The Application of Space Syntax Analysis in Project Identification: A Special Reference to the Moratuwa

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Introduction

Project success is decided on best project identification which provides guidance regarding setting project objectives to solve a given development problem or to use the opportunity for the development of a particular aspect (Westland, 2006). Project identification involves a review of alternative approaches or options for addressing a set of development problems and opportunities. Prior research found that the project identification can be handled by software technologies which are modern techniques to identify the projects (GTZ, 1996). The "Space Syntax Analysis" is a science-based Geographical Information System (GIS) and human-focused analysis, a plug-in for spatial network and statistical analysis. This provides a front-end for the depth map software within GIS, offering user-friendly space syntax analysis workflows in a GIS environment. In practice, the space syntax provides a fundamental project planning information including patterns of movement, density, land use and land value, urban growth and societal differentiation, safety as well as crime distribution, which can be used for generation and evaluation of project ideas.

The research objective is to identify the usage of space syntax technology in the project identification. Moratuwa, which is a large suburb of Colombo city on the southwestern coast of Sri Lanka, was selected to investigate the relationships between spatial layout and project identification with a range of social, environmental, technical and economic aspects. This study supports the space syntax methodology and enhances with GIS data analysis and visualization features to raise fundamental research question which is how space syntax analysis create the project ideas and help to project identification that is fed back from practice. New development project ideas are generated using the space syntax analysis and GIS software. The result of this study helps to exchange knowledge for stimulates innovation, facilitates practice and ultimately benefits our surroundings and regions for sustainable development.

Literature Review

Project identification is important to assess the outset situation for establishing a system of objectives. **GTZ (1996) categorized project cycle into three phases such as** identification phase, concept phase (establish project concept, prepare decisions to implement the project) and implementation phase (operationalize planning, implement, adjust and update planning, and terminate project). Westland's (2006) project life cycle consists of four phases including project initiation, concept, implementation, and monitoring. During the project initiation phase, a business problem or opportunity is identified and defined in a business case that provides various solution options. Next, a feasibility study is conducted to investigate whether each option addresses the business problem and a final recommended solution is then put forward. After the solution is defined, a project is formed, and a project team is appointed to build and deliver the solution to the customer. According to Manual on Project Cycle Management (2009), the project concept should be relevant to priority local needs and consistent with policy priorities. In the project identification stage, project ideas are developed using different technologies and assessed the relevance as well as the feasibility. This is important to determine the scope of further work required during the formulation stage for individual projects.

Space syntax is used for a construction) project identification practices worldwide, for urban design, building design and design education professional. Space syntax was pioneered in the 1970s by Prof. Bill Hillier, Prof. Julienne Hanson and colleagues at The Bartlett, University College London. Built on quantitative analysis and geospatial computer technology, space syntax provides a set of theories and methods for the analysis of spatial configurations of all kinds and at all scales. The space syntax approach has since grown around the world in a variety of research areas and practical project applications including archaeology, criminology, information technology, urban and human geography, anthropology, and cognitive science. Dursun (2007) discussed the roles of space syntax in design through case studies in real design projects as follows. First, space syntax serves as a language for thinking and talking about space in the dialogue between architect and designed space. Second, it merges science-based knowledge into the design process, which constitutes the core of "evidence-based design" (Hanson 2001). Third, space syntax provides tools for architects to explore their ideas, to understand the possible effect of the design, and to let them evaluate their design beforehand. Fourth, space syntax gives a chance for architects to evaluate the designs as living organism experienced by inhabitants.

Space syntax provides a configurative description of both urban structure and architectural space and attempts to explain human behaviours and social activities from a spatial point of view. Most space syntax studies concern issues related to urban patterns, but the method is also relevant for studies on the scale of urban and architectural design. Space syntax can produce a kind of knowledge which supports architects to find out how well their designs might work; what kinds of properties their design solution has, and so on. In practice, urban planners and designers can predict pedestrians' movement flows before the actual development of real urban systems and buildings by analyzing the morphological structure of the design plan using space syntax. It makes the deployment of non-discursive intuition more rational and therefore more discursive (Hillier and Hanson 1997). Space Syntax seems to offer a natural platform for such methods (Jiang, 2002), with its ability to handle geographic and geometric data associated with attribute information, to easily perform spatial, mathematical and statistical calculations, and to visualize the results. These previous researches and its findings and ideas were very helpful for this research.

Methodology

This research is based on the secondary data. Further, field study and observation of the city formation and existing functions of the area were used to get primary data. The application of this technique initially involves the graphic representation of the Moratuwa urban street network based on the cartographic information of the area. Segment map was built in the axial map which segments allowing the analysis of street segments. Then the integration index (topological accessibility or permeability) was used for the analysis.

After the construction of axial and segment maps of these systems, Geographical Information System and Depth map software were used for the calculation of the connectivity matrix and configurationally measures and to identify their configurationally features according to the variables from space Syntax studies. Analyses always consider a 2D layout model. All of them start from the subjective process of separating elements of spatial configuration. The subjective step involves considering all the visibility obstacles. The result is an estimated model where open public space is bordered and painted in contrasting colours (like black and white). The next step is to draw the possible smallest number of the longest lines of movement (lines of sight) in space. The whole space should be covered with them to show all the possibilities for movement. It represents the relationships of accessibility between all axial spaces of a layout model. Axial lines which represent spaces are presented as circles (nodes) which are linked by lines showing intersections with subsequent axes. Nodes are numbered according to the numbers on the axes. The number of immediate neighbours that are directly connected to a node is a local measure of connectivity. The algorithm described below serves to examine axial maps and count all four syntactic measures. The result of axial map calculations, a spatial accessibility map, or spatial integration maps are obtained, where lines representing the most accessible spaces are marked red, and the least available blue. The algorithm used to calculate the shortest paths from one topologically specified point to any other point on the map. Such an operation is performed for each segment of the map. It turns out that the obtained results are almost always the same as the ones from studies where users are counted empirically.

There are four syntactic measures calculated such as connectivity, depth, control value and local and regional integration. Connectivity measures the number of neighbour axes directly connected to space. Depth or degree of depth was counted in a graph and is determined by parameter k. Parameter connectivity considers immediate neighbours and depth considers the neighbours of the k-th degree. Connectivity and depth measures can be written as a sum:

$$d(= \sum_{S =}^{m} s \times Ns$$

Connectivity iff m = 1

Local depth off m = k   1< k < l/local

Regional depth if m = 1

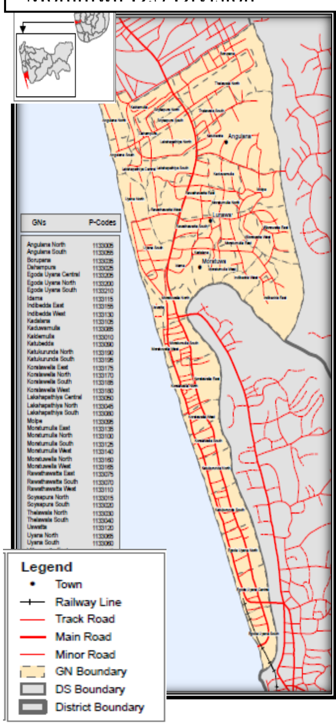
Where, k – Parameter, s – operator (s is an integer), l – the shortest distance, Ns – the number of nodes with the shortest distances. Where 1 < k < l, usually three steps are adopted for the calculation of local depth, i.e. k is equal to 3 (this means that we consider lines within three steps from an axial line). We can also note that connectivity is equivalent to local depth if k = 1.

The control value is the sum of the inverse values of the parameter connectivity of all neighbours from the selected axial line. It measures the degree to which a given space controls access to all immediate neighbours of the axis line. It takes into account all alternative connections. This is a dynamic local measure. Integration also called availability is a variable that refers to how space is connected to other spaces in its surroundings. This is the key parameter leading to the understanding of the relationships that exist between users and the urban space and it is a global measure. It can be used to predict the potential of meetings in the space because it is directly linked to the presence of people in a given location. The greater integration of the space, the more people will appear in it. For this reason, integration is sometimes called accessibility. The most important observation is the fact that the axis system will lead users into the best-integrated spaces in that system. Similarly, if less integration means less human presence, and uncontrolled space, it increases the chances of criminal and antisocial behaviour in such structures.

Results and Discussions

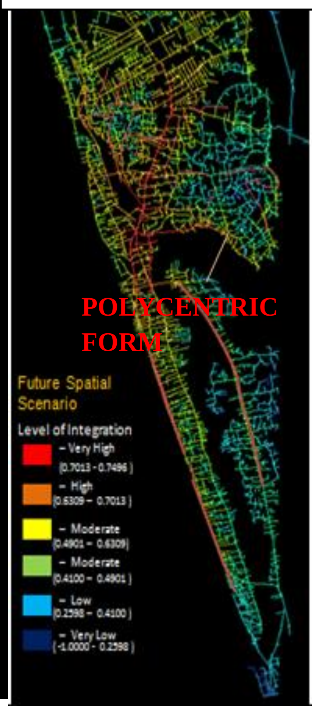
According to the space syntax analysis final map was prepared. There is a very big potential for the project identification in the study area because high integration (red colour) shows in the centre grid network area. The integration or accessible areas indication is varying based on roads accessibility. It spreads along some parts of the main arterials roads (Map:02). These parts of roads are the high integration roads segments in Moratuwa Area. This is not enough for the further development activities and integrates to all physical land areas. Therefore, there was a need to reroute the planning assessment through these scientific analysis methods. New linking roads identified and applied into the space syntax analysis. According to those analyses, new simulation space syntax maps were prepared for some new project ideas and special development activities (See Map: 05). Based on the proposed polycentric spatial form of the area some new projects were identified (Map:04).

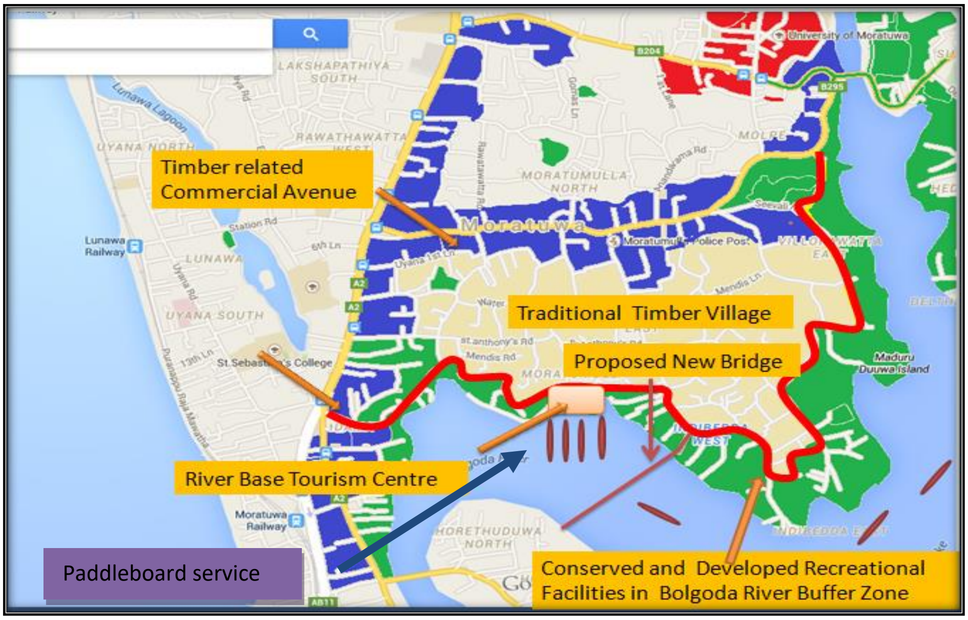
Map:1, Study Area- Moratuwa D.S Division



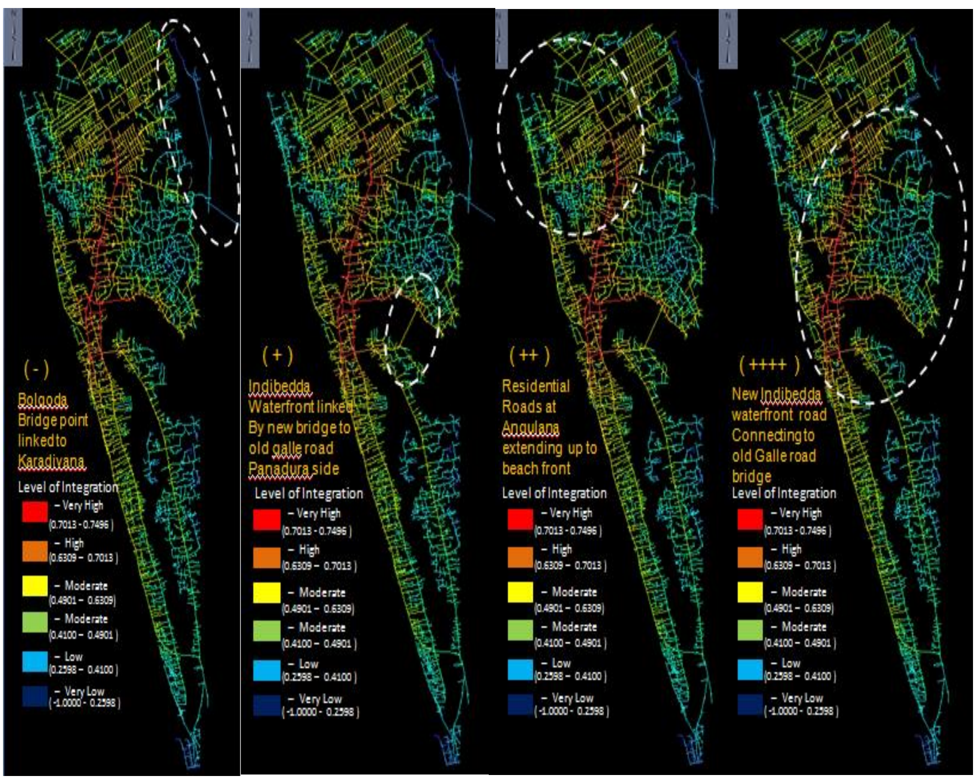
Map:2, Existing LINEAR spatial form

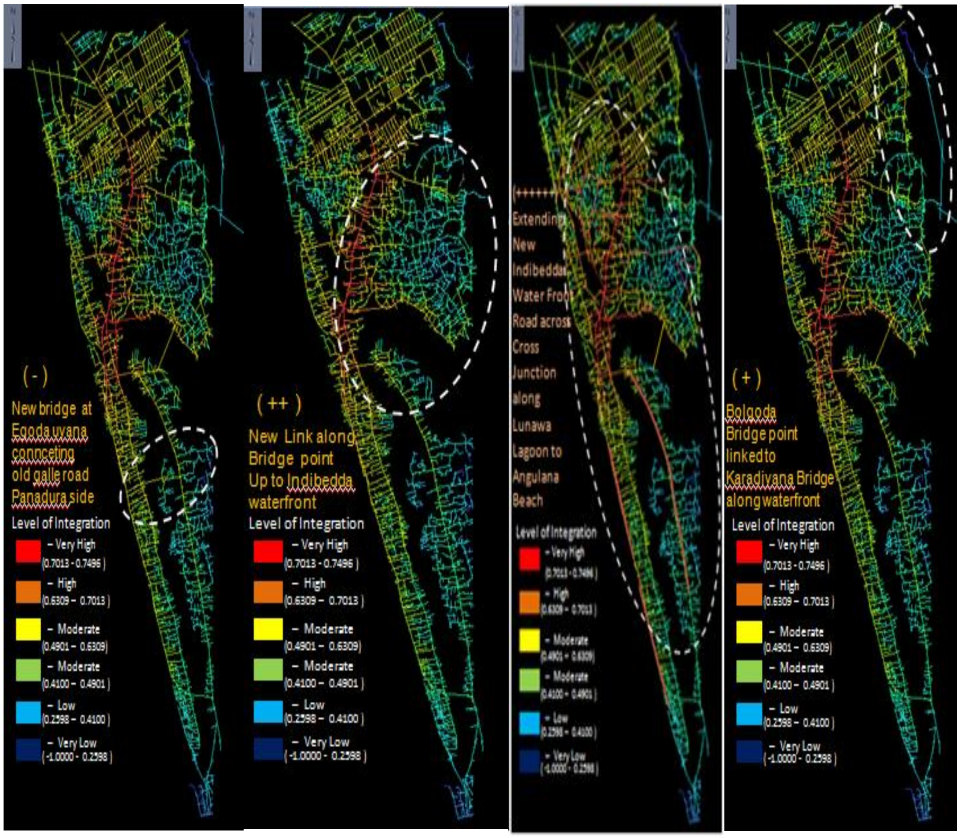
Map:3, Proposed POLYCENTRIC Spatial Form





Map:4, Identified Future Development Projects





Map:5, New Simulation space syntax maps

Projects and ideas were identified based on the prepared polycentric spatial map and given an indication of future developments through this research using space syntax technology. (Map: 03). The potential of the most viable concepts has been overlooked at the identification phase. Those are new road project (Extending New Indibedda Water Front Road across Cross Junction along Lunawa Lagoon to Angulana Beach), formation of Traditional Timber Village and Timber related commercial avenue, Recreational Zone project (300m Buffer Zone along the Bolgoda River), River based Tourism Centre project and Paddleboard service project.

At the project identification stage, ideas came up with project solutions that can have a positive contribution to the environment. If not positive the projects should be at least neutral in the pace of their impact on the environment. One of the main reasons for the failure of projects either at an early stage of the implementation or not being sustainable after getting into operation stages is low attention given at the project identification and selection stage.

Recommendation

The project identification stage is important to the sustainability of the project. Different scientific software chooses projects from many alternative ideas or schemes that balance between local demands, strategic priorities and research or baseline studies. Project identification should be both demand and supply driven. It should not only be focused on the needs of the local entities but should also look at the overall strategy of the government in particular and donor agencies in general. The needs to consult the country's strategy from the allocation of scarce resources spatially. The local needs are enormous, particularly in any projects. It is difficult to meet all these local needs with the vast area. Therefore, there is a need to prioritize through a different strategy. The pre-feasibility studies at project identification stages should seriously look at the criteria of selection in order to filter those projects that have versatile effects on the overall economy of the country. Lack of paying attention to this stage or phase of the project cycle can lead to the identification of projects that can lead to failure in meeting the envisaged objectives and goals.

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