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DEVELOPING SUSTAINABLE URBAN-RURAL HOUSING SYSTEM: FORMULATING IMPLEMENTATION FRAMEWORK USING BLOCK DIAGRAM AND HEURISTIC ALGORITHM SYSTEM

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ABSTRACT

Developments in the urban communities has become issue of great concern. Urban development has been rapid with urban centres springing up from rural communities and sometimes creating an imbalance in environmental systems with attendant consequences and advantages. The study therefore explored the urban system housing development within the context of formulating framework for development, renewal and upgrading in order to achieve sustainable development in urban and rural communities. The aim of the study was to carry out a longitudinal survey of selected areas where there is occurrence of concentration of rural-urban, urban-rural settlement within the selected study areas. Block diagram and heuristic algorithm system were used as means through which factors can be selected and paired. Survey was conducted on some parameters as part of the calibrated data collation method. The parameters include evaluation of existing renewal and upgrading pattern, upgrading system, renewal strategies, and features of rural-urban growth. The developed framework would assist in eliminating accommodation challenges, employment problems and health care issues often associated with disparity in settlement growth when rural settlement metamorphosed into urban settlement.

KEY WORDS: Settlement, System, Sustainability, Transition

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INTRODUCTION

Modern day urbanism has led to encroachment on existing development on affected areas. Modernization of community is essential for some attendant desirable effects that come with it. In recent times there have been introduction of modern houses in the midst of poor communities and traditional communities. Urban development has been notably adjudged as catalyst of rural-urban metamorphosis. In rural-urban metamorphosis, slums are often found in the midst of modern development with no particular development pattern. Sometimes, there is a need for urgent intervention to be adopted. Some of urgent intervention that could be deployed to correct the imbalance include regeneration of rural section, restoration of destroyed structure and revitalization for setting up formal structure in such environment. It is on this note that this study explored the urban system housing development with a view to propose a framework for creating a sustainable urban-rural and rural-urban development.

Urban and Rural Housing Development Systems

Urban and rural development initiative could be viewed in two perspectives, the demand for housing vis a vis

dynamics of urban space vacancy and dynamics of regeneration and revitalization. Urbanization is usually associated with space demand, and the demand sometimes could be urgent, the urgency of the demand often necessitates evaluation of current residents at the time of initiating the urban development, for the purpose of setting up necessary framework. The framework is necessary in order to accommodate all necessary requirements and needs that would be residents oriented in term of their compensation package. In rural housing development type of space usually in demand is Commercial accommodation that is, office and business related spaces than residential accommodation. However, regeneration is the concept that is usually being used to describe emergence of civilized environment in the midst of slum and less privileged society. According to Saccomani (2011), Lee and Chan (2016) in a study titled ‘Urban regeneration and crisis, described the concept of regeneration in another form, as urban renaissance, redevelopment, reconstitution of society profile, resurgence of decay spaces, urban renewal and urban revitalization. Also, Caruso and Saccomani (2016) described urban regeneration succinctly using 7 concepts, economics, sociological content, spatial allocation, economic orientation, environmental approach, economic approach, socio-economic content and social integration. Holistic interpretation of the concepts would undoubtedly provide an access to decoding the myth surrounding failure in developmental programme implementation in the developing world.

METHODOLOGY OF RESEARCH

The study adopted quantitative and qualitative approach to developing sustainable urban-rural housing system. Factor reduction method were used to process data that was used in model development. Block diagram and heuristic algorithm system were used as means through which factors can be selected and paired. Survey was conducted on some parameters as part of the calibrated data collation method. The parameters include evaluation of existing renewal and upgrading pattern, upgrading system, renewal strategies, and features of rural-urban growth. The data was analysed using Mean Item Score, Simple percentages and regression analysis.

BLOCK DIAGRAM

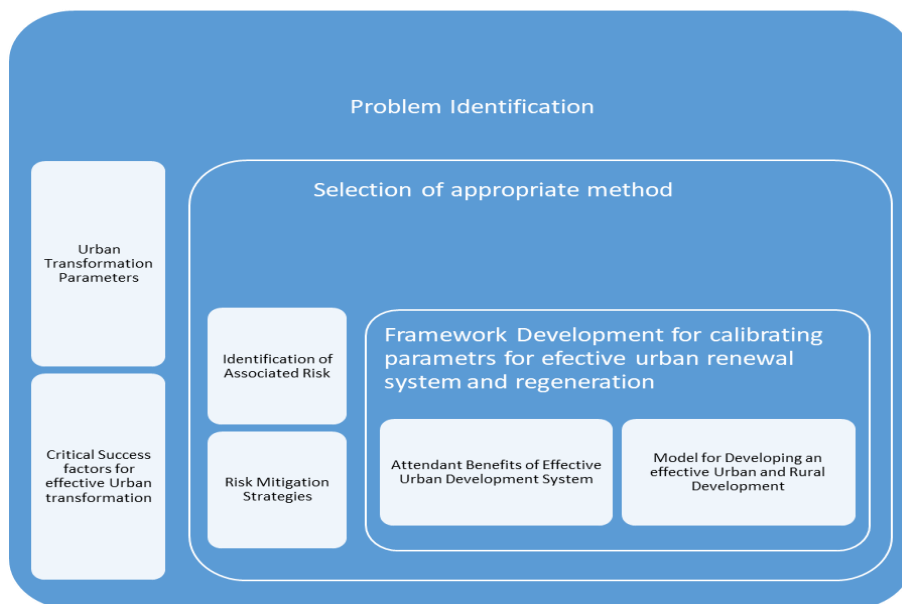


Figure 1: Block Diagram for Urban and Rural Development System

The diagrammatic representation of a systematic guide in block diagram to the process of carrying out the renewal

of urban communities and upgrading of rural to urban or urban communities. The diagram shows the interrelationship among the various operation points that could lead to successful achievement of developmental process. The most important aspect of solving problem in solving scientific problem is identifying the source of the problem. Every community has its own peculiarity which is rooted in the housing and environmental requirements of the area. Once the problem has been identified, appropriate method need to be developed to be able to solve the problem. Similarly, risk associated with the developmental process should be identified while the strategies to mitigate the risk should be profiled as well. The risk mitigation strategies when duly applied would provide means of achieving success in the urban developmental program. Some factors are critical to the effective urban transformation some of them include, profiling residents need, using appropriate government standard, allocating funds for the developmental programme, setting up monitoring and control system among others. The parameters in Figure one could form the crux of a valid model for developing effective urban and rural development system.

ALGORITHM

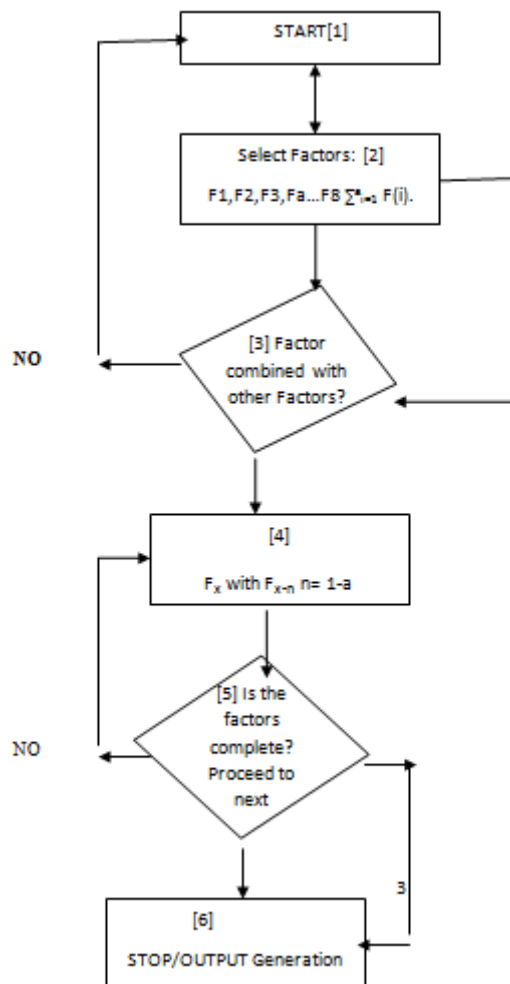


Figure 2: Urban Development Process Heuristic Algorithm

Node 1 signifies the initialization point of the algorithm. Node 2 of the Flow chart contains the

Node 2 contains flow chart initiator where the structural component of the factors to be selected are summarized.

The factors include F_1, \dots, F_9 . The node operation is governed by the equation: $F_1, F_2, F_3, \dots, F_8 \sum_{i=1}^a F(x_n)$. Where F represents factors F_1-F_9 , and 'l' represents integer at lower limit and 'a' stands for upper limit of variables 1-infinity. The operation shifts to node 3 once the criterion on node 2 is satisfied.

Node 3: The node is the Factor combination node. The factors are inter combined for an effective selection. Each of the factor constituents is paired in sequence order and the factor component include $F_1, F_2, F_3, F_4, F_5, F_6, F_7, F_8$ and F_9 . Once the selection is satisfactory the operation shifts to the next node. However, if the combination is not satisfactory, the algorithm retracts to Node 1 until satisfactory combination is achieved.

Moreover, Node 4: This node is factor combination perfection node, here, the combination achieved at Node 2 is checked against benchmark parameters. Once the combination is satisfactorily the operation moves to node 5. Node 5: Node five is tagged 'check and control node'. In this node check and control is usually carried out, this entails carrying out completeness check on the operation carried out at the node 5. If the section operation carried out is ineffective the operation would revert back to node 4 for remedial action however if the selection operation at node 5 is completed the algorithm would proceed to Node 6 where output of all the selection operations from node 1 to node 2 would be completed and generated and classified accordingly. Finally, Node 6: Total output of operations is terminated at node 6.

Flow Chart for Factor Combination for Model Development

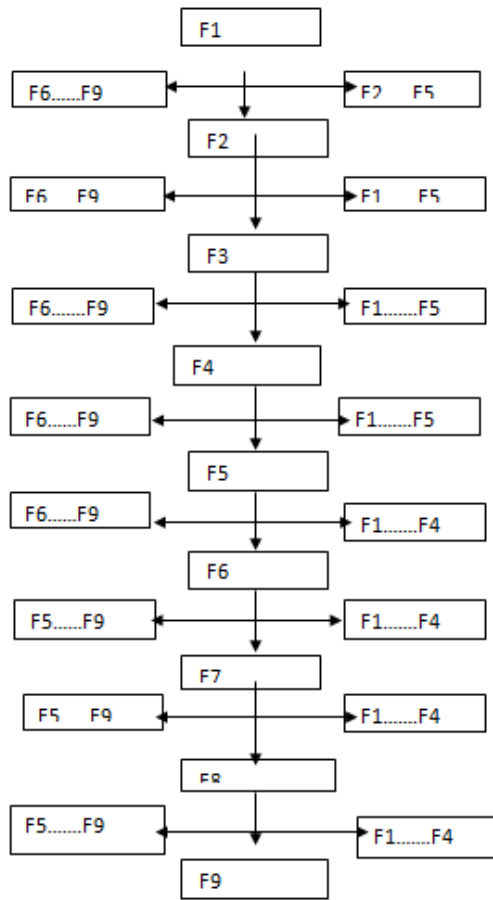


Figure 3: Flow Chart for Factor Combination

In developing a model for the urban and rural development system, the factors need to be effectively paired. Therefore in Figure 3, Flow chart for factor combination showing the interoperability of the nine factors F1, F2, F3, F4, F5, F6, F7, F8, and F9 was presented. The detail of feasible interdependence among the factors is described with factor 1 to factor 9 taking the predominant main trunk of the combination tree. For instance, Factor F1 can combine to form a formidable and workable factors using the following combinations; F2, F3, F4, F5, F6, F7, F8 and F9. Similarly, F2 can combine with the following factors; F2, F3, F4, F5, F6, F7, F8 and F9.

RESULT ANALYSIS

The results of the application of Block diagram, flow chart and heuristic system in developing framework for implementation of system that could be used in rural upgrading and development. The results covers the parameters that could be used for profiling action point during the task of determining existing renewal and upgrading agenda for a community and a location, framework development for urban and rural development, and summary of developed model.

Table 1: Parameters for Profiling Existing Renewal and Upgrading Agenda for Urban and Rural Development

S/N	Parameters	R.A.I
1	Profiling and resuscitation of dilapidated component of rural and urban settlements.	0.78
2	Resettlement of collateral damages among the displaced component of components marked for upgrading.	0.77
3	Clearing of deteriorated components of urban settlement	0.80
4	Remodification of obsolete structures in areas to be renewed	0.82
5	Compensating residents of displaced component of area under renewal and upgrading	0.72
6	Replacing old structures with modern structures	0.85
7	Removal of structures that cannot be remedied from renewal and upgrading sites.	0.84

Source Amusan Et Al (2019)

According to Amusan et al 2019, in the table above, existing and renewal and upgrading pattern was presented, it contained issues on evaluation of existing renewal and upgrading agenda. Some of the agenda of renewal and upgrading agenda include resuscitating decayed component of rural setting at urban location RAI (0.78), relocation of displaced residents of rural component upgraded to urban standard (0.77), clearing of deteriorated components of urban settlement (0.80), remodification of obsolete structures in areas to be renewed and compensating residents of displaced component of area under renewal and upgrading (0.82). Relocation of residents and upgrade of a location should be priority of developmental programme of a community, also clearing of deteriorated component of a community should also be a centre of focus of a community. This would ensure continuity of developmental programme in any community.

Framework Development

In developing the framework, the factors that formed the component of factors to be used has to be reduced with the aid of factor rotation method using Varimax and Obilim factor rotation method. The factors were reduced based on the value of Eigen values with values from 0 to 1. The factors that has weight from 0.9 to 1.0 were selected and used for the model/framework development. The summary of rotated factors was presented in Table 2 below.

Table 2: Rotated Factors

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6
CDCU04	1.000					
UPRP01		1.000				
UPRP02			1.000			

UPRP03				1.000		
UPRP04					1.000	
UPRP05					1.000	1.000
UPRP06					.999	.999
UPRP07					.999	.998
FRUG01	.997	.992				
FRUG02	.997					
FRUG03					.992	.993
FRUG04	.991		.990		.990	.992
FRUG05		.993	.998			
FRUG06	.999	.	.			
FRUG07	.992		.			.991
	Factor7	Factor8	Factor9	Factor10	Factor11	Factor12
CDCU01	1.000					
FRUG01		1.000				
FRUG02		1.000	1.000			
FRUG03	.990			1.000		
FRUG04	.991	.993	.993	.999	1.000	
FRUG05			.	.990	.990	1.000
FRUG06		.999	.999	.989	.995	
FRUG07	.993	.990	.989	.992	.997	

8. The matrix of the 9 factors was presented in Table 7. While the interpretation of the codes is as presented in Table 8.

Table 2: Legend for Coded Factors and their Titles.

A.	Clearing of Deteriorated Components of Urban Settlement CDCU
1	Re-modification of obsolete structures in areas to be renewed CDCU01
2	Compensating residents of displaced component of area under renewal and upgrading CDCU02
3	Replacing old structures with modern structures CDCU03
4	Removal of structures that cannot be remedied from renewal and upgrading sites.CDCU04
B.	Upgrading and Renewal Parameters UPRP
5	Compilation of plans for physical development of the areaUPRP01
6	Profiling and classification of features to identify urban-rural and rural-urban locationUPRP02
7	Presentation of adequate design and codes for residents relocation from area to be upgradedUPRP03
8	Feasibility survey of economic, socioeconomic and demographic requirements of the area under upgrading and renewalUPRP04
9	Development of identified locations UPRP05
10	Reconstruction of the areas devastated by development programmesUPRP06
11	Re-accommodation and resettlement of displaced settlementsUPRP07
C.	Features of Rural-Urban Growth FRUG
12	Renewal development activitiesFRUG01
13	Upgrading of slum settlements to urban standard FRUG02
14	Afforestation of overcrowded urban settlement for air mass control and ecosystem balance FRUG03
15	Revitalization of desertified and eroded locations of occupied settlements in urban-rural and rural-urban location FRUG04
16	Redevelopment of components of rural-urban and urban-rural locationsFRUG05
17	Reconstruction of dilapidated section of rural settlement within areas upgraded areas FRUG06
18	Reinvigoration of amenities and services in slum locations of urban components to urban standardsFRUG07

The Legend for that could assist in interpreting the factors generated is presented in Table 2 above. For instance CDCU04 represents removal of structures that cannot be remedied from renewal and upgrading sites represents a factor under CDCU which could be describe as Clearing of Deteriorated Components of Urban settlement CDCU. Also, UPRP represents Upgrading and renewal Parameters UPRP while UPRP1 indicates Compilation of plans for physical

development of the area. Similarly, FRUG stands for Features of Rural-Urban Growth FRUG while FRUG01 represents Renewal Development activities which is a factor under Features of Rural-Urban Growth (Ayo, Daramola, and Azeta 2009 a & b).

Summary of the Developed Framework

One of the objectives of the study was to develop a framework of application for Urban renewal and upgrading. The factors were selected based on the values of Eigen values of 9 parameters set while processing the data. Nine [9] factors emerged with Eigen values of between 0.99 and 1.00. The nine factors are summarized below, that is Factor F1 to Factor F9.

- F1 ---- 1.000CDCU04, 0.997FRUG01, 0.997FRUG02, 0.991FRUG04, 0.999FRUG06, 0.992FRUG07.
- F2 ---- 1.000UPRP04, 1.000UPRP05, 0.999UPRP06, 0.999UPRP07, 0.992FRUG03, 0.990FRUG04.
- F3 ---- 1.000UPRP05, 0.999UPRP06, 0.998UPRP07, 0.993FRUG03, 0.992FRUG04, 0.991FRUG07.
- F4 ---- 1.000FRUG01, 1.000FRUG02, 0.993FRUG04, 0.999FRUG06, 0.990FRUG07.
- F5 ---- 1.000FRUG03, 0.999FRUG04, 0.990FRUG05, 0.989FRUG06, 0.992FRUG07.
- F6 --- 1.000FRUG 02, 0.993FRUG04, 0.993FRUG06, 0.989FRUG 07
- F7 ---- 1.000CDCU01, 0.990FRUG03, 0.991FRUG04, 0.993FRUG07.
- F8 ----1.000FRUG04,0.990FRUG05, 0.995FRUG 06, 0.997FRUG07
- F9----- 1.000UPRP02, 0.990FRUG 04, 0.998FRUG05

From the above each of the factors incorporates parameters that could be adopted independently of other factors and could be combined for further effectiveness. Also, the factors could be combined with other factors for maximum possible effect, the various combinations that could be adopted is as presented in Equations 1.

In term of application, an individual may decide to adopt Factor one, the action points when Factor F1 is picked could be described as follows:

$$F1 = [F2+F3+F4+F5+F6+F7+F8+F9] \text{ ----- Equation 1}$$

$$1.000CDCU04, 0.997FRUG01, 0.997FRUG02, 0.991FRUG04, 0.999FRUG06, 0.992FRUG07.$$

Removal of structures that cannot be remedied from renewal and upgrading sites. CDCU04; Renewal development activities FRUG01; Upgrading of slum settlements to urban standard FRUG02; Feasibility survey of economic, socioeconomic and demographic requirements of the area under upgrading and renewal UPRP04; Reconstruction of the areas devastated by development programmes UPRP06 and Reinvigoration of amenities and services in slum locations of urban components to urban standards FRUG07. Other factors F2 to F10 could be selected and describe in similar ways (Zhiyong, Guiwen Liu, Wei Lang, Asheem and Igor 2017).

CONCLUSIONS

The analysis carried out in this study has indicated the potency of Urban-rural or Rural urban development in providing civilization and poverty Vis-a-vis unemployment eradication if properly managed.

In urban regeneration, slums gives way to modernized building units with accompany luxury. Most of the slums in parts of the world are always identified with certain inadequacies, e.g. lack of employment opportunities, poor medical services, scarcity of accommodation and the like. However rural upgrading enables rural community to receive face lift. Social amenities like pipe borne water, electricity supply, modern housing, and rural road upgrade are always being introduced. Upgrading will lead to people from less privileged community to flock into the upgraded areas thereby stimulating economy in the direction of more provision of accommodation and this in turn would lift up economic activities. Influx of people would also translate to more customer and more income as indicated in Table 5 of this study.

Similarly, rural and urban development would bring employment opportunity for all classes of trade either skill labour, un-skill labour and semi-skill labour. Construction activities would attract and provide fortune to different workers category there creating prosperity for all.

Moreover, there is environmental pollution that often come with urbanization, for instance upgrading often leads to balancing of the ecosystem and environmental bio mass which would tend to replenish environmental elements that have been depleted. However, urban theory tend to provide for wellbeing of residents therefore provision should be made for any developmental programme so as to ensure continuity. In the study area consulted, many health care centres, convalescence homes, maternity centres, drug dispensing centres, pharmacy and medical care centre both private and public were introduced when the communities were upgraded from slums to urban centres. Medical facilities are easily available in upgraded community as compared to those not yet engaged. This is an indication that people in those upgraded communities would have access to health care facility advantage over others(Amusan, Dosunmu and Joshua 2017).

Therefore, the study recommends adoption of workable framework in the upgrading of slums and rural components of a community into a more civilized form where all organs of environmental system would be present. For instance, a framework that could guide in policy formulation and implementation rooted in the Urban theory, System theory, regeneration theory, economic theory and spatial theory was presented in the study, it is a believe in this study study that proper application of the theory is a panacea to accommodation, employment and healthcare issues that characterizes underdeveloped community in our time.

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