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# Application of Analytic Hierarchy Process (AHP) in Evaluating the Achievement Level of Objectives of Urban Development Plan

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## ABSTRACT

Planning evaluation can be a systematic assessment of plans, planning processes, objectives and outcomes compared with explicit standards or indicators. Evaluating the achievement level of objectives of development plan has been ignored in the field of planning due to lack of proper method. But in practice, these evaluations are complicated because objectives are not always clear and measurable. Therefore this study is supposed to evaluate the level of achievement of objectives of the development plan by applying Analytic Hierarchy Process (AHP) when objectives are not measurable. Public perception on achievement of objectives criteria of related action projects considering overall benefits of each project were judged as ex post facto evaluation. Field surveys and questionnaire surveys were carried out to identify different views of different stakeholders. This application can be used as an objective evaluation tool for planners and policy makers to improve planning practices and provide necessary knowledge for revising plans.

## 1. Introduction

Planning is the process of analysing information, making decisions and formulating plans of action for future (Glasson, 1982).Development plan will provide the spatial framework for promoting and regulating the physical development of lands and buildings in each of the urban area to ensure the sustainable urbanization (Bruton and Nicholson, 1985).The implementation of development plans and the evaluation of objectives of plans have been ignored for decades in the field of planning (Houghton,1997).Since the mid-1990s planning scholars have given considerable attention to define the characteristics of plan quality (Erickson et al,2004,Laurian,2010).In the late 1990's it was considered evaluating the outcomes of planning activities, rather than focusing on planning processes (Houghton ,1997,Carmona and Sieh,2008).Achievement of objectives of development plan can also contribute to the accountability and trust in, public managers and institutions, and should guide improvements in plans and practices (Kaiser et al, 1995). Laurian et al. (2004) introduces conformance-based evaluation which assume observable causal linkages between planning goals, activities and outcomes and require clearly defined goals and objectives which can be measurable with measurable indicators and logically derived planning strategies. But in practice, these evaluations are complicated because plan objectives are not always clear and measurable and multiple strategies are used to advance objectives (Seasons,2003,Snyderand Coglianese,2005).Since there is no proper method to evaluate the achievement of objectives, planners cannot know whether plans achieve their objectives, or learn from the results of past interventions to improve planning practice (Baehler,2003,Seasons,2003).Therefore this study is supposed to evaluate the achievement of objectives of development plan as the main objective of the study. The other objectives supposed to be fulfilled while carrying out this study are identifying the importance and progress of planning evaluation, application of AHP to evaluate the human judgments in different conditions.

## 2. Literature Review

### *2.1. Levels of Planning and Planning Evaluation*

Planning can be undertaken by government in many sectors with appropriate strategies and action projects to achieve goals and objectives involved (Glasson, 1982). Planning can include preparing and formulating plans in different levels as National plans, Regional plans, Local plans, and urban development plan to promote and regulate the development.(Bruton and Nicholson,1985).Impacts of action projects are the outcomes of development plans, which are to be contributed to the development impact of the planning region (Bagwat and Sharma,2007).They are accountable for achieving objectives of development plan and contributing to the development impact (Morrison and Pearce,2000).

Patton(1989) and Michael (2002) states that planning evaluation is the systematic assessment of plans, planning processes, objectives and outcomes compared with explicit standards or indicators and it is important since it ensures accountability, improvement and knowledge of the development plan. Berke (2006) states three types of planning evaluations as process, impact and outcome evaluations. Planning evaluation can be conducted for different purposes as a priori or ex ante evaluation (Alexander, 2006), on-going monitoring or formative evaluation (Scriven, 1967) and ex post facto or retrospective evaluation

(Baum, 2001, Snyder and Coglianese,2005).This study focus on impact evaluation in terms of achievement of objectives related to each action projects of Moratuwa development plan as an ex post facto or retrospective evaluation. Most ex post studies evaluate planning objectives considering policies, programs, action projects and regulations rather than outcomes (Baum, 2001). Yet, the literature on the ex post facto evaluation of planning outcomes is underdeveloped and actual outcome evaluations by practitioners are rare (Carmona, 2007; Carmona and Sieh, 2008). This study also evaluates planning objectives considering overall benefits of action projects based on public perception.

### *2.2. Barriers for Evaluating Plan*

The rational perspective assumes that plan goals and objectives translate into policies and methods, which are implemented to address specific problems and yield expected outcomes. This is how legislation and planning mandates tend to be designed and how planners usually conceptualize their practice. (Berke et al, 2006, Laurian et al, 2004). But in practice objectives of plan are rarely evaluated by planning agencies (Carmona and Sieh, 2008, Seasons, 2003).This gap can be explained by several factors. First, evaluation requires selecting indicators of success and obtaining relevant data and information (Baum, 2001; Snyder and Coglianese, 2005). Incompatible objectives need to be reinterpreted by evaluators to select evaluation criteria and indicators (Seasons, 2003). Monitoring and evaluation also require appropriate and reliable data to identify trends and changes of the plan implementation (Baehler, 2003; Seasons, 2003).Yet, very few plans are provided for monitoring processes to evaluate the effects of land-use decisions, or identify discriminating indicators suitable for linking plan objectives to measurable outcomes, especially in the area of spatial planning (Snyder and Coglianese,2005).Thus, evaluators often rely on proxy variables, which are often too removed from planning decisions to talk much about their outcomes (Baum, 2001). Secondly, evaluation also assumes that weaknesses should be identified to promote change, but more organizations and administrators reluctantly can resist evaluations they perceive as threatening (Baehler,2003).Even if committed, many planning agencies, and especially local authorities, often lack of resources in time, staff, or expertise to support plan monitoring or evaluation (Baehler, 2003; Seasons, 2003).Third, evaluating plan outcomes is methodologically difficult. Existing evaluation methods are generally not designed to address the physical, environmental, and spatial components of planning. The main difficulty faced by evaluators is the lack of a generally accepted ex post facto method for evaluating objectives of plan (Baehler, 2003; Talen, 1997). The most problematic methodological question is the attribution, or causality, question. It is difficult to distinguish the objectives of planning activities from other factors (Carmona and Sieh, 2008).Finally identifying a cause relationship between planning decisions and objectives is difficult (Baum, 2001, Seasons, 2003).

### *2.3. Different Planning Evaluation Methods and their Limitation*

Laurian et al. (2004) and Laurian et al. (2010) introduced the Conformance-based evaluation method that assume observable causal linkages between planning objectives, activities, and outcomes, and require clearly defined goals and objectives and logically derived (and properly implemented) planning strategies. It does not assess the impacts of strategic plans overall, but rather the specific outcomes of discrete plan elements with specific goals and objectives. It seeks to answer these questions: Are plan objectives achieved? Why or why not? Are observed outcomes attributable to the plan?. First, it develops and builds on a conceptual model of plan logic and implementation and investigates associations between plan goals and outcomes. This step relies on `plan logic mapping' to determine whether the plan is logically capable of achieving its objectives. Evaluating the associations between objectives and action projects is essential because planners, legislators, and taxpayers are primarily interested in achieving stated goals or objectives. Finally it uses structured expert assessments to identify causal relationships between plan provisions and outcomes.

Laurian et al. (2004) support a conformance-based approach on where a plan is considered implemented if development patterns adhere to its policies and meet its objectives. While this approach sounds reasonable, challenges arise when it is used as a framework for evaluating whether or not a plan has been implemented. A major criticism is that strictly adhering to the conformance approach may be too rigid or narrow in practice. For example, Laurian et al. (2004) evaluated plans by systematically comparing issued permits to plans to see whether the plans were followed. While this process would indicate whether the permitting process was done in accordance to the plan, it would hardly tell you that the plan had been implemented. What about the social and political objectives of a plan? How those are assessed using a conformance-based approach? What about the actions of other actors outside of the planning department? The difficulty in answering these questions may be explained by the postmodernists. Performance-based evaluation is well suited to evaluate comprehensive and strategic plans, seen as broad efforts to identify, formulate, and promote main visions and goals and objectives (Mastop and Faludi, 1997).It focuses on process and not the plan itself. If we assume that the plan's major purpose is to serve as a guide for implementation, then the plan (and subsequent implementation) cannot be evaluated solely as a process tool. An additional problem plaguing both the conformance and the performance approaches is that, they have not agreed upon what is a `good' plan, let alone what constitutes the successful implementation of a plan. An inquiry into the reasons for planning success seems an unbelievable task because (1) there is no existent definition of what success is (2) there is no empirical knowledge of when or what circumstances of planning has in fact succeeded and (3) there is no method for measuring planning success (Talen, 1997).

### *2.4. Proposals to Overcome above Limitation*

First, identifying relationship between objectives and action projects is required since action projects are the results that link to the immediate objectives as described in the development plan (Bagwat and Sharma,2007). Second, Berke (2006) shows that stakeholders should be get involved in the process of evaluating the objectives of plan. Third, reviewing public perception is a good technique to study the present situation and evaluate the overall impacts of action projects of plan (Marqueset al, 2010; Baum,2001; Seasons, 2003). Fourth, Planners must be aware of the factors that affect stakeholder participation (Burby, 2003) because planners' failure to recognize the differences in evaluation between experts and public may lead to figurative protests (Norton, 2008).According to the Section 8D of UDA Act of No: 4 of 1982, public are being consulted only during post preparation of development plan and that should be done for plan evaluation. Local authorities' responsibility is to get involve people in both planning, implementing activities (Circular No 01 under reference 08/01/38 dated on 20/03/1985) and suggested to be involved in evaluating activities as well.

## 3. Methodology

Reviewing public perception is one of the techniques which can be applied to study the present situation and overall benefits of each action projects and to evaluate objectives, since it has being benefited greatly throughout the past practices (Berke, 2006; Seasons, 2003; Marques et al., 2010). Objective achievement matrix is another advance planning technique which has been applied to identify the relationship between objectives, proposed strategies and action projects(Lichfield,1996, Sager,2003). Field surveys and questionnaire surveys were selected as the data collection technique, since they will be supported for reviewing public perception on achievement of objectives criteria of related action projects considering overall benefits of each action project of Moratuwa development plan. Accordingly 100 people who live in Moratuwa MC Area, 20 project officers who have been involved in each project and 05 planning officers of Moratuwa MC were selected randomly, for a125 sample size. In this study, the researcher cannot control the independent variables (Kraemer,2002) that are occurred as outcomes of the development plan itself. Therefore, experiment is not applicable for this study. That is why field surveys and questionnaire surveys were carried out as suitable techniques to investigate the achievement of objectives of all action projects of Moratuwa Development Plan.

### *3.1. Analytic Hierarchy Process (AHP)*

Today decision makers are benefited using AHP as a technique which can be applied to quantify relative priorities for identified elements, human values and judgments of problems in order to make reasonable decision. AHP has recognized as which has theoretical sound which was invented by Saaty in early 1970's. Further in 1994 he introduced the AHP as a tool to make decisions and stated that the AHP is about breaking a problem down and then aggregating the solutions of all the sub problems into a conclusion. It is also a reliable tool to facilitate systematic & logical decision making processes & determining the significance of set of criteria & sub criteria. Liang (2003) described AHP as a multi attribute decision tool that allows financial and non-financial quantitative and qualitative measures to be considered and trade-offs among them to be addressed. Islam & Rasad (2005) used AHP to evaluate employees performances based upon the criteria such as quantity and quality of the work, planning organization, initiative commitment, team work, communication and obtained overall ranking of the employees. And also Cheng & Li (2001) has provided convenient and effective method based on AHP to evaluate human resources. Braglia et al. (2006) provided a structure methodology to permit an optimal selection of the best suited computer managed maintenance system software within process industries. Wu et al. (2007) applied the AHP is to determine the priority of accessibility criteria. Chan et al (2004) used AHP method to assess safety management in construction industry. Cheng, & Heng (2001) introduced use of AHP to select the right candidate for a posted position based on a set of weighted selection criteria. Furthermore Barclay & Osei (2010) emphasized the use of AHP in selection best supplier to perform construction activities of a project. In this background AHP was used as the main technique to evaluate the achievement level of objectives of each action projects. It builds on perception of local community, project managers and planners to identify the impacts of action projects, the influence of non-plan factors and the unintended consequences of planning activities considering as overall benefits of each projects.

Criteria of objectives related to each action projects were compared with each other under pair wise comparison. Intensity of contribution of each action project towards the achievement of each objective criteria was measured using Likert scale indicating in Table 1 considering given scale values through structured questionnaire surveys for each project separately. All these values were applied to Analytical Hierarchical Process and AHP derived the final priority vector [(Pj) =eign(A)] (normalized principal eigenvector ) as percentage value. These values indicate the achievement of criteria of objectives as an overall assessment of the intensity of contribution of each action project and planning intervention.

***Table 1:*** *Likert Scale*

| Intensity of contribution | Definition |
|---|---|
| 1 | Two elements were achieved equally by the project |
| 3 | Contribution slightly achieved one element over another |
| 5 | Contribution strongly achieved one element over another |

## 4. Analysis: Evaluate the objectives of Moratuwa Development Plan

### *4.1. Step one - Identify the Coherence of Plan Elements and association between Objectives and Action projects*

Urban Development Plan for the Urban Area of Moratuwa, constituted by the Municipal Council Area of Moratuwa, has been considered the recommendations made by the Board of Management of the UDA on 04th August, 2004 under Section 8F of the Urban Development Authority (Amendment) Act No.4 of 1982. This Development plan provides the legal basis for the physical development of Moratuwa town through a vision that is 'Moratuwa town has the potential to be developed as a model town embodying a regional service center, through industry and educational services, while maintaining its environmental equilibrium'.

Identified objectives, strategies and action projects of the Moratuwa development plan can be illustrated with the application of objective achievement matrix in Table 2. This matrix was developed considering contribution of the proposed development to achieve stated specific objectives and their relationship. The progress of the development plan reveals that only three action projects have been implemented successfully. They are Lunawa lagoon development project, development of Lunawa hospital land for a low income housing development and parks development project which consisted with redevelopment of Puranappu open air theatre and beach park development in Koralawella. Under this study, when evaluate the objectives of Moratuwa development plan related to each action project, it was considered the overall benefits of above implemented three projects and the overall benefits which are currently achieved pertaining to partly implemented action projects. After identified the objectives which are to be achieved through specific action project, it was further examined to extract the main criteria of them as shown in Table 3.

### *4.2. Step Two–Evaluate the Objectives of Each Action Project Using AHP*

Above identified criteria of objectives regarding to each action project were included as a matrix to the structured questionnaire for the pair wise comparison. Intensity of contribution of each project towards the achievement of each objective criteria is evaluated using Likert scale values of 1(equally achieved), 3(slightly achieved one element over

***Table 2:*** *Objective Achievement Matrix*

| Action Projects | Objectives | Strategies | Proposed Development | Progress up to year 2014 |
|---|---|---|---|---|
| Town Center Development Project | • Development as a water-front city<br>• Improve the infrastructure facilities | • Zone for mixed residential and commercial activities<br>• Planning the town Centre to suit the future requirements by implementing planning regulations. | Development of Post Office Premises | Partly Implemented |
| Katubedda Sub-Town Development project | • Improve the infrastructure facilities<br>• Provision of facilities to improve the industries in the town<br>• Improvement of the fishing industry | • Maintenance of existing common amenities and regularization of physical development of the town by implementing planning and building regulations.<br>• Establishment of a sewerage system<br>• Implement Zoning regulations, housing & common amenities. | Proposed Katubedda Super Market<br>Commercial Activities at Katubadda junction | Not Implemented<br>Partly Implemented |
| Lunawa Lagoon Development Project | • To protect natural resources, and maintain the development of the town and its environmental equilibrium | • Zone for various land uses<br>• Implement planning regulations<br>• Extend the existing infrastructure facilities<br>• Develop the of coastal strip and the reservations of watercourses | Landscaping and Improvement Plan for the Lakesides | Implemented |
| Housing development Project | • Improve the standards of living by providing housing and infrastructure facilities for low income settlements in the town | • Implement Zoning regulations.<br>• Special planning standards | Commercial Houses, Low Income Houses. Around Lunawa Hospital Premises (2 Acers) | Implemented |
| Coastal Road Development Project | • Establishment of an efficient transport system<br>• Maintenance of reservations of public roads and waterways | • Maintenance of adequate road reservations and improvement of the relevant facilities<br>• Enforce the reservations of roads and waterways | Coastal line Road Extension<br>Development of Coastal Park Entertainment Park | Partly Implemented |
| Parks Development Project | • Establishment of adequate number of parks, playgrounds and open spaces | • Enforce Zoning Regulations of recreational open spaces and playgrounds. | Redevelopment of PuranAppu Open Air Theatre<br>Beach Park development | Implemented |

another) and 5 (strongly achieved one element over another) considering the given values by all respondents. When there is equal contribution level (achievement level), scale is given as 1 and it is three times as higher for moderate level (3) and five times as higher for high level (5). When responding to a Likert scale, participants specify their level of agreement to statements with typically five or seven ordered response levels (Joost and Dodou, 2010).Several studies show that people are not able to place their point of view on a scale greater than seven since more than seven points scale are too much. Seven or less is preferred. Studies are not conclusive on what is the perfect number, most commonly mentioned are five, four or three point scales (Intelligent measurement, 2007). They showed that numbered scales are difficult for people. For example, scales that are marked "1 to 5, with 5 being the highest" result in less accurate results than scales with labels such as "low" or "high". If numbered scales are used, signposts are recommended (e.g. put "low" as 1, "moderate" as 3 and "high" as 5). In this background the above 1, 3, 5 Likert scales has been selected to measure the intensity of contribution of each project towards the achievement of each objective criteria. Since this study based on public perception survey and to have a clear variance among the achievement level, 1, 3, 5 scales were taken rather than considering 1, 2, and 3. Finally responded values were applied to AHP calc version 22.5 software program developed by Geopel, K.(2012) to run the process of application of AHP. It was calculated priority vector (Pj) for each project which indicates the achievement of criteria of relevant objectives. The software facilitated to calculate lambda max, consistency index (CI) and consistency ratio (CR) for each action project. Table 04 illustrates the achievement level of objective criteria of Lunawa Lagoon development project.

## 5. Conclusions

The Conformance-based evaluation method introduced by Laurian et al. (2004) can be applied to evaluate the objectives when there is a observable causal linkages between planning goals, activities and outcomes and it is required to have clearly defined goals and objectives which can be measurable with measurable indicators and logically derived planning strategies. But in practice, these evaluations are complicated because plan objectives are not always clear and measurable and multiple strategies are used to advance the objectives. Since there is no proper method to evaluate the achievement of objectives when objectives are not always clear and measurable,

***Table 3:*** *Criteria of objectives relevant to each action project*

| Action Projects | Objectives | Related Criteria of the objectives |
|---|---|---|
| Town Center Development Project | 1. Development as a waterfront city | C1-City development<br>C2-water front city |
| | 2.Improve the infrastructure facilities | C3-Improve infrastructure facilities |
| KatubeddaSub-Town Development project | 2. Improve the infrastructure facilities | C1-Improve infrastructure facilities |
| | 3.Provision of facilities to improve the industries in the town | C2-Provide facilities to improve industries |
| | 4. Improvement of the fishing industry | C3-Improve fishing industry |
| Lunawa Lagoon Development Project | 5. To protect natural resources, and maintain the development of the town and its environmental | C1-to Protect natural resource<br>C2-to maintain City development |
| Housing development project | 6. Improve the standards of living by providing housing and infrastructure facilities for low income settlements in the town | C1-to Improve standard of living<br>C2-to provide better quality houses<br>C3-Provide infrastructure facilities |
| Coastal Road Development Project | 7. Establishment of an efficient transport system | C1-to establish efficient transport system |
| | 8. Maintenance of reservations of public roads and waterways | C2-to maintain reservation of public roads<br>C3-to maintain reservation of water ways |
| Parks Development Project | 9. Establishment of adequate number of parks, playgrounds and open spaces | C1-Provision urban recreational facilities<br>C2-Optimum utilization of Urban land<br>C3-Provide open space |

planners cannot know whether the development plans achieve their objectives, or learn from the results of past interventions to improve planning practice. In this background this study attempted to evaluate the achievement level of objectives of Moratuwa urban development plan applying AHP as a technique that can be used to overcome such an issue. The AHP application shows that all six action projects have been contributed to achieve relevant criteria of objectives in different levels (Table 5). Addition of percentage values of achievement level of objective criteria under each project is 100% and the percentage value relevant to each criteria indicate achievement level as a ratio of comparison with other. In a situation action projects are partly implemented, these values do not indicate the significance difference. Therefore the study revealed that this application is totally suitable for evaluating objectives relevant to implemented action projects only. It was suggested that this application should be updated according to the dynamic nature of the planning industry.

### *5.1. Limitations*

Objectives of Moratuwa urban development plan were evaluated towards the achievement of objective criteria considering the overall benefits of all identified action projects only. This case study reflects the stakeholders' satisfaction on the overall benefits of action projects but has not done a study about the planning process and theories which were applied to identify strategic action projects of selected urban development plan. The level of achievement of objective criteria under each action project was evaluated considering perception of planning

***Table 4:*** *Achievement level of Objective Criteria for Lunawa Lagoon Development Project*

| Lunawa Lagoon Development Project | To Protect natural resource C1 | To maintain City development C2 | For Ecological Balance C3 | Sum | Priority vector |
|---|---|---|---|---|---|
| To Protect natural resource C1 | 0.425 | 0.486 | 0.406 | 1.317 | 43.91% |
| To maintain City development C2 | 0.125 | 0.143 | 0.166 | 0.434 | 14.46% |
| For Ecological Balance C3 | 0.450 | 0.371 | 0.429 | 1.249 | 41.63% |
| Sum | 1.000 | 1.000 | 1.000 | 3.000 | 100.0% |
| Lambda max | | | 3.014 | | |
| Consistency Index (CI) | | | 0.69% | n = 3 | |
| Consistency Ratio (CR) | | | 1.20% | | |
| The value of consistency ratio (CR) is 1.20%. Since it is smaller than 10% judgment matrix is consistent and reliable. | | | | | |

***Table 5**: Achievement level of objective criteria of other all six action projects of Moratuwa Development Plan*

| Action Projects | Objectives | Related Criteria of the objectives | Objective Criteria Achievement Level |
|---|---|---|---|
| Town Center Development Project | 1. Development as a waterfront city | C1-City development<br>C2-water front city | 61.51%<br>13.78% |
| | 2.Improve the infrastructure facilities | C3-Improve infrastructure facilities | 24.71% |
| Katubedda Sub-Town Development project | 2. Improve the infrastructure facilities | C1-Improve infrastructure facilities | 60.80% |
| | 3.Provision of facilities to improve the industries in the town | C2-Provide facilities to improve industries | 26.27% |
| | 4. Improvement of the fishing industry | C3-Improve fishing industry | 12.92% |
| Lunawa Lagoon Development Project | 5. To protect natural resources, and maintain the development of the town and its environmental equilibrium | C1-to Protect natural resource<br>C2-to maintain City development<br>C3-for Ecological Balance | 43.91%<br>14.46%<br>41.63% |
| Lunawa Housing development project | 6. Improve the standards of living by providing housing and infrastructure facilities for low income settlements in the town | C1-to Improve standard of living<br>C2-to provide better quality houses<br>C3-Provide infrastructure facilities | 36.38%<br>47.16%<br>16.46% |
| Coastal Road Development Project | 7. Establishment of an efficient transport system | C1-to establish efficient transport system | 18.46% |
| | 8. Maintenance of reservations of public roads and waterways | C2-to maintain reservation of public roads<br>C3-to maintain reservation of water ways | 36.99%<br>44.55% |
| Parks Development Project | 9. Establishment of adequate number of parks, playgrounds and open spaces | C1-Provision urban recreational facilities<br>C2-Optimum utilization of Urban land<br>C3-Provide open space | 12.06%<br>35.24%<br>52.70% |

officers, project officers and community as only 30 respondents for each project. The achievement level of each criteria of objectives were evaluated as low, moderate and high by giving likert scale values of 1, 3 and 5 consequently. Since criteria of objectives are ambiguous, it was needed to explain them to participants. This method should avoid selecting only stakeholders who will positively evaluate the plan's objectives. There can be long time lags between plan adoption, implementation, project outcomes and development impacts.

### *5.2. Contribution to Industry*

This method will be a useful tool to planners, project managers and academics seeking to assess the objectives of development plans in local level. Because Objective Criteria Achievement level indicate the intensity of contribution of the action project to achieve related criteria of its relevant objectives considering overall benefits of each action project. These evaluations facilitate to learn and improve planning practice, while providing the necessary knowledge to revise plans, improve performance of action projects, and increase the transparency and accountability of planning practice. This method involves all relevant stakeholders to evaluate the objectives of plan. Therefore community will identify how the plans have shaped up their communities and they will help the planners, project managers and the politicians to achieve the expected objectives. The effectiveness of this method in Sri Lankan planning industry should be tested with a few more implemented development plans.

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