban Transformation, Environmental Design for Territorial Reinforcement and Environmental Design for Natural Surveillance.

As Environmental Design for Activity and Image is introduced R^2 change is 0.897 which means, about 89.7% of the variation in Social Sustainability is explained by Environmental Design for Activity and Image, also the regression equation appears to be very useful for making predictions, as the value of R2 is close to 1, i.e. 0.897.

The Fischer Test and ANOVA analysis at 95% of confidence limit shows that with UT (Urban Transformation), EDT (Environmental Design for Territorial Reinforcement) and EDN (Environmental Design for Natural Surveillance) as Predictors, F value was 818.098, after introduction of EDA (Environmental Design for Activity and Image) as one more Predictor (Independent Variable) along with UT, EDT and EDN, the F value is 688-084 at total degree of freedom 319. The significance value reported is 0.000. The magnitude of significance value is less than 0.05. This reflects that linear relationship exists between the variables. The co-efficient of regression as calculated by SPSS reflects that when EDA is introduced, the value of constant is 1.384, co-efficient of UT is 0.465, co-efficient of EDN is 0.194, co-efficient of EDT is -0.036 and co-efficient of EDA is 0.162.

From the above co-efficient, regression equation is:

SS= 1.384+0.465UT+0.194EDN-0.036EDT+0.162EDA

The relationship expressed by the values is very significant, as any change in EDA will bring about larger change in SS. Thus it is clear that EDA has significant effect on SS.

Model Summary[b]

Model	Change Statistics					Durbin-Watson
	R Square Change	F Change	df1	df2	Sig. F Change	
1	.897[a]	688.084	4	315	.000	1.166

a. Predictors: (Constant), EDA, EDT, UT, EDN

b. Dependent Variable: SSFINAL

Table 4

(v) For Model no. 5, Social Sustainability as Dependent variable, EMA (Environmental Design for Milieu and Accessibility) as Independent variable introduced along with pre-existing independent variables – UT (Urban Transformation), EDT (Environmental Design for Territorial Reinforcement), EDN (Environmental Design for Natural Surveillance) and EDA (Environmental Design for Activity and Image) .

As EMA (Environmental Design for Milieu and Accessibility) is introduced R^2 change is 0.906 which means, about 90.6% of the variation in Social Sustainability is explained by EMA (Environmental Design for Milieu and Accessibility, also the regression equation appears to be very useful for making predictions, as the value of R2 is close to 1, i.e. 0.906.

The Fischer Test and ANOVA analysis at 95% of confidence limit shows that with UT (Urban Transformation), EDT (Environmental Design for Territorial Reinforcement), EDN

(Environmental Design for Natural Surveillance) and EDA (Environmental Design for Activity and Image) as Predictors, F value was 688.084, after introduction of EMA (Environmental Design for Milieu and Accessibility) as one more Predictor (Independent Variable) along with UT, EDT, EDN and EDA the F value is 604.116 at total degree of freedom 319. The significance value reported is 0.000. The magnitude of significance value is less than 0.05. This reflects that linear relationship exists between the variables. The co-efficient of regression as calculated by SPSS reflects that when EDA is introduced, the value of constant is 1.370, co-efficient of UT is 0.512, co-efficient of EDN is 0.204, co-efficient of EDT is 0.007, co-efficient of EDA is 0.169 and co-efficient of EMA is -0.096 .

From the above co-efficient, regression equation is:

SS= 1.370+0.512UT+0.204EDN+0.007EDT+0.169EDA-0.096EMA

The relationship expressed by the values is very significant, as any change in EMA will bring about larger change in SS. Thus it is clear that EMA has significant effect on SS (Social Sustainability).

Model Summary[b]

Model	R	R Square	Change Statistics		Durbin-Watson
			R Square Change	F Change	
1	.952[a]	.906	.906	604.116	1.259

a. Predictors: (Constant), EMA, UT, EDT, EDA, EDN

b. Dependent Variable: SSFINAL

Table 5

It is observed that when the variables of Environmental Design were introduced, the F value got reduced; the co-efficient also got changed. Hence it can be concluded that the ED (Environmental Design) takes up the impact on Social Sustainability.

Hereby the null hypothesis is rejected as significance value is 0.000 and model does improve the prediction.

Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	1.370	.049		27.825	.000		
UT	.512	.056	.377	9.192	.000	.179	5.601
EDT	.007	.029	.013	.251	.802	.114	8.784
EDN	.204	.029	.402	6.965	.000	.090	11.107
EDA	.169	.026	.334	6.434	.000	.111	8.973
EMA	-.096	.018	-.167	-5.333	.000	.305	3.274

a. Dependent Variable: SSFINAL

Table 6

IV. Relation of this Research with Previous Research

Present study by the researcher shall have more important impact on the research world as it has concluded that both factors- Urban Transformation and Environmental Design are important for Social Sustainability.

Researcher's preposition is that Urban Transformation and Environmental Design act together. According to the final model,

SS= 1.370 + 0.512 UT + 0.204 EDN + 0.007 EDT + 0.169 E DA – 0.096 EMA

All constructs of Environmental Design have their impact on Social Sustainability; similarly Urban Transformation has impact on Social Sustainability.

As per R^2 values, 90.6% of variation in Social Sustainability is explained by Environmental Design for Milieu and Accessibility.

This research has answered the question of finding impact of two factors – Urban Transformation and Environmental Design on Social Sustainability.

In this way this research is considerably ahead of other previous studies in which only one independent variable and one dependent variable was considered. This study has one dependent variable, i.e. Social Sustainability and two independent variables i.e. Urban Transformation and Environmental Design.

V. Importance of Outcome for Various Stake Holders

In the study it has been found that Urban Transformation is an inevitable and dynamic process. The control of this process and streamlining it in proper direction is in the hands of professionals. The practices and outcome fit with the theory reviewed. In the study it has been found that social interaction must be fostered, which is possible through proper planning and designing of the settlements. Hence it is the duty of architects, urban designers / planners and policy makers to give proper direction to this growth.

VI. Further Research

The areas for further research can be – to find out whether social values are changing due to urbanization or urbanization ways are changing due to social values. Happiness of life creates value systems and value systems generate Urban Transformation; or does the process of Urban Transformation create value systems.

VII. Conclusion

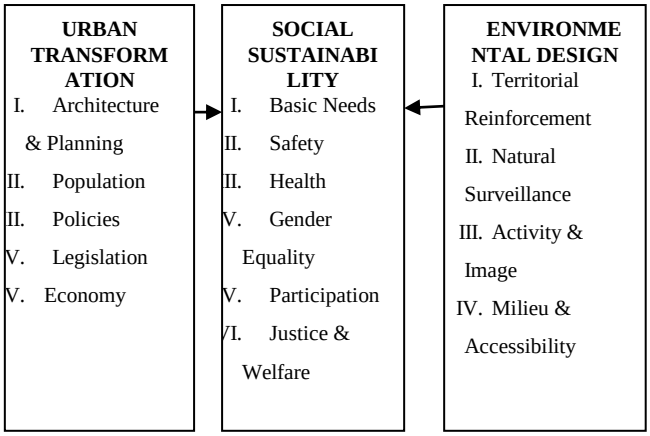
The research has been carried out to compare Urban Transformation, Environmental Design and Social Sustainability of Indore city and analysis of four locations the city. It was revealed that that there has been noticeable change in citizens' standard of living due to urbanization and environmental design in various neighborhoods of Indore city.

Although crime records tell that crime rate in Indore city is high, but citizens of locations under study feel that frequency of theft, burglary, chain snatching and eve teasing have reduced over the period of twenty years.

This brings to the conclusion that one cannot make absolute judgment on the basis of F.I.R. Population has increased in higher rate, crime rate has increased in lower percentage; and the assumption is that 100% crimes are reported. There is overall reduction in fear of crime, hence better Social Sustainability.

It has been proved in the research through statistical analysis that Urban Transformation and Environmental Design have their impact on Social Sustainability; a model has been evolved showing their relationship.

The graphical representation of the model is as placed below:



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