Challenging for Transport Policy Appraisal in Developing Countries - Review of Selected Strategic Sustainability Assessment Research

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Abstract: The concept of sustainability emerged in the early 1970s since The UN Conference in Stockholm in 1972. The sustainability concept must be implemented earlier in the strategic planning process, that the appraisal plays a key role. Through the good appraisal process, all the possibilities related to the impact of the implementation can be identified earlier. The infrastructure development in the developing countries, has the typical problems such as environmental, social and economic, the large demand of infrastructure development, but has inadequate funding and the issue of the short term and long term impact that arising from infrastructure development which often cannot be anticipated earlier. An appropriate working title for this new assessment approach seems to be Strategic Sustainability Analysis (SSA). The emphasis of SSA is on comprehensive transport policies, assessing policies simultaneously in order to detect possible interdependencies and cumulative impacts, handling the three basic aspects of sustainability equally.

Keywords: Sustainability Appraisal, Strategic, Integrated, Developing Countries, Transport Infrastructure

1. INTRODUCTION

Developing countries are facing unprecedented challenges towards sustainable societies in the sense that they have to balance economic growth and environmental consideration even though they are not major contributors to environmental loads. There are numerous constraints that restrict societal development. (Fujiwara et al, 2005)

Developing countries have many unique issues related to the development of infrastructure, particularly transport infrastructure such as issues of sustainability, the huge demand for infrastructure development, but has limited resources such as funding and efforts to maximize the benefits with the minimum resources. Developing countries according to the World Bank is a state in the world that has: ".. gross national income per capita as follows: (a)

low-income, $ 1.025 or less, (b) lower-middle income $ 1.026 - $ 4.035 "(World Bank, 2011). In this definition, the numbers of developing countries have the largest population in the world compared to the total population in developed countries.

These constraints reduce the total range of future possibilities and consequently leave only a limited, potentially accessible set of options (i.e., accessibility space). Different from the situations at early development stage of developed countries, developing countries have to pay more and more attentions to such accessibility space in order to realize the same level of economic growth and to support policy decisions in developing countries that are facing unprecedented challenges towards sustainable societies, some practical, cost-effective and easily measured indicators are needed. (Fujiwara et al, 2005)

The purpose of this study is to map and review some selected of Strategic Sustainability Appraisal research project, so that can develop the research problem for developing a strategic appraisal that suitable for developing countries to arrange better, effective, efficient and well targeted planning of sustainable transportation infrastructure.

According to (Schade and Rothengatter, 2000) "strategic" concept in strategic appraisal itself must have three main meanings, namely: First, the assessment process is on a long-term horizon. Second, There is a integrated systemic perspective that implemented and includes on transportation systems and their interrelationships with other systems such as the environment or the economics. Third, the spatial scope of the strategic review of policies and programs aimed at not on assessment of transport projects. This paper was developed as the research mapping of problem for the first author's dissertation research in area of developing strategic sustainability appraisal for transport policy in developing countries especially on urban transportation policy appraisal.

2. PROBLEM

The concept of sustainability emerged in the early 1970s since The UN Conference in Stockholm in 1972. The sustainability concept must be implemented earlier in the strategic planning process, that the appraisal plays a key role. Through the good appraisal process, all the possibilities related to the impact of the implementation can be identified earlier.

Starting from this moment, Environmental Impact Assessment (EIA) was developed to evaluate impact of project implementation to environment. Then, EIA that is based on project level was tried to expand for evaluating programs and policies level, two major innovations have been made the last decade. Firstly, environmental assessment methods were developed which were able to evaluate compete policy packages which is based on EIA that called Strategic Environmental Assessment (SEA), since many environmental issues need to be tackled on higher decision-making levels than the project level. Secondly, it was tried to integrate environmental assessments with the more traditional economic and social assessment methods since decisions are not based on environmental issues only, such an Integrated Environmental Assessment (IEA) has been developed for the project level, but recently there have been demands for closer integration of strategic environmental assessment methodologies like SEA with strategic economic and social assessments methodologies. (Martino, et al, 2010).

Conventional assessment tools like cost-benefit analysis are used widespread amongst economists and other decision-makers though it is shown that such static concepts which perform point-to-point assessments cannot reasonably be applied for long-term assessments dealing with complex systems like social systems or interlinked social and ecological systems. Further more in**,** the meaning of strategic is threefold. First an assessment on a long-term time horizon is aspired; second an integrated or systemic perspective is applied that covers the transport system as well as interlinked systems like environment or economy; third

the spatial scope is aimed at transport policies and programs rather than on project assessment. (Schade and Rothengatter, 2000)

However, the need is realized to further integrate environmental assessment with economic and social assessment to achieve sustainability. Therefore a so-called Strategic Sustainability Analysis (SSA) is suggested. The SSA is applied for integrated long-term assessment of policies and programs.

The emphasis of SSA is on comprehensive transport policies, assessing policies simultaneously in order to detect possible interdependencies and cumulative impacts, handling the three basic aspects of sustainability equally (economic, social and environmental) equally. (Martino A, et al, 2010) The focus of SSA is more on long-term consequences of policies rather than on infrastructure plans and programs as in SEA. (Schade and Rothengatter, 2000)

The sustainability concept must be implemented earlier in the strategic planning process, that the appraisal plays a key role. Through the good appraisal process, all the possibilities related to the impact of the implementation can be identified earlier. The wrong analysis in the appraisal process will lead to mistake in decision-making processes. That has big implications for the emergence of effects that are not good for society and the environment due to the implementation of the project / investment in the long run.

In the SSA, it is necessary to assess long-term consequences of transport policies, because the impact of transport policy implementation will be felt both in the short, medium and even long term. The question arises why does need to assess the impact in the long term?, and why is it so necessary?. Schade and Rothengatter (1999) was argued that the question arises as one might argue that assessments with a time horizon of more than 5 to 10 years are tainted with high uncertainty or even are speculative. This might be right for some systems for which the framework of the system can be changed completely within short-terms e.g. in financial markets where varying money flows can change the whole system within hours or days. However the framework in which the transport system is embedded behaves different. Major driving forces of the transport system can be changed only in the long-term. For instance the construction and planning of transport infrastructure might take up to 10 years and the usage duration is often longer than 40 years.

3. STRATEGIC SUSTAINABILITY ANALYSIS (SSA)

Transport forms a complex system that is highly interrelated with socio-economic systems as well as with ecological systems. Negative environmental impacts of transport present a major obstacle in achieving sustainability. However, major determinants of the transport system can only be changed on a long-term horizon. Transport policy assessment approaches therefore have to be capable of reflecting these highly interrelated systems as well as of measuring long-term changes (Schade and Rothengatter, 1999).

In sciences real systems usually are split up and allocated to different disciplines. The conventional models are constantly up-graded to support assessments in terms of analysing and forecasting impacts that are internal in the transport sector - such as on transport demand and modal choices, modal capacity and traffic level and patterns. Also, in an increasingly number of applications transport models are being used to assess transport related impacts on environment as well as on location choices of both families and firms. But other interrelationships e.g. between transport and macro-economic or between location choices and the transport system (vice versa then mentioned before) are often treated as exogenous or not existing. Here lies the field of application of system dynamics (Forrester, 1969) because it is one of the few tools, which are able to re-establish these interrelationships and to tie together the elements of reality in one model again**.** (Schade, et at, 2000)

Recently arguments are arisen that request for a further integration of these predominant environmental assessments together with assessments of economic and social impacts, which form the two other dimensions of sustainability. The aim of this integration would be to analyze the trade-off between environmental impacts and socio-economic effects of policies and to test the results against sustainability targets. An appropriate working title for this new assessment methodology, coined at the OECD/ECMT conference on SEA in Warsaw in 1999, seems to be Strategic Sustainability Analysis (SSA). The focus of SSA would be more on long-term consequences of policies rather than on infrastructure plans and programmes (ECMT 1999) cited in (Schade and Rothengatter, 2000)

Then, purpose two basic requirements that can be identified. These requirements can be formulated in the following hypotheses named *Integration* and *Pathfinding*. **Integration** is a process to assess the long-term consequences of policies methodologies are required that first integrate the concerned real systems into one model and second integrate the impact prediction and impact assessment steps into the same or at least interlinked model. **Pathfinding** is a process for long run decisions that should be guided by desired images of the future the approach has to be capable to show and to investigate the development paths from the future to the current situation respectively reverse. Point-to-point analysis is not sufficient. Therefore the applied modelling approach for SSA has to be *dynamic*, *quantitative* and *consistent*. **Dynamic** methods are needed to introduce the time axis into the model and to capture the secondary effects of systems that are interlinked with several feedbacks or time lags. **Quantification** is primarily necessary to create operable models of the real systems. Depending on the modelling approach verifiability by experts and decision-makers can be fostered with quantitative modelling as quantified relationships can be reviewed more easy than for example qualitative expert judgements. **Consistency** means that the baselines for the economic, social and environmental part of the assessment are based on a common system of assumptions. (Schade and Rothengatter, 2000)

4. REVIEW STUDIES IN STRATEGIC SUSTAINABILITY APPRAISAL

This study reviewed 11 (eleven) research projects that related to the Strategic Sustainability Appraisal for the sustainable development of several countries. As for this review as follows:

4.1. ASTRA : Assessment of Transport Strategies Project

The ASTRA project started in October 1997 and ended in January 2000. It is carried out by a consortium composed by IWW, Institut für Wirtschaftspolitik und Wirtschaftsforschung, Universität Karlsruhe, Germany (project co-ordinator). The study's resume that taken from (Schade, W et at, 2000) is described below.

The aim of ASTRA is to develop a tool for analysing the impacts of the Common Transport Policy (CTP) including secondary and long-term effects. The ASTRA project is in charge for enhancing present abilities of analytical tools and models to support strategic assessment of non-marginal impacts of transport policies and infrastructure investments. For this purpose the System Dynamics modeling method is applied. ASTRA was using system dynamics software platform and developed ASTRA System Dynamics Platform (ASP). The ASP integrates and is composed of the four sub-modules: macroeconomics sub-module (MAC), regional economics and land use sub module (REM), transport sub-module (TRA) and environment sub-module (ENV). Results of the conventional models are used for calibration of the ASP sub-modules. The ASTRA System Dynamics Platform (ASP) is not designed as a stand-alone system dynamics model. Instead it integrates for sub-modules, which are regarded to be the most important systems of reality that have an impact on the assessment of the Common Transport Policy (CTP) of the European member states. The four real systems are (Schade, W et at, 2000) :

1) Transport system as a basis for modeling transport infrastructure and traffic volumes. The transport sub-module is composed by five passenger sectors and four freight sectors.
2) Regional economics and land use because of the relationships between regional development (business, housing), transport and environment. The purpose of the REM is to represent the fundamental mechanisms that generate the demand for travel.
3) Macroeconomics to integrate national or continental level influences into the model. The macroeconomics sub-module is divided in two main parts: the description of the demand and the supply side.
4) Environmental system because of the relationships to the transport system and the importance for the national welfare position.For this purpose three kinds of environmental impacts should be treated by the environmental sub-module: Global Impacts, Impacts on Human Health and Ecological Impacts.

4.2. Strategic Impact Assessment And Enterprise Development

The result of the project presented by Norman Lee (2002). The study's resume that taken from **(**Lee, Norman, 2002) is described as follow :

The main purposes of this paper are to examine: how strategic impact assessments (SIAs) may be applied to policies, plans and programs (PPPs) for enterprise development (ED) and the processes and methods by which EDSIAs may be undertaken and their findings used in practice.

This paper reviews how strategic impact assessments (SIAs) may be used to strengthen the appraisal and evaluation of policies, plans and programs (PPPs) for enterprise development (ED) in developing countries. However, the general features of an effective SIA process are broadly similar and this section of the paper is mainly concerned with these (Lee, Norman, 2002) **:**

- **Screening,** to determine which PPP measures require an assessment and which do not.
- **Scoping,** to determine the terms of reference for the impact assessment, which is to be undertaken, taking into consideration, where relevant, whether a 'simplified' or 'full' assessment is required.
- **Impact Assessment,** assuming all of the scoping tasks described above have been satisfactorily performed, the work plan for the impact assessment and how it is to be carried out, should be well-defined by the time this stage commences.
- **Options and M&E Analysis,** this stage in the assessment process partially overlaps the previous stage.
- **Decision-making and Implementation,** the findings of the options and mitigation analyses, and the supporting impact assessments from which these are derived, provide the information base (together with the findings of consultations based on these) for decision-makers to determine which option, and its accompanying M&E measures, is to be selected for implementation.
- **Monitoring, Evaluation and Post-auditing,** a distinction is to be drawn between the monitoring and evaluation of individual PPP implementation and the more detailed, but selective, monitoring, evaluation and post-auditing of the implementation of the PPP system as a whole.

4.3. PROSPECTS (Procedures for Recommending Optimal Sustainable Planning of European City Transport Systems) PROJECT

This is a research project of (Pfaffenbichler and Shepherd, 2002). The resume of the study that taken from (Pfaffenbichler and Shepherd, 2002) is described below.

This paper aims to present a framework to appraise long term urban planning strategies. It consists of two main items: a dynamic land-use/transport model (termed Sketch Planning Model, SPM) and an evaluation/optimization procedure. Both are results of the EU funded 5th framework research project PROSPECTS (Procedures for Recommending Optimal Sustainable Planning of European City Transport Systems). Environment, Safety, Health, Land Use and Congestion are the domains of the STELLA Focus Group 4. All five of them are addressed by the framework of PROSPECTS. Environment, safety and health aspects are part of a sustainable objective function used in the evaluation procedure.

Therefore one of the objectives in the project PROSPECTS was the development of a dynamic LUTI model on a strategic level. The PROSPECTS consortium refers to this model as the Sketch Planning Model (SPM). The optimization method applied within the appraisal framework presented here is based on the downhill simplex method in multi-dimensions (Nelder and Mead, 1965) cited in (Pfaffenbichler and Shepherd, 2002).

4.4. MARS (Metropolitan Activity Relocation Simulator) Model

This research is Dissertation Doctoral Thesis of Paul Pfaffenbichler at Institut für Verkehrsplanung und Verkehrstechnik, Technische Universität Wien in 2003. The resume of the study that taken from (Pfaffenbichler, Paul, 2003) is described as follow :

This research proposed the high aggregated strategic, dynamic and integrated urban land model that called MARS (Metropolitan Activity Relocation Simulation). MARS was developed as the core of a sustainability assessment framework. The underlying hypothesis is that cities are self-organising systems and that the principles of synergetics can be applied to describe collective behavior. A qualitative model was developed based on Viennese research. The method of causal loop diagrams was used for this task. From this basis a quantitative model was built and written into code.

The proposed assessment framework simulates system behavior over time and is designed in a modular way. It consists of four modules : Policy instruments (Module - 1), MARS (Module – 2), Objective functions (Module – 3) and An optimization method (Module – 4). MARS was calibrated for the city of Vienna. An extensive model-testing program was carried out using observed data from 1981 to 2001. A back casting exercise and sensitivity tests have proven the usability of MARS. Nevertheless some weak points were identified. It was possible to find explanations for them. Potential fields for future improvements were identified and ranked. (Pfaffenbichler, Paul, 2003)

4.5. ESCOT (Economic assessment of Sustainability poliCies Of Transport) PROJECT

The report of ESCOT Project was published by (Schade, B and Schade, W, 2003). The resume of the study that taken from (Schade, B and Schade, W, 2003) is described below.

The aim of ESCOT (Model for **e**conomic assessment of sustainability poli**c**ies **o**f **t**ransport) is to describe a development path towards a sustainable transport system in Germany and to assess its economic impacts. In ESCOT the System Dynamics Methodology is applied for integrated modeling of transportation scenarios. ESCOT is used to assess a development path towards sustainable transport in Germany in the project on **e**nvironmentally **s**ustainable **t**ransport (EST) of the OECD. Within the EST project ESCOT contributes to the backcasting strategy of EST. Besides environmental protection the economic feasibility forms a fundamental part of sustainability.

ESCOT is divided in five models, the macroeconomic model, the transport model, the regional economic model, the environmental model and the policy model. The Macroeconomic Model of ESCOT forms the backbone of the economic assessment and enables to make complex policy studies. ESCOT offers the opportunity to derive the

macroeconomic development, considering first round effects that are in case of a path towards sustainability mostly governed by negative influences like higher prices and restrictions on the demand side. But it also considers structural changes including secondary effects that occur only in the long run. Secondary effects arise because transport is highly interrelated with other social systems such that a policy measure e.g. charges for one mode causes a direct effect e.g. decrease in demand for this mode but also secondary effects e.g. technological changes for other modes because of increased demand for these modes, changes in state revenues or private consumption. This ability makes the System Dynamics Model ESCOT to a powerful instrument for the assessment of such large ecological changes. (Schade, B and Schade, W, 2003)

4.6. FUJIWARA et al. RESEARCH

This research was conducted by Professor Akimasa Fujiwara et. al from Transportation Engineering Laboratory, IDEC, Hiroshima University, Kagamiyama, Japan. The resume of the study that taken from (Fujiwara et al, 2005) is described below.

This paper attempts to establish a simplified dynamic structural equation model in order to capture complex cause-effect relationships existing in the measurement of sustainability over time, considering data availability in developing countries. This paper attempts to evaluate urban sustainability based on *land use*, *transportation* and *energy consumption* (alternative variable of environmental loads), considering data availability. *Transportation* is further divided into *transport demand* and transport supply, because these two new latent variables represent two completely different aspects of transportation system. Structural equation model is first applied to describe the pooled data in 1970, 1980 and 1990.

This study therefore focuses on developing such indicators at city level based on a data-driven approach, considering the data availability in developing countries. As a result, a dynamic structural equation model is established, where dynamics are captured based on the concept of state dependence and latent variable is used to derive the indicators of urban sustainability. Dynamic evaluation is realized by introducing the concept of state dependence and latent variables are introduced to represent indicators of urban sustainability, i.e., transportation, land use and energy consumption in this study. Model estimation results suggest the validity of the resultant model.

This paper confirmed the effectiveness of the dynamic model to overcome methodological shortcomings in existing indicator frameworks based on internal validity (goodness-of-fit). It is necessary to examine external validity, i.e., temporal and spatial transferability. It is also an interesting research topic how to represent the missing data as well as serial correlation and heterogeneity. Furthermore, evaluation of urban sustainability should not ignore social dimensions (e.g., equity). Finally, it seems worthwhile to evaluate the effects of policies contributing to the sustainable urban development in developing cities. (Fujiwara et al, 2005)

4.7. MATISSE (Methods and Tools for Integrated Sustainability Assessment) Project

The MATISSE project (Weaver, P and Rotmans, J, 2006) is interested in the role that Integrated Sustainability Assessment (ISA) could play in the process of developing and implementing policies capable of addressing persistent problems of unsustainable development and supporting transitions to a more sustainable future in Europe. The core activity of MATISSE is to develop, test and demonstrate new and improved methods and tools for conducting ISA. The resume of the this project report that taken from (Weaver, P and Rotmans, J, 2006) is explained as follow :

Within the MATISSE project (Weaver, P and Rotmans, J, 2006), Integrated Sustainability Assessment (ISA) has been defined as a cyclical, participatory process of scoping, envisioning, experimenting, and learning through which a shared interpretation of sustainability for a specific context is developed and applied in an integrated manner, in order to explore solutions to persistent problems of unsustainable development. ISA is conceptualized as a complement to other forms of sustainability assessment, such as Sustainability Impact Assessment, Integrated Assessment and Regulatory Impact Assessment. Whereas these other forms of assessment fulfill the pragmatic need for *ex ante* screening of incremental sectoral policies that are developed within the prevailing policy regime, ISA is conceptualized as a support to longer-term and more strategic policy processes, where the objective is to explore persistent problems of unsustainable development that have a systemic pathology and possible solutions to these. ISA is therefore oriented toward supporting the development of cross-sectoral policies that specifically address sustainable development and at exploring enabling policy regimes and institutional arrangements.

This research suggests an approach to policy development that is fundamentally different from the prevailing sectoral approaches; a cross-sectoral approach with an explicit orientation toward sustainability. In concrete terms this means that ISA involves the whole palette of: (i) analyzing human activities as driving forces; (ii) estimating the impacts on ecosystems functioning and human health; (iii) indicating critical thresholds and potential damage; (iv) setting policy targets; (v) developing mitigation and adaptation strategies; and (vi) monitoring the process. Furthermore, through using a participatory approach that engages stakeholders, experts and decision makers in a social learning process, ISA has the possibility to develop, simultaneously, strategies and action plans for a transition towards sustainability. (Weaver, P and Rotmans, J, 2006)

4.8. THE SASI MODEL

THE SASI MODEL actually is a part of a research project that conducted by ECORYS Nederland BV which contracted with European Commission, DG-REGIO. This report was published entitle *Study on Strategic Evaluation on Transport Investment Priorities under Structural and Cohesion funds for the Programming Period 2007-2013* with special project location study was Latvia. The resume of the this project report that taken from (ECORYS N, 2006) is described below.

The SASI model (ECORYS N, 2006) is a recursive-dynamic simulation model of socio-economic development of 1330 regions in Europe. The model was developed to assess socio-economic and spatial impacts of transport infrastructure investment and transport system improvements. It has been applied and validated in several large EU projects including the IASON and ESPON projects. The SASI model differs from other forecasting models of regional development by modeling not only production (the demand side of labour markets) but also population (the supply side of labor markets). Regional production by industry is forecasted by regional production functions containing production factors capital, labour, regional endowment and accessibility. Regional population is forecasted by a demographic model including fertility, mortality and migration.

The SASI model is specifically relevant for projects that serve a function on a European level (e.g. the TEN projects). Such projects cannot be adequately evaluated using traditional cost-benefit analysis on a national scale, since they are less able to capture the international effect and the indirect effects occurring in non-transport sectors. To determine the need for transport investments, the SASI model has been used to assess the present situation of the road and rail systems in each country without the national transport projects to be examined later. For this the accessibility provided by the road and rail systems in each country was

evaluated from both a national and a European perspective. To assess the impacts of new transport investments a reference scenario has been prepared. This mainly implies an adjustment of the transport network in the SASI model. The dynamic network database of SASI is based on highly detailed pan- European transport networks with respect to roads (including short-sea shipping), rail (including ferries) and air (including regional airports). Network calculations are based on travel times or generalized costs including border waiting times and (political, economic cultural and language) barriers. These other factors include: Cost-effectiveness of projects, Availability of other sources of funding, Appropriateness of transport policy, Administrative capacity to adequately absorb and manage funds. In addition to the Reference scenario, two major scenarios have been distinguished "the Maximum Scenario" and "the Maximum Rail Scenario" which illustrates the differential impact of rail versus road projects. The other scenario is "the Balanced Scenario", which applies a budget restriction (with in parallel an assessment of additional financing opportunities). Projects are prioritized on the basis of their benefit-cost ratio and their contribution to specific objectives and needs (sustainability, regional disparity, and contribution to accessibility). (ECORYS N, 2006)

4.9. SEA : PORTUGAL AND THE UNITED KINGDOM PROJECT

This research was conducted by (Sheate, WR and Partidário, MR, 2010). The resume of this project report that taken from (Sheate, WR and Partidário, MR, 2010) is explained below.

This paper is the first exploratory step in developing a more systematic framework for evaluating strategic approaches and assessment techniques for their knowledge brokerage potential, and therefore ultimately to build knowledge brokerage into such approaches and techniques more explicitly in the future. This paper draws on lessons from practical experience of the application of SEA/ SA in Portugal and the UK, to explore the conditions that facilitate the knowledge brokerage potential of such approaches, and potential barriers to success. Such a perspective offers significant benefits for improving the performance, and consequent outcomes, from the approaches themselves, and for the wider exchange of knowledge and understanding of stakeholders at the science–policy interface. (Sheate, WR and Partidário, MR, 2010)

Six case studies of SEA/SA/sustainability strategies (Sheate, WR and Partidário, MR, 2010) were selected, three from Portugal and three from the UK, on the basis of the authors' experience and involvement (in various capacities) in these case studies, and according to the following criteria:

- Range of geographical scales;
- Mix of strategic approaches;
- Range of techniques used within the assessment approach;
- Mix of stakeholder/public engagement approaches;
- Mix of types of proponent (authorities, agencies).

4.10. REFIT (Refinement And Test Of Sustainability And Tools With Regard To European Transport Policies)

The REFIT Project is a research project co-funded by the European Commission within the 6th Framework Programme. This resume of project taken from Martino A, et al, (2010) and resume of report from (Martino A, et al, 2010) is described below.

The REFIT project idea was developed as a remedy to this problem, to allow systematic, program-level (strategic) evaluation. REFIT tries to establish a linkage between these different sustainability domains enriching the modelling toolbox with new models able to assess the impact of transport policies on regional economic growth, on social equity and on

local environmental quality. The REFIT project objective is precisely to limit the inherent vagueness of the sustainability concept by linking the current EU transport policy priorities and indicators to a concrete set of possible quantification methods and models. The lack of a consistent approach, not just because of the lack of indicators or tools, but especially as most of these were concerned with individual projects and not programs, emerged during the ASSESS project, the mid-term evaluation of the White Paper (Transport Mobility Leuven, 2005) cited in (Martino A, et al, 2010).

The way these models help to make progress in their respective fields is motivated by the wide framework for assessment adopted in REFIT. The REFIT project aims to develop, test and validate a "modeling tools-based" methodology that, through the analysis of selected indicators, enables ex-ante evaluation of the European Common Transport Policy considering the economic, environmental and social dimensions of sustainability. Indicators are policy sensitive in the sense that their ingredients include variables whose value is affected by the policy implementation. As already mentioned, the REFIT "tool box" includes the two *core* models and three modules created *ad-hoc* to analyze specific aspects, which are not addressed by the two main models in sufficient detail by the core models with respect to the economic, environmental and social dimension. The TRANS-TOOLS/TREMOVE integrated model structure is the *core* of the quantitative procedure: TRANS-TOOLS is a network-based transport model whereas TREMOVE simulates aggregate demand and includes a detailed description of fleet development, fuel consumption and emissions factors. These two models simulate the change induced by a policy on a wide range of variables and produce a set of data, which are either indicators themselves or the input of the *ad-hoc* models. (Martino A, et al, 2010)

4.11. ACCRA (GHANA) PROJECT

This research had been conducted by (Jones, S et al, 2013) and resume of report from (Jones, S et al, 2013) is described as follow :

This paper documents a framework suggested for screening urban transport projects in developing countries to reflect local issues relevant to sustainability. The framework is based on the integration of indigenous and scientific knowledge to reflect the sustainability of candidate projects. This is achieved through a participatory approach to integrate inputs from system users and providers to produce a term defined as the Localized Sustainability Score (LSS). The LSS of the projects are then used to produce a relative ranking of potential projects, for use as a decision support for project screening and selection. (Jones, S et al, 2013)

Proof-of-concept development of the proposed LSS framework is presented via a preliminary case study in Accra–Ghana and the results indicate that the framework adequately represented local sustainable transport needs, priorities and perceptions. The LSS determined for some selected projects maintained the original relative rankings that were already derived using conventional methods. The LSS also has the added advantage of evaluating projects of different scales, which were not easy to evaluate together by conventional methods. The LSS framework is a tool for capturing and integrating indigenous and scientific knowledge of urban transport in developing countries. It is based on the Analytical Hierarchy Process (AHP). (Jones, S et al, 2013)

5. COMPARISON OF THE STRATEGIC SUSTAINABILITY RESEARCH

5.1. Research Comparison

Based on the review that conducted on the above, it can be compared a view things related to the implementation of the results are shown in **Table 1** :

1. Parameters : parameters and indicators were developed largely based on the concept of sustainability is alignment of economic, environmental and social sector, in some cases of the research project all three aspects is more detailed become detail indicator included health, safety, etc.
2. Methods: The method that developed mostly try to adopt a new method that is based on a dynamic concept that is using the Systems Dynamic platform and Structural Equation Models and others develops a participatory approach. However, in some cases, the research project is still trying to use conventional methods such as CBA and MCA with some certain modifications.
3. Case studies and study locations: most researches have taken a case study to examine the strategic policy assessment related to transportation policy and other development policies assessment. Whereas most of the study area is in European countries, but there are also some developing countries taken as an object of the research.

5.2. SSA Platform Comparison and Finding

5.2.1. SSA Platform Comparison

a. Integration,
   Among the 12 studies reviewed; there are three research projects that do not use integration platform i.e. the SIA & ED project, which focuses on economic studies, Fujiwara Research which does not aim as an assessment process and Acrra (Ghana) project that developed public participation approach.
b. Path finding,
   It is interesting that among the 12 research projects reviewed were only two research projects that use back casting path finding approach while others use forecasting approach.
c. Dynamic,
   The methods developed by the entire research project entirely using the dynamic approach and simulation, which is 4 (four) studies using Systems Dynamic platform, while others use a variety of methods but still using dynamic approach framework.
d. Quantification,
   There are not all existing research quantification process, at least 3 (three) studies combined qualitative and quantitative parameters in the analysis process.
e. Consistency,
   In general, quantitative analysis research-based have a platform of consistency, whereas others using qualitative parameters have not use this platform.

The comparison of these selected SSA research platform can be described in **Table 2**.

5.2.2. Findings

Based on the results of this study and review some of the findings can be presented as follows:

a. SSA approach is very rarely used in the evaluation process and assessment of transport policy so it is potential to generate this method.
b. SSA approach has great potential to be developed especially in developing countries that has less made it as a research project case, desperately they need an assessment tools such as the SSA to maximize their development result.
c. Platform SSA is still very possible to be developed by taking into account a variety of issues, such as the availability of data, issue a combination of quantitative and qualitative approaches, short or long term time horizon that are adequate for each type of policy studies (e.g. between highway modes comparing with airport, ports and others).
d. The use of a dynamic system simulation method is very interesting to develop by observing and combining the advantages and disadvantages of each simulation method.

Table 1. Comparison of Selected Strategic Sustainability Appraisal Research Project

No.	Research Project	Indicator/ Parameter	Method	Case of Studies	Location	Strength	Weakness	Comment
1	ASTRA (2000)	• Macroeconomics • Regional economics and land use • Transportation • Environment	System Dynamics Platform (ASP)	Policy appraisal for vehicle fleets, fuel price, fuel taxes and level of congestion of five alternative passenger transport freight and three transport modes.	27 countries in the European Union (EU27) plus Norway and Switzerland	• The ASTRA model is a successful application to the simulation of transport at the strategic level. • The Model has a rich set of indicators in the analysis.	• ASTRA is a huge model and is actually almost reaching the maximum manageable size in Vensim. • Facilities and modeling conventions work on modules as stand-alone models and then merge them again.	This model used the "backasting" procedure to get desired picture in the future then back to the existing condition using pathfinding process.
2	SIA AND ED (2002)	• financial services • business development • improving the regulatory environment • improving the infrastructure environment	• Causal chain analysis (CCA) • Cost-benefit analysis (CBA) • multi-criteria analysis (MCA)	Use in assessing enterprise development PPPs in a major study of the potential economic, social and environ-mental impacts of trade liberali-sation.	Selected low-income countries.	Integrated forms of appraisal and evaluation that provide opportunities to streamline and rationalize assessment procedures and inter-organization working practices as well as to make these more effective.	Require some additional provision for awareness-raising and training in strategic-level appraisal.	Using Causal chain analysis (CCA) and combining with CBA and MCA produced a good result to overcome the data deficiencies in low income countries.
3	PROSPECTS (2002)	• Environment, • Safety, • Health, • Land Use and • Congestion	• A dynamic land-use/transport model (termed Sketch Planning Model, SPM) • An evaluation / optimization procedure	Optimizing the policy instruments of public transport fares, public transport frequency and parking charges	Vienna, Austria	• The evolution of processes over time can be observed. • Useful in determining the trends in the longer term of indicators of sustainability.	The model needs the profile of policy that being assess must optimize the shape first to give optimal implementation..	SPM can be observed processes over time, but the profile of policy that being assess must optimize the shape first to give optimal implementation.
4	MARS (2003)	Land use and Transportation system	• The method of causal loop diagrams was used for this task. From this basis a quantitative model was built. • An optimization algorithm	An extensive model-testing transport ad land use program in Vienna was carried out, using observed data from 1981 to 2001.	Vienna, Austria	• MARS fully considers the non motorized modes in its transport sub-model. • MARS, although not employing an assess-ment stage, includes such a feedback from the supply side up to desti-nation and mode choice and trip generation.	• Do not rely on cross sectional modeling. • Due to its aggregated and strategic character • MARS takes into account a relative small number of different actors and sectors.	• A back casting exercise and sensitivity tests have proven the usability of MARS. • MARS is not an "ex-ante" appraisal tool.

Table 1 (continued)

No.	Research Project	Indicator/ Parameter	Method	Case of Studies	Location	Strength	Weakness	Comment
5	ESCOT (2003)	Environment Pollution from transportation and land use changes for transport infrastructure	System Dynamics Model (SDM) collaborated with macroeconomic model, regional economic model, transport model, environmental model and policy model	Policy Appraisal : • Increase of fuel tax • Increase of road pricing • Improvements in emission regulation • Expansion of railway infrastructure • Economic and land use • Energy policy	Sweden, Norway, The Netherlands, Canada, France, Switzerland, Austria and Germany	• ESCOT offers the opportunity to derive the macroeconomic development, considering also structural changes including secondary effects that occur only in the long run. • ESCOT is a powerful instrument for the assessment of such large ecological and economic changes	Macroeconomic is the major impact that assess in ESCOT. The other parameter and indicator just being completion of measuring the macroeconomic impact of transport policy.	It is necessary to evaluate the other element (not only economic based) to an integrated analysis and combine with the qualitative approach..
6	FUJIWARA et al. (2005)	• Land use, • Transportation • Energy consumption, • Transport demand • Transport supply	Structural Equation Model (SEM)	The Study uses the data from 46 cities in developed and developing countries in the world at four different points in time (1960, 70, 80 and 90)	46 cities in developed and developing countries	This study resulted a dynamic structural equation model, where dynamics are captured based on the concept of state dependence and latent variable is used to derive the indicators of urban sustainability.	• This research had not yet represented how to overcome the missing data as well as serial correlation and hetero-genetic in many developing countries. • Evaluation of urban Sustainability should not ignore social dimensions.	It seems worthwhile to evaluate the effects of policies contributing to social dimension in the sustainable urban development in developing cities.
7	MATTISE (2006)	Economic, social-cultural, ecological and institutional/ governance principles	The principal methods to deal with this set of ISA principles are a combination of an analytical approach in the form of an integrated systems analysis, and a process approach in the form of a participatory process.	Within the MATISSE project, four types of case-studies had been performed: water, dematerialization, land-use and environmental technologies.	EU Countries	EU MATISSE project refer to the needed development in terms of Integrated Sustainability Assessment, since the needed procedures, tools and methods are characterized by a high degree of integration of sustainability values and principles and others into the assessment process.	• There is a need to develop and explore new, innovative tools, indicators, and to learn how to combine these effectively. • There is a need to explore the role of ISA and its contribution to social learning at the science-policy-society interface.	This model is good enough, but there is also a need to explore which capacities, resources and knowledge need to be strengthened to make public participation more effective and representative and to ensure outcomes are used adequately in ISA.

Table 1 (continued)

No.	Research Project	Indicator/ Parameter	Method	Case of Studies	Location	Strength	Weakness	Comment
8	THE SASI MODEL (2006)	• Cost-effectiveness • Availability of other sources of funding; • Transport safety & Transport pricing / charging • Administrative capacity. • Economic competitiveness • Territorial cohesion • Environmental sustainability	The SASI model is a recursive-dynamic simulation model of socio-economic development of 1330 regions in Europe.	The strategic evaluation results in specific country reports for all 15 countries and a synthesis report. The current report is the Country Report for Latvia.	Latvia	General modeling results have demonstrated that investing in the main transport axis, particularly in missing links, results in larger economic benefits for a single country, but also for surrounding European countries.	From an economic perspective, prioritizing investment projects should focus therefore on resolving missing links and upgrading the main transport axis and focus on facilitating good access of the major economic centers.	It's necessary to give a more detailed of prioritizing procedure and indication of the strengths and weaknesses of the transport system in the country and to address areas for future intervention. Also, how to identified the "missing link" and to overcome it.
9	PORTUGAL AND UK PROJECT (2010)	Combining social, economic and environmental objectives	• Develop a Local Sustainability Strategy (LSS) that would adopt an integrated sustainability approach; • A SWOT analysis based	Case Study 1—Loulé Municipal Sustainability Strategy, Portugal	Portugal and UK	This method included the relevance to local citizens and the full acknowledgement of findings achieved in the public for a need to adopt different methods to deal with different stakeholders; including the use of the LSS to set the framework for the review of the local master plan.	The insufficient human resources in the municipality, some suspicious attitudes of local stakeholders toward the good intentions of the initiative and lack of engagement by some municipality departments also acted as bottlenecks to the whole process	Key lesson learned with this case is that the political commitment at the highest decision level is very crucial in public policy evaluation.
		Sustainability (Economic, Environmental and Social)	Sustainability Appraisal (SA, incorporating Strategic Environmental Assessment) was applied to the draft Eco-towns Planning Policy.	Case Study 6—SA of the UK Government's draft Planning Policy Statement on Eco-towns and Eco-towns Program	United Kingdom	This method developed a public participation widely through many forums for receiving as much as public opinion and needed.	A key barrier to success has been the failure to address "reasonable alternatives" in the SEA process. There was an inconsistent approach from scoping to the assessment stage. There was also a simple failure to use GIS in strategic analysis.	Strategic assessments need to show strategic thinking and therefore consider a proper range of "reasonable alternatives", which would also help in applying techniques appropriately to the issues in hand.

Table 1 (continued)

No.	Research Project	Indicator/ Parameter	Method	Case of Studies	Location	Strength	Weakness	Comment
10	REFIT (2010)	• 24 transport system operation indicators; • 10 transport economic indicators; • 59 transport environmental indicators including the LoI (Level of Internalization); • 9 transport social indicators.	The main element in this area is the "Transport System Operation", which includes the core models, TRANS-TOOLS and TREMOVE, and the ad-hoc models, which produce sustainability indicators respectively for the economic, environmental and social dimension	The REFIT framework was tested by assessing different policies of the internalization of external costs of transport : : climate change, air pollution, noise, accidents and congestion.	25 European countries	The application of the REFIT framework for the assessment of the effects of EU transport policies provides a complete set of indicators covering all the sustainability domains and allows the user to analyze the policies impacts in a multidimensional manner and identify advantages and disadvantages of the measures simulated.	Since a trade-off exists among the different dimensions of sustainability, the best alternative scenario does not become apparent from indicators. And the selection of the 'most preferable one' is not part of the objectives of REFIT;	The assessment framework offers several detailed data that can be used for further analysis, that do not use in this project. There were too much indicator included, and it made this method difficult to implementation in "insufficient data" countries.
11	ACCRA (GHANA) (2013)	ECONOMIC (Job access Market access Education access Reliability Affordability Roadside commerce Safety) TRANSPORT Public transport SOCIAL Healthcare access Activity access Personal security Stress free travel Neighborhood preservation ENVIRONMENT Air pollution Noise pollution	Localized Sustainability Score (LSS) Multi-Criteria Decision Making (MCDM) Methods.	Proof-of-concept development of the proposed LSS framework is presented via a preliminary case study in Accra–Ghana and the results indicate that the framework adequately represented local sustainable transport needs, priorities and perceptions	Accra–Ghana	Computing an LSS for individual projects allowed a relative comparison among the different types of projects. Such relative rankings among different projects may allow transport planners and policy makers to prioritize and/or eliminate candidate projects. Development and application of the proposed LSS framework does not require extensive collection of quantitative data.	Future applications of the LSS framework should employ a "stratified sampling approach" to ensure that various stakeholder groups of system users are represented. Employing the stratified sampling approach will require an increased number of total respondents. A key means to increasing the overall number of respondents will be improving the efficiency of the interview process.	Incorporating location information could further enhance the richness of the information obtained during the interview process.

Source : Analysis Result

Table 2. Strategic Sustainability Assessment (SSA) Platform Comparison

No.	Research Project	Author(s)/ Year	SSA Platform										
			Integra-tion		Path Finding		Dynamics		Quantification			Consis-tency	
			Yes	No	Fore-casting	Back-casting	System Dyna-mics	Others Simu-lation	Pu-re	Mone -tized	Qua-lita tive	Yes	No
1	ASTRA	Schade, W, (2000)	☑			☑	☑			☑		☑	
2	SIA & ED	Norman Lee (2002)		☑	☑			CCA, CBA, MCA		☑	☑		☑
3	PROSPECT	Pfaffenbichler and Shepherp (2002)	☑		☑		☑		☑			☑	
4	MARS	Paul Pfaffenbicher (2003)	☑			☑	☑		☑			☑	
5	ESCOT	Schade, B and Schade, W (2003)	☑		☑		☑			☑		☑	
6	FUJIWARA RESEARCH	Fujiwara et al (2005)		☑	-	-		SEM		☑		☑	
7	MATTISE	Weaver, P and Rotmans, J (2006)	☑		☑			ISA		☑		☑	
8	THE SASI MODEL	ECORYS, N (2006)	☑		☑			Recur-sive Dyna-mics		☑		☑	
9	SEA : PORTUGAL & UK PROJECT	Sheate, WR and Partidario (2010)	☑		☑			LSS, SWOT		☑	☑		☑
10	REFIT	Martino, et al (2010)	☑		☑			TRAN STOO L, TREM OVE		☑		☑	
11	ACCRA (GHANA)	Jones, S et al (2013)		☑	-	-		LSS, AHP			☑		☑

Source : Analysis Result

6. RESEARCH PLAN AND DEVELOPMENT – FOR CASE OF DEVELOPING COUNTRIES

6.1. Sustainability Issues

Sustainable development, lays down the principle of sustainability on three major aspects of development: environmental, economic and social aspects, also known as the Triple Bottom Principles. Some things to be criticized is that the concept was developed largely based on the context of the conditions and developed countries, and whether the same concept applies to developing countries are suitable or not. This is need in-depth study tailored to the

characteristics of developing countries that have a lot limitation. In addition, in terms of policy appraisal in the developing countries, the problem is, that many of the processes and methods of partial appraisal such as environmental appraisal and sustainability appraisal that is currently evolving from and based on the conditions in many developed countries (mostly from North America and Europe), but its characteristics are very different from those in developing countries. Depth study needs to be done in this regard.

Study of sustainability development in developing countries needs in-depth study which is different from developed countries. This can be seen as an example for the implementation of transport policies, in developing countries is expected to impact on the social aspects for example is focused on reducing poverty, improving public welfare, increasing the value to the region, increasing accessibility and in cumulative, it is expected to reduce social inequality, while in developed countries focus more on improving the safety and health for example. In the economic aspects, in developing countries more focused on increasing revenue per capita, minimizing the use of resources (natural, financial etc) and focuses on improving the real sector and micro economics, while in developed countries focus more on the macroeconomic impact. While the environmental sector, developing countries are faced with conditions reservation area reduction, compared to study the impact of transport policies to city pollutions in developed countries.

6.2. Budgets Constraint Issues

In many developing countries the need for infrastructure development in particular transport infrastructure is very huge, but the ability to provide government funding is very limited. Financial and budgets constraints in developing countries, need prioritization efforts for the very urgent infrastructure development. In terms, it could give much benefits of both short-term and long-term as well as and having a broad positive impact for whole state development.

However in many developing countries have less funding effort that available to fulfill the needs of transport infrastructure development (as the main role) to accelerate the development that are very amounts. For that, they need a very selective and objective consideration that result maximum positive impact prediction in the short, medium and long run. Of course, economic principle with minimum budget is expected to obtain maximum results be the most important principle for low income developing countries. These conditions in developed countries are usually quite different, where the availability of the budget is under control and generally progress or expected effects are not expected in the short term directly.

6.3. Time Horizon and Complexity of Appraisal Analysis Issues

As that was stated above. Transportation forms a complex system that is highly interrelated with socio-economic and ecological systems. Negative environmental impacts of transport present a major obstacle in achieving sustainability. However, major determinants of the transport system can only be changed on a long-term horizon. Transport policy assessment approaches therefore have to be capable of reflecting these highly interrelated systems as well as of measuring long-term changes (Schade and Rothengatter, 1999). In this case, developing countries need the appraisal that is able to anticipate those needs.

In the developing countries, demand for obtaining the impact of a policy implementation or development of transport infrastructure are usually expensive (or even very expensive). From these policies are usually expected a lot positive effects that can occur in the short term, although often in the long run turned out to be bad impact, for example in many developing countries try overcome the congestion in urban area by road widening, construction of new roads or the construction of toll roads policy than maintaining and improving the public transit

system. In the short term it success to reduce congestion (and usually it is an immediate impact), but in the long run, these policies actually worsen congestion, because the process of motorization continues to occur and worsen the quality of the movement and the environment. There are many cases like this in developing countries, that why the integrated and objective dynamics appraisal process that considers the long run time horizon in strategic level and consideration of complexity is desirable.

6.4. Impact The Emergence of Infrastructure Development Issues

It is inevitable that the transport infrastructure development as a form of transport policy could encourage increased production of economic activity, improving social welfare and stimulate spatial development. But, we cannot ignore that there are so many negative effects caused by the transportation project either. Unlike the developed countries that the conditions of the land use and society are quite stable, in developing countries the sensitivity due to changes in of the system to the public transport infrastructure and other components is very high. It must be considered. The very important problem in the assessment of transport infrastructure projects in developing countries in particular is difficult to identify impacts which arising from the construction and operation of transport infrastructure in the medium and long term which is mainly due to the limitations of methods, data, funds and other resources.

Although the difficulty in identifying future impacts resulting from the implementation of transport policy is very likely to occur also in developed countries that may be caused by the world economic instability, the new trend of globalization and so on. Otherwise the condition of developing countries with a large number of population, a low level of income (high poverty level) and low macroeconomic condition, beside that the policy-making conditions even more highly influenced by non-technical issues such as political problems resulting the developing countries stability (economically or politically) often are in less stable condition, meaning little change in the sub-systems development are very sensitive to the consequences for the other sub system. For example, applying the wrong transport policies caused crippled transportation between urban and rural area. In developing countries, this condition have a direct impact on the occurrence of rapid urbanization, which in turn led becoming increasing problematic of urban system worsen. It will be different conditions and impact if occur in the developed countries, with the same thing, the problem of urbanization will not be as severe as in developing countries and usually it takes time slower than in developing countries.

6.5. Strategic Policy Appraisal Issues

In developing countries, the fundamental problem in the appraisal process is not only at the project level, but further is the policy decision making level, because it is related to limited of funding, resources and effort to produce a value of greater benefit to the community. However, other issue that may arise related to the strategic review is related to the quality and reliability of data, public participation, and uncertainty, furthermore, one big weakness that the social and economic aspects are usually abandoned or ignored.

Studies on a strategic level in many developing countries are constructed very less. These happen due to resource constraints, the understanding of concept at the strategic level assessment that is less than in developed countries. Also in developing countries, the choice of package plans and policies are very amounts and variety and they "as if" have the same level of importance in effort to accelerate the progress of society welfare, which is ultimately used is subjective and partial considerations, and interests of many factors influenced (read: politics) . Under these conditions, the unavailability of objective and transparent assessment

tool in strategic level can produce bad impact for the community and environment in the long-run.

6.6. Integrating Methods In Appraisal Process Issues

Developing countries require a set appraisal tool that is effective, efficient and as simple as possible method. For that needed, the efforts to develop an integral and comprehensive appraisal method are needed.

According to (Eales, R, et al, 2003), the integration has a different meaning in the context of the appraisal despite frequent reference to considerations of economic, social and environmental issues in an single integrated appraisal. Other forms of integration in the context of assessment include vertical integration (ie integration between levels of hierarchy appraisal process carried out at different levels in the hierarchy of decision-making), the integration between the processes of decision-making and appraisal processes, and integration of the role of stakeholders in the appraisal process.

7. CONCLUSION

The infrastructure development in the developing countries has the typical problems which often cannot be anticipated earlier. A new assessment approach was developed that called Strategic Sustainability Analysis (SSA).

The emphasis of SSA is on comprehensive transport policies, assessing policies simultaneously in order to detect possible interdependencies and cumulative impacts, handling the three basic aspects of sustainability equally.

Some problem that must be faced for implementing this SSA in developing countries and need for in-depth research are sustainability issues, budgets constraint issues, time horizon and complexity of appraisal analysis issues, impact the emergence of transportation infrastructure development issues, strategic policy appraisal issues, integrating methods in appraisal process issues.

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