Development Aspirations and Infrastructure without Sense

Suresh Kariyawasam, Mark McGovern and Clevo Wilson[1]

School of Economics and Finance, Queensland University of Technology

Abstract

Exiting models and techniques used in analyzing complex development problems typically exhibit two main limitations. Firstly, techniques often feasibly accommodate only two dimensions at once and rely upon extensive use of averages. Secondly, they are cast narrowly and exclusively, as in either macro-economic or micro-economic, so simultaneously precluding both broader contexts and many details. Development decisions so-informed are then based on partial information. Too often this has resulted in unsatisfactory outcomes for many groups of stakeholders along with increasing risk and heightened uncertainties. This is particularly notable with infrastructure development projects.

A novel approach to development decision-making called "Complex Stakeholder Perception Mapping" is introduced in this paper. Evaluation inclusively involves a spectrum of insights. Maps generated offer presentations of flexibly combined, complex perceptions of multiple stakeholders on multiple aspects of development. A three-dimensional platform comprising multiple stakeholders, multiple aspects and multiple attributes has been designed with its applicability demonstrated using a fourth perceptual dimension in infrastructure development evaluation examples.

Key Words: Development Planning, Multiple Stakeholders, Participatory Planning, Infrastructure Investment Evaluation, Perception Mapping

[1] Email suresh.kariyawasam@qut.edu.au , m.mcgovern@qut.edu.au and clevo.wilson@qut.edu.au

The core problem is firstly a practical one. Development outcomes, specifically those associated with infrastructure projects, are limited. Investments often generate few returns. As failures are widespread, deeper conceptual and procedural problems can be expected.

Four main arguments underlie the developments reported in this paper:

1. Development outcomes from infrastructure investments are often disappointing, arguably as a result of inadequate evaluations of the multiplicity of potential and realized impacts.
2. Such failures reflect a convention of narrowing the perceptions admitted to analysis and limiting stakeholder considerations so as to allow narrow "formal positions" to be "rigorously developed", irrespective of their adequacy.
3. Evaluations need to be cast more inclusively, adequately and comprehensively.
4. Mapping of perceptions of various combinations of project stakeholder groups broadly cast as in "Complex Stakeholder Perception Mapping" (CSPM) can enhance evaluations, improve decision-making, support project successes and effectively promote development.

Each is developed in turn in separate sections. It will be seen that CSPM offers a way to improve evaluations and to inclusively foster development outcomes.

1. Development project underperformance

Globalization, national economic reforms, increased direct foreign investment and policies to foster industrialization have resulted in enormous changes with mixed benefits to the economies of developing countries. Many countries in Africa and Asia are experiencing a growing distortion or gap between regional income, wealth, investment and quality of life (Kochend*rfer-Lucius & Pleskovic, 2009).

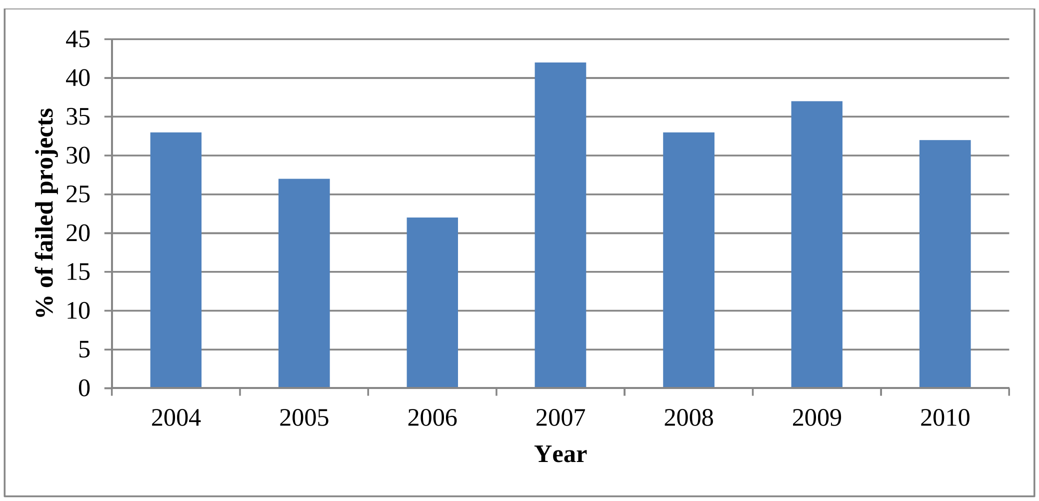
The reasons for these distortions occurring are many, varied and complex, but the lack of affordable and accessible investment in strategic infrastructure is a significant factor in explaining why many are not able to realise their full economic development potential (Cockburn, Dissou, & Duclos, 2013). While many governments in Asia have emphasized public infrastructure as a determinant of regional disparities and a key element constraining Economic Development (Kessides, 1993 ; I. Kessides & ebrary Inc., 2004), the results of public infrastructure investments have too often been disappointing.

"Even for a large country such as China, analysts warn that the economic ramification of an individual megaproject such as the Three Gorges dam could likely hinder the economic viability of the country as a whole" (Development, 2011)

"In UK, the National Audit Office identified forty-one Department of Transport and Welsh Office road projects where actual traffic flows were below forecast flows to a degree that the authorities might have adopted lower design standards with possible savings of some £225 million" (Nyerges, Jankowski, & Ebooks Corporation., 2010)

Under-performing infrastructure is a global problem with cost overruns for very many projects and frequent considerable shortfalls in returns. Some argue that in the long run cost overruns and unrealized return forecasts do not really matter given the wider benefits of the project. But this overlooks two critical points: projects must still be paid for from some revenue source; and, misrepresentations of costs and returns are likely to lead to misallocation of scarce resources which affect the whole system.

The percentage of Asian Development Bank's (ADB) projects that fell short of delivering the intended core sector development outcomes[2] based on bank evaluations are shown in Figure 1. About one third of core sector projects completed between 2004 and 2010 failed to achieve investor's expected development outcomes.

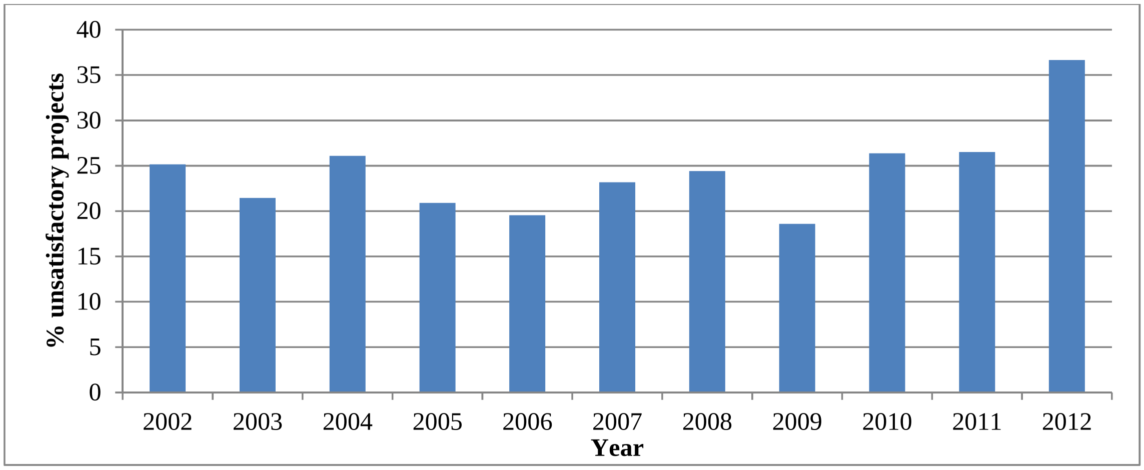


Source - Asian Development Bank (2011)

Figure 1 Percentage of failed projects of ADB in achieving sector outcomes– 2004-2010

[2] Core sector development outcomes were measured based on the level of contribution of recently completed operations to energy, transport, water, education, and finance sector outcomes of economic growth, environmentally sustainable growth, and regional integration.

World Bank project performances from 2002 to 2012 show a similar pattern of "underachievement". Infrastructure projects with "inadequate" outcomes are not limited to any one country or one development institution.



Source - World Bank (2014)

Figure 2 Percentage of projects with unsatisfactory outcomes of World Bank – 2002-2012

Given that one quarter of World Bank's and one third of ADB's projects over the past decade had unsatisfactory outcomes[3], there are serious problems. These become particularly important in current circumstances as funding situations worsen as a consequence of the global financial crisis. Challenges are evident in statements from the development banks.

> *"Various lessons drawn from the experience of ADB in the urban water supply sector call attention to the diversity and varying complexity of risks, along with measures pursued by various Developing Member Countries to address these risks. A careful understanding of the risk environment is a must, with due regard to specific contexts in which risks occur, the arrangements that can mitigate these risks, and the extent to which stakeholders and stakeholder alliances can affect policy, planning, and implementation processes. Where sector reforms are required, assessing roadblocks to collaboration as well as potential areas for engagement is crucial. Differences in stakeholder responses and the interplay of institutional, organizational, and capacity-related factors often shape development outcomes"* (Asian Development Bank, 2011b).

How to evaluate development initiatives like infrastructure projects within the broader perspectives brought by the many parties operating in various spatial units is the focal point of interest and concern of this paper. In this context, an approach is needed to help evaluate the development decisions within its wider complexities.

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[3]The World Bank evaluation was based on the Likert-scale project performance indicators of World Bank including risk to development outcomes, bank performances (quality at entry, quality of supervision), and borrower performances (government performances, implementing agency performances)

2. Complex Development Decisions

> "*The concept of development has never been in greater need of analysis and clarification than in the present era. Indeed, a point has been reached where it urgently needs to be unpacked by informed, rigorous thinking*" (Payne & Phillips, 2010)

The term "development" involves actors, multiple dimensions, and contexts of time and space (*ibid*). Development initiatives involve engagement of different stakeholders with wide interests over an idiosyncratic investment lifecycle. Although the definition of the term development ***"stakeholder"*** includes persons and entities that can effect or be affected by the project, more consideration was on project "***partners"*** who associated with each other in a project and shared in both the risks and rewards of the joint effort (Mitchell, Agle, & Wood, 1997). Development decision-making processes should appreciate the wider interests of stakeholders by considering the many and varied impacts of projects.

Challenges facing distinct actors in development decisions may include:

- There needs to be **greater appreciation** of social decision-making and decision dynamics when there are multiple distinct interests.
- There appears to be a **specific need** for greater understanding and balancing of interests associated with development initiatives.
- The key evaluative **question** scoped here is how different parties *may b*e variously advantaged, or not, in such situations.
- A more direct **question** involves perceptual and analytical bias, specifically of how evaluations may be inclusive of particular considerations, or not, through the positions and framings adopted. The ways an evaluation is scoped can be highly significant.

On the brighter side, greater involvement of stakeholders can help build better local business climates with stronger community attitudes towards change, experimentation, networking, better dialog among members (communication), greater acceptance of risk and commitment to resource sharing (Shaffer, Deller, & Marcouiller, 2006). At the same time enhanced and intensified interaction between different stakeholder groups in the locality can address the different uncertainties in development decision making process such as cognitive, strategic and institutional uncertainties (van Bueren, Klijn, & Koppenjan, 2003).

More inclusive dialogues can complement formal procedures. Each has characteristic strengths and weaknesses. Either alone will find some issues difficult (and expensive) to deal with. Together they can efficiently and inclusively promote growth and development, but bridging between these two positions remains a challenge. Building conceptual and practical bridges that aid development is a central goal of the research undertaken.

The term "development" has evolved over time to reflect different demands from, and capabilities in, distinct disciplines and communities. Broadly, the academic focus has evolved from a concern with economic and physical growth to later add equity, social development, environmental sustainability and governance considerations (Payne & Phillips, 2010). However, development is properly more than growth. In development, each is "building some capacity", "going somewhere" or "aspiring to something" <u>seen as</u> *somehow better* but the ways such movements are perceived, communicated and facilitated will be imperfect and varied. Language, conventions, cultural and other models, individual traits and the like all play a part in the moulding of any message or planning position. While a common goal for development planning is *advancing human aspirations in communities and their society*, its realisation is complex.

3. Evaluating complex decisions

Initial results demonstrated the need for more detailed analysis of perceptions associated with development initiatives. Perceptions could be cast on a multi criteria, multi attribute and multi stakeholder basis requiring a three dimensional frame.

Current approaches and limitations in evaluating economic development oriented infrastructure projects are summarised in Table 1. Multi Criteria Analysis (MCA), Planning Balance Sheet (PBS), and Goal Achievement Matrix (GAM) are based on same principles and used as tools of comparing alternatives using set of criteria, goals or objectives. All three tools are two-dimensional (2D) and provide partial insights in project evaluation. At the same time, weighted, aggregated outcomes from the analysis provide sparse information on criteria and on groups with potential problems.

Cost Benefit Analysis (CBA) is used as a tool of calculating and comparing Costs and Benefits of a development proposal (often cast in terms of policies, programmes, plans, projects, and the like). Apart from its generic limitations in measuring cost and benefits, there are two limitations particularly relevant in project evaluation. First, it cannot easily incorporate the full ranges of factor like risk, return and external environment influences. Second, aggregated social cost and social benefit figures do not provide any information on sources (who bears the costs and who benefited) of the costs and benefits.

Table 1 : Different approaches in evaluating infrastructure and local economic development

Approach/ Tool	Source	Context	Implications
Ex – ante evaluation (Pre-feasibility)			
MCA/GAM/Planning Balance Sheet Analyse	(Kain et al., 2008; Nijkamp, Rietveld, & Voogd, 1990)	• Use weighting and scoring method to prioritize projects based on qualitative and quantitative multiple criterions. • Can ensure the participation of multi stakeholders in scoring and weightings of criterions	• The outcome would only express the best project out of list projects. But there is no any clue on the success of that project. • There are limitations in scoring and weightings of criterions
CBA	(Nooij, 2011; Salling & Banister, 2009)	Can calculate the net benefit of a project for all the activities which express in monitory terms	• Have limitations with intangible costs and benefits. • Not broad enough to see the impact of other factors (risk, return,local links, etc) to the project cost and benefits of a project
EIA/ SIA	(Goodenough & Page, 1994; Morrissey et al,2012; Zhou & Sheate, 2011)	Provide useful insight on single aspect of a project i.e. EIA – Environmental impacts of a project, SIA- Social impacts of a project, NPV ,IRR and payback period – financial viability of a project, Sensitivity Analysis – Risk of a project	Although it can be used as decision supportive tools, not comprihensive enough to provide a perform as a single measure at project decision making
NPV ,IRR, Payback period	(Bonnafous & Jensen, 2005)		
Sensitivity Analysis	(Grimsey & Lewis, 2002)		
Ex – post evaluation			
Micro Economic Approach Cost Benefit Analysis	(Anguera, 2006; Chan, 2011; Laird & Nellthorp, 2005; Magnussen & Olsson, 2006; Mohring, 1996)	• Determine the net social surplus of public investment or of institutional decision. It involves impact assessment and monetary assessment of those impacts.	• Deficient in not treating the further 'network' or the general equilibrium effects of infrastructure improvements on economy using sectors in the broader economy

Macro Economic Approach i. Production Function - Cobb-Douglas formulation - Translog formulation - Generalized Quadratic formulation ii. Cost Function iii. Computable General Equilibrium Model	(David Alan & Aschauer, 1989; Mamuneas, 1996; Mera, 1973)	• Argue that there are externalities to investments in infrastructure that are not captured in microeconomic CBA studies. These economy-wide cost reductions and output expansions deriving from infrastructure are identified in these macroeconomic models • Expansion effects of infrastructure are captured in the macroeconomic approach empirically by the formulation and estimation of production functions and cost functions	• Sharp differences and conflicts among these models on the magnitudes and direction of economic impacts of infrastructure • Models offer little clue to the mechanisms linking infrastructure improvements and the broader economy • No any indication of return on investment to project partners and the cost recovery of the project
Performance measurement Approach	(Nijkamp, et al., 1990; Nyerges, et al., 2010; Stimson, Stough, & Roberts, 2006)	Developed to evaluate project in multi aspects under limited data situations in developing nations	• Possible to capture both micro and macro-economic impacts of a project • Compatible with limited data situations
Evaluation during construction			
Qualitative tools like progress review meetings	(Hansen, Winckler Andersen, & White, 2013)	Manage the assigned tasks and process at ex-ante evaluation of the development and adjust the tasks with the circumstances	• The scope of the evaluation limited to monitoring assigned tasks and process at the ex-ante evaluation

There are many tools used in project evaluation like Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), Net Present Value (NPV) and Internal Rate of Return (IRR) that can provide information on particular aspects of a project. However, all are limited by the simplifications used to incorporate multi aspects into decision information.

Given these limitations, a novel approach called Complex Stakeholder Perception Mapping (CSPM) was researched, developed and tested so as to address existing limitations in infrastructure evaluation processes. Key steps involve capturing the relevant interests of various stakeholders through more complete information on perceptual mixes within and between groupings so as to foster more adequate dialogues and a basis for improved evaluations.

For example, stakeholders associated with the Batticaloa water supply project were included in Community, Local Industry, Finance, National Water Supply & Drainage Board and Divisional Secretary Division groups. Perceptions were surveyed and allocated to a different layer for each group (Figure 3), with the layers then overlaid (Figure 4). The criteria list involved nine criteria: direct cost, indirect cost, benefit, risk, return, local socio-economic environment, local physical environment, external environment, and local links. These are presented as column titles (Figure 3). Five desirability levels were used to measure each criterion from a "most desire level" to a "no desire level" (rows in Figure 3). A five-colour grading was used in each cell to show (across a single layer) the different concentration levels of perceptions at each desirability level of each criterion for each group or group combination.

With stakeholder perceptions displayed via the 4D GIS platform, any decision maker can observe perception patterns at each stakeholder level. They can also easily explore different perception combinations using the spatial analysis tools in the GIS platform. Accordingly CSPM can efficiently manage complex perception data relevant to development decisions and provide decision support information at different levels across the whole life of the project. This is not possible with existing evaluation techniques.

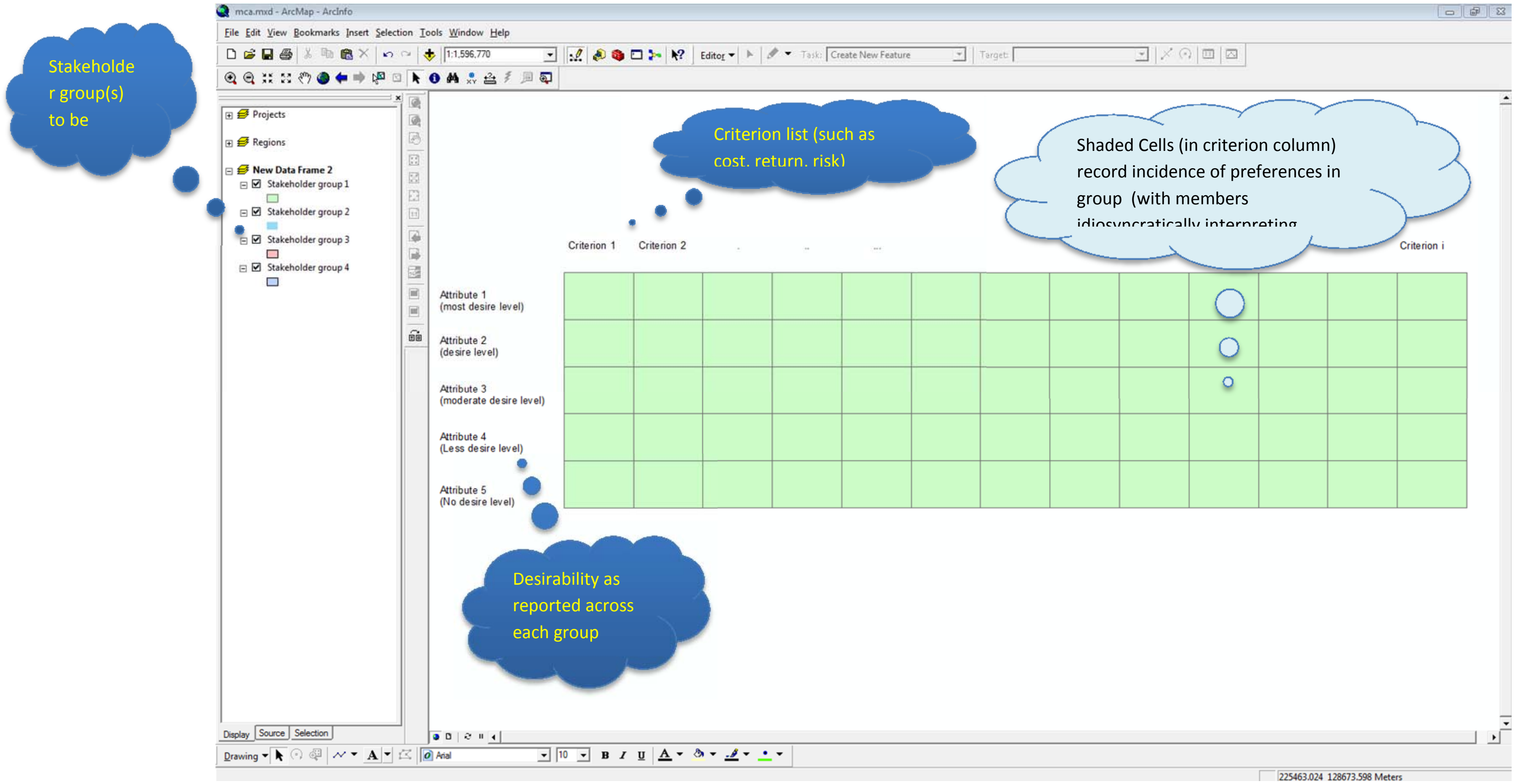


Figure 3 CSPM platform, allowing mapping by stakeholder by group by criterion by desirability

4. Mapping multiple perceptions

To facilitate more adequate dialogues between relevant parties involved in infrastructure investments and development decision-making, a process for presenting and evaluating interacting multiple perceptions is needed. Such a process can be considered in terms of a composite three-dimensional analysis environment. Additionally, there is a need to address the limitation of a high degree of substitutability between criteria and attributes in utility based MCA (Nijkamp, et al., 1990, p. 68). The model developed combines some features of Multi Criteria Analysis (MCA) and spatial Multi Criteria Analysis.

The evaluation process is designed with a three dimensional frame of attributes, criteria and stakeholder perceptions. Instead of obtaining a mathematical value of the weighted evaluation criteria by attribute score as in conventional MCA, **CSPM** maps all the potential attribute levels under each criterion in a finite space using a standard Geographic Information System. In order to store and overlay each stakeholder group's perceptions, an artificially structured grid of features is used. A regular grid replaces associated physical areas with a structured perceptual landscape. This structuring is repeated for all groups allowing easy comparisons of perceptual patterns.

These features are artificial objects drawn in a set (but task-adaptable) map space. Current maps position stakeholder perceptions in order from a "most desired" attribute level to a "not desired" attribute level under each criterion. Since attributes located themselves in a hierarchical order in the map space, it does not require present attribute score of each feature as in the spatial MCA. This provides the flexibility of including another dimension into the process and CSPM uses it to present the intensity of stakeholder perception at each attribute level under each criterion.

Accordingly CSPM provides a four dimensional analysis environment, which is beyond the limits of conventional MCA and spatial MCA. It uses columns to represent multiple criteria, rows to represent multiple attribute levels, layers to represent multiple stakeholders and colours to represent different intensity levels.

Each cell in the grid represents intensity of stakeholder perceptions (I_{ijk}) at particular attribute level (i), under particular criteria (j) of a particular stakeholder group (k). Combination of particular group's perception with another or more will overlay similar attribute levels of similar criteria. Therefore each cell (i attribute level of criteria j) in combined perception model will represent combined intensities (CI_{ij}) of similar attribute level under similar criteria of different stakeholder groups (k).

$$CI_{ij} = \sum_{k=1}^{n} I_{ijk}$$

In order to prevent compensation of bad performance by good performance it treats different threshold levels of attributes and different evaluation criteria separately. For example in Figure 4, most desired attribute level of "Project negative impact on LA's revenue streams"("direct cost") criterion of local government stakeholder group will overlay with most desired attribute level of "cost on livelihood" "direct cost") of local community stakeholder group.

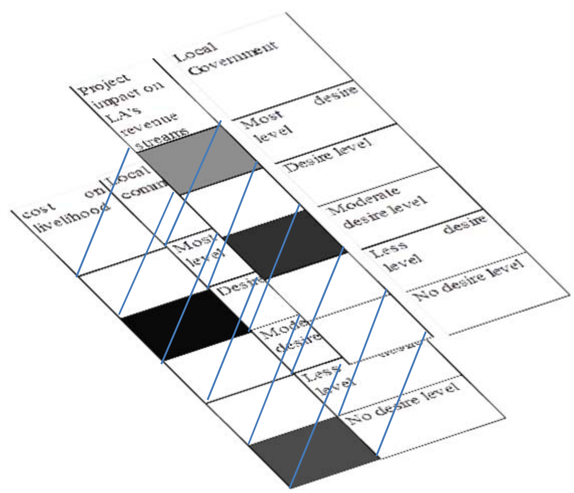


Figure 4 Overlay of similar attribute levels of similar criteria

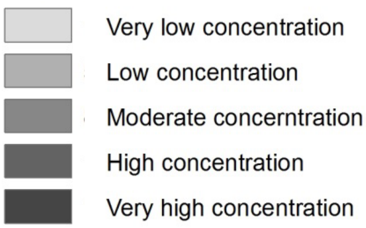
To avoid any participation biases at stakeholder group level or at any criterion level, the process is designed to scale stakeholder intensity three dimensionally. In cases not having 100% participation under particular criterion, horizontal participation bias can occur. To avoid this, this formula was applied to each attribute level of each criterion:

$$I_{ij} = P_{ij} \frac{\sum P_j}{Max \sum P_j}$$

where I_{ij} represents the adjusted stakeholder perception intensity at i attribute level of criterion j. Where P_{ij} represents the actual perception intensity at i attribute level of criterion j and P^j represent the actual perception intensity at j criterion.

To avoid vertical biases among different attribute levels, the distribution of perceptions are re-scaled in to five main groups with equal distance excluding ‘0’ values as below.

$$Break\ Value = \frac{Max\ \sum P_i - Min\ \sum P_i}{5}$$



Combining one particular stakeholder group’s perception with another different participation levels at different focus groups could result in bias representation. Such bias is screened from the process by re-scaling perceptions at each stakeholder group level from 0 to 10 before perception overlay. So the scaled intensity (*SI*) of particular attribute level (*i*) of particular criterion (*j*) would be:

$$SI_{ij} = I_{ij}\ \frac{10}{Max\ \sum P_j}$$

At each stakeholder level, CSPM provides a map of colour grading signalling perceptions about decision supporting information. Having produced a perceptual map using these steps, the next step is interpretation. Some patterns and their interpretations are provided in Table 2.

Table 2: Map patterns and interpretations

Observation	Information
Position of each cell	Stakeholder perception levels (most desired, desired, moderate desire, less desired and no desire levels) at each criterion
Colour of each cell	Intensity of stakeholder views for that particular attribute level.
Presence of more than one coloured cell under a criterion	Presence of groups within the same stakeholder group with different perceptions. Internal heterogeneity present in a group.
Columns without any grading	Stakeholders in the group either do not know the impacts of that particular criterion or consider it as not relevant for them.

As an example, consider the “local government” perception map for the Southern Expressway shown in Figure 5. Five cells show high intensity of desirability (with direct cost and direct risk seen as most desired considerations, external and local links seen as desired, and the physical environment essentially precluded by this group). Other cells show less intensity whatever the desirability. Further, the marker symbol

- “1” shows the most desired attribute level of direct cost criteria. The position of a cell indicates stakeholder perception level under a criterion.
- “2” shows how the cell colours indicate different intensity levels of the stakeholder group. Accordingly, the intensity could be categorized into different levels and concentration.
- “3” shows the presence of two groups within the same stakeholder group with different perceptions on social benefits criterion. Note that if we were to naively average these two, the reported value would be “less desired” which is a markedly different (and potentially misleading) interpretation.
- “4” shows the return criterion without any stakeholder perception. That is, consideration of this criterion is effectively absent for this group.

Similarly, CSPM provides decision-supporting information for combinations of stakeholder perception. It converts the intensity of each cell of each stakeholder group into a common scale to prevent errors of different levels of participation in each group. Common insignificant perceptions will wane out and common significant perceptions highlighted in the combination results. At the same time, CSPM allows the decision makers to weight stakeholder group perceptions and criterion separately or equally based on the situation being investigated.

Modelling performances of CSPM were tested with data from two project areas in Sri Lanka. Primary data was collected on infrastructure project and its development impacts with analyses conducted using multiple focus groups of stakeholders. Results indicate the potential of CSPM in monitoring the project progress and development impacts of an infrastructure investment throughout its lifecycle with the engagement of relevant stakeholders across multiple aspects.

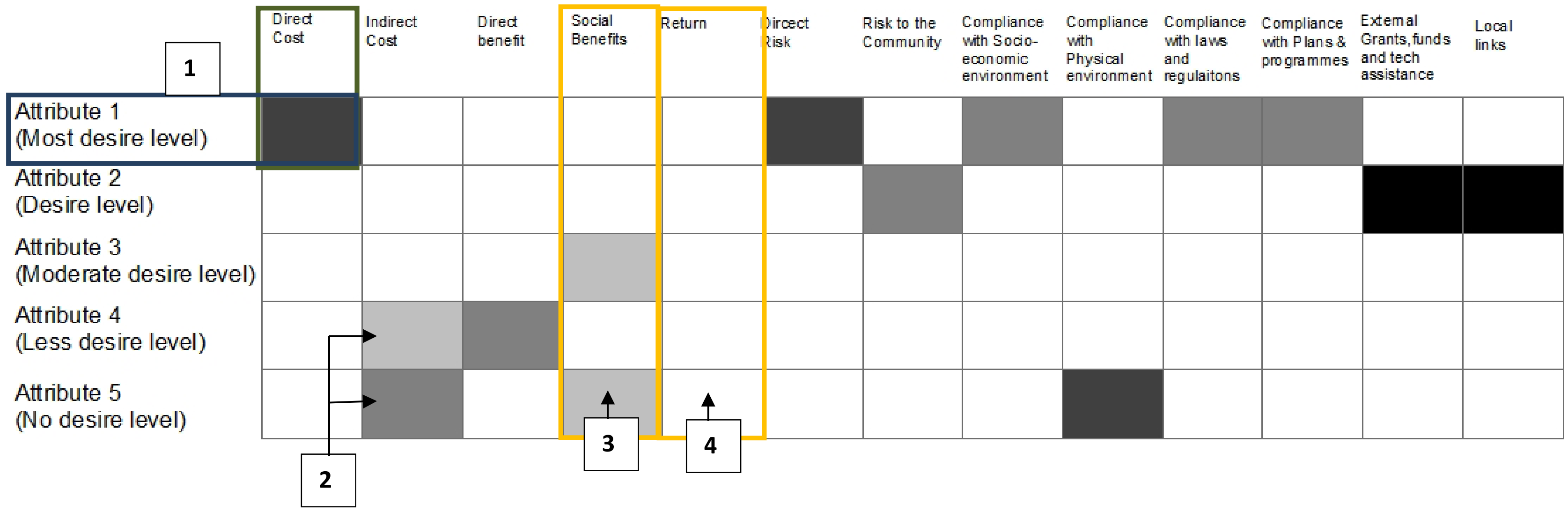


Figure 5 Interpreting CSPM model output: Local Government perception map - Southern Expressway Project, Sri Lanka

5. Conclusion

The term "development" in planning has evolved over time to accommodate different demands from professions and disciplines. It evolved from the concept of economic growth and later added equity, social development, environmental sustainability and governance into considerations. Adding issues of sustainable development and global Millennium Development Goals made development decisions more challenging. In standard approaches, multiple aspects and involved parties are often little considered. More adequate and inclusive approaches are needed.

Complex Stakeholder Perception Mapping (CSPM) embraces the complexity of interactions and development, the key roles of multiple stakeholders, the importance and variety of perceptions and the need to be able to map and relate positions. A more inclusive and comprehensive process for evaluating infrastructure investment and local economic development potentials has been developed.

CSPM outputs profiles stakeholder perceptions against chosen attributes and criteria, including their intensity and variation. Four notable patterns were identified which indicate a high level of agreement between and among stakeholder groups (mono clusters and multi clusters), disperse perceptions (scattered grading) and unattended aspects (blank).

The results of the study show infrastructure investment analysis has tended to focus on the direct costs and broad benefits of the investment. However, cost overruns and recovery failures, overly abundant facilities and incomplete projects are common infrastructure failures. These indicate an inadequacy in organizations unable to deal with uncertainties in terms of return, risk, and internal and external environment. Better ways to evaluate plans and project prospects, and support development decisions are needed. Specially, countries tend to fail in managing uncertainties when projects are funded with foreign finance.

Improved awareness and better access to information on project aspects could result in better development decisions and project outcomes. Parties involved in development planning, evaluation and decision-making should consider relevant partner perceptions and a wider range of factors including uncertainties such as risk, return and economic ramifications. Failure to do so adds to project risk. An improved process of development decision evaluation with adequate consideration of relevant factors and parties could benefit all interest groups and affected parties. It could also prevent losses and facilitate the development of local economies. CSPM can facilitate such a process by modelling multi stakeholder perceptions. It offers a flexible means of presenting perception overlays at different levels and a way of interpreting multi stakeholder insights to improve infrastructure projects and development impacts. At the same time, it attempts to make a contribution to advance the multi criteria literature by addressing the existing scoring and aggregation drawbacks of the technique.

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